

COPYRIGHT NOTICE:

David Stark: The Sense of Dissonance

is published by Princeton University Press and copyrighted, © 2009, by Princeton University Press. All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher, except for reading and browsing via the World Wide Web. Users are not permitted to mount this file on any network servers.

Follow links for Class Use and other Permissions. For more information send email to: permissions@press.princeton.edu

Heterarchy: The Organization of Dissonance

Searching Questions

Search is the watchword of the information age. Among the many new information technologies that are reshaping work and daily life, perhaps none are more empowering than the new technologies of search. With a few keywords at the toolbar, we can access enormous databases to find an obscure article by a long-distant colleague, identify the supplier of a critical component, read about the benefits and side effects of new pharmaceutical products or medical procedures, or find the fact that immediately settles a dispute about the performance of an opera, an athlete, or a mutual fund. Whereas the steam engine, the electrical turbine, the internal combustion engine, and the jet engine propelled the industrial economy, search engines power the information economy.

Search is among the key concepts of this book because search is the process that best exemplifies the challenges of contemporary organization. Ironically, those challenges cannot be solved by the search technologies that are transforming how we work, how we shop, and even how we locate ourselves in social and physical space. Certainly, new search technologies have become invaluable for how organizations manage knowledge. But the results they yield are of precisely the wrong kind to answer the more fundamental problems confronting organizations today. The more challenging type of search does not yield coordinates for a preidentified entity or category, as, for example, when I search for an e-mail address or for a recent paper that I heard presented at a conference. Nor is it even a search for solutions to clearly defined problems. The fundamental challenge is the kind of search during which you do not know what you are looking for but will recognize it when you find it.

Academics are familiar with the process. In fact, to distinguish it from the search for the already known, we have a ready term: *research*.¹ In other

¹If you are a reader searching for a dissertation topic, you are familiar with this kind of search. If you already knew precisely what you were looking for, chances are it has already been done. Innovative research expands the problem field. The challenge therefore is to work enough outside the already known while casting the research such that the new problem, concept, method, insight will be recognized by others.

fields, the process goes by a different name: *innovation*. John Dewey, one of the founders of the pragmatist school of American philosophy, used another term: *inquiry*.²

Dewey was emphatic that inquiry, as a distinctive mode of search, should be distinguished from problem solving. His clarification merits quoting at length because it so nicely turns our attention from a well-defined problem to the more interesting case of a perplexing situation:

[I]t is artificial, so far as thinking is concerned, to start with a ready-made problem, a problem made out of whole cloth or arising from a vacuum. In reality such a “problem” is simply an assigned *task*. There is not at first a situation *and* a problem, much less just a problem and no situation. There is a troubled, perplexed, trying situation, where the difficulty is, as it were, spread throughout the entire situation, infecting it as a whole. If we knew just what the difficulty was and where it lay, the job of reflection would be much easier than it is. . . . In fact, we know what the problem *exactly* is simultaneously with finding a way out and getting it resolved.³

Dewey’s evocation of perplexed and troubling situations will ring true to any reader who has faced the challenge of knowing that sometimes you must search even when you do not know what you are looking for. We grasp the difference between an assigned task, as Dewey labels a simple search, and a challenging situation. We sense that there is a difference between occasions when we look for solutions within a set of established parameters and other occasions (Dewey would say situations) rife with uncertainty and yet, precisely because of that, also ripe with possibilities.⁴ Life would be blessedly simple if we could solve our searching questions with a few clicks at the toolbar. But it would be neither interesting nor satisfying.

In their study of new-product development in cellular telephones, blue jeans, and medical devices, Richard Lester and Michael Piore succinctly capture the difference between the two types of search.⁵ In the *analytic* mode, the task of the good manager is to clearly identify the problem, break it down into independent components, and organize a series of decisions about how best to solve them. But Lester and Piore conclude that the

² Dewey was working in the pragmatist tradition that began with Charles Sanders Peirce’s idea of communities of inquiry to account for the ways that people construct knowledge in collaboration with others.

³ John Dewey, “Analysis of Reflective Thinking,” [1933] 1998, p. 140 (emphasis in the original).

⁴ Ann Mische and Harrison White, “Between Conversation and Situation: Public Switching Dynamics across Networks,” 1998.

⁵ Richard K. Lester and Michael J. Piore, *Innovation: The Missing Dimension*, 2004.

most important component of innovation is a process that is not directed toward the solution of well-defined problems. This second mode is characterized by *interpretation*. Whereas problem solving involves the precise exchange of information, the interpretive model fosters open-ended, unpredictable conversation. Where the former seeks clarity, the latter seeks spaces of ambiguity since the challenge is to integrate knowledge across heterogeneous domains. Lester and Piore demonstrate that each of their cases of radical innovation involves combinations across disparate fields: Fashion jeans are the marriage of traditional workmen's clothing and laundry technology borrowed from hospitals and hotels. Medical devices draw on the basic life sciences as well as clinical practice. And cellular phones recombine in novel form radio and telephone technologies. They conclude that "without integration across the borders separating these different fields, there would have been no new products at all."⁶

Because innovation, in this view, involves bringing together incompatible traditions, we should not expect that the process will be harmonious. With hindsight, it is easy to see that high-fashion faded blue jeans are a recombination of workmen's clothing and laundry technology. If we can say that "of course!" cellular phones are the marriage of the radio and the telephone, it is only because, as Lester and Piore show, the respective communities worked from the starting point of their differences. In hindsight, we infer that they must have known all along what they were looking for whereas, in fact, as Dewey and the pragmatists argued, it was only in the conflictual process of attempting to make a transformation in the world that the problem could even be formulated.⁷ Working broadly from within this same tradition, Lester and Piore observe:

In many industries, innovations can be identified that did not, at least initially, address a particular need or problem, or for which the problem became apparent only after the product was in use. In such cases, *the product developer frequently starts out without really knowing what she is trying to create.* (p. 41, emphasis added)

The search problems that this book addresses are thus different from the everyday notion of exploration, if that term calls to mind a process like exploring for petroleum or similar searches for a good that is known in advance. Following James March, I shall use the term *exploration* narrowly to refer to processes that break from successful, familiar routines to

⁶ Lester and Piore, *Innovation*, pp. 14–15.

⁷ For a similar account of discovering the world through the conflictual process of attempting to transform it, see Tracy Kidder, *The Soul of a New Machine*, 1981.

search into the unknown.⁸ That is, if exploring for territory is your metaphor of choice, the challenging searches would be efforts to recognize the *terrae incognitae*.

Stated as recognition of the *incognita*, the process of innovation is paradoxical, for it involves a curious cognitive function of recognizing what is not yet formulated as a category. It is one thing to recognize an already-identified pattern, but quite another to make a new association. To take some mundane yet now ubiquitous examples: gas for industrial lighting in the nineteenth century (recognizing a waste product of the process of converting coal to coke as a valuable resource);⁹ the shopping cart (a basket on wheels);¹⁰ the parking meter (a hitching post with a clock-type main-spring); the car radio (pioneered by a family firm, now famously Motorola, that had made accessories for carriages and sought a market in accessories for the new automobile); the airport shopping mall (combining consumption and travel); and, more troubling, the megachurch of American exurbia (combining Wal-Mart architecture, televangelism, and highly niched small groups or cells from the repertoire of underground movements to create a new form of spirituality as mass-customized consumption). Each example of recombination or repurposing involved a category switch, obvious now in retrospect precisely because each could be recognized with little cognitive difficulty by the user.

Whether we refer to the process as research, innovation, exploration, or inquiry, the kind of search that works through interpretation rather than simply managing information requires *reflective cognition*. Whether in science, politics, civic associations, or business, it is not enough just to embark on a search for an unknown breakthrough; you must also be able to recognize it when you find it. And you must present the category-breaking solutions in forms that are recognizable to other scientists, citizens, activists, investors, or users. This is a tall challenge, for the more ambitious the project, the more deliberately ill defined the initial process of search; and the more demanding the processes of eventual recognition, the greater is the discomfiting ambiguity facing the innovating organization. Innovation, as Joseph Schumpeter observed, is recombination; but, as Schumpeter argued as well, it is also deeply disruptive of cultural taken-for-granted and routines of organizational cognition.

We can now appreciate again Dewey's characterization of inquiry as provoked by "troubled, perplexed, trying situations." Organizations fac-

⁸ James G. March, "Exploration and Exploitation in Organizational Learning," 1991.

⁹ Wolfgang Schivelbusch, *Disenchanted Night: The Industrialization of Light in the Nineteenth Century*, 1995, p. 18.

¹⁰ Catherine Grandclément, "Wheeling One's Groceries around the Store," 2008.

ing such perplexing situations have several options. The first temptation for the leaders of science projects, corporate projects, or civic projects is to immediately address ambiguous situations pregnant with interpretive search by using the clearly defined problem-solving strategy of analytic search. But such a managerialist strategy of early top-down control entails the risk of forgoing the big opportunities represented in innovations such as cellular phones, fashion jeans, and breakthrough medical equipment. Although problem solving eventually came into the picture, interpretation was the dominant mode of product development that led to innovative success in each of these cases.¹¹

The alternative strategy is more in line with John Dewey's notion of inquiry as a guide for innovation. Dewey's attention to the productive possibilities of situations is the lesson that I try to keep in mind throughout this book. Instead of avoiding perplexing situations, organizations can embrace them. Even more radically, organizations can take the next step: If perplexing situations provoke innovative inquiry, then why not build organizations that generate such situations? Instead of merely responding to external situations as they happen to present themselves, why not foster organizational forms that regularly and recursively produce perplexing situations within the organization itself? Organizations that adopt such forms will then be poised to undertake the challenging task of ongoing innovation.

At the most elementary level, a perplexing situation is produced when there is principled disagreement about what counts. Organizations that seek to generate productive, perplexing situations can work from this basic starting point. Instead of enforcing a single principle of evaluation as the only legitimate framework, they recognize that it is legitimate to articulate alternative conceptions of what is valuable, what is worthy, what counts. Such organizations have heterogeneous criteria of organizational "goods." To signal that this organizational form is a mode of governance that differs from a hierarchy of command and a conceptual hierarchy of cognitive categories, I refer to it as a *heterarchy*. As the case ethnographies in the following chapters demonstrate, heterarchies are cognitive ecologies that facilitate the work of reflexive cognition.

Such organizations, we shall see, are not frictionless. But friction is not something to be avoided at all costs. We all prefer a smooth ride, but as you and your tire dealer know, when taking a sharp curve, we count on friction to keep us on course. Friction can be destructive. But, as the

¹¹ Lester and Piore, *Innovation*.

designers of the U.S. Constitution well understood when they built the friction of checks and balances into our system of government, it can also be a principled component of a functioning system with productive outcomes. That is, having multiple performance criteria can produce a resourceful dissonance. If you are confident that you know precisely what resources your organization will need in the indefinite future to meet stable and predictable markets (or continue to get grants to meet your unchanging mission as a nonprofit or a research operation), then dissonance is an avoidable headache that you need not abide. But for many organizations the “foreseeable future” is not long distant. Where the organizational environment is turbulent and there is uncertainty about what might constitute a resource under changed conditions, contending frameworks of value can themselves be a valuable organizational resource. Entrepreneurship then, in this view, exploits uncertainty. Not the property of an individual personality but, instead, the function of an organizational form, entrepreneurship is the ability to keep multiple principles of evaluation in play and to benefit from that productive friction.

For a Sociology of Worth

What counts? Each of us confronts this question on a daily basis. Faced with decisions involving incommensurable frameworks—work versus family life, career opportunities versus loyalty to friends or attachment to a locality, vacations versus investments for retirement, and so on—we ask ourselves what really counts. What is valuable, and by what measures? As our lives are a search to find out what is really valuable, we try, we fail, and we try again to learn from our mistakes.

In our roles as actors in organizations we face similar questions. In these organizational settings we need to sift through a barrage of information—seemingly growing at an exponential rate—to select what counts, what matters, what is of true relevance. More fundamentally, organizations are engaged in a search for what is valuable. What new products can be brought to market? What new technologies or production processes should be pursued? Which will prove to be valuable and which will be a costly dead end? And how should the performance of units, of teams, and of the individual employees within them be evaluated? Nonprofits might be tax-exempt, but they are not exempt from similar questions. Which campaigns and projects are worthy of pursuit? Will our members, constituents, activists, targeted communities, and donors recognize their value, perhaps quickly, or perhaps too late?

Within the sociological discipline, economic sociology is the specialization that deals with societal and organizational questions of the valuable. The field's founding moment took place more than a half century ago at Harvard, where Talcott Parsons was developing his grand designs for sociology. Parsons's ambitions were imperial, with the aim of reshaping much of the social sciences. But his instincts in academic politics led him to be wary of economics as the discipline that could thwart his agenda if his program was perceived as encroaching on its territory. Whereas sociology, psychology, and anthropology could be claimed outright, economics would have to be maneuvered around. To dispel any doubt about his intentions, Parsons walked down the hall in Harvard's Littauer Center to his colleagues in the Economics Department, alerting them to his ambitious plans and assuring them that he had no designs on their terrain.¹² Thus, Parsons made a pact. In my gloss: You, economists, study value; we, the sociologists, will study values. You will have claim on the economy; we will stake our claim on the social relations in which economies are embedded.¹³

Although Parsons's Pact suggests that we must choose a single vantage point—value *or* values, economy *or* social relations—I adopt an analytic strategy of fusing the two notions across this divide.¹⁴ The key concept in this fusion is the notion of worth. The polysemic character of the term—*worth*—signals concern with fundamental problems of value while recognizing that all economies have a moral component. Rather than the static fixtures of value and values, it focuses instead on ongoing processes of *valuation*—whether in assessing the value of firms under competing

¹² Charles Camic, "The Making of a Method: A Historical Reinterpretation of the Early Parsons," 1987. Although he characterizes it slightly differently, Velthuis similarly argues that in the mid-1930s Parsons and the economist Lionel Robbins agreed on the terms of a disciplinary division of labor. Olav Velthuis, "The Changing Relationship between Economic Sociology and Institutional Economics: From Talcott Parsons to Mark Granovetter," 1999.

¹³ Parsons's Pact thus imposed a jurisdictional division of the social sciences that placed constraints on sociology by limiting its range. Yet, by delimiting a legitimate object of study—society, though not the economy—it ensured that the discipline would flourish in the great postwar expansion of the social sciences.

¹⁴ Economic sociologists have adopted various strategies to break with Parsons's Pact. In *Markets from Networks* (2002) Harrison White basically turns the tables on the terms of the pact. Markets, he argues, are not *embedded in* social relations; they *are* social relations. Instead of accepting the economists' conception of markets, White has developed a sociological theory of markets. As the counterpart to Harrison White, Viviana Zelizer pointed out a way to escape from Parsons's Pact along the value/values dimension. In *Pricing the Priceless Child* (1985) Zelizer examines the interrelation between market or price and personal or moral values in a rich historical study of child labor, adoption, and insurance. Zelizer's later work on the social meaning of money, on payment systems, and circuits of commerce boldly transgresses and transcends the disciplinary divide.

metrics of performance, or in studying the incommensurable assessments made in everyday life. “What are you worth?” is a question that can be unambiguous when constrained by context (as, for example, when applying at a bank for a mortgage). But the same question in an art gallery—“Yes, but what is it worth?”—already suggests that value might be different from price. And when the question comes up among friends—“Honey, do you really think he’s worth it?”—we know that several opposed evaluative criteria have been brought into play.

Worth is a wonderful word with deep roots (*wort*) in the old Anglo-Saxon tongue before the Norman invasion brought the Latinate separation of value and values into the English language. With its double connotations of an economic good and a moral good, *worth* is a difficult noun to translate into Italian, for example. None of the candidate terms has that twinned salience, as each is heavily loaded toward either the value or the values side. On the other hand, there is no such verb as “to worth” in English. We can “value something as worth a great deal” or “judge someone as worthy,” but we cannot “worth” something or someone. Meanwhile Italian has a perfectly apt verb, *stimare*. In this case, it was English that separated the verbs “to estimate” (on the value side) and “to esteem” (on the values side)—connotations that are equally salient in the Italian verb.¹⁵

Perhaps more than anyone on this topic, John Dewey was aware not only of how everyday language constrains our thinking but also of how it can reveal insights about the concepts we deploy. In his *Theory of Valuation*, Dewey explores the double meanings in ordinary speech and points to words such as *praise* and *appraise* that parse in different directions from a common root. After noting the twins *estimate* and *esteem*, Dewey observes that it is suggestive “that praise, prize and price are all derived from the same Latin word; that appreciate and appraise were once used interchangeably; and that ‘dear’ is still used as equivalent both to ‘precious’ and to ‘costly’ in monetary price.”¹⁶

With Dewey, I agree that we cannot appeal to everyday language to solve analytic problems. But I also take his point that when we see some commonsense terms pulling apart and others joining together, we should pay attention, for we will usually find a problem worth studying. In particular, we can often see how ideas from ordinary language become incor-

¹⁵ I recently encountered this problem when giving a simultaneously translated public lecture at the University of Modena and later when my essay “For a Sociology of Worth” was translated for an Italian journal. On a more general note, writers who make words work very hard should give them due recognition—or, at least, follow the lead of Humpty-Dumpty in *Alice in Wonderland*: “When I make a word do extra work, I’m always sure to pay it very well.”

¹⁶ John Dewey, *Theory of Valuation*, 1939, pp. 5–6.

porated in the false dichotomies that we use in analysis—for example, in viewing ends as values that are prized while regarding means as objects that are appraised. For Dewey, it makes as much sense to see means as prized and ends appraised. His pragmatic theory of inquiry as action shatters these dichotomies.

In the closing section of his *Theory of Valuation* Dewey provides a diagnosis of the crisis of his time. Writing in 1939, he observes that emotional loyalties and attachments are not linked to scientific debate, while ideas with their origin in scientific inquiry have not succeeded in gaining emotional force.¹⁷ For Dewey this is a practical problem, and an analytic one. In the penultimate paragraph he highlights this problem by returning to the discussion of common speech with which he began his study.

In fact, and in net outcome, the previous discussion does not point in the least to supersession of the emotive by the intellectual. Its only and complete import is the need for their integration in behavior—behavior in which, according to common speech, the head and the heart work together, in which, to use more technical language, prizing and appraising unite in direction of action. (p. 65)

It is, then, with Dewey that we embark on an analysis of worth to develop tools for understanding a richer calculus that integrates value and values, the intellectual and the emotive, valuation and the evaluative. When we see that acts of estimation entail practices of esteem, we see that payment systems are about recognition as well as about monetary rewards. When we see inquiry as action, we see search less as a process of finding what we already know to be valuable than as distributed practices for recognizing opportunities by re-cognizing resources. When we regard calculation as not separated from judgment, we see that what counts in the processing of information is the capacity for interpretation.

Following Dewey will require that economic sociology's preoccupation with the analysis of *institutions* should be augmented by close study of indeterminate *situations*. In making this shift, economic sociology can draw lessons from developments in the field of science and technology studies (STS). During its inaugural stage, the sociology of science, led by

¹⁷ “We are living in a period in which emotional loyalties and attachments are centered on objects that no longer command that intellectual loyalty which has the sanction of the methods which attain valid conclusions in scientific inquiry, while ideas that have their origin in the rationale of inquiry have not as yet succeeded in acquiring the force that only emotional ardor provides. The practical problem that has to be faced is the establishment of cultural conditions that will support the kinds of behavior in which emotions and ideas, desires and appraisals, are integrated.” Dewey, *Theory of Valuation*, p. 65.

Robert Merton, carved out a distinctive place for sociology by focusing on the institutions of science—the structure of rewards and careers, patterns of citations, and the norms of scientific life. Departing from this tradition, the next generation of STS researchers moved into the laboratories to study scientists at work, observing the difficult labor of stabilizing facts, the challenges of replicating experiments, and the ongoing controversies of science in the making.¹⁸

Just as post-Mertonian studies of science moved from studying the institutions in which scientists were embedded to analyzing the actual practices of scientists in the laboratory, so can economic sociology move from studying the institutions in which economic activity is embedded to analyzing the actual evaluative and calculative practices of actors at work.

In making this move, I draw on insights by Luc Boltanski and Laurent Thévenot, whose book *On Justification: The Economies of Worth*, only recently translated, was originally published in France in 1991.¹⁹ Boltanski, a sociologist, and Thévenot, an economist, are part of a group of French economic sociologists²⁰ whose work is collectively known as “the economics of convention.”²¹ Just as Harrison White has developed a sociological theory of markets, Boltanski and Thévenot are developing a sociological theory of value. Their first move is to demonstrate that there is not just

¹⁸ Bruno Latour and Steve Woolgar, *Laboratory Life: The Social Construction of Scientific Facts*, 1979; Trevor Pinch, *Confronting Nature: The Sociology of Solar-Neutrino Detection*, 1986; and Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society*, 1987.

¹⁹ Luc Boltanski and Laurent Thévenot, *On Justification: The Economies of Worth*, 2006. For an accessible introduction to the major concepts in article form, see Boltanski and Thévenot, “The Sociology of Critical Capacity,” 1999. Michèle Lamont together with Thévenot led an exciting project involving a set of empirical studies, pairing French and American researchers, that demonstrates the fruitful application of these ideas. See their edited collection, *Rethinking Comparative Cultural Sociology: Repertoires of Evaluation in France and the United States*, 2000.

²⁰ For a recent collection in English, see *Conventions and Structures in Economic Organization: Markets, Networks and Hierarchies*, edited by Olivier Favereau and Emmanuel Lazega, 2002. Introductions to the economics of conventions are provided in John Wilkinson, “A New Paradigm for Economic Analysis?” 1997; and Thierry Levy, “The Theory of Conventions and a New Theory of the Firm,” 2001.

²¹ The French conventionalist school began with the idea that the qualities of labor were unknown prior to hiring, but soon extended this idea to other commodities that suffered from deficiencies of “incomplete contracts.” (The market for used cars is now a well-known example; see George A. Akerlof, “The Market for ‘Lemons’: Quality Uncertainty and the Market Mechanism,” 1970.) Guidance systems and other instrumentation in space vehicles provide a different kind of example in which the buyer cannot know in advance how the qualities of the product will perform in extreme conditions. Of even greater interest are cases in which the parties embark on complex collaborations in which the fundamental characteristics of the joint product are not known in advance but are themselves the key aim of the collaboration. In this case, the critical quality is the ability to collaborate. On discursive quality standards, see especially Charles Sabel and Jane Prokop, “Stabilization through Reorganization?” 1996.

one way of making value but that modern economies comprise multiple principles of evaluation. A modern economy (and note that the word is not society but economy) is not a single social order but contains multiple “orders of worth.”

One might object that this is not an escape from Parsons’s Pact. After all, as soon as you make a plural out of value, you get *values*. But the orders of worth of the French school, in fact, differ from the cultural systems of Parsonsian values and from the classificatory codes of the new institutionalists. For my colleagues in American economic sociology, values are counterposed to calculation; they are outside and distant from calculation. More precisely, if cultural taken-for-granted are the embeddings for value, they make calculation possible precisely because they are a kind of antimatter to calculation.²² For my French conventionalist colleagues, on the other hand, orders of worth are not values counterposed to value but are constitutive of value. Orders of worth are the very fabric of calculation, of rationality, of value.

Boltanski and Thévenot’s work refuses a dichotomy of value and values; instead, it fuses them in the concept of worth. Although we are accustomed to thinking about “moral economies” as opposed to market economies—for example, in the norms of close-knit communities that embodied precapitalist traditions of the just and fair²³—Boltanski and Thévenot see all economies as moral economies. Each of the orders of worth operating in the domain that we conventionally denominate as “the economy” is an economy. And, as an economy, each is a moral order.

Boltanski and Thévenot delineate six discrete orders of worth, each epitomized by a particular moral philosopher. From their perspective, I would be mistaken to say that I live in a market economy. Markets are, indeed, one of the organizing principles of the U.S. economy. But, as they show in their study of the domain of the corporation, in addition to a *market* rationality (exemplified by the moral philosophy of Adam Smith), a modern economy also has an *industrial* or technological rationality (Saint Simon), another organized around a *civic* logic (Rousseau), and still

²² Paul J. DiMaggio and Walter W. Powell, “Introduction,” in *The New Institutionalism in Organizational Analysis*, 1991. In this agenda-setting statement for the “new institutionalism” in economic sociology, DiMaggio and Powell present a sharp critique of Parsons (pp. 15–22), making clear that whereas the old institutionalism was about “values, norms, attitudes,” the new institutionalism analyzes “classifications, routines, scripts, schema.” Emphasizing the importance of “unreflective activity,” DiMaggio and Powell explicitly counterpose such cultural taken-for-granted to calculative behavior (p. 22).

²³ Social historian E. P. Thompson emphasized the force of such traditions in his pioneering article “The Moral Economy of the English Crowd in the Eighteenth Century,” 1971.

others arrayed according to principles of *loyalty* (Bossuet), *inspiration* (Augustine), and *renown* or fame (Hobbes).

Boltanski and Thévenot are emphatic that their orders of worth do not map to separate domains.²⁴ Inspiration, for example, is not the special province of the world of art; nor does a civic rationality correspond to the public sphere; and the market order can operate as well in the domains of academia and religion. In the second part of *On Justification*, Boltanski and Thévenot illustrate the operation of each of the orders of worth within a single domain, that of the large corporation, through a content analysis of six best-selling guidebooks to being a good manager—each written from the perspective of a different order respectively.

As an example that each of the orders of worth is salient in the world of academia, take letters of recommendation for faculty appointments. You do not need to read a great many such letters to recognize that recommenders frequently refer to multiple principles of evaluation. In fact, a given letter might include performance criteria from each of the six orders of worth. We would not be surprised, for example, to read that a given candidate is “very creative” (the order of inspiration); that she is incredibly “productive” (the industrial); and that she is a “good citizen” (the civic). Moreover, the same letter could note that her work is “frequently cited” (the order of fame or renown) and that she is fiercely “loyal to her graduate students” (check off another). Has the letter writer neglected the market order? We are not likely to hear about an academic as the author of a “best-selling” book. Look through the letter again and you might find that the candidate “has a strong record of getting grants.”

As coherent principles of evaluation, each of the orders of worth has distinctive and incommensurable principles of equivalence. Each defines the good, the just, and the fair—but according to different criteria of judgment. Each qualifies persons and objects with a distinctive grammar or logic. As principles of evaluation, the orders involve systematic associations of concepts; but the entities that populate an order of worth are not

²⁴ Despite the similarity of a notion of multiple rationalities, Boltanski and Thévenot’s framework differs markedly from that of Roger Friedland and Robert Alford, who identify several institutional domains, each with its distinctive “logic of action” (“Bringing Society Back In: Symbols, Practices, and Institutional Contradictions,” 1991). Whereas Friedland and Alford parse logics to domains (e.g., affective in the family, cognitive in the market, etc.), Boltanski and Thévenot’s respective orders of worth are not isolated to specific societal domains. Although it shares a similar intuition, their view also differs from that of Wendy Espeland and Mitchell Stevens, who argue that “because societies are complexes of multiple institutions, they are characterized by multiple modes of valuing” (“Commensuration as a Social Process,” 1998, p. 332). Because Boltanski and Thévenot’s orders of worth do not parse to separate institutions, all can be operating in the economy.

limited to persons and ideas. *On Justification* shows in rich detail how the principles of evaluation established in each order of worth entail discrete metrics, measuring “instruments,” and proofs of worth objectified in artifacts and objects in the material world.

In this view, rational calculation is not opposed to moral judgment; instead, rationality works within orders of worth. As such, I interpret Boltanski and Thévenot’s work as casting new meaning on the term “bounded rationality.” Whereas we conventionally think about bounded rationality as the cognitive limits on rationality (as, for example, in the usage of the term by economist Oliver Williamson), in Boltanski and Thévenot’s work rationality is possible only insofar as it takes place within the boundaries and through the social technologies of particular orders of worth. In this latter sense we should speak—and with a very different meaning—of bounded *rationalities*.

Drawing from Boltanski and Thévenot, as well as from Michel Callon and his colleagues,²⁵ in the framework that I adopt in this book, the familiar culturalist *versus* materialist opposition becomes meaningless. All economic objects are thoroughly cultural, and no moral order could operate without specific material objects. Moreover, rationality is not something “above” the preconscious, nor is calculation somehow “below” moral orderings. From my field research in Hungary, where I found a plurality of economic forms operating in a single factory (see chapter 2), I was predisposed to the idea that organizations are settings where multiple principles of evaluation are at play. But because I do not confine these to the six moral orders of *On Justification*, I specify the evaluative principles differently from one case to another, as is appropriate for each case. Most importantly, my field research leads me to different conclusions from those of Boltanski and Thévenot. As I shall argue in the next section and develop in the subsequent substantive chapters, whereas they see orders of worth as making action possible by resolving problems of uncertainty, my case ethnographies led me to see the mix of evaluative principles as creating uncertainty and therefore as opening opportunities for action.

Entrepreneurship at the Overlap

Economic sociology, like many fields in the discipline, is populated with dualisms. In addition to the dichotomy of value and values and the perennial

²⁵ See especially Michel Callon and Fabian Muniesa, “Economic Markets as Calculative Collective Devices,” 2005.

“structure versus agency,” we also find notions of calculation versus trust, and efficiency versus legitimacy. One particularly productive distinction that continues to generate insights was formulated by economist Frank Knight as the problem of *risk versus uncertainty*.²⁶ For Knight, uncertainty and risk are both shaped by the fact that the future is unknown. But the two are not the same. In circumstances of risk, chances are calculable; that is, the distribution of outcomes can be expressed in some probabilistic terms. Uncertainty, however, lacks calculation: “All bets are off.”

The problem of uncertainty, it must be emphasized, is not a function of the limited calculative power of the human actors confronting it. Instead it is a property of the situation. The situation is indeterminate. John Dewey, writing about the same time as Knight but in a different context, nicely expresses the problem of indeterminate situations:

A variety of names serves to characterize indeterminate situations. They are disturbed, troubled, ambiguous, confused, full of conflicting tendencies, obscure, etc. It is the *situation* that has these traits. We are doubtful because the situation is inherently doubtful.²⁷

Santa Fe Institute economist David Lane succinctly summarizes the situation of uncertainty: “the question is not what we do not know, but what cannot be known.”²⁸

Although economists are now giving renewed attention to the problem of uncertainty,²⁹ the typical view in the discipline, institutionalized in the neoclassical framework, was to frame all economic action as cases of risk.³⁰ Knight could see the direction that his discipline was moving, and in his view the tendency to see all situations as those in which the distribution of outcomes could be expressed in probabilistic terms would deprive economists of the ability to grasp a problem that should be at the core of the discipline. Knight argued that a world of generalized probabilistic knowledge of the future leaves no place for profit and, as a consequence, no place for the entrepreneur. For Knight, what defines profit is that it cannot be measured *ex ante*—as distinct from rents, which constitute contractualizable residual revenue. In Knight’s framework, the entrepreneur,

²⁶ Frank H. Knight, *Risk, Uncertainty and Profit*, 1921.

²⁷ John Dewey, “The Pattern of Inquiry,” [1938] 1998, p. 171, emphasis in the original.

²⁸ David Lane, “Models and Aphorisms,” 1995.

²⁹ Adam Brandenburger, “The Power of Paradox: Some Recent Developments in Interactive Epistemology,” 2007; Sheila Dow and John Hillard, eds., *Keynes, Knowledge and Uncertainty*, 1995; and Edward Fullbrook, ed., *Intersubjectivity in Economics: Agents and Structures*, 2001.

³⁰ Jens Beckert, “What Is Sociological about Economic Sociology? Uncertainty and the Embeddedness of Economic Action,” 1996.

properly speaking, is not rewarded for risk taking but, instead, is rewarded for an ability to exploit uncertainty.

In Boltanski and Thévenot's framework, there is little space for entrepreneurial activity. For this French school of economic sociology, conventions (of which orders of worth are a particularly well-elaborated variant) are a way of dealing with uncertainty. They are engines for turning situations into calculative problems. Orders of worth can be considered as social technologies to transform uncertainty into risk.³¹ The limitation of this view—and here is my departure from Boltanski and Thévenot—is that it does not give adequate attention to the problem that orders of worth cannot eliminate uncertainty. In particular, they cannot eliminate the possibility of uncertainty about which order or convention is operative in a given situation.

Taking this into account, we are in a position to restate the insight of Knight, but now in new terms: it is precisely *this* uncertainty that entrepreneurship exploits. *Entrepreneurship is the ability to keep multiple evaluative principles in play and to exploit the resulting friction of their interplay.*

In exploiting the uncertainty about which order of worth is operative, entrepreneurship involves *asset ambiguity*.³² From ambiguity it makes an asset; and in creating assets that can operate in more than one game, it makes assets that are ambiguous. In the subsequent chapter, for example, we shall see how a group of highly skilled machinists, working in Communist Hungary, exploited the ambiguity of the “economies” of redistribution, market, and reciprocity that were operative in their factory. Their strategy was not without limits and was not always successful, but it

³¹ The coordination problems in Boltanski and Thévenot differ from Schelling's case of a couple who get separated in a large department store but who do not have a predefined meeting place (Thomas C. Schelling, *The Strategy of Conflict*, 1960). The couple succeed in coordinating not despite the circular specularly but because each knows that the other is trying to coordinate with him/her. Schelling's case is more like the common knowledge framework in Lewis's notion of convention. (David K. Lewis, *Conventions: A Philosophical Study*, 1969. For discussion see especially Jean-Pierre Dupuy, “Common Knowledge, Common Sense,” 1989.) Boltanski and Thévenot's orders of worth are not about the application of *rules* and hence differ from “institutions” either in game theory or in the new institutionalism.

³² Asset ambiguity, thus, contrasts sharply with the concept of asset specificity developed by the economist Oliver Williamson. By *asset specificity* Williamson referred to the extent to which investment in a given asset was specific to a particular transaction. The degree of asset specificity was critical, Williamson argued, in the decision to make or buy. (Oliver Williamson, “The Economics of Organization: The Transaction Cost Approach,” 1981.) Charles Sabel and Bruce Kogut, by contrast, explored the problem of asset interdependence, demonstrating that, under conditions of extraordinarily rapid technological change, actors engage in hedging strategies vis-à-vis other organizations (partners or competitors) in their organizational field. (Charles F. Sabel, “Moebius-Strip Organizations and Open Labor Markets,” 1990; and Bruce Kogut, Weijian Shan, and Gordon Walker, “The Make-or-Cooperate Decision in the Context of an Industry Network,” 1992.)

well-illustrates the possibilities and the difficulties of playing in multiple games simultaneously. In chapter 3, we encounter a new-media firm in Manhattan's Silicon Alley that attempts to stay ahead of the curve of a very rapidly changing market by benefiting from the friction between multiple, incompatible principles for assessing the company's products—sophisticated e-commerce websites. In chapter 4, we shall see how a Wall Street trading room is organized as a cognitive ecology in which the friction among competing principles of arbitrage generates new ways of recognizing opportunities. That is, although very different in their settings, the ethnographies will demonstrate how an entrepreneurial rivalry of performance principles makes assets of ambiguity by keeping open multiple ways of redefining, and hence recombining and redeploying, resources.

Entrepreneurship exploits the indeterminate situation by keeping open diverse performance criteria rather than by creating consensus about one set of rules. As such, my conception of entrepreneurship differs considerably from the strategic action of Neil Fligstein's "institutional entrepreneur." For Fligstein, "Strategic action is the attempt by social actors to create and maintain stable social worlds (i.e., organizational fields). This involves the creation of rules to which disparate groups can adhere."³³ Rather than involving the creation of rules for stability, my concept of entrepreneurship draws from Harrison White, for whom the problem is not "how is there social order?" but that of "getting action" in worlds that are already too ordered and rule governed.³⁴

In more general terms, whereas the "new institutionalism" in economic sociology during the 1980s developed concepts of classificatory rules, scripts, and cultural taken-for-granted to explain how organizations gain legitimacy to operate in stabilized institutional environments, today organizations in rapidly changing environments face the problem that their taken-for-granted can soon be out-of-date. In this situation, entrepreneurship is less about creating stability (building on success) than about creating disruptions that prevent the path-dependent effects of locking in to early successes.³⁵ That is, in fast-breaking fields, among the many challenges facing firms is the problem of coping with success. Organizations that keep multiple evaluative principles in play, I argue and demonstrate in my case studies, foster a generative friction³⁶ that disrupts

³³ Neil Fligstein, "Social Skill and Institutional Theory," 1997, p. 398.

³⁴ See especially Harrison C. White, *Identity and Control*, 1992.

³⁵ I elaborate these ideas further in chapter 5.

³⁶ On the notion of "creative abrasion," see Dorothy Leonard-Barton, *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*, 1995; and John Seely Brown and Paul Duguid, "Knowledge and Organization: A Social-Practice Perspective," 2001.

received categories of business as usual and makes possible an ongoing recombination of resources.

My perspective thus combines Knight's notion that entrepreneurship exploits uncertainty with Schumpeter's emphasis that entrepreneurship is disruptive and recombinatory. My conception of entrepreneurship as keeping multiple evaluative principles in play and exploiting the resulting dissonance thus differs from brokerage.

Brokerage, as Ron Burt powerfully demonstrates, exploits "structural holes" in the social field, strategically locating gaps and profiting from the ability to broker among units that are otherwise disconnected.³⁷ Brokerage is frequently mistaken for entrepreneurship, but the two roles and their corresponding social processes are distinct. Whereas the broker is an insider to none and taxes flows, the entrepreneur is an insider to multiple games and recombines assets.

For Burt, the key problem is access to *information*. Bridging ties provide access to new ideas that are free-floating in the network environment—access that, in Burt's view, is not possible through redundant, cohesive ties. In my view, by contrast, the most innovative ideas are not "out there" in the environment of the group. Instead of waiting to be found, they must be generated.³⁸ When the problem is the production of new *knowledge* rather than simply access to information, the bridging ties of brokerage are insufficient. Generating new knowledge of the Schumpeterian recombinant type requires more intimate familiarity than can be produced by weak ties.

Recall Lester and Piore's observations, mentioned at the outset of this chapter, about cellular phones as a novel recombination of radio and telephone technologies: "without integration across the borders separating these different fields, there would have been no new products at all."³⁹ For me, the telling phrase in this passage is "integration across the borders." Lester and Piore do not refer to "contacts" across borders, for it is not enough for different communities to be *in contact*. Recombinant innovation requires that they *interact*. In network analytic terms, this suggests that entrepreneurship occurs at the overlap of cohesive structures where different communities (defined by their cohesive ties) intersect

³⁷ Ronald Burt, *Structural Holes: The Social Structure of Competition*, 1995.

³⁸ "When entry-detering benefits are absent, competition switches from traditional elements of market structure to the comparative capabilities of the firm to replicate and generate new knowledge." Bruce Kogut and Udo Zander, "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology," 1992.

³⁹ Lester and Piore, *Innovation*, pp. 14–15.

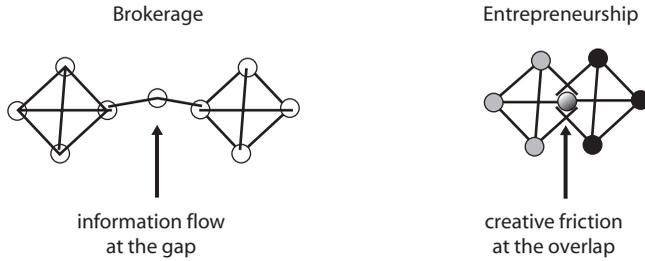


Figure 1.1 Brokerage and Entrepreneurship

without dissolving their distinctive network identities.⁴⁰ The network diagrams in figure 1.1 represent these differences between brokerage and entrepreneurship.

In addition to deep familiarity about resources, the work of recombinant innovation also requires diversity. What is overlapping are not simply cohesive network structures but also diverse, even disparate, evaluative principles. Thus, the diagram in figure 1.1 maps diverse discursive frames as well as network ties.⁴¹ Within the same domain space, even within the same organization, diverse performance criteria are colliding and competing. Because there are multiple codes to evaluate performance, codified knowledge can be broken up and recoded. With analogy to genetics, think of the friction of rivaling principles as increasing the rate of mutation. But the dissonance of diverse evaluative frameworks does more than simply speed up the production of novelty. The coexistence of multiple, principled standpoints means that no standpoint can be taken for granted as the natural order of things. Creative friction yields an organizational reflexivity.

From this perspective, entrepreneurship, as an enabling capacity, proves productive not so much by encouraging the smooth flow of information or the confirmation of fixed identities as by fostering a productive friction

⁴⁰To date, network analysts have typically defined cohesion as exclusive; that is, a given node can be a member of only one cohesive structure. This view was driven more by methodological limitations than by sociological insight. Georg Simmel, one of the founding figures of network analysis in the early decades of the twentieth century, had recognized that an individual could simultaneously participate in more than one cohesive group. Balazs Vedres and I adopt new methods consistent with this insight to identify a distinctive network position, “intercohesion,” at the intersection of cohesive group structures. Using historical network analysis of the ties among the largest 1,800 enterprises in Hungary from 1987 to 2001, we demonstrate that the entrepreneurial opportunities created by such overlap significantly contribute to high group performance. Balazs Vedres and David Stark, “Opening Closure: Intercohesion and Entrepreneurial Dynamics in Business Groups,” forthcoming.

⁴¹As such, my notion of entrepreneurship resonates with Mische and White’s notions of situations and publics (Mische and White, “Between Conversation and Situation”).

that disrupts organizational taken-for-granted, generates new knowledge, and makes possible the redefinition, redeployment, and recombination of resources. In short, entrepreneurship occurs not at the gap but through the generative friction at the overlap of evaluative frameworks.⁴²

As an ability to promote productive friction, entrepreneurship is not the property of an individual—it is not, for example, the personality trait of tolerating ambiguity. Instead of seeing entrepreneurs as individuals, I consider entrepreneurship as a property of organizations. That is, organizational forms will differ in their capacity to sustain an ongoing and productive rivalry among performance criteria making it possible to break out of the lock-in of habituated, unreflective activity. I use the term “heterarchy” to refer to the organizational forms with a capacity for reflexive cognition.

Heterarchy

Heterarchy⁴³ represents an organizational form of distributed intelligence in which units are laterally accountable according to diverse principles of evaluation. Two key features are at work here. In contrast to the vertical authority of hierarchies, heterarchies are characterized by more crosscutting network structures, reflecting the greater interdependencies of complex collaboration. They are heterarchical, moreover, because there is no hierarchical ordering of the competing evaluative principles. Here I discuss the first feature of heterarchies—distributed intelligence coordinated through lateral accountability. I then turn to the second, related feature of heterarchies—the organization of diversity enacted through the friction of competing performance principles.

⁴² Espeland and Stevens offer a related perspective: “We suspect that claims about incommensurables are likely to arise at the borderlands between institutions, where what counts as an ideal or normal mode of valuing is uncertain, and where proponents of a particular mode are entrepreneurial” (Espeland and Stevens, “Commensuration,” p. 332). My position has two points of similarity with this view, emphasizing, first, uncertainty about principles of valuation and, second, that this occurs at the borderlands (especially if we understand this not as boundary but overlap). But there are two very important points of difference: First, because entrepreneurship is not between institutions but between principles of evaluation, it can take place within an institution. As my cases demonstrate, it can take place within a single organization. Second, entrepreneurs are not proponents of a particular mode of valuing but are exploiting the uncertainty of multiple modes of valuing.

⁴³ As I discuss in more detail in the next section, the term *heterarchy* was first used by neurologist Warren McCulloch in 1945. Gunnar Hedlund introduced the term to the social sciences with application to the multinational corporation. See Gunnar Hedlund, “The Hypermodern MNC: A Heterarchy,” 1986; and Gunnar Hedlund and Dag Rolander, “Action in Heterarchies: New Approaches to Managing the MNC,” 1990.

Distributing Intelligence

Heterarchy's twinned features are a response to the increasing complexity of the firm's environment, in which it becomes difficult to project future states of the world from current trends. Analysts at the Santa Fe Institute have several terms to refer to these complexities. David Lane and Robert Maxfield denote them as "limited foresight horizons," in which the strategy horizon of the firm is so unpredictable that the firm cannot even be certain about what product it will be producing in the near future.⁴⁴ Stuart Kauffman adopts the language of the irregular shape of "rugged fitness landscapes" with multiple optimal solutions.⁴⁵ A smooth fitness landscape is highly regular and single peaked, reflecting a single optimal solution possessing a higher fitness value than any other potential solution. A more complex or "rugged" fitness landscape, by contrast, is not amenable to linear programming models (e.g., lower unit costs through economies of scale), because the topography is jagged and irregular, with multiple peaks corresponding to multiple optimal solutions.⁴⁶

As an example of such complexities, think of the scrambling that is taking place among firms that are producing in fields that were once previously separated into the relatively discrete categories of computers, telecommunications, software, media, or banking. When a major computer electronics company markets songs and videos (Apple) or when major software companies (Microsoft and Google) collide with newspapers and broadcast giants over the delivery of news and entertainment, we know that competition is not taking place within the boundaries of Standard Industrial Classification (SIC) categories. In retrospect, we might say that the problem was simple: the industries listed above are all converging. That retrospective view would suffer from the typical problem of 20/20 hindsight, assuming that what we see now could have been anticipated by the actors involved. But it would also be incorrect; whatever else is happening, the rearrangements have not been a case of simple convergence, as the key multimedia artifacts continue to morph. Most critically, we cannot assume that our retrospective view, with its promise of stabilization, offers guidance for the future. It does not. Because just when we have figured out the intersecting paths among the list of industries above,

⁴⁴ David Lane and Robert Maxfield, "Strategy under Complexity: Fostering Generative Relationships," 1996.

⁴⁵ Stuart Kauffman, "Adaptation on Rugged Fitness Landscapes," 1989.

⁴⁶ On the use of genetic algorithms designed to explore initially unpromising paths and thereby avoid the danger of "climbing to the nearest peak," which might simply be the highest point in a valley surrounded by yet higher peaks, see John Holland, "Complex Adaptive Systems," 1992; and Kauffman, "Adaptation."

along will come new developments in such fields as genetics, linguistics, biophysics, mapping, and even social network analysis to add to the mix of new recombinations.

The situation in “old” manufacturing sectors is scarcely different. Not so long ago, firms like General Motors (GM) were easily categorizable. Then, the major materials were steel, rubber, and plastic; the major costs were equipment and labor; and these firms made automobiles and other vehicles. Today, an automobile can be viewed as an entertainment system that we travel in;⁴⁷ various computer components, taken together, account for the greatest share of the value of a car; financing contributes the greatest share of profits; and pension plans and medical insurance for retired employees are among the highest costs. GM, doubtless, makes automobiles. But it could well be seen as being in the computer business, the finance business, the insurance business, or even the entertainment business.

Thus, in an increasing number of areas, many firms literally do not know what products they will be producing in the not so distant future. To cope with these uncertainties, instead of concentrating their resources for strategic planning among a narrow set of senior executives or delegating that function to a specialized department, heterarchical firms embark on a radical decentralization in which virtually every unit becomes engaged in innovation. That is, in place of specialized search routines in which some departments are dedicated to exploration while others are confined to exploiting existing knowledge, the functions of exploration are generalized throughout the organization.⁴⁸

These developments increase interdependencies between divisions, departments, and work teams within the firm. But because of the greater complexity of these feedback loops, coordination cannot be engineered, controlled, or managed hierarchically. The results of interdependence are to increase the autonomy of work units from central management.⁴⁹ Yet, at the same time, more complex interdependence heightens the need for fine-grained coordination across the increasingly autonomous units.

These pressures are magnified by dramatic changes in the sequencing of activities within production relations. As product cycles shorten from years to months, the race to new markets calls into question the strict sequencing of design and execution.⁵⁰ Because of strong first-mover advantages,

⁴⁷ John Urry, “The ‘System’ of Automobility,” 2004.

⁴⁸ The search for new markets, for example, is no longer the sole province of the marketing department, if units responsible for purchase and supply are also scouting the possibilities for qualitatively new inputs that can open up new product lines.

⁴⁹ Luc Boltanski and Ève Chiapello, *The New Spirit of Capitalism*, 2005.

⁵⁰ The still-definitive statement on the transformation from the long production runs of mass production to the customized production of flexible specialization is Michael Piore and

in which the first actor to introduce a new product (especially one that establishes a new industry standard) captures inordinate market share by reaping increasing returns, firms that wait to begin production until design is completed will be jeopardized in competition. Like the production of “B movies” in which filming begins before the script is completed, successful strategies integrate conception and execution, with significant aspects of the production process beginning even before design is finalized.

Production relations are even more radically altered in the processes analyzed by Sabel and Dorf as simultaneous engineering.⁵¹ Conventional design is sequential, with subsystems that are presumed to be central designed in detail first, setting the boundary conditions for the design of lower-ranking components. In simultaneous engineering, by contrast, project teams develop all the subsystems concurrently. In such concurrent design, the various project teams engage in an ongoing mutual monitoring, as innovations produce multiple, sometimes competing proposals for improving the overall design.

Thus, increasingly rugged fitness landscapes yield increasingly complex interdependencies that in turn yield increasingly complex coordination challenges. Where search is no longer departmentalized but is instead generalized and distributed throughout the organization, and where design is no longer compartmentalized but deliberated and distributed throughout the production process, the solution to the nonhierarchically distributed intelligence of heterarchical firms is distributed authority.⁵²

Under circumstances of simultaneous engineering where the very parameters of a project are subject to deliberation and change across units, authority is no longer delegated vertically but instead emerges laterally. As one symptom of these changes, managers socialized in an earlier regime frequently express their puzzlement to researchers: “There’s one thing I can’t figure out. Who’s my boss?” Under conditions of distributed authority, managers might still “report to” their superiors, but increasingly they are accountable to other work teams. A young interactive designer whom we shall meet in chapter 3 expressed this succinctly: When asked to whom he was accountable, he replied, “I report to [the project manager] but I’m

Charles F. Sabel, *The Second Industrial Divide*, 1984. Whereas mass production uses specialized tools to make standardized products (think of the dedicated tools of the Fordist car assembly line, replaced each year to make a new line of nearly identical automobiles), flexible specialization uses standardized tools to make specialized products.

⁵¹ Michael C. Dorf and Charles F. Sabel, “A Constitution of Democratic Experimentalism,” 1998.

⁵² Walter W. Powell, “Inter-organizational Collaboration in the Biotechnology Industry,” 1996.

accountable to everybody who counts on me.” Thus, corresponding to the patterns of knowledge and communication that are recombined laterally rather than flowing vertically, authority in the heterarchical firm takes the form of lateral accountability.

Organizing Dissonance

Mid-twentieth century, there existed a general consensus about the ideal attributes of the modern organization: it had a clear chain of command, with strategy and decisions made by the organizational leadership; instructions were disseminated and information gathered up and down the hierarchical ladder of authority; design preceded execution, with the latter carried out with the time-management precision of a Taylorist organizational machine. This consensus was still strong thirty years later when economist Oliver Williamson published an article in the *American Journal of Sociology* confidently assuming that he could embrace all economic activity within only two logics of coordination—“markets and hierarchies.”⁵³ By the end of the century, the main precepts of that ideal organizational model would be challenged. The primacy of relations of hierarchical dependence within the firm and relations of market independence between firms was giving way to relations of interdependence among networks of firms and among units within the firm.⁵⁴

Heterarchical forms do not take the boundaries of the firm and the boundaries of its internal units as fixed parameters. As Walter Powell and others show, the boundaries of the firm, especially those in fast-breaking sectors, are crisscrossed by dense ties of interlocking ownership and complex patterns of strategic alliances.⁵⁵ Where the environment is most volatile and uncertain, the real unit of economic action is increasingly not the isolated firm but networks of firms. Turning to network ties inside the firm, Peter Dodds, Duncan Watts, and Charles Sabel show that top-down patterns of organizational communication perform much more poorly than decentralized networks on tasks of distributed problem solving. In a simulation of network perturbation (comparable to an attack or other serious disruption), they further demonstrate that “multi-scale networks”—with

⁵³ Williamson, “The Economics of Organization.”

⁵⁴ Kogut and Zander, “Knowledge of the Firm”; Gernot Grabher and David Stark, “Organizing Diversity: Evolutionary Theory, Network Analysis, and the Postsocialist Transformations,” 1997; and Paul DiMaggio, ed., *The Twenty-First Century Firm: Changing Economic Organization in International Perspective*, 2001.

⁵⁵ Kogut, Shan, and Walker, “The Make-or-Cooperate Decision”; Powell, “Inter-organizational Collaboration”; and Walter W. Powell, Douglas R. White, Kenneth W. Koput, and Jason Owen-Smith, “Network Dynamics and Field Evolution,” 2005.

enough pockets of cohesion and enough random ties among them—have the robust connectivity required to recover rapidly and respond effectively in episodes of crisis.⁵⁶ Networks dissolve boundaries external and internal to the firm.

At this point, the reader is likely wondering why I am proposing another term—*heterarchy*—to label the emerging organizational form. If these forms exhibit distinctive network properties, then why not label them as “network organizations”? Similarly, if the emerging organizational forms are characterized primarily by their nonbureaucratic features, then terms such as “nonhierarchical” or “postbureaucratic” would come more readily to hand.

Within the triplicate of markets, hierarchies, and networks, the term *network* stands for an alternative coordinating mechanism.⁵⁷ This alone would be enough to account for the path dependency exhibited by the field in continuing to deploy “network” as a term to denote changes in organizational form. But, however fruitful in stimulating more than a decade of research, the problem of labeling these forms as “networks” conflates the name for an organizational form with an analytic approach. That is, as the literature also abundantly demonstrates, not only the emergent network form but also markets and hierarchies can be analyzed in network terms.

But there is an even more important reason for not adopting the “network” label. In economic sociology and organizational studies, social network analysis typically refers to patterns of ties among persons (or anthropomorphized entities such as firms). But actors in and across organizations do more than communicate with, or link to, others. They also evaluate performance, justify their actions, and offer reasons to explain why things should be done this way instead of that.⁵⁸ When they do so, they refer either explicitly or (more often) implicitly to principles of evaluation. Organizations can be seen as patterns of ties, but they should also be seen as sites in which actors engage in practices of justifying worth. Network ties are mechanisms of coordination but always alongside performance criteria and the evaluative principles on which they are based.

A similar logic holds for rejecting the “postbureaucratic” label. Organizations can be analyzed as patterns of authority; but all relations of authority, whether vertical or lateral, must rest on principles of account-

⁵⁶ Peter Sheridan Dodds, Duncan J. Watts, and Charles F. Sabel, “Information Exchange and the Robustness of Organizational Networks,” 2003.

⁵⁷ Walter W. Powell, “Neither Market Nor Hierarchy: Network Forms of Organization,” 1990.

⁵⁸ Charles Tilly, *Why?* 2006.

ability. And the more lateral the patterns of authority, the more diverse the principles of accountability.

When authority is distributed along lines of lateral accountability, we need to study those who make and keep accounts (and who, most emphatically, are not simply the accountants). To analyze the processes of evaluation that are central to the problems of worth in organizations, we must thus first explore the concept of *accounts*. Etymologically rich, the term simultaneously connotes bookkeeping and narration. Both dimensions entail evaluative judgments, and each implies the other: Accountants prepare story lines according to established formulas, and in the accounts given by a good storyteller we know what counts.

In organizations, as in everyday life, we are all bookkeepers and storytellers. We keep accounts and we give accounts, and, most importantly, we can be called to account for our actions. It is always within accounts that we “size up the situation,” for not every form of worth can be made to apply and not every asset is in a form mobilizable for a given situation. We evaluate the situation by maneuvering to use scales that measure some types of worth and not others, thereby acting to validate some accounts and discredit others. How am I accountable? What counts? Who counts? Can you be counted on? Will you credit my account? By which accounting?

Heterarchies flatten hierarchy. But they are not simply nonhierarchical. The new organizational forms are heterarchical not only because they have flattened reporting structures but also because they are the sites of heterogeneous systems of accounting for worth. A robust, lateral collaboration flattens hierarchy while promoting diversity of evaluative principles. Heterarchies are complex adaptive systems because they interweave a multiplicity of performance principles. They are heterarchies of worth.

Distributed authority implies not only that units will be accountable to each other but also that each will be held to accountings in multiple registers. The greater interdependence of increasingly autonomous work teams results in a proliferation of sometimes competing performance criteria. Heterarchies are organizations with multiple worldviews and belief systems such that products, processes, and properties carry multiple “tags” or interpretations.⁵⁹ Because resources are not fixed in one system of interpretation but can exist in several, heterarchies make assets of ambiguity.

⁵⁹ Andy Clark, “Leadership and Influence: The Manager as Coach, Nanny, and Artificial DNA,” 1999; and John H. Clippinger, “Tags: The Power of Labels in Shaping Markets and Organizations,” 1999.

Organizational ecologists have long held that adaptability is promoted by the diversity of organizations *within a population*.⁶⁰ I extend and, in the process, modify⁶¹ this notion by considering the problem of diversity for adaptability *within an organization*. In making the shift from the societal to the organizational level, analysis moves from the ecologists' *diversity of organizations* to the heterarchical *organization of diversity*. The adaptive potential of organizational diversity may be most fully realized when diverse evaluative principles coexist in an active rivalry within the enterprise. By rivalry, I refer not to competing camps and factions but to coexisting logics and frames of action. The organization of diversity is an active and sustained engagement in which there is more than one way to organize, label, interpret, and evaluate the same or similar activities. It increases the possibilities of long-term adaptability by better search because the complexity that it promotes and the lack of simple coherence that it tolerates increase the diversity of options.

As it shifts from specific search routines to a situation in which search is generalized, the heterarchical firm is redrawing internal boundaries, regrouping assets, and perpetually reinventing itself. Under circumstances of rapid technological change and volatility of products and markets, it seems there is no single best solution. If one solution could be rationally chosen and resources devoted to it alone, the benefits of its fleeting superiority would not compensate for the costs of subsequent missed opportunities. Because managers hedge against these uncertainties, the outcomes are hybrid forms.⁶² Good managers do not simply commit themselves to the array that keeps the most options open; instead, they create an organizational space open to the perpetual redefinition of what might constitute an option. Rather than a rational choice among a set of known options, we find practical action fluidly redefining what the options might be. Management becomes the art of facilitating organizations that can reorganize themselves.

The challenge of the modern firm is the challenge of building organizations that are capable of generating new knowledge. Flexibility requires an ability to redefine and recombine assets: in short, a pragmatic reflexivity. To do so, heterarchies maintain and support an active rivalry of evaluative principles. Rivalry is not competition among units based on the same

⁶⁰ "A system with greater organizational diversity has a higher probability of having in hand some solution that is satisfactory under changed environmental conditions." Michael T. Hannan, "Uncertainty, Diversity, and Organizational Change," 1986, p. 85.

⁶¹ I elaborate my theoretical discussion of these issues in the section "From Diversity of Organizations to the Organization of Diversity" in chapter 5.

⁶² Sabel, "Moebius-Strip Organizations"; and Charles F. Sabel and Jonathan Zeitlin, "Stories, Strategies, Structures: Rethinking Historical Alternatives to Mass Production," 1997.

principles of evaluation. Neither is it compartmentalization, in which different principles of worth map to separate departments or units, bounded and buffered from contamination. It is not a replicative redundancy or slack (more of the same) but a generative redundancy of difference.

I write of *organizing dissonance* because some forms of friction can be destructive. When personalized, differences can be petty as opposed to productive. To be constructive, rivalry must be principled, with the adherents of the contending frameworks offering reasoned justifications. Moreover, where multiple evaluative principles collide in heterarchical forms, the danger is that arguments displace action and nothing is accomplished. Success requires attention to the structure of temporal processes. I refer to a collective sense of rhythm and timing—of when to make temporary settlements to get the job done, with the knowledge that this is not a once-and-for-all resolution of the disagreements—as a *discursive pragmatism*. Heterarchy is neither harmony nor cacophony but an organized dissonance.

Dissonance occurs when diverse, even antagonistic, performance principles overlap. The manifest, or proximate, result of this rivalry is a noisy clash, as the proponents of different conceptions of value contend with each other. The latent consequence of this dissonance is that the diversity of value-frames generates new combinations of the firm's resources. Because there is not one best way or single metric but several mutually coevolving yet not converging paths, the organization is systemically unable to take its routines or its knowledge for granted. It is the friction at the interacting overlap of multiple performance criteria that generates productive recombinations by sustaining a pragmatic organizational reflexivity. Heterarchies create wealth by inviting more than one way of evaluating worth.

A Metaphor for Organization in the Twenty-first Century

From where have we found metaphors for organization? The manufacture of pins served as Adam Smith's metaphor for the division of labor. Clocks have been ever popular; for example, interrupted watchmakers served as Herbert Simon's parable for the "nearly decomposable" features of hierarchical systems.⁶³ Where organizations, whether as national economies or firms, were conceived as systems of planning, linear programming served both as method and as metaphor. More recently, organizational ecology

⁶³ Herbert Simon, *The Sciences of the Artificial*, 1969.

has looked to biological systems for metaphors of evolution, selection, population, births, and deaths.

But the dominant and long-lasting metaphor for organization, remarkably consistent over fifteen centuries, comes from religion. The term *hierarchy* was originally coined by Dionysius the Areopagite, a fifth-century medieval theologian, in two treatises on the celestial and ecclesiastical hierarchies, respectively.⁶⁴ In his *Celestial Hierarchy* we find all the elements of the metaphor fully elaborated: nine distinct levels organized in three tiers corresponding to senior executives, middle management, and lower-level functionaries, with the angels (closest to humans) at the bottom and the seraphim (closest to God) at the top. Each level supervises the level below and reports to the level above; beings can advance through promotion up the ordering; information cannot bypass the chain of command; and the structure is based on a strict hierarchy of knowledge, with the literally all-knowing boss at the top.

The term *heterarchy* is not of such heavenly provenance. It was coined at the beginning of the computer age, in 1945, by neurologist Warren McCulloch in an article published in the (appropriately hybrid) *Bulletin of Mathematical Biophysics*. McCulloch titled his elegant, five-page paper “A Heterarchy of Values Determined by the Topology of Nervous Nets.”⁶⁵ In place of Dionysius the Areopagite’s nine levels, McCulloch simulates a network of six neurons. Several years earlier, with Walter Pitts, McCulloch showed how to formalize the brain as a network of neurons viewed as logical processing elements.⁶⁶ In the “Heterarchy of Values” paper, he is simulating choice.

In his simulation, McCulloch first maps the neuron circuits on a plane with no diallels, or “crossovers.” He observes that the resulting structure is a hierarchy: “The order is such that there is some end preferred to all others, and another such that all are preferred to it, and that of any three

⁶⁴ See especially Gunnar Hedlund, “Assumptions of Hierarchy and Heterarchy, with Applications to the Management of the Multinational Corporation,” 1993.

⁶⁵ Warren S. McCulloch, “A Heterarchy of Values Determined by the Topology of Nervous Nets,” [1945] 1965.

⁶⁶ Warren S. McCulloch and Walter H. Pitts, “A Logical Calculus of the Ideas Immanent in Nervous Activity,” 1943. This work was critical in the definition of the classical computer architecture based on stored programs devised by John von Neumann. It also laid the basis for the new field of “automata theory.” Another collaboration (Pitts and McCulloch, “How We Know Universals: The Perception of Auditory and Visual Forms,” 1947) was a pioneering paper on neural networks for pattern recognition showing how visual input could control motor output through the distributed activity of a neural network without the intervention of executive control. McCulloch and Pitts later collaborated with Lettvin and Maturana on one of the classic papers on single-cell neurophysiology (“What the Frog’s Eye Tells the Frog’s Brain,” 1959). For an overview, see Michael A. Arbib, “Warren McCulloch’s Search for the Logic of the Nervous System,” 2000.

if a first is preferred to a second and a second to a third, then the first is preferred to the third” (p. 43).

McCulloch explicitly notes the similarity of such a hierarchical system to “the sacerdotal structure of the church” and implicates the notion of a transitivity of values with “the notion of the sacred or holy.” He points out that “to assert a hierarchy of values is to assert that values are magnitudes of some one kind. Summarily, if values were magnitudes of any one kind, the irreducible nervous net would map (without diallels) on a plane” (p. 43).

Aware that extant theories of value assume that values can be treated as magnitudes of some one kind, McCulloch argues to the contrary, stating explicitly that “for values there can be no common scale.” The next step elegantly anticipates Kenneth Arrow’s Impossibility Theorem on the intransitivity of preference orderings:

Consider the case of three choices, *A* or *B*, *B* or *C*, and *A* or *C* in which *A* is preferred to *B*, *B* to *C*, and *C* to *A*. (p. 43)

To simulate intransitivity as the more realist problem in modeling choice, McCulloch presents two solutions: introduce a diallel, a crossover, in the network (if represented on a plane) or shift to the more complex topology of a torus. Either solution is nonhierarchical:

An organism possessed of this nervous system—six neurons—is sufficiently endowed to be unpredictable from any theory founded on a scale of values. It has a heterarchy of values, and is thus interconnectively too rich to submit to a *summum bonum*. (p. 44)

McCulloch’s highly original work led to the development of artificial networks as a new computing technology, which, in turn, fed back to the computational modeling of the brain.⁶⁷ His idea of redundant network ties was important for the conception of reliable organization built from unreliable parts, laid the basis for the new field of “automata theory,” and contributed to the fertile concept of “self-organization.”⁶⁸ “A Heterarchy of

⁶⁷ After publishing “A Heterarchy of Values,” McCulloch chaired a series of ten meetings set up by the Macy Foundation to explore what biologists could teach computer scientists about signal processing, computation, and communication. The group involved biologists, technologists, and social scientists including John von Neumann, Norbert Wiener, Gregory Bateson, and Paul Lazarsfeld. Its inaugural meeting in New York, March 1946, was titled “Feedback Mechanisms and Circular Causal Systems in Biological and Social Systems.” For summaries of the conferences and lists of participants see www.ascybernetics.org/foundations/history/MacySummary.htm. For a lively discussion of the Macy Conferences, see Jean-Pierre Dupuy, *The Mechanization of the Mind: On the Origins of Cognitive Science*, 2000.

⁶⁸ John von Neumann, “Probabilistic Logics and the Synthesis of Reliable Organizations from Unreliable Components,” 1956; and Warren S. McCulloch, “The Reliability of Biological Systems,” 1960.

Values” is cited as an inspiration for non-Turing, or non-Euclidean, computing, most recently in efforts to develop biology-based computing.

As one of the first efforts at network analysis—developed at the intersection of neurology, computer science, mathematics, biophysics, and linguistics⁶⁹—McCulloch’s pathbreaking paper is an appropriate source for a new metaphor for organization in the twenty-first century. Metaphors matter. The field of organization studies will be enriched if we adopt a concept that has applicability to the problem of “organization” inclusive of, but also of wider generality than, the study of formal collectivities of human agents.

Biologists, for example, have recently rediscovered the problem of organization (of which “the organism” is only the most apparent instance); levels of organization extend down to the cellular, even molecular, level, and outward to speciation and processes of coevolution.⁷⁰ Life is organization. Similarly, to speak of information or knowledge is to speak of organization. Work by colleagues in information science and the study of cognition and learning⁷¹ suggests that hierarchy is not the only form of organization in these fields.

Most revealing are changes in our conception of code. Formerly, the term evoked procedures of *codification* in which elements were organized into a system of encompassing and mutually exclusive categories. With language as the exemplar of nonhierarchical structuring, code is now grasped in network terms. Researchers in genetic code, for example, see two structural properties as critical to the evolution of evolvability. The first is modularity, whereby elements retain their structure even as they are recombined with other modules in higher levels of organization. The second, no less important, is pleiotropy, whereby a sequence of genetic code is expressed in more than one subsystem.⁷² In network terms, genetic code is tangled code. The term comes from computer science, referring to

⁶⁹ McCulloch was involved in the design of a (graphical) triadic logic and was very interested in Charles Sanders Peirce’s experiments with a triadic logic (see Arbib, “McCulloch’s Search”). Peirce, regarded as the founder of philosophic pragmatism, argued that all cognition is irreducibly triadic. His triadic theory of signs as icon, index, and symbol was a major contribution to modern linguistics.

⁷⁰ See especially Walter Fontana and Leo Buss, “‘The Arrival of the Fittest’: Toward a Theory of Biological Organization,” 1994; and Walter Fontana and Leo Buss, “The Barrier of Objects: From Dynamical Systems to Bounded Organizations,” 1996.

⁷¹ Geoffrey Bowker and Susan Leigh Star, “Knowledge and Infrastructure in International Information Management: Problems of Classification and Coding,” 1994; and Luis M. Rocha, “Adaptive Webs for Heterarchies with Diverse Communities of Users,” 2001.

⁷² Gunter P. Wagner and Lee Altenberg, “Complex Adaptations and the Evolution of Evolvability,” 1996; and Thomas F. Hansen, “Is Modularity Necessary for Evolvability? Remarks on the Relationship between Pleiotropy and Evolvability,” 2003.

the bane of the programmer dealing with crisscrossing pieces of software. But where tangled code was to be avoided at all costs, work at the forefront of software engineering—for example, in the qualitative shift from object-oriented to aspect-oriented programming—is developing heterarchical software code in a field that was once seen as quintessentially hierarchical.

As a more general process, then, heterarchy refers to an organizational structure in which a given element—a statement, a deal, an identity, an organizational building block, a sequence of genetic code, a sequence of computer code, a sequence of legal code—is simultaneously expressed in multiple crosscutting networks. “A program which has a structure in which there is no single ‘highest level,’ or ‘monitor,’ is called a heterarchy.”⁷³

Thus, as a metaphor for organization in the twenty-first century, heterarchy has its provenance at the intersection of extraordinarily generative sciences. It also has potential for applicability across a wide set of domains including computer science, biology, and informatics as well as organizational analysis in the social sciences. It does have one drawback: it does not immediately trip off the tongue on first vocalization. But the terms “bureaucrat” and “bureaucracy”—as amalgams of bureau and aristocrat/aristocracy—also seemed peculiar when introduced to account for a new role and a new phenomenon. Despite this drawback, *heterarchy* has a distinct advantage because, as a member of a family of terms such as monarchy, anarchy, polyarchy, and hierarchy, the term immediately denotes a form of governance. Indeed, perhaps the first exemplar of heterarchical social organization was the U.S. Constitution, with its three branches of government, each based on a distinctive principle of legitimation, none of which is overarchingly superior.⁷⁴ As a form of governance, heterarchy organizes dissonance. But it is not a panacea. Just as the metaphor of heterarchy is not of heavenly provenance, so the problems that the implementation of heterarchy creates are all too human.

Worth in Contentious Situations

I follow John Dewey’s insights on problems of inquiry, worth, and uncertainty; I also look to him for guidance on issues of methodology. In his *Theory of Valuation*, Dewey insists repeatedly on the need to study

⁷³ Douglas R. Hofstadter, *Gödel, Escher, Bach*, 1979.

⁷⁴ See László Bruszt, “Market Making as State Making: Constitutions and Economic Development in Postcommunist Eastern Europe,” 2002; and Martin Landau, “Redundancy, Rationality, and the Problem of Duplication and Overlap,” 1969.

processes of “actual valuation.” His remarks from 1939 remain on target today:

[T]he notion that an adequate theory of human behavior—including particularly the phenomena of desire and purpose—can be formed by considering individuals apart from the cultural setting in which they live, move, and have their being—a theory which may justly be called metaphysical individualism—has united with the metaphysical belief in a mentalist realm to keep valuation-phenomena in subjection to unexamined traditions, conventions, and institutionalized customs.⁷⁵

The case studies presented here adopt Dewey’s guidelines on both counts. First, following Dewey’s injunction to study actual valuations in “cultural settings,” I further specify the notion of setting, using ethnographic methods to study three very different kinds of workplaces. I study situated cognition *in situ*. In each case the ethnographic site is a single room—a factory workshop with about 100 manual workers, a former printing loft converted to an open-plan layout housing about 80 new-media employees in Manhattan’s Silicon Alley, and the Wall Street trading room of a major international investment bank, similarly open plan, with about 160 traders.

Second, I follow Dewey’s advice that practices of evaluation should not taken as “unexamined traditions, conventions, and institutionalized customs.” Methodologically, the move is not simply to employ ethnography in specific settings but to shift from the analysis of *institutions* to the study of indeterminate *situations*.⁷⁶ As we shall see in the following chapters, unsettling situations are special moments in which the researcher discovers what is at stake because it is in such situations that the actors themselves become cognizant of what had previously been taken for granted. By studying cases involving the heterarchical rivalry of evaluative principles, we see that traditions, conventions, and institutionalized customs are not left unexamined. Indeed, they are opened up to reflective cognition by the actors themselves.

Because I examine situations in three distinctively different settings, the analytic lens for studying worth—evaluative practices—changes focus as we move from case to case. Correspondingly, the forms of indetermi-

⁷⁵ Dewey, *Theory of Valuation*, p. 64.

⁷⁶ On the rejection of both methodological collectivism *and* individualism in favor of “methodological situationalism,” see Karin Knorr-Cetina, “Introduction: The Micro-sociological Challenge of Macro-sociology,” 1981.

nate situations and the distinctive challenges of recognition are specified as analytically appropriate for each case.

In the case of the Hungarian factory, we meet 18 highly skilled workers, operating machine tools to build machine tools, who recognize an opportunity to win recognition of their self-proclaimed worth. The cultural setting is state-socialist Hungary with its central planning under one-party rule. More specifically, it is the exciting period of the mid- to late 1980s, after the upheavals of the rise and later suppression of Solidarity in Poland but before the collapse of communism in 1989. Yet more specifically, the machine shop of about 100 workers is part of Minotaur, one of the largest state-owned enterprises in Hungary, with more than 11,000 employees. The initial situations arise once Minotaur recognizes the legal right for its employees to form “partnerships,” using the factory’s equipment on the “off-hours,” during which the members of the partnership are free to organize work on their own terms. If the routines of the shop floor had ever been “taken-for-granted,” they certainly could be no longer. The parent company Minotaur exploits the partnership form as a way to earn hard-currency revenues; meanwhile the members of the partnership itself capitalize on the new form as a chance to demonstrate their worth. But their success creates new situations in which the toolmakers, however unified in their agreement that skill is the ultimate principle of value, face a series of perplexing challenges about how to measure its performance. In the process, they come to recognize new criteria of worth and new identities bound up with them. Later, with the collapse of communism after 1989 and the privatization of their factory, they confront new situations that challenge their worth, provoking them to articulate again their sense of justice.

The new-media employees in the second ethnography are also, in their own way, toolmakers building something—not operators of drills and lathes for cutting and boring costly metals but software programmers and interactive designers using new-media tools to build sophisticated online retail websites. The cultural setting is Manhattan, following the recession of 1993 that lowered rents and left programmers as well as artists and copywriters looking for work. More specifically, it is Silicon Alley at the end of the 1990s after the initial public offerings of Netscape and theGlobe.com but before the dot-com boom went bust. Yet more specifically, it is in NetKnowHow, a start-up company that grew from 15 to 150 employees during the several years we studied it. Here the relevant situations are in projects where business strategists, interactive designers, programmers, information architects, and merchandising specialists bring distinctive disciplinary identities. Projects are sites of contention, not primarily about

the worth of the respective specialists but about the best criteria by which to evaluate the worth of the websites they are building. It is this rivalry of evaluative principles that allows the firm to never take its knowledge for granted. The collision of performance criteria yields a distributed cognition capable of the kind of search in which you don't know what you're looking for but will recognize it when you find it.

The arbitrage traders in the third ethnography would seem to be anything but toolmakers. But, as we shall see, each trader skillfully customizes his tools of the trade. The setting is Wall Street investment banking. More specifically, it is exactly at the turn of the century in the period after the emergence of quantitative finance but before the Enron scandal. Yet more specifically, it is the hedge fund of a firm we call International Securities, a major international investment bank whose traders are engaged in sophisticated arbitrage. Like the Hungarian toolmakers (uniformly highly skilled workers) and the new-media workers (almost uniformly young and culturally hip), the traders are culturally homogeneous. Even more than the Hungarian toolmakers, they share a common definition of how to measure the worth of a trader, in this case by "the value of his book" (the profitability—computed yearly, monthly, daily, hourly, literally minute by minute—of a given trader's deals). But this marked homogeneity belies a generative diversity, for although the traders share a metric for evaluating one another, they differ on the most salient dimension of their work: how to measure value in the games of arbitrage. As to situations, it might seem at first glance that a trading room is a site for responding to situations "out there" in the markets. But this is the nightly news version of markets with stories of crises, surges, and swings. The actual problem for these arbitrage traders is less how to respond to situations "out there" than how to recognize situations that their competitors have not seen. As we shall see, the trading room is organized as a cognitive ecology in which commitments to distinctive principles of arbitrage combine with interactions across these principles to produce a situated cognition that not only recognizes already-known kinds of opportunities but also *re*-cognizes situations as opportunities. In the epilogue to this chapter, I examine how the traders responded to a crisis situation, potentially a crisis of their identities, after their trading room was destroyed in the September 11 attack on the World Trade Center.