PART III

THE SPECIALIZATION OF ENTERPRISE

The Atlantic Telegraph Cable Fleet, 1866

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According to the Met's website, laying a telegraphic cable beneath the Atlantic was "one of the 19th century's great technological achievements." Robert Charles Dudley's 1866 painting shows the cable-laying fleet assembled at Berehaven on the southwestern coast of Ireland. The fleet then sailed to Canada, reaching Newfoundland on July 28, 1866, after a sixteen-day voyage, having laid 1,960 miles of cable.

Note the diversity of the fleet. The six-masted Great Eastern, five times larger than any other vessel of its time, had been converted to cable laying after losing money carrying passengers. The Great Eastern's support ships included HMS Terrible, the largest frigate built for the Royal Navy when it was designed, the Alby, the Medway, and the William Cory. In addition, as Dudley's painting shows, rowing boats ferried crew and provisions to the fleet. This diversity symbolizes the entrepreneurial ecosystem that produces much of modern innovation, as we will see.

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Including Uncertainty: Recapitulation and Preview

Entrepreneurship offers a natural staging ground for renewing uncertainty-based research. Knight had called his examination of the "role of the *entrepreneur*, or enterpriser," the main "technical contribution" of *Risk, Uncertainty and Profit*.[1] Little else was "fundamentally new"[2] in the book. But as mentioned in chapter 6, the "perfectly interlocking" microeconomics that developed after the 1930s left no room for uncertainty or entrepreneurship. Both were off the paradigmatic research agenda. Later developments of industrial organization (IO) and information economics (chapter 7) could have let both back in, but the pioneering researchers and their followers had different priorities. Many targeted Big Business and the Invisible Hand.

By the end of the twentieth century, however, top business schools began recruiting large numbers of young economists to satisfy the growing demand for entrepreneurship courses. These recruits researched entrepreneurial topics but maintained the uncertainty-free focus of mainstream economics. This focus has created a gap that my uncertainty-based conjectures can help fill.

As mentioned (chapter 4), I analyze two applications—the specialization of entrepreneurial initiatives and the role of imaginative discourse. These applications have a dual purpose: (1) to improve our understanding of entrepreneurship in the modern economy and (2) to suggest an exemplary "paradigm-case" demonstrating what a broader uncertainty-based approach can reveal.

This chapter sets up the first of the two applications (on specialization) by

- Describing how economists who undertook entrepreneurship research repurposed models taken from information economics that focused on incentives rather than uncertainty.
- Recapping my conjectures about uncertainty outlined in chapter 3 and expanded in the chapters on Keynes, Ellsberg, and Simon.
- Previewing how these conjectures can add to our understanding of the specialization of entrepreneurial initiatives.

1. Repurposing Incentives

Unexpected Boom As mentioned in Part 1, William Baumol's 1968 article in the *American Economic Review* lamented that without entrepreneurship, economic theory was a *Hamlet* without the Prince.[3] In a 1993 book, Baumol repeated, nearly verbatim, his 1968 observations that economic theory did not "deal effectively with the description and analysis of the entrepreneurial function."[4]

Still No Prince

References to entrepreneurs in "indexes of recent writings" Baumol complained in his 1993 book, remained "scanty or, more often, totally absent."[5] "While some recent theoretical writings seem at first glance to offer a convenient place for an analysis of entrepreneurial activities, closer inspection indicates that matters have not really improved substantially on this score."[6]

Oliver Williamson's "managerial discretion model," Baumol wrote, featured "a calculating robot, a programmed mechanical component in the automatic system that constitutes the theoretical model of the firm."[7] New models of investment programs and product launches seemed to "smell more of the ingredients of entrepreneurship" but did not take us "a whit further in the analysis of entrepreneurship." They remained "mechanistic and automatic and call[ed] for no display of entrepreneurial imagination or initiative."[8]

Baumol was frank that his own book would not "discuss the activities that constitute entrepreneurship." Instead, he would focus on the "institutional arrangements that encourage the exercise of entrepreneurship and that provide incentives for it to take productive directions."[9] I argue in the chapters to follow that the same emphasis on incentives—at the expense of uncertainty—continues to constrain economic research on entrepreneurship.

Then in the 1990s, soaring demand for entrepreneurship courses ignited a boom in entrepreneurship research. Harvard Business School (HBS) offered the first-ever course in entrepreneurship in 1947. In 1991, about a dozen business schools offered entrepreneurship courses. By 1998, according to Ethan Bronner's *New York Times* story published that September, about 120 schools offered majors in entrepreneurship. "Driven by student and alumni demand," Bronner wrote, "no field is hotter today in business studies than that of entrepreneurship."[10]

Yet although donors were sending "truckloads of dollars" for chairs in entrepreneurship, there were "no scholars to fill them." Schools often hired part-time adjunct faculty and recent PhDs whose training and research had not emphasized entrepreneurship.[11] And many new hires had been trained in economics, even though the discipline had kept entrepreneurship outside its purview.

The young recruits nonetheless proved exceptionally enterprising and capable. Like European settlers of newly "discovered" continents, the new arrivals to entrepreneurship dominated their new terrain while keeping the core conventions and convictions of their homelands. As the first business economics PhD to secure tenure in Harvard's entrepreneurship unit—and the first (in 1990) to publish research on VCs in a top finance journal—used to say, "Entrepreneurship is not what or how I study, it's where I study it." (The declaration was likely intended to deflect scholarly skepticism).

Applying models and methods from the homeland secured publication in top journals eager for papers about the new entrepreneurial continent. The process snowballed. Publishing in top journals won the pioneers tenure in top schools, attracting more of the brightest and best young economists. Helped along by ample funding, a large, influential community of economists who researched entrepreneurship emerged. For example, the first meeting of the entrepreneurship working group at the National Bureau of Economic Research (NBER) in 2002 had 25 invitees and 20 attendees.[12] The group now invites papers from more than 400 researchers, and its fall 2021 meeting had more than 150 registered participants.[13]

A Shrewd and Ruthless Prince Expectedly, tenure-winning entrepreneurship research conformed to paradigmatic rules. Articles published in top journals contained formal models or statistical analyses—and excluded uncertainty. The rules also dictated what was and was not studied. Venture capital contracts, initial public offerings (IPOs), and patents, which provided a rich vein of statistical data and opportunities for formal modeling, attracted attention. Research on informal startups (that do not raise venture capital, expect to go public, or file for patents) was less popular and undertaken mainly from a statistical lens. Economists also avoided Baumol's "clever ruses" and "ingenious schemes"—the stuff of stories told by adjunct instructors but disdained by serious scholars.[14] Knight's main "technical contribution" was also forgotten. A 2021 NBER paper attributes to Knight the definition of entrepreneurs as "individuals who take economic risks,"[15] perhaps because the authors reject Knight's 1921 distinction between risk and uncertainty or, less charitably, because they had not read his century-old book.[16]

The uncertainty-free use of information economics is notable. Researchers studying fund-raising and contracting in entrepreneurial ventures focused on

information asymmetries and conflicts of interest. Signals of truth-fulness and "incentive compatible" contracts to align interests became standard modes for analyzing the relationship between investors and promoters of new and fledgling businesses. Implicitly, economists researching entrepreneurship treated lying and cheating, not uncertainty or honest mistakes, as the primary problems they should study. Their entrepreneurial Prince was no wishy-washy Hamlet.

The lying and cheating path was well-trodden. As mentioned in chapter 7, information economists had emphasized such problems before entrepreneurship research took off. Yet avoiding uncertainty and mistakes was, I believe, a mistake. True, uncertainty-free models can provide insights about the dangers of dishonesty that resonate with everyday experiences, such as the benefits of a professional inspection before purchasing a property or car. Similarly, we take costly signals more seriously. A letter or roses delivered by courier service gets more attention than an email or text message. But other uncertainty-free applications rely on implausible examples.

Signaling Unobservable Quality

In an archetypal example of signaling, employees communicate their true but otherwise unobservable talents to employers by acquiring expensive educations. But why should employers trust young applicants to know their actual abilities? As it happens, educational institutions award observable uncertainty-reducing grades that employers can use to rank and screen applicants. Moreover, employers who require applicants to document their grades never ask for tuition bills to validate signals. Nor do state-subsidized fees reduce the value of degrees from selective institutions. My undergraduate college, the heavily state-subsidized Indian Institute of Technology, charged minuscule fees while admitting very few students after a three-day entrance exam. Other unsubsidized private schools charged high tuitions and levied steep "capitation fees" for admission. Guess which degrees employers favored as evidence of talent? And could merit scholarships (John Maynard Keynes, whose father had independent means, got one to go to Cambridge) diminish job prospects by reducing the potential for credible signaling (by lowering the costs of university educations)? Arguably, the tangible "weight of evidence" (chapter 8) of entrance exams and scholarships far outweighs lost signals of unobservable quality.

Moreover, as mentioned in chapter 7, information economics did not require excluding uncertainty. In the 1980s and 1990s, Raaj Sah and Joseph

Stiglitz studied problems of controlling honest mistakes. Of course, technical challenges could make combining information asymmetries and misaligned incentives with uncertainty and honest mistakes in an equilibrium model difficult. Excluding uncertainty and mistakes may also be a sensible choice for analyzing one- off, arm's-length transactions such as selling secondhand cars. When strangers—who expect each other to take whatever they can get away with—trade, concerns about mistakes may be inconsequential. Indeed, buyers may hope that sellers mistakenly underprice their offerings—and sellers hope that buyers will overpay. And even with known individuals, we often "trust but verify." Parents and children, husbands and wives, bosses and subordinates, and teachers and students cannot ignore the possibility of misrepresentations and worse.

However, common experience also supports the dictum attributed to Napoleon: "Never ascribe to malice that which can be adequately explained by incompetence." And in ongoing relationships, concerns about honest mistakes are at least as crucial as worries about lying and cheating. Concerns about mistakes may even dominate within "unitary" groups and organizations, such as families and partnerships whose members have common interests. When we first select a personal or professional partner, we may be seriously concerned about honesty. Lying and cheating can also end such relationships. Between the starting and the ending, however, mutual concerns about misjudgments will often take priority over worries about dishonesty. Mechanisms to control information asymmetries and misaligned incentives are thus not a suitable hammer for many real-life nails.

Nonetheless, the preoccupation with lying and cheating, reflected in Leroy and Singell's 1987 creative reinterpretation of Knightian uncertainty as moral hazard (chapter 7), has endured. Asymmetric information and misaligned incentives—and to a lesser degree, behavioral defects (chapters 11 and 12)—have remained the primary lens for economists studying entrepreneurship and many other topics. The "spawning" of research on mistakes produced by lim-ited information that Stiglitz predicted in 2001 did not proceed. The limited re-search on mistakes and misjudgments focuses on "screening out" individuals with poor decision- making abilities—not, as in the Sah and Stiglitz papers, on organizational routines to catch the errors that capable decision-makers occasionally make.

Excluding uncertainty seems particularly ill-suited to studying entrepreneurship—an activity in which correctness and error are critical determinants of success or failure. "Incentive-compatible" contracting models that assume away uncertainty, for example, may help explain some conditions used to secure venture capital.[17] These models do not, however, plausibly

explain why so many entrepreneurs who stake all their wealth, borrow as much as they can, and are willing to sign incentive-compatible contracts cannot secure funding.

Advocates of incentive-based, uncertainty-free explanations have proposed a catch-all category of "private benefits" to include an egotistical preference for one's own opinions. Conflicts of interest can thus cover disagreements and not just the financial stakes. But, invoking private benefits can make explanations tautological or contrived, like postulating epicycles to defend the Ptolemaic, geocentric model of the universe.

I do not exclude concerns about incentives and dishonesty from my analysis, but to balance out the lopsidedness of mainstream economic research—and offer a different perspective—I stress concerns about honest mistakes as barriers to enterprise. Unlike the new behavioralists, I also disregard demonstrably illogical reasoning or foolishness. I base my analysis on conjectures, recapitulated below, that assume procedurally reasonable conduct (per Simon, chapter 9) while modernizing Knight's 1921 analysis of uncertainty (Part 1).

2. Recapitulation of Conjectures

Uncertainty as Doubt I specify uncertainty as doubt, typically produced by missing information about known unknowns, where we know what we do not know. The subjective or internal mental state of doubt thus has its source in a more objective external situation or condition. This specification, which follows research on ambiguity started by Ellsberg (chapter 10), includes incomplete prior knowledge and expertise as doubt-producing missing information. For example, I regard my ignorance of how to interpret electrocardiograms as a source of uncertainty. However, I exclude inchoate anxieties about unknown unknowns.

Like Knight's situational uniqueness, known-to-be-missing information can produce misjudgment and error. We may overestimate the prospects of an odds-on favorite winning a race if we are unaware of its jockey's mental distress. Without a radar map, we may fail to foresee a thunderstorm. Similarly, without an X-ray, orthopedists may miss hairline fractures, and without DNA evidence, prosecutors may jail the innocent.

The missing-information specification subsumes Knight's distinction between uncertainty and numerical "risks." Risk is often regarded as the numerical probability of loss—and in financial markets, as the volatility of prices. The

extent of missing information—the source of uncertainty in my specification—is unrelated to the magnitude of such risks. For example, bets on long-shot horses are riskier than bets on odds-on favorites, in the common probabilistic sense. But the information from which bookmakers estimate odds may be the same, higher, or even lower (if the long-shot horses have longer track records, as it were).[18]

However, Knight's risk-uncertainty dichotomy *does not* play a significant role in my modernization project. Instead, my conjectures and applications emphasize:

Targets and Sources of Doubt Like Keynes's broad 1921 conception of probability (chapter 8), my specification of uncertainty includes but is not limited to doubts about statistical distributions. Doubts routinely have contextual or specific ("one-off") targets, such as whether a patient has heartburn or clogged coronary arteries. In fact, my applications emphasize doubts about one-offs and not statistical distributions. I likewise emphasize contextual sources of doubts (such as the ambiguity of a particular patient's symptoms) rather than statistical sources (such the inconclusive results of clinical trials).[19]

Degrees of Doubts Diverse contextual sources usually make it impossible to numericize the extent of missing information and thus the uncertainty produced. Nonetheless, my specification allows many kinds of doubts to be ranked and ordered as "more" or "less." For example, a medical diagnosis based just on patient symptoms is more uncertain than one that includes lab tests. Therefore, while "degrees," like doubts, pertain to internal mental states, observable "weights of evidence" (per Keynes's *Treatise*) affect their extent—although neither degrees nor weights are quantifiable.

Disagreements Uncertainty about what is or could be can spur discovery, innovation, and enterprise. But uncertainty can also produce disagreements by prompting quirky responses, as Knight's and Elster's analyses suggest. Differences may arise without quirks because individuals with different imaginations and prior experiences fill in gaps in their missing information differently. As Ellsberg's ambiguity research suggests, even simple missing information can produce different (yet reasonable in the ordinary sense) psychological reactions ranging from affinity to aversion. And different reactions can hinder collaboration even if there are no information asymmetries or conflicts of interest (except in some tautological "private benefits" sense).

Variations in Routines In Simon's decision- making theories (chapter 9), un-certainty encourages a routinized search for solutions that satisfy aspirations rather than maximize utility. My view of routines goes beyond searching for and selecting satisficing solutions. Routines also help secure uncertainty- reducing information (as in police procedures to identify the most likely perpetrators), justify claims (as in criminal trials), and reduce disagreements (as in jury deliberations). These functions influence the design of routines, such as the min-imum information needed to justify choices and default rules if the necessary data is obtainable (shown in Table 3.1).

Typically, organizations specializing in high-stakes activities follow "strict" routines, requiring high levels of information (Keynes's evidentiary weight) and extensive scrutiny of choices. Strict routines, often multistage, include research to find initially missing information.

Research cannot always discover doubt-reducing information, however. Technical barriers can present insurmountable obstacles. Until about the mid- 1960s, angiograms that physicians now routinely use to resolve uncertainties about heart problems would have been technically impossible. Securing missing information may also be prohibitively costly. But regardless of why the information is unavailable, strict routines discourage novel or innovative choices where the amount of missing information is irreducibly high (Figure 3.1).[20]

3. Previewing the Specialization Application

Scope, Framework, and Antecedents In principle, uncertainty is everywhere. All worldly "matters of fact," according to Hume's *Enquiry concerning Human Understanding*, warrant some doubt. We can never be absolutely certain about natural events (from sunrises to tsunamis) or human efforts (from solving jigsaw puzzles to space exploration). My scope is far narrower than of Hume's 1748 *Enquiry* (or Keynes's wide- ranging 1921 *Treatise on Probability*), however. I am mainly interested in efforts to change what would otherwise happen. My conjectures (such as the relationship between novelty, stakes, and strict routines, depicted in Figure 3.1) reflect this focus on forward-looking human enterprise.

Yet enterprising efforts to change what would otherwise happen are also diverse and commonplace. They span initiatives in, for instance, public health, environmental protection, urban planning, space exploration, politics, and the arts. Examining this vast range would weaken my demonstration of how taking uncertainty seriously can improve our understanding of entrepreneurship.

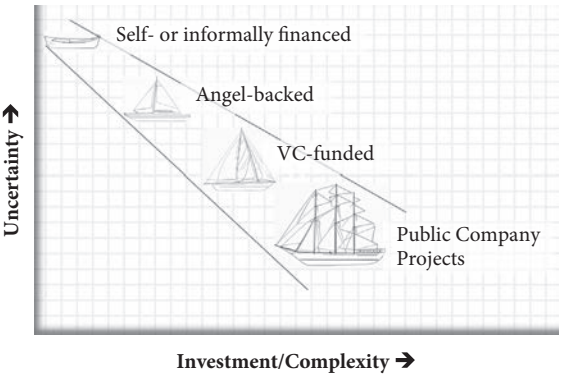

Figure 13.1 Specialization Diagonal
Source: *Simplified from Figure 4.1*

Therefore, following Simon's example of emphasizing *business* in his 1978 lecture, I limit my attention to contemporary commercial initiatives. Accordingly, while keeping the general conjectures about novelty, stakes, and routines (chapter 3) in mind, the following four chapters examine the more detailed map of commercial initiatives and the functional rationality (Simon, chapter 9) of its specialization diagonal (Figure 13.1).

As we will see, the coordinates of the map and its functional rationality—why the specialization on the diagonal makes sense—turn on a three-way "alignment" or "fit" between: (1) the routines used to evaluate and plan entrepreneurial initiatives; (2) The uncertainty, complexity, and resource requirement of the initiatives; and (3) The sources financing the initiatives (Figure 13.2).

My analysis follows the spirit of Sah and Stiglitz's[21] models of the relationship between organizational design and investment errors and, of course, Simon's routines. The crucial details of my analysis, particularly the influence of funding sources, adapt ideas from papers by Gene Fama and Michael Jensen.[22] The Fama and Jensen papers (which are not their most cited) relate the control mechanisms of different organizations to the complexity and capital

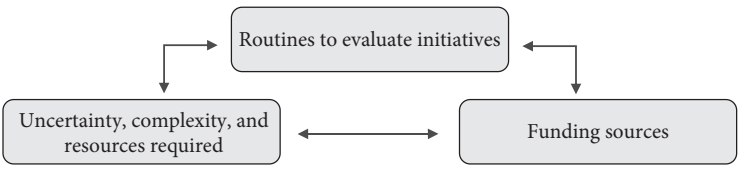

Figure 13.2 Routines, Initiatives, and Funding

requirements of their investments. But, as in much of standard information economics, they exclude symmetric ignorance—missing information that no one has—to focus on asymmetric information and misaligned incentives. I emphasize symmetrically incomplete—and known to be missing—information to showcase the advantages of analyzing uncertainty.

Outline Chapter 14 argues that irreducibly high uncertainty about the prospects of their ventures—arising from missing information about consumers, technologies, and competitive capabilities—forces entrepreneurs to self-finance their startups or raise money from their relatives and friends. Self-financed entrepreneurs cannot, however, start businesses with large capital requirements.

Chapter 15 explores the differences between wealthy angel investors and professional venture capitalists (VCs). Angel investors typically require more information about consumers, technologies, and competitive capabilities than self-financed founders. VCs, who follow more rigorous evaluation routines, are even less tolerant of missing information than angels. But wealthy angels and VCs can both fund and, in fact, favor businesses that require more capital and are more complex than self-financed startups.

Chapters 16 and 17 examine large public companies that invest (or reinvest) funds raised in stock markets. Their strict justification routines severely limit tolerances for market uncertainties but encourage specialization in complex mega-projects requiring vast capital and other resources.[23]

While these chapters do not question the value of "incentive-compatible contracts," they help explain some otherwise puzzling features of how entrepreneurial initiatives are financed. For example, they can explain why self-financed entrepreneurs can later raise outside financing, even though more information about customers, technologies, and competitors increases potential information-asymmetry problems. In my account, symmetrically missing information—two-sided ignorance—deters outside investors more than asymmetric information.

Exclusions and Emphases To highlight the differences between bootstrapped, angel- and VC-financed, and public-company initiatives, I gloss over differences within the categories, which can be considerable. The categories also exemplify uncertain enterprise but do not cover all its forms. For example, I exclude the enormous but "simple" bets placed by "macro" hedge funds in currency markets and the leveraged buyouts of mature businesses. Moreover, investment manias, like the 1999 internet bubble—when teenage college students started VC funds—and the 2010s "spray and pray" funding of startups[24] are also outside my purview.

Behavioral quirks may amplify misjudgments and encourage stricter due diligence and oversight, but they are not pivotal to my applications. And as before,

I exclude concerns about Rumsfeld's "unknown unknowns" and cataclysms such as out-of-nowhere pandemics and revolutionary possibilities, as in Keynes's examples of European wars and the seizures of private wealth.[25] I focus instead on missing information about known unknowns, such as the demand for a new product, that make the prospects of a new business uncertain.

Contextual information (about known unknowns) and its analysis are more important in my applications than statistical data and inferences. Entrepreneurial choices (including the mundane expansion of a "works" in Knight's archaic language) are situationally unique "one-offs." Any reasonable choice—or procedurally rational routine to evaluate such choices—must lean heavily on heuristics, analogies, abductive inference, and other nonstatistical consideration of contextual factors.

My entrepreneurial applications themselves use abductive inference rather than deductive reasoning. Although I have studied more than a thousand cases over the last thirty-plus years, I cannot and do not offer econometric validation for my generalizations. The credibility of my propositions depends on their fit with contextual and historical data. Methodologically, I follow the "inference to the best explanation"[26] approach implicit in Fama and Jensen's papers[27] rather than Sah and Stiglitz's equilibrium models—and I do not claim any timeless, universal validity for my results.