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UNCERTAINTY AND ENTERPRISE: SYNOPSIS AND FURTHER THOUGHTS

ABSTRACT: *Uncertainty and Enterprise: Venturing Beyond the Known* proposes modernizing Frank Knight's now forgotten examination of unmeasurable risk ("uncertainty"). I begin by summarizing my basic premises: how missing information creates disagreements that imaginative, narrative-mode discourse and reasonable routines help resolve. Next I offer further thoughts on uncertainty, imagination, and narratives. Finally, I propose reinstating classical humanistic styles of inquiry to mainstream economics.

Keywords: *Knightian Uncertainty; Innovation; Entrepreneurship; Narrative; Imagination; Economic Methodology; Intellectual History*.

> There is much here, which is novel and, being novel, unsifted, inaccurate, or deficient. I propound my systematic conception of this subject for criticism and enlargement at the hand of others, doubtful whether I myself am likely to get much further, by waiting.
>
> John Maynard Keynes, *Treatise on Probability* (1921)

> There is little that is fundamentally new in this book. It represents an attempt to state the essential principles of the conventional economic

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> doctrine more accurately, and to show their implications more clearly, than has previously been done … [It] endeavors to isolate and define the essential characteristics of free enterprise as a system or method of securing and directing coöperative effort in a social group.
>
> The [main] technical contribution to the theory of free enterprise which this essay purports to make is a fuller and more careful examination of the role of the entrepreneur or enterpriser, the recognized "central figure" of the system. and of the forces which fix the remuneration of his special function.
>
> Frank Knight, *Risk Uncertainty and Profit* (1921 vii, i and ix)

Frank Knight's *Risk, Uncertainty, and Profit* (RUP) provides the starting point for my own book, *Uncertainty and Enterprise: Venturing Beyond the Known*, which is so thoughtfully and generously examined in this volume. Like RUP—and unlike Keynes's avowedly "novel" *Treatise*—my book has "little that is fundamentally new." Knight's distinction of numericized risk from unmeasurable uncertainty—excluded from mainstream economics—underlies my conception of the nature of uncertainty, and like Knight (2021, vii) I too examine "method[s] of securing and directing coöperative effort in a social group."

That said, my project to modernize Knightian uncertainty takes a different path to different destinations. I attempt to reanimate and connect forgotten ideas, including Knight's, rather than restate "conventional economic doctrine more accurately." I don't merely distinguish Knight's unmeasurable uncertainty, typically arising from uniqueness or "one-offness," from numericized risk. I highlight differences in uncertainty arising from known-to-be-missing contextual evidence. I examine how imagination, discourse, and routines enable "securing and directing coöperative effort." Knight does not. And, I show how the enabling shapes the specialization of entrepreneurial effort, whereas Knight analyzed profit—the "remuneration of [the entrepreneur's] special function."

I do not question Knight's arguments or challenge mainstream economics. I aim to broaden rather than refute. Conversely the broadening aim doesn't offer much scope for refutation. Claiming that there are attractive opportunities implies value in redeployment of at least some scarce effort. But this claim is not verifiable. Unfortunately, offering neither a bazooka nor a target makes my project unpromising. Controversial challenges excite the heterodox while traditional positivists

require falsifiability, so both have reason to ignore my propositions. Additionally, while I rely on common language and experience, my constructs are well outside the usual discourse in disciplinary economics.[1] The prognosis for my project is thus unpromising.

The contributions of distinguished and thoughtful scholars to this special issue offer some countervailing hope. Peter Boettke is a leader of Austrian economics, which has steadfastly kept Knight's ideas in its now-heterodox canon (Gerrard 2024, 1259). Encouragingly, other contributors from mainstream traditions that often neglect unmeasurable uncertainty also have a long-standing interest in the topic. Economist Richard Friberg's (2015) *Managing Risk and Uncertainty* examines the strategic implications of dealing with the two constructs. Another economist, Morck (2022), argues that seemingly destructive manias can offset socially undesirable underinvestment in uncertain innovations. Unbeknownst to either of us, the legal scholar Claire Hill and I have been thinking in similar ways about uncertainty for years. While my main venue has been entrepreneurship and innovation, Hill's prolific research has examined deal lawyers and their clients, and financial regulators.[2] This journal's editor, political scientist Samuel DeCanio (2014, 2021, 2024), has analyzed uncertainty about counterfactuals in democracies.

Other contemporary scholars have also emphasized unmeasurable uncertainty. As I mention in my book's preface, John Kay and Mervyn King published their deservedly well-received *Radical Uncertainty: Decision Making Beyond the Numbers* in 2020. Kay and King, joined by Tim Besley, then convened a multidisciplinary group (which included this author) to continue the conversation in an on-line seminar at the London School of Economics. Some of the participants had a keen but peripheral interest, while others, including psychologists Gerd Gigerenzer and David Tuckett, have long studied Knightian uncertainty.[3]

Jon Elster's (2023) magisterial *America before 1787* places uncertainty at its core. Citing Otto Neurath (1913), Keynes (1936), and Kay and King (2020), Elster (2023, 9) calls uncertainty—and its avoidance — "a pervasive, if very often underestimated, feature of political life."

Yet there is no denying that mainstream enthusiasts are a minority. Measurable risk in research is especially dominant in studies of anonymous markets in stocks, bonds, currencies, and other standardized financial instruments. Large databases of transactions and virtually limitless computing capacities encourage both partisans and skeptics of market efficiency to rely on statistical analysis. The statistics-wielding skeptics

include the now-mainstream behavioral researchers (see Bhidé 2025, Chapter 12) as well as heterodox Imperfect Knowledge economists and Narrative economists.

What of cooperation in actual social groups, that Knight sought to explain? Like RUP, my modernization project focuses on conduct in the so-called real economy, on Main Street, rather than Wall Street. Here, the standard economic models of cooperation and conflict rely more on mathematical deduction rather than statistical inference, but they too exclude uncertainty. Coase's transaction costs, Akerlof's lemons problems, and Kahneman and Tversky's behavioral biases all assume well-specified facts and possibilities.

In the absence of an accepted paradigm, the authors of the essays in this volume, who all believe that uncertainty deserves more scholarly attention, have different thoughts about how to proceed. Yet, in my reading, many of these differences are of language and taste or reflect different disciplinary backgrounds. Attempting to reconcile the differences would be tediously off-putting. Likewise defending my constructs and proposals as best would be churlish; moreover, there is almost nothing in the essays contained in this volume that I meaningfully disagree with. Instead, I will use the essays as pointers to what in *Uncertainty and Enterprise* warrants underlining, clarifying, amending, and expanding. Accordingly, the following three sections of this paper: 1) Summarize the main ideas in my book. This synopsis should give readers who have not read the book a starting point for understanding the other essays. 2) Examine new questions spurred by these essays. 3) Propose restoring humanistic styles to mainstream economics research.

I. SUMMARY OF MAIN IDEAS

Disputed and Overextended Distinction

In RUP, quantifiable risks require apriori calculation (as in bets on roulette wheel spins) or statistical extrapolations (as in estimating life-expectancies). In either case, reliable calculation depends on the future being like the past. For bets on roulette wheels, mechanical contrivance assures this, while for life expectancies, practical experience supports the continuation of previous patterns. In contrast, novel or unique situations (what I call one-offs) produce unmeasurable uncertainty because there is no reason to suppose a future that follows the past.

Mainstream microeconomics, going back to Ramsey, Savage, and Friedman, rejects Knight's risk-uncertainty distinction. Foundational microeconomic models assume rational decision makers can and will always estimate subjective numerical probabilities. These estimates enable 'consistent' utility maximizing choices claimed to protect against hypothetical "Dutch book" bankruptcy at the hands of an imaginary bettor who stalks decision makers in their every waking moment. How the subjective utilities are estimated is unspecified, other than to suggest reliance on 'priors.'

Like Kay and King and many others I reject the mainstream rejection. Notwithstanding the use of subjective numerical odds in exceptional circumstances, such as writing catastrophic insurance, this is not common practice. In most cases reasonable people cannot and do not rely on numericized subjective probabilities. If we talk of a 50:50 chance or a 90% probability that's little more than a figure of speech, a numericized expression of our confidence. Nor is there any evidence that people who don't estimate probabilities act "as if" they do (like Friedman's proverbial billiard player, cited by Morck in this volume) or risk Dutch book bankruptcy if they don't.[4]

Professional gamblers can profitably bet on numerical apriori probabilities in lotteries and blackjack.[5] However, such opportunities, where mechanical devices and rules ensure precisely calculable odds, are exceptional. Statistical estimates based on historical data—Knight's second kind of numericized risks are more common. But these too are practically dependable only in limited applications like life insurance. More frequently, particularly in human affairs, ever-changing circumstances make numerical estimates pointless. Without stability, airy invocations of subjective probability distributions are just magical thinking. Moreover, situational or temporal distinctiveness, where the future isn't like the past, does not entail any revolutionary discontinuity. As Heraclitus said: "No man ever steps in the same river twice, for it's not the same river and he's not the same man."

Indeed, the banality of distinctiveness raises questions about calling unmeasurable uncertainty radical. Radical evokes an exceptional condition, while unmeasured uncertainty is perfectly routine as Knight pointed out. Knight offers the mundane example of a manufacturer's capacity expansion choice. By implication, unmeasurable uncertainty is radical only by the standard of theories far removed from normal human experience.

My Definition and Scope

I define uncertainty as the internal mental condition of doubt about what is or could be. Knight had used the term to describe external situations. Fortunately, there is little practical difference: we call situations that produce doubt, uncertain. Calling President Donald Trump's next move uncertain is almost exactly like saying that we feel uncertain about what the president will do next. Uncertainty also typically involves questions which we are curious about but where we aren't sure of the answer. These questions can be broad or narrow, and pertain to the past, present, or future. The desired answers may be quantifiable (what proportion of today's teenagers will develop cancer?) or not (why are cancer rates rising?).

To narrow this vast space, I focus on reasonable doubts arising from known-to-be missing information, which, if known, would reduce doubts. Often called ambiguity, this specification connects mental states of doubt to informational conditions, supporting the near equivalence of common internal and external usages of uncertainty. It also excludes inchoate doubts and Rumsfeld's unknown unknowns that can have occult connotations. I aim (like Knight) to focus attention on routine forms of uncertainty.

The "missing information" specification can also permit comparisons of unquantified uncertainty. Everyday experience suggests doubts increase with missing information. The absence of a blood test increases doubts about a patient's diagnosis, for example. Moreover, even if the differences can't be quantified, the degrees of doubt produced by differences in missing information (or the "weight of evidence," to slightly adapt Keynes's *Treatise* term) can be consequential. The lack of forensic evidence leaves more room for finding reasonable doubt in criminal trials—without any numerical assessment of probabilities. The degrees of doubt don't appear in Knight's theory, while considering the weight of evidence can violate the foundational assumptions of standard microeconomics (Ellsberg 1961). In my modernization however, degrees and weights have important roles (as discussed below).

Targets of Doubt

While disregarding differences in mental and situational uncertainties I emphasize distinctions between doubts about one-offs—the

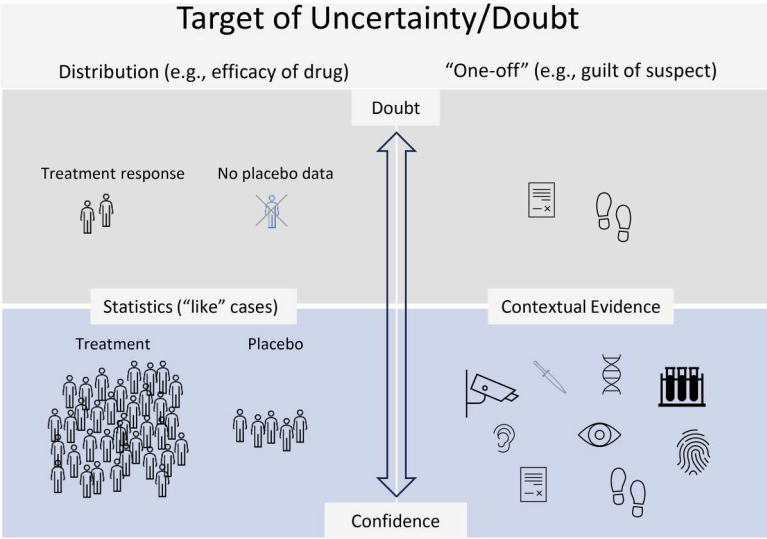
particularities of a specific case or instance—and doubts about a distribution—some general characterization of several similar cases or instances. For example, whether it will rain tomorrow is a one-off question, whereas the number of rainy days and average rainfall next month are distributional questions. What caused the US Civil War is a one-off; whether democracy reduces warmongering is a distributional question.[6]

Although missing information creates doubts about both one-offs and distributions, the kind of information that matters is different. Using drug trials (to assess the safety and efficacy of a new medicine) as an archetypal example of distributional uncertainties, I argue that *statistical data*, which abstracts away from the nuances of individual observations, dominates. More abstract data distilled from representative samples (or the complete distribution) produces more confidence. Small or biased samples increase doubts. For example, a randomized Phase III trial for a new treatment that enrolls thousands of patients (while abstracting away from their individual case histories) produces more convincing results than a Phase I trial on a few volunteers.

With one-off uncertainties, in contrast, *diverse* data can be more persuasive than numerous observations of the same kind. In a murder investigation—my archetypal, one-off example—many instances of a suspect's fingerprints at the crime scene may be less persuasive than a few fingerprints and evidence of the suspect's DNA, blood, and bodily fluids (see Figure 1). Moreover, *contextual* data, specific to persons, times and places is more convincing than abstracted data. The overall frequency of homicides by drug abusers carries less weight than eyewitness testimony of violent threats by a particular addict accused of murder.

The *methods* used to interpret information are typically different. Interpretations of statistical data on distributional questions often combine accepted generalizations and statistical tests. For example, regulators' evaluations of a new drug combine scientific knowledge of the disease mechanism and statistical techniques to verify differences between "treatment" and "placebo" results. In contrast, interpreters of disparate contextual evidence construct what Jerome Bruner calls "narrative" mode accounts whose persuasiveness depends on their plausibility, not verifiable truths.

Figure 1. How Targets and Missing Information Affect Degrees of Doubt



Logico-Scientific vs Narrative Modes

Bruner distinguishes between logico-scientific and narrative modes of thought that provide "distinctive ways of ordering experience, of constructing reality." Bruner bases his characterization of narrative thought from "great works of fiction," which "come closest to revealing 'purely' the deep structure of the narrative mode." Likewise, mathematics and the physical sciences "reveal most plainly (and purely) the deep structure" of logico-scientific thought.

The logico-scientific mode, according to Bruner, idealizes a "formal, mathematical system of description and explanation." It "deals in general causes," seeking to transcend the particular by "higher and higher reaching for abstraction." Requirements of consistency and noncontradiction regulate its language. In contrast, imaginative narrative leads to "good stories, gripping drama, believable (though not necessarily 'true') historical accounts. It deals in human or human-like intention and action," and the "particulars of experience" that it locates in "time and place."

> The two modes have different criteria of "well-formedness" and "differ radically in their procedures for verification." Both good stories and well-formed logical arguments "can be used as means for convincing another. Yet what they convince of is fundamentally different: arguments convince one of their truth, stories of their lifelikeness." Scientists may invent facts and worlds, but their "world-making" is of "a different order from what story-making does." They must "eventuate in predicting something that is testably right, however much it may speculate. Stories have no such need for testability. Believability in a story is of a different order than the believability of even the speculative parts of physical theory" (as quoted in Bhide (2025) Chapter 18 passim).

In my archetypal example, the "logico-scientific" investigation of a new drug is designed to yield results that correspond to some objective reality that is "out there." True, clinical trials can produce incorrect results. Widespread use often uncovers the ineffectiveness of FDA approved drugs (Lehrer, 2010). But, in principle at least, "post-market surveillance" can reveal mistakes. In my archetypal one off—the criminal trial—verifiable truth isn't directly in play. Under the "reasonable doubt" standard, jurors' convictions or acquittals aren't mistakes, whatever the actual guilt or innocence of the accused.

My own book—and this essay—clearly use narrative mode discourse to advance the narrative mode aim of plausibility. I rely on metaphors, biographical sketches of colorful characters, and case histories. I offer no mathematical models or statistical analyses of large sets of abstracted data. As in a criminal trial, I offer diverse examples and ideas. A reader (personal communication) wryly says I "forage." But the foraging has a purpose: By connecting many seemingly unrelated dots, I aim to make an unfalsifiable case for widening the scope of economics, plausible.

Imaginative Opinions

According to skeptical standards for true knowledge, we cannot be certain about anything.[7] Even the expectation of repeated sunrises, according to David Hume, derives from an instinctive rather than a rational belief in the uniformity of nature. Regardless, the expectation is universal. Unlettered shepherds, with no knowledge of astronomy, will treat future sunrises as certainties because they believe that, as far

as sunrises are concerned, one day is exactly like the next—they aren't one-offs. However, with dynamic phenomena (such as the evolution of drug-resistance in pathogens), change is the reasonable default expectation. What happens next is then a novel one-off.

Doubts about stable conditions and predictable trajectories are particularly warranted in human conduct. Repeated experience of "be careful what you wish for" teaches we shouldn't be confident of our own future wants even. In human affairs, Knight's (1921, 313) observations are instructive:

> Change of some kind is prerequisite to the existence of uncertainty; in an absolutely unchanging world the future would be accurately foreknown, since it would be exactly like the past. Change in some sense is a condition of the existence of any problem whatever in connection with life or conduct … We live in a world full of contradiction and paradox, a fact of which perhaps the most fundamental illustration is this: that the existence of a problem of knowledge depends on the future being different from the past, while the possibility of the solution of the problem depends on the future being like the past.

The disconnect between past and future impels according to Knight (1921, 199) acting on opinions that rely on partial knowledge:

> We live only by knowing something about the future; while the problems of life, or of conduct at least, arise from the fact that we know so little. This is as true of business as of other spheres of activity. The essence of the situation is action according to opinion, of greater or less foundation and value, neither entire ignorance nor complete and perfect information, but partial knowledge.

My conjectures expand Knight's past/future contrast to include the gap between the familiar about which something is known and the unfamiliar about which little can be known. The gap may include questions about the present ("Why are my students bored?") and the past ("did an AI bot write this paper?"). I further stipulate that people form "opinions" through a mental process, commonly called "imagination." The process combines information about the present (or, more generally, the familiar) with memories and background beliefs to fill in gaps in information about the future (or the unfamiliar). In practical domains the exercise produces an actionable opinion (or "judgment").

Problems and Antidotes

Imaginative gap filling raises the possibility of honest mistakes. Perfectly reasonable, thoughtful, and careful individuals can form incorrect opinions because of incorrect background beliefs. Without any lapse in logic, they may draw on inapt experiences to construct their imagined possibilities. Likewise, different life-experiences and background beliefs can produce different opinions and sincere disagreements. No conflicts of interest or suspicions of dishonesty are necessary.

For example, the tireless multi-year research of Drs. Warren and Marshall persuaded them that their finding of h-pylori bacteria in the stomach tissue samples of patients with ulcers strongly indicated a causal relationship. Skeptics, who did not have Warren and Marshall's "lived experience," suspected otherwise. They thought the bacteria, Marshall (2005, 267) reported in his Nobel lecture, "merely infected people who already had ulcers." Marshall then realized that "medical understanding of ulcer disease was akin to a religion. No amount of logical reasoning could budge what people knew in their hearts to be true. Ulcers were caused by stress, bad diet, smoking, alcohol and susceptible genes. A bacterial cause was preposterous."

Honest differences can include conflicting assessments of each other's opinions. Unless one of us has demonstrably superior expertise in the matter I will have more confidence in my opinions and you in yours. Even if I don't have an opinion, I may question the strength of your confidence. Yet, acting on opinions, according to Knight (1921, 226-227), involves a two-step sequence: forming an opinion about a future state, and then an opinion about the likely correctness of that opinion.

If, as in atomistic markets, individuals can act autonomously, disagreements about imagined states and the correctness of opinions are inconsequential. You write your own novel, and I will write mine. But resource requirements or jurisdictional limits can preclude unilateral action. Novelists need publishers to disseminate their work. Judges usually cannot dictate jury verdicts. I need editors to accept my submissions.

Contracts or other mechanisms to align incentives cannot resolve differences about how readers will respond to a novel or break deadlocks in hung juries. Nor can the complete and honest exchange of information produce agreements about imagined states. Unless someone secures unilateral "control rights," possibly through some Hobbesian social contract, disagreements can make "coöperative effort in a social group" impossible.

The giving and taking of plausible reasons ("discourse") can help reduce or adjudge differences in opinions. In adversarial discourse, as in legal trials, the more persuasive side prevails. In other situations, as in planning a family vacation, constructive discourse synthesizes multiple opinions.[8]

Like the opinions it aims to rank or reconcile, the discourse relies on more than just objective information. In aligning imagined futures, rather than disagreements about present or past conditions, the discourse also goes beyond sharing subjective interpretations. It exchanges envisioned possibilities and paths for their attainment. For this, *imaginative discourse*, like Bruner's "narrative mode" persuasion, employs literary devices such as metaphors, similes, exemplary analogies, and sequencing of possible happenings that suggest causal chains. Paradoxically, and even in hardnosed practical applications, imaginative discourse draws on made up details to make imagined futures plausible. Purely "evidence based" choice is fiction. Evidence complements but cannot replace imagination when unruly change detaches the future from the past.

Imaginative (or, synonymously, "narrative mode") discourse which goes beyond just the facts is particularly important in aligning opinions about one-offs. This is not to say that discourse about one-offs is entirely literary, as in Bruner's archetypal case (above). Criminal prosecutions weave forensic evidence based on cutting edge science, into their narratives about an accused's opportunity and motive, for example. Even unscientific evidence is expected to be as dependable and objective as possible. In criminal investigations, witnesses must pick suspects from a line-up and trials exclude hearsay evidence.

Conventions and rules further bind imaginative discourse. Societal conventions of grammar and vocabulary are obvious constraints. Additionally, institutions and organizations establish procedural *routines*. While the routines can include hard and fast rules—courtroom routines forbid hearsay evidence and require plaintiffs to have "standing"—they also set some broad expectations. They are thus like genre conventions in fiction—what themes, plots and characters readers expect in detective novels versus historical romances—not the invariant procedures for swearing in and cross-examining witnesses. Their design variables include who participates in the discourse (many or few), strictness of scrutiny, evidentiary rules (how much, what kind), and default rules if the adjudicators cannot agree.

Functionally reasonable routines align with a group's or organization's purpose. High stakes activities typically encourage strict routines.

Criminal courts, for example, can impose severe punishments. Their rules and procedures require prosecutors to establish "beyond reasonable doubt" guilt and unanimous or super-majority verdicts, while traffic court judges can, on cursory evidence, summarily fine drivers for speeding. Similarly, complex projects undertaken by large teams require extensive mutual consultation and reviews to align the plans of specialized subgroups and team members. Conversely, specializing in highly speculative projects (such as edgy fashion design) or operating in rapidly changing conditions (such as fighting forest-fires) can preclude high evidentiary demands and protracted review.

Reciprocally, routines reinforce specialization: strict routinized demands for evidence and review discourage speculative projects and operating in fast-moving conditions. The command-and-control systems of infantry regiments make them unsuited for fluid covert operations.

Antecedent Ideas

Great literature, according to Bruner, can make the reader's familiar world seem strange and unfamiliar. The narrative challenge addressed in my review of antecedent ideas (in Chapters 5-12) is to make the unfamiliar seem more familiar to the mainstream economist. Here's why the challenge arises and how I deal with it.

For the non-economist, my exposition should be accessible, if dense. I stick to everyday language and invoke common experience. I pause to clarify when I invoke potentially unfamiliar terms. For example, when I mention Kuhnian paradigms—which I repeatedly do—I tell the reader what a Kuhnian paradigm normally refers to.

Paradigms, per Thomas Kuhn

According to Kuhn, who established its present-day meaning, scientific paradigms "define the legitimate problems and methods of a research field."[9] In the pre-paradigmatic stage, scientists record several facts and observations but with competing explanations fitting different facts. Paradigm-enabling breakthroughs combine "two essential characteristics." First, they explain a wide range of facts. This "achievement" is "sufficiently unprecedented to attract an enduring group of adherents away from competing modes of scientific activity." For example, gravitation

explained the parabolic paths of cannon balls on Earth and the elliptical orbits of planets in the skies. Darwin's theory of evolution explained a vast diversity of life forms. A second essential characteristic is that the breakthroughs are "sufficiently open-ended to leave all sorts of problems for the redefined group of practitioners to resolve."[10] Modern physics and evolutionary biology began and did not end with Newton and Darwin's contributions. They were seminal, not terminal.

The two characteristics enable research communities to undertake "normal science." Compelling, unified explanations legitimize agreements that researchers do not question. The "open-endedness" is also crucial because it gives researchers something to do. A breakthrough that solved everything would not; if breakthrough discoveries were a job requirement, few scientists would find employment.

Paradigms are typically tacit and unspoken, cultural rather than codified. They do not require a common acceptance or understanding of the basic assumptions or "axioms." What researchers do and how they do it defines their "paradigm." Repeated doing produces agreements about pertinent problems, methods for solving those problems, and solutions the researchers consider acceptable.[11] Kuhn's scientists "do not even need to make their axioms explicit in order to know how to 'go on,'" writes the Cambridge philosopher of science John Forrester (2017, 48). "A paradigm is what you use when 'you don't have to have agreement about the axioms.'"

Paradigmatic theories, writes Kuhn, are learned by the "study of *applications* including *practice problem-solving* both *with a pencil and paper* and with instruments in the laboratory. If, for example, the student of Newtonian dynamics *ever discovers* [italics added] the meaning of terms like 'force,' 'mass,' 'space,' and 'time,' he does so less from the incomplete though sometimes helpful definitions in his text than by observing and participating in the application of these concepts to problem-solution." [12]

The unspoken agreements and half-understood concepts, internalized through paradigmatic examples, profoundly influence normal scientific research. The agreements accelerate advances by aligning the efforts of many scientists, but they also discourage unconventional research. Only a confidence-shattering crisis, produced by the accumulation of observations contradicting basic, unquestioned assumptions, creates room for a new paradigm.[13]

At most, lay readers might have difficulty keeping track of the many diverse dots I try to connect. They may also ask: "Why the fuss—Why isn't the kind of modernization you suggest already mainstream?" Mainstream economists pose the opposite problem. They usually don't distinguish between unquantified uncertainty and statistical risk or between one-off and distributional doubts. Their theories focus on incentive and contracting problems or "behavioral" biases, not on honest mistakes and disagreements. They don't examine context-rich discourse. The give-and-take of grounded yet imagined reasons about imagined possibilities is beyond their scope. Even Austrian economics, which emphasizes the value of local knowledge, focuses on the terse communication of changes in supply and demand through wordless price adjustments. The local expert acts autonomously. Routines that embed rich discourse are also absent: Mainstream economics focuses on outcomes, not the process of choice (Leijonhufvud 2004, 353).

Moreover, I don't present the mathematical models or statistical results that now serve as backbones of paradigmatic economic contributions. My everyday language, as Calomiris (this volume) astutely notes, is rarely used in scholarly journals. There is thus little overlap between my discourse and the discourse of mainstream economics in their modes (narrative vs. logico-scientific) and in their building blocks.

My review of antecedent ideas therefore goes well beyond—and in some ways falls short of—the scholarly obligation to acknowledge prior work. Unlike a dry literature review, I use intellectual histories to show how and why mainstream economics came to exclude Knightian uncertainty. This aim—and gaps in my knowledge and reading—preclude a complete review of the literature on uncertainty. Instead, I focus on developments that shaped and strengthened an uncertainty-free mainstream paradigm on the one side and the now forgotten ideas that did include uncertainty on the other.

In the mainstream category I start with the foundations of utility maximization theory laid by the wunderkind and Keynes protégé, Frank Ramsay, Knight's high-profile PhD student, Milton Friedman, and the statistician L. J. Savage. Next, I show how Industrial Organization and Information Economics research questioned the perfect competition assumptions of the foundational theories. In principle, they could have also included uncertainty. In practice they did not, likely helping their

incorporation into the existing paradigm. Finally, I examine how behavioral economics, as pioneered by Kahneman and Tversky and extended by Richard Thaler, became mainstream. It questioned the extreme rationality of mainstream subjective utility maximization while keeping its exclusion of unmeasurable uncertainty. Indeed, I argue that sticking to numerical probabilities was a deliberate, paradigm-conforming choice that won Kahneman, Tversky, and Thaler mainstream accolades and acceptance.

My review of failed attempts to include unmeasurable uncertainty starts with Knight's RUP and Keynes's *Treatise*. Both did not get traction. As the subjective utility paradigm—strongly shaped by their students and proteges, Friedman and Ramsey—gained momentum, neither Knight nor Keynes made a serious effort to advance the ideas in their 1921 books. In fact, Keynes's invocation of an extreme kind of uncertainty in his 1936 *General Theory*, I suggest, may have helped keep his more routine 1921 *Treatise* form out of the mainstream view.

Next, I review Herbert Simon's ambitious attack, which he launched after the mainstream paradigm was well entrenched. Simon's alternative approach is now sometimes considered a cornerstone of the "old" behavioral economics. It failed utterly, I argue, because it was a more head-on insurgency than Kahneman and Tversky's subsequent paradigm-friendly questioning of rationality.

Finally, I review Daniel Ellsberg's 1961 demonstration of how reasonable people react to missing information. Violating standard theories, people do care about missing information, which Ellsberg called ambiguity. An ambiguity averse majority favor options with more information while some favor less. Ellsberg's ambiguity finding may have secured a more lasting, if peripheral, place in economics than Simon's attack because it was less threatening. Although economists couldn't incorporate ambiguity into their paradigm, they could treat it as what Kuhn would call an isolated "anomaly."

As mentioned, this is a highly selective review of forgotten uncertainty promoting ideas. My choices have been guided by the standing of their promoters. Knight served as President of the American Economic Association in 1950. Keynes is considered an inventor of modern macro-economics. Simon won one of the early Nobels in economics. Ellsberg, better known for anti-Vietnam war activism, published his ambiguity result (Ellsberg 1961) in the prestigious *Quarterly Journal of Economics* before he had completed his doctoral dissertation on the

topic. Mainstream journals have continued to publish replications and extensions of Ellsberg's (1961) results.

My choices also reflect the value of the selected ideas as building blocks for modernization. For example, Keynes's *Treatise* provides the weight of evidence in assuaging doubts and—like Knight's RUP—emphasizes the ubiquity of unquantifiable risks. Simon's work highlights the role of organizational routines. Ellsberg's ambiguity supports a minimalist, down-to-earth specification of doubt producing circumstances (namely as known-to-be-missing information).

These building blocks have subtly useful complementarities. For example, while suggesting that more evidence reduces mistakes, Keynes's *Treatise* puzzles over when to stop looking for more evidence (Keynes 1921, 357). Simon's routines offer a possible stopping device. Reciprocally Keynes's weight of evidence enriches Simon's routines. Simon's routines feature satisficing search in place of the paradigmatic —and practically impossible—optimization standard. In Simon's model, decision makers form target aspirations—say for the price of a secondhand car. When the aspiration is reached—when a car is found at the target price—search stops. In my extension, routines include satisficing levels of evidence. When that level is reached—or if it is determined it cannot be reached, given a standardized degree of investigation—search stops.

Thus, the dots my modernization proposal connects—notably the ideas of Knight, Keynes, Simon, and Ellsberg—have coherence. I extend the connections in later parts of my book to include Schumpeter, Chandler, and Bruner. The connections, like the standing of the thinkers I invoke, hopefully increase the credibility of the modernization proposal.

Entrepreneurial Applications

"So what?" the skeptical economist may yet ask. "What concrete phenomena can the unobservable internal condition of doubt predict or explain?" This is a pivotal question for my project. Knight's 1921 book argued that true profit requires bearing (taking "responsibility" for) uncertainty rather than risk. Providing capital for risks that can be calculated from the laws of probability or statistical tables only earns the going market rate for risk-bearing. Like many, I find this "no-

uncertainty, no-profit" thesis appealing.[14] Unfortunately, Knight's true profit (net of the market rate for risk-bearing) is unobservable. Worse, even conceptually, more uncertainty does not yield more profit.[15] In contrast the subfield of Industrial Organization (above) offers theories of profit with quantifiable variables. I therefore see little hope of adding Knight's theory of profit into mainstream economics that demands falsifiability and statistical validation.

My modernization meets the mainstream demand half-way with two concrete applications. Like RUP, both are in the domain of business enterprise but are less ephemeral than Knight's profit thesis. The first shows how imaginative discourse helps promoters secure and coordinate the resources they need for their ventures. The second examines the specialization of organizations that undertake entrepreneurial initiatives. While neither offers statistically testable propositions, both examine observably striking phenomena that mainstream uncertainty-excluding theories do not attempt to explain (as in imaginative discourse) or cannot plausibly explain (as in the specialization application).

Imaginative Discourse

Entrepreneurial ideas emerge from a creative process that combines facts and imagination. The promoter of an enterprise must imagine what could be and a plausible path for getting there. Almost by definition (and according to Knight's thesis), information gaps preclude deducing the desired destination and path through logic or statistical analysis. If sufficient information for logical or reliable statistical inference existed, there would be no opportunity for profit, as I keep reminding students in my entrepreneurship classes.

Moreover, promoters of an enterprise cannot just imagine desired future states and feasible paths. They must also persuade financiers, customers, employees, and others that their imagined scheme is worth supporting. Here, too, promoters cannot merely provide objective facts and signal their confidence in their ventures by putting their own money into them. They must also engage in imaginative discourse that is more literary than logico-scientific, using figurative language, colorful analogies, engaging stories, and sometimes, attention getting stunts, and theatrical presentations. This is not a con job aimed at gullible targets. Imaginative discourse is necessary to overcome the doubts

of experienced financiers, recruits, suppliers, and buyers about the promoters' imagined futures.

Imaginative discourse entails paradoxes: for example, as in a television docudrama or historical novel, imagined details make imagined futures and paths more plausible. Even if no one really believes in the entrepreneur's financial projections, a detailed spreadsheet model with made-up numbers can help make the envisioned future more vivid. The details also demonstrate the promoters' industry and market knowledge. And, the coherence of a made-up model provides evidence of the imagination required to cope with the unforeseen problems that will inevitably arise.[16]

Yet, the discourse must be groundedly imaginative, not pure fantasy. If the assumptions of a spreadsheet do not conform to experience (e.g., about how many sales calls a salesperson can make) the details can undermine rather than increase credibility. Moreover, the routines of business organizations, like those of law courts, bound the extent of the groundedness they require and thus the missing information they will tolerate. This is covered in a second application, on entrepreneurial specialization, summarized below.

Specialization

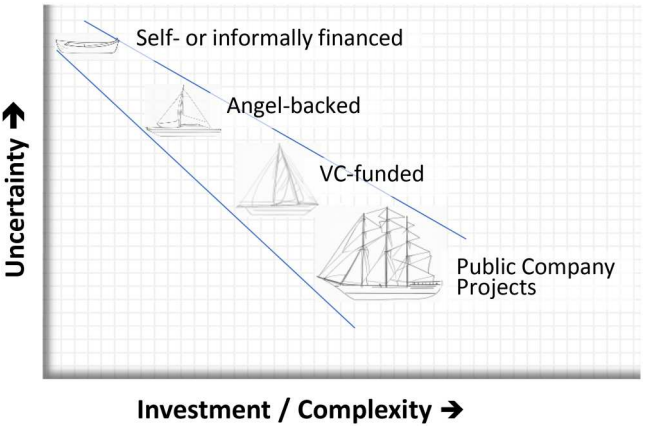
This application examines how and why four archetypes—self-financed founders, wealthy "angel" investors, venture capitalists, and large corporations—occupy different niches in contemporary entrepreneurial ecosystems (as shown in Figure 2).

The functional rationality of the ecosystem turns on a three way "alignment" or "fit" between: (1) the routines used to evaluate and plan entrepreneurial initiatives; (2) The uncertainty, complexity, and resource requirements of the initiatives; and (3) The sources financing the initiatives (Figure 3).

Simply put: Large corporations establish strict, intricate routines that enable them to fund and coordinate complex megaprojects. The routines also impose unintended but unavoidable restrictions. They discourage small projects whose profit potential cannot justify the fixed planning and oversight costs. Requirements for objective evidence and consensus similarly deter initiatives with high uncertainty about customers, technologies, and competitors.

The unintended restrictions provide space for self-financed (or informally financed) entrepreneurs to undertake small, simple initiatives in

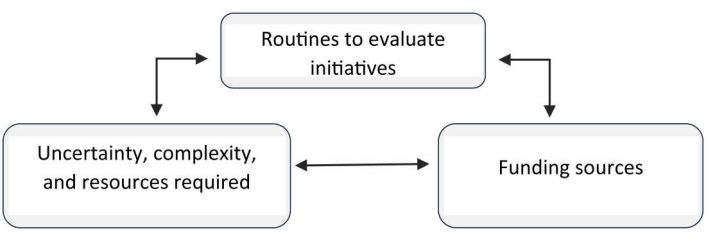
Figure 2: Map of Entrepreneurial Specialization



unsettled markets and rely on their personal capacities to seize fleeting opportunities. Likewise, professional venture capitalists (VCs) and angel investors are not as spontaneous or adhoc as self-financed entrepreneurs, but their justificatory requirements are not as strict as those of large public corporations. These "in-between" requirements encourage VCs and angel investors to specialize in ventures involving intermediate funding needs, uncertainty, and complexity.

The hypothesis about specialization emphasizes the value of a diverse entrepreneurial ecology: venture capital alone cannot sustain widespread innovation. The underlying uncertainty-based reasoning likewise helps us see the advantages of often-mocked large-company routines. They are as indispensable for complex technological advances as time-consuming jury trials are for a civilized criminal justice system. Yet, while large company routines reduce tolerances for uncertainty, they do not

Figure 3: Routines, Initiatives, and Funding



eliminate uncertainty—a Knightian precondition for profit—or replicate the inflexibility of Weber's idealized bureaucracy.[17]

II. NEW QUESTIONS

Selective Reconsideration

For all its 450 pages, *Uncertainty and Enterprise* inevitably contains many loose ends. Guided by the other essays in this volume, the section below picks up on *some* of these loose ends. I select threads that seem most relevant to the main themes (discussed above), and which I can realistically hope to weave into a coherent pattern. Regretfully the selection excludes many ideas contained in or stimulated by the insightful essays. Their range is too broad for my expository capacities.

I start by refining my "uncertainty as doubt" definition and my archetypal distinction between its one-off and distributional manifestations. Upon reconsideration I realize that the definition neglects the optimistic, constructive side of uncertainty and that my murder and clinical trial archetypes ignore the importance of ambiguous cases. The versatility and limitations of narrative mode discourse likewise warrant more examination.

Constructive Uncertainties

Everyday language and commentary often associate uncertainty with fears about undesirable possibilities, such as economic collapses, military conflicts, and political turmoil. Financial pundits declare that "the market hates uncertainty" to explain falling stock prices. Policy uncertainties are said to discourage business investments. Advice on "coping with uncertainty" focuses on hedging against unpleasant surprises. Everyday experience further suggests that human conduct is often directed at anticipating or forestalling undesirable possibilities. We consult weather maps, check references, carry umbrellas, buy insurance, install anti-virus programs, and tolerate unpleasant colonoscopies and reactions to vaccines.

In contrast, Knightian uncertainty has no such negative connotations. In fact, as a prerequisite for profit, uncertainty is a desirable condition for individuals with entrepreneurial dispositions. My introductory chapter and book title further suggests that besides seeking financial rewards,

entrepreneurs can crave the excitement of "venturing beyond the known." More generally, foreknowledge can make life dull. At least some of the enjoyment of going to a football match comes from not knowing who will win.

Uncertainty thus involves a duality, a Yin and a Yang. We may read reviews before going to a movie or a new restaurant to avoid disappointment. But we don't want the movie review to reveal the surprise ending and we go to new restaurants for the novelty of the experience. Similarly, the thrill of the uncertain chase energizes medical researchers who develop pathbreaking tests and vaccines that reduce uncertainties for users.

Additionally, whether we interpret incomplete information pessimistically or optimistically can become a self-fulfilling prophecy. If you think you can't—make a sale, deliver a rousing speech, or ace a test—you likely won't. If you dwell on dubious data about the high-failure rates of new businesses you won't start a venture or you will give up quickly if you do start one (Bhidé 2025, 179, 194). Suspecting the worst in others can prompt them to fulfil your low expectations. Conversely optimistic imaginings increase the likelihood of good things happening. Top skiers use visualization techniques to anticipate the perfect run in their minds eye. Confident entrepreneurs brush aside highly incomplete information about customers and competitors (and questionable statistics about overall failure rates) to start ventures in unsettled markets and try to find creative ways to keep going when unforeseen problems arise. Trusting subordinates and teammates encourages them to meet or exceed our expectations.

While I sprinkled the duality described above throughout my book, my labeling of uncertainty as doubt undoubtedly favored the negative side. We rarely refer to doubt in a positive way. At most doubt is neutral—as in I'm not sure about the capital of Pennsylvania. Normally, doubt is a downer, a cognate of labels like foreboding, skepticism, and fear. Eagerness, excitement, and hope convey the positive possibilities produced by incomplete information. In retrospect I could have included more references to these positive labels or used the more neutral 'wonder' or a 'curiosity' that can arise when agents aren't certain of what is or could be.

Parenthetically I realize my book also truncates the role of imagination and its relationship to uncertainty. I emphasized imaginative problem-solving, as exemplified by Pasteur's conjectures about fermentation, spurred by a brewer's plea for help in making alcohol from beetroot

(Ligon, 2002). Imagination can also identify unrecognized puzzles and problem-solving opportunities. For example, Alexander Fleming's discovery of penicillin didn't result from a problem-solving effort. The accidental discovery of dead bacteria on a moldy agar plate spurred Fleming's conjecture that the mold contained a possibly medicinal anti-bacterial agent. Charles Kelman imaginatively envisioned photo-emulsification (to remove cataracts after pulverizing them with ultrasound) at a dental cleaning with an ultrasound device (Bhidé 2017a, 26). Imagination, like necessity, can mother invention by identifying problems and puzzles for imaginative solution.

Importance of Ambiguous Cases

I used murder and drug trial archetypes (section I) to dramatize the differences between one-off and distributional uncertainties. In the one-off murder trial archetype, the availability of contextual evidence, interpreted and discussed in the narrative mode dominates the extent of doubts and disagreements. In distributional uncertainties investigated in drug trials, statistical data and logico-scientific reasoning and discourse are preeminent.[18]

Usually, however, how to categorize, analyze, and discuss uncertainties is itself uncertain. To start with, there is no objective bright line between one-off and distributional questions. As Knight (1921, 227) observed: "nothing in the universe of experience is absolutely unique any more than any two things are absolutely alike. Consequently it is always possible to form classes if the bars are let down and a loose enough interpretation of similarity is accepted." Analogously, paralleling Knight's risk-uncertainty extremes, we can think of many doubts as falling between purely one-offs or entirely distributional questions.

Yet there is no foolproof formula for deciding where a doubt should fall. To what degree should a physician individualize diagnoses and treatments for obesity rather than prescribe drugs for anyone above a statistically established body mass index threshold?[19] Should a bank analyze the creditworthiness of individual borrowers or rely just on numerical credit scores designed to predict defaults? How much weight should college admissions place on applicants' essays and interviews vis-a-vis standardized test scores designed to predict academic performance? How much sentencing discretion should judges have? Inevitably, the choices reflect personal preferences and beliefs, considerations of costs

(individualization can be expensive), and cultural, political, and institutional traditions. Prevailing practices can therefore diverge across persons, organizations, and regulatory regimes.[20]

Defining the class or subclass targeted for distributional analysis poses further difficulties. In business, uncertainties about the sales potential of a market or market segment start with uncertainties about defining the market and its segments. Similar difficulties arise in political polling. Uncertainty about sample selection produces uncertainty about poll results. In his great book, *The Origin of Species*, Darwin worries about defining a species and distinguishing it from a variety: No one definition satisfies all naturalists, who only know vaguely what they mean when they speak of a species. The term "variety" is almost equally difficult to define. Additionally, individuals of the same species, even siblings, "often present great differences of structure" (Darwin 1896, Chapter 2 *passim*).

Yet how to explain Origins without specifying Species? Darwin chooses to "look at the term species as one arbitrarily given, for the sake of convenience, to a set of individuals closely resembling each other, and that it does not essentially differ from the term variety, which is given to less distinct and more fluctuating forms. The term variety, again, in comparison with mere individual differences, is also applied arbitrarily, for convenience' sake" (Darwin 1896, 66).

The ambiguities have real world implications. Whether to treat a question as distributional or as a one-off—and if distributional where to draw the boundaries has direct consequences: Prescribing (or not prescribing) an obesity drug, approving or rejecting loan or college applications, and over-or-underestimating the size of a market or the attractiveness of a political candidate or slogan matters. Choices can also have subtle, indirect effects. For example, I have previously argued (Bhidé 2017b) that exceptional US rules to promote the widespread use of credit scoring (and discourage case-by-case analysis) have strongly favored securitized credit over traditional loans in the US.

As with other uncertainties, ambiguous distinctions create disagreements. In medicine these go back to ancient disputes about holistic rather than disease-based diagnoses and treatments. Hippocrates and his followers favored the holistic, whereas the now forgotten Cnidian physicians focused on diseases (Nuland 2008, 17). Does formulaic sentencing (like California's 'three-strikes' law) reduce crime or merely overcrowd jails? Do standardized test scores level the playing field for college applicants or do their implicit biases discriminate against minority test takers?

Current culture wars over whether organizations should be race or gender blind (and how they should define the categories) show the heated emotions that questions of grouping can produce.

Versatility of the Narrative Mode

The association between modes and targets is often weaker than in my murder and drug trial archetypes. True, treating a question mainly as a one-off limits statistical analysis. Conversely, estimating the parameters of a statistical distribution requires statistical techniques. That said, the value of qualitative narrative mode inquiry isn't limited to one-offs. It can provide plausible answers to broad questions, often by generalizing from localized, non-statistical, studies. After studying and writing about several civil wars, a historian can offer a plausible general theory about such wars. Sun Tzu's *The Art of War* and Machiavelli's *The Prince* use concrete examples, real and imagined, to advance general precepts about military strategy and statecraft. Darwin based his general theory of natural selection on many granular studies undertaken over decades. Transformative medical advances from 1950s heart lung machines (Bhidé, Datar and Villa 2020) to recent immunological cancer treatments (Bhidé and Datar 2021) have emerged from imaginative experiments performed on a few nearly sure to die patients. My own research, undertaken in the narrative mode style, has also addressed one-off questions[21]—and offered generalizations derived from one-off studies.[22]

Narrative discourse can play an important role in logico-scientific debates. The dedication of economists to scientific methods and objective data notwithstanding, they use rhetorical language and arguments extensively, as Diedre McCloskey and others have pointed out (Klamer et al. 1989, McCloskey 1994). Advocates of novel propositions in the natural sciences often invoke more familiar analogies or metaphors.[23] For example, in the 1950s and 1960s, the emerging fields of molecular biology and genetics adopted metaphors from the more established domains of information processing and computing.[24]

Scientific researchers may also rely on attention-getting demonstrations. For example, after Warren and Marshall failed to overcome skepticism about their bacterial infection claim (above) through a conventional animal model, Marshall infected himself with h-pylori. As it happens, the infection spontaneously disappeared (Marshall 2005, 270). Yet the sample-of-one demonstration attracted global media attention.

While the attention itself did not change scientific views, it likely stimulated more traditional research that ultimately persuaded the medical community (Bhidé, Datar, Stebbins 2019).

Limits of Narrative Mode Discourse

I found Calomiris's eloquent essay, "Humanity and Entrepreneurship," both heartening and unsettling. We both believe that understanding human conduct requires a humanistic perspective that assigns a prominent role to human faculties like imagination and faith. As with Friberg's mountaineering avidity, Calomiris's lived experience as a devout Christian and music composer informs his insights about these human faculties in venues far removed from standard economics. I draw an encouraging inference: If other economists would also add a humanistic perspective to their research, the barriers posed by scientific conditioning to modernizing uncertainty would be less daunting.

Yet some of the particulars of Calomiris's language also amplify my anxieties about the imprecision of more humanistic accounts of human conduct. The overlapping connotations of recognition and their relation to imagination are noteworthy. In my original formulation (summarized above) we use imagination to reduce gaps in our information. Calomiris argues that imaginative gap reduction isn't enough—we must also discipline our imaginations through "recognition." I found the addition of recognition appealing—until I realized that I had not and could not define imagination precisely. I was simply using it as an evocative label for what it did, namely reduce gaps in information. Recognition—and its relationship to imagination was similarly befuddling. Was it a synonym, substitute, or complement?

Complicated Relationship

Decades ago, Simon (1992, 155) confidently characterized "intuition" thus: "In everyday speech we use the word intuition to describe a problem solving or question answering performance that is speedy and for which the expert is unable to describe in detail the reasoning or other process that has produced the answer. The situation has produced a cue; this cue has given the expert access to information stored in memory, and the information provides the answer. Intuition is nothing more and nothing less than recognition."

But what is "recognition?" Simon's characterization of intuition and his "mind as a computer" model of cognition (more on this in the next section) suggests a memory match. For example, computerized optical character recognition and face recognition systems match digitized images to specific letters and faces. Similarly, physicians match patient symptoms to their clinical experience to diagnose and treat diseases. There diagnoses are more "intuitive" than digitized optical character or face recognition, but they also rely on memory matching. Both conform to the Latin origins of recognize: *recognoscere* 'know again, recall to mind.'

While medical diagnosis and character and face recognition aim at precise, objective matches, 'recalling to mind' recognition can also map instances into broad categories. For example, we may recognize a building as "art-deco," a painting as "expressionist," music as "hip-hop," a play as a "farce," and a politician as "authoritarian." This category recognition is more subjective: one person's authoritarian may be another's bold visionary. Regardless, the recognition matches an instance at hand with memories of like past instances. Recognition of novel possibilities can be regarded as broader than memory matching, however. As in the Fleming and Kelman examples above, recognizing may be understood as perceiving or seeing something that others don't. In this meaning, recognition is synonymous with or results from imagining some desirable future state.

Calomiris (this volume) treats recognition as following the imaginative conception of possibilities, rather than the initial recognition of possibilities:

> A good musical idea should be new, but it should also sound good, which is judged in the context of what we humans have been listening to before. This latter point is important: imaginative thinking is disciplined by recognition.

But even that distinction has complications. In my mind, the first sentence invokes Simon's recognition as intuitive matching in the following way. Music is an acquired taste shaped by "what we humans have been listening to before." If something sounds good, it is because we subconsciously recognize in it music we (and others) have previously liked. The same kind of matching is thought to apply in other creative products like

movies and novels: deviations from the conventions expected of a genre can be disturbing. Movie makers and novelists who aim for popular success must "recognize" the disturbance to "discipline" over-creative imaginations. At the same time, because formulaic conformity can bore audiences, excessive disciplining can be counterproductive. Plausibly, disciplining—selecting the appropriate balance—is an imaginative act, informed by memory (Simon's "recognition" above).

The despair of disentangling imagination from recognition led to further anxieties. Besides imagination, I invoke several unobservable mental states and processes such as doubt, confidence, leaps of faith, reasoning, justification, and judgment. Like Elster's (2023, 33) "honor" and its cognates, these mental states and processes "form a cluster." Unlike physical objects like "tables" or "chairs" their meanings cannot be based on shared sensory experience. Drawn mainly from everyday language they invite subjective, context-specific interpretations.

I cannot soothe anxieties about miscommunication by constructing artificially unambiguous definitions. Readers would likely find any faux precision forced on them as unappealing as Humpty Dumpty's assertion to Alice. ("When *I* use a word," Humpty Dumpty said in rather a scornful tone, "it means just what I choose it to mean—neither more nor less.") Instead, I take comfort from the 'later' Wittgenstein's celebration of messy, culturally and contextually infused language.

Comfort From the Later Wittgenstein

Ludwig Wittgenstein, like Keynes in economics, became a 20th century giant in philosophy without conventional qualifications in the discipline. The Manchester University trained Austrian aeronautical engineer joined his country's army in 1914 at the start of the First World War, was taken prisoner in 1918 and remained a captive through the end of the War. He drafted what became his landmark *Tractatus Logico-Philosophicus* during the War. Published in German in 1921 (the same year as Knight's RUP and Keynes's *Treatise*) the *Tractatus* epitomized efforts to develop ideal languages to depict reality. In this view, the ideal language is a formal, artificial construct. Like mathematics, it must be logically consistent and exclude contradiction and paradox. Language can then only accept the propositions of the natural sciences that are sharply true or false. Everything else is senseless or nonsense.

Therefore, Wittgenstein's last sentence in the *Tractatus* declares: "Whereof one cannot speak, thereof one must be silent." By this standard, much of my book is senseless or nonsense. Should I have been silent whereof I spoke?

It happens, after the 1921 publication of his book, Wittgenstein took a break from philosophy. Giving away a large part of his family fortune he worked as a gardener, teacher, and architect in Austria. In 1929 he returned to philosophy as Fellow and philosophy lecturer at Cambridge University which accepted his *Tractatus* as the equivalent of the requisite dissertation. Wittgenstein then formulated ideas, recorded through lecture notes and letters, and consolidated into the *Philosophical Investigations* published in 1953, after Wittgenstein's death in 1951. The ideas in *Investigations* also served as a cornerstone for what came to be known as "Ordinary Language Philosophy."

If Wittgenstein's post-1929 work didn't explicitly recant his 1921 *Tractatus*, his later views, especially on language, were unquestionably different. In the *Tractatus*, language expresses thoughts about falsifiable propositions; and, to learn a language, is to acquire the facility of putting thoughts into words. In his later *Investigations*, Wittgenstein abandons regimented linguistic precision and attacks the idealized picture of language, in which "Every word has a meaning. This meaning is correlated with the word. It is the object for which the word stands" (Monk 2025).

Not so, in Wittgenstein's revised view. Language has no deep essence. Language is a tool used in a range of common human activities, including shopping, telling jokes, making up riddles, describing things, and writing up plans that others will implement. Citing the innumerable ways in which it is used in human interactions, Wittgenstein argues "the speaking of a language is part of an activity, or of a form of life." The meanings of words cannot be reduced to one object they represent. Rather meanings depend on their use in "the stream of life" (Monk 2025).

Tied to human practice, language evolves with changing use. And because uses are multifarious and context-dependent, words are ambiguous. At most we might see a 'family resemblance' across usages. The messiness of ordinary language isn't a defect, an illegitimate deviation from idealized language. That we cannot associate 'mind' with one observable thing does not negate its linguistic utility (Monk 2025).

> Communities are crucial. Language doesn't autonomously express inner private thoughts. It embodies practices in a community. It is acquired through participation in a community and is used in exchanging thoughts: Even Hamlet addresses his soliloquy to an audience. Its now archaic sounding language follows what might be called Elizabethan "community standards."[25]

The Wittgensteinian comfort does not take away my responsibility for material misunderstanding, however. If the gist is grasped, it is acceptable if my use of "imagination" does not map into a well-defined object or if Calomiris uses different language. It is acceptable to use different words with similar meanings, and within limits, use the same word to mean different things in different contexts. Yet the absolution is not absolute. Serious differences between what I mean and what the reader understands remain my fault. I am also to blame if the bored reader stops reading.

To reduce misunderstandings and boredom I use many practical examples: I 'show' what I cannot unambiguously 'say.'[26] I use figurative language. My book's illustrations have a nautical theme designed to evoke uncertainty. Following Orwell's advice, I try to write clearly and simply. Addressing a diverse (but not mass) audience, I don't make up words, talk about ergodicity, "colligate," "problematize," "ravell-up," or develop "joint mathematical–statistical objects." I lean on, but don't slavishly follow, McCloskey's (1985, 2019) advice for clarity in "Economical Writing."

Nonetheless, my narrative mode presentation aimed at a disparate audience complicates communicating with disciplinary economists. Recall Kuhn's observation that members of scientific communities acquire a common understanding of their foundational constructs through "pencil and paper" exercises. Scientists start to internalize the elusive specialized concept of "mass" (and its distinction from everyday 'weight') with high school problem sets. So too with basic constructs of economics such as utility, rents, production functions, demand elasticity, and monopolistic power that cannot be directly observed or measured. Aspiring economic scientists acquire a common understanding through problems sets.

My ordinary language terms do not belong to this internalized lexicon. I also do not see how my propositions could be translated into Kuhn's

pencil and paper problems. Quite apart from the scientific skepticism of narrative mode thought, is this linguistic barrier to understanding—and legitimacy—worthwhile? Below, I argue it is.

III. THE CASE FOR HUMANISTIC STYLES

Broadening the Widening

The final chapter of my book, "A Plea for Widening" suggested adding uncertainty to the agenda of mainstream economics. The addition could widen the range of plausible accounts offered beyond just entrepreneurship and suggest alternatives for addressing practical contemporary problems. But widening risks the preeminence of economics in the social sciences by diluting the cohesion of its paradigm.

The concluding section of this essay expands on the book's plea. Broadening the "styles" of research would help add uncertainty—and its practical effects—to the research agenda. The styles I suggest build on Bruener's narrative mode and would move economics in the direction of the humanities. Such a movement undoubtedly involves tradeoffs. A more humanistic approach would threaten the scientific aspirations and standing of economics. On the positive side it would reduce the "Excessive Ambitions" problem that limits the legitimate scope of a social science according to Elster (2009, 2013). Humanistic, narrative mode styles would also revive classical practice—without requiring the discipline to abandon its contemporary scientific styles.

To walk the talk I proceed, as ever, in the narrative mode. I start with how disappointment with Forrester's enticingly entitled *Thinking in Cases* got me thinking about research styles.

Disappointing Extension

I encountered John Forrester's posthumously published *Thinking in Cases* just as I was completing my book manuscript. The title resonated: case studies have undergirded my teaching and research for decades. Their emphasis on diverse contextual details—and possibilities for imaginative interpretations—have shaped my characterization of archetypal "one-off" uncertainties. The cases I have written and taught also satisfy several requirements of Bruner's specification of stories, including human intents and unfolding over time. But their match with Bruner's

specification isn't perfect—many of my cases don't have an unexpected reversal of fortune, for instance. Might Forrester's *Thinking in Cases* offer a better alternative, or at least a complement, for examining one-offs? But facing manuscript deadlines, I put that thought on hold and stuck with Bruner's narrative mode framing.

Subsequent investigation suggests that putting Forrester aside was fortunate. Forrester does offer engaging accounts of case teaching and case research (and their intertwined development) by Harvard's law, medical, business schools, and Arts and Science faculties. As mentioned, he recounts Kuhn's claim that members of scientific communities internalize the basic constructs of their disciplines through repeated "pencil and paper" solving of exemplary problems. Forrester calls such problems cases.

Herein lies a problem. Some of Forrester's cases, notably on Kuhn's experience with psychoanalysis, have evocative story-like structures with rich contextual and historical detail. "Pencil and paper" exercises in physics texts do not. Unfortunately, Forrester does not specify what he considers a case or what "thinking in cases" might entail. A special issue in *History of the Human Sciences* doesn't clarify either. Consider one of the more straightforward contributions to this special issue by the economic historian, Mary Morgan. Morgan (2020, 199) notes Forrester's suggestion "that 'thinking in cases' should be the seventh style of thinking or practical reasoning in science, to join the six styles outlined by Crombie (1988, 1994) and Hacking (1992). But he forbears to outline that mode."

Morgan forbears as well. Like many others before her (see Ragin and Becker 1992 and Becker 2014).[27] Morgan observes that cases have numerous forms (many without contextual detail) and uses (for example to question the premises as well as the inferences of propositions). But if nearly everything under the sun, including made-up physics problems, is a case that can be used for virtually any kind of reasoning, *Thinking in Cases* has little value as a useful style category.

Appealing Sextet

Fortunately, I found Crombie and Hacking's styles of scientific thinking that Forrester off-handedly invoked supported my widening plea.

Alistair Crombie, an Australian zoologist turned Cambridge University science historian, had originated "Styles of Scientific Thinking" as

"part of a grand narrative stretching back to the Ancient Greeks." But it was Ian Hacking, a Canadian philosopher, who starting with a 1982 book chapter, "Language, Truth and Reason" had attracted philosophers and historians of science to Crombie's styles. And, thirty years after the 1982 book chapter, it was Hacking's writing that inspired a special issue of *Studies in History and Philosophy of Science* (Ritchie 2012).

Hacking's contribution to the special issue reports that the novelty of Crombie's proposal is its "exhaustive" list of six types: the styles "cover the waterfront" (Hacking 2012, 601). The first three—mathematical, experimental exploration, and hypothetical modelling—concern "individual regularities." The remaining three—probability, taxonomy, and historico-genetic explanation—concern "regularities of populations," and are "less prestigious" (Hacking 2012, 603).

Attributes of Scientific Styles per Hacking

Although no necessary and sufficient conditions characterize a 'style,' styles have "distinct objects and methods of reasoning." The mathematical style for example, concerns itself with "abstract objects" such as "numbers, shapes, and groups" whereas species and genara of biology exemplify the taxonomical style. "Hypothetical modelling introduces non-observable theoretical entities" (Hacking 2012, 600-601).[28]

(Parenthetically the disparate objects and uses of "cases" invites skepticism about Forrester's claim that thinking in cases is a seventh "style" or cohesive "way of finding out").

Styles have distinctive historical trajectories and are "often associated with a legendary figure, a name, a hero in history" (Hacking 2012, 603).[29] They start in different eras, evolve in unpredictable, accidental ways,[30] before crystallizing or, perhaps more accurately, stabilizing.[31]

A crystallized style includes techniques that make it "autonomous" so that it can endure and travel to places far from where it started. But, paradoxically, styles continue to "change, evolve, divide, and unite" after crystallizing (Hacking 2009, 94). Mathematics crystallized in 6 BCE with Thales. But the ways of doing math have evolved over millennia and continue to change through, for example, computer-generated proof (Hacking 2012, 604).

Styles are "self-authenticating" as well as autonomous. They are "not good because they find out the truth. They have become part of our

standards for what it is, to find out the truth. They establish criteria of truthfulness." Applications of science and technology have profoundly changed the material world. But styles are not chosen because they 'work.' They help determine what counts as working (Hacking 2012, 605).

Nonetheless, even self-authenticating styles can disappear. Hacking offers the example of Paracelsus's Doctrine of Similitudes "as a style of reasoning that we can [now] scarcely comprehend." But, in contrast to Kuhn's scientific revolutions which are triggered by a "crisis," styles can become defunct without any noticeable failure: "Paracelsian medicine did not die because it did not cure people. A commonplace nowadays: doctors never cured people until late in the 19th century" (Hacking 2012, 604-605).[32]

Styles, writes Hacking (2012, 602), describe "the distinct genres of inquiry deployed in all the sciences, though in varying proportions for each special science."[33] I am personally skeptical about the 'all'—do mathematics and physics really deploy taxonomy and historico-genetic explanation? The deployment of "varying proportions" is however persuasive. You could say that the proportions characterize the distinctive paradigm of a science, broadly conceived. Moreover, we can imagine that changing proportions (and evolving methods of the constituent styles) would alter paradigms. Even gradual changes could then transform paradigms without any Kuhnian crisis-triggered revolution.

Relationship Between Scientific and Narrative Styles

The Hacking-inspired styles project focused on math and the natural sciences. In Bruner's terminology, the project covered the logico-scientific mode. Practitioners and scholars also study styles in Art and Psychiatry (Hacking 2012, 601). Bruner discusses the evolution and role of literary "genres" in considerable detail. Thus, we can—and do—examine narrative mode styles.

Some features of scientific styles described above, such as crystallization associated with legendary figures—and continued change—after crystallization—may also be found in narrative mode styles. There are further noteworthy similarities and affinities. We can discern the scientific historico-genetic style in Bruner's examination of the narrative mode in the law. Conversely Darwin had called his treatise that crystallized the

historico-genetic style "one long argument," suggesting a close affinity to Bruner's narrative mode.

Another connection: Hacking and other researchers who examine scientific styles are mainly historians and philosophers of science. They raise historical and philosophical questions and use modes of reasoning that lie outside the styles they study. "Anthropology, sociology, and cognitive science, especially of the more speculative sort, are also invoked" (Hacking 2012, 600). Differently put, the Hacking styles project studies the logico-scientific mode using narrative mode enquiry and discourse.

But don't ignore the differences. The six Crombie-Hacking scientific styles—and their objects and methods—hardly "cover the waterfront" of the artistic and narrative modes. Moreover, as I have argued elsewhere, scientists are exceptionally "autonomous" in comparison to their technological colleagues (Bhidé 2020b). Similarly, unlike scientific research, successful narratives in Art, Literature, the Law, and business require acceptance by outside audiences. Outsiders then must also help determine whether a style becomes established, reducing "autonomous" crystallization and durability.[34]

Styles in Disciplinary Economics

Adam Smith, who many modern economists consider their patron saint, was trained in and had a chair in moral philosophy at Glasgow. In keeping with his humanist education and professorship, Smith's landmark *Wealth of Nations* followed a narrative mode style, as did most canonical writing of classical economics. That would change with the rise of neoclassical economics in the 20th century.

By the first decades of the 20th century many economists favored the logico-scientific mode. The first sentence of Knight's 1921 book tells us that economics is "the only one of the social sciences which has aspired to the distinction of an exact science" like physics (Knight 1921, 7). Over the next several decades the aspiration made the logico-scientific mode preeminent.

Economic styles followed the scientific pattern outlined above. Economists adopted "autonomous," "self-authenticating" styles promoted by legendary figures. Their style selections reflected commitments to their "exact science" aspirations. The mathematical, hypothetical modelling, and probability genres, to use the Crombie-Hacking categories led the charge. Later Kahneman and Tversky's surveys, Vernon Smith's

experimental markets, and Bannerjee and Duflo's randomized controlled trials popularized experimental exploration. Economists confined openly rhetorical arguments to polemical policy debates.

Only economic historians, using what Hacking might call the historico-genetic style (which Hacking says is less prestigious), retained the classical narrative mode in their scholarship. Even here, cliometry that favored formal models and econometric analysis of statistical data (Williamson & Whaples, 2005) came to dominate high status economic history. More generally, the classical narrative mode style, like Paracelsian medicine (above), withered away without noticeable defects. Put aside Smith's (1776) *Wealth of Nations*. Marshall's (1890) *Principles*, Knight's (1921) *RUP*, and Keynes's (1936) *General Theory* would not be considered mainstream contributions today. The *American Economic Review* publishes next to nothing in the style of Hayek's (1945) "The Use of Knowledge in Society." *The Journal of Law and Economics* likewise excludes articles like Coase's (1960) "Problem of Social Cost" and the discipline would not now regard Coase's argument as a "theorem."

Logico-scientific styles and their overarching paradigm have been a great success for economics. They have helped make the discipline a high-status social science. According to Stanford economist David Kreps (2004, 125), economics is the only social science with a "strong, cohesive paradigm." The paradigm has given economics "remarkable unity and consensus" and the "ability, through unity, to defend itself and to arrogate to itself particular perks and benefits."[35] Why risk allowing the humanistic, narrative styles of classical economics back into the fold?

I argued in my book that by excluding uncertainty, the prevailing paradigm promotes a blinkered view of cooperative human conduct. I also suggested that while the exclusion might be mathematically convenient it isn't always necessary. For example, Information Economics usually focuses on problems of lying and cheating arising from conflicts of interest that ignore honest mistakes and sincere disagreements. Yet Stiglitz, an information economics pioneer, has published several papers (many co-authored with Raaj Sah) modeling mistakes made by "well intentioned" individuals (Stiglitz 2002, 481). These papers are clearly in Hacking's "mathematical" and "hypothetical modeling" styles.

Similarly, Friberg's essay (this volume) proposes an ambitious agenda for including uncertainty in economic analysis (that goes beyond the questions I have addressed and suggested). Friberg's thoughtful proposal

includes reviving Knight's risk-uncertainty distinction and a systematic analysis of unknown unknowns. Like his previous work, Friberg's proposal remains within the scope of accepted logico-scientific styles. No narrative mode reasoning or risky deviation from a successful paradigm seems necessary. In other applications as I will argue below involving simple known unknowns, scientific stylebooks may be severely limiting—even if style followers do not see these limitations.[36]

Defusing "Excessive Ambitions"

My "Case for Widening" chapter cited (Bhidé 2025, 315-316) two Elster essays to challenge the defeatism of principled logico-scientific commitments:

> In *Excessive Ambitions*, Jon Elster argues that "large bodies of social science are permeated by explanatory hubris. Economists and political scientists, in particular, rely on deductive models and statistical tools that are vastly less robust and reliable than their practitioners claim." In *Excessive Ambitions II*, Elster similarly attacks "overreaching" prescriptions aimed at creating institutions that will "produce good decisions, select good decision-makers, or create good decision-making bodies." Instead, Elster proposes a more modest, harm-minimizing approach: "insulate decision-makers as much as possible from the influences of self-interest, passion (emotion or intoxication), prejudice and cognitive bias. Once that has been done, one should let the chips fall where they may."
>
> But chips do not just "fall where they may." Choices, no less than chance, matter. And why hold unavoidably uncertain choices hostage to the logico-scientific standards of verifiability that Elster demands? What is so wrong with Bruner's plausible "narrative-mode" reasoning? Recognizing the impossibility of provable certitudes, why discard the legitimacy and solidarity—Albert Hirschman's "voice"—of debating the best imaginable choice?

Elster himself is no methodological dogmatist or careless popularizer. His prolific publications are wide-ranging and insightful. His recent *America Before 1787* (which, as mentioned, places uncertainty at its core) is an original (and ambitious!) account of the American Revolution. While it draws on social science research, its reasoning and exposition is unquestionably in the narrative mode style. The same kind of style – with the same emphasis on uncertainty – I submit would be invaluable in examining many socio-economic questions. Below I will focus on

how narrative economics research undertaken in a humanistic style could help examine constructive discourse.

Humanizing Narrative Economics

Morck (this volume) suggests Narrative Economics as an important uncertainty including initiative.[37] The initiative, promoted by Nobel prize winners Akerlof and Shiller, seems commendably novel (for economics) in examining emotion laden communication—instead of just the bloodless transmission of price signals. In principle it could also improve our understanding of imaginative discourse, that as repeatedly mentioned in my book and this essay, helps reduce disagreements about imagined futures.

My reservations arise from intertwined issues of scope and style. The new efforts typically focus on harmful narratives, particularly in anonymous financial markets. Shiller's metaphor of "narrative epidemics" is telling. He "likens the contagion effects of narratives to the transmission of disease from person to person," Mangee observes. Mental and personality "disorders" and "conspiracy thinking" amplify the effects. Shiller's narrative research extends Shiller's earlier work on the "irrational exuberance" that inflates stock market bubbles (Shiller 2000). There, Shiller "popularized models of feedback effects between media-driven stories and asset demand that become increasingly disconnected from fundamentals" (Mangee 2021, 10-12). Mangee's book has a similar slant: Part II of the book is entitled: "News Analytics as a Window into Stock Market Instability."

This kind of narrative economics has no agency or imaginative give and take. As in medical epidemiology, stock traders are merely "susceptible" to pathogenic news and rumors. In my account of constructive entrepreneurial discourse, investors and promoters co-produce narratives about plausible paths to attractive envisioned destinations. Likewise, where my unit of analysis is discourse between a few individuals about one-off ventures, the new narrative economics analyzes the behavior of multitudes and systemic macro-effects. It is thus akin to Charles McKay's 1841 *Memoirs of Extraordinary Popular Delusions* rather than Dale Carnegie's 1936 *How to Win Friends & Influence People*.

But, while both McKay's and Carnegie's classics relied on engaging stories, modern information technologies encourage today's narrative economists to use scientific "probabilistic" styles. Since 1960,

computerized databases at the University of Chicago's Center for Research in Security Prices have provided a convenient means for analyzing stock prices. Now, vast troves of unstructured text have been digitized, while advances in machine learning provide tools to analyze the "associated narrative considerations" (Mangee 2021, 8). Where McKay's 19th century *Popular Delusions* told colorful tales, Shiller's 21st century research uses "bag-of-word references tracking mentions from the internet database of books and articles." Shiller assumes that "Google Ngram and ProQuest searches of terms such as 'secular stagnation,' 'stock market crash,' 'Bitcoin,' 'profiteer,' 'housing bubble,' and 'Laffer curve'" are proxies for "narrative dynamics." His analysis connects the proxies to "major events" such as financial crises." Mangee's own research also uses "Google Trends searches and bag-of-word approaches" (Mangee 2021, 10-11). Thus, as with the cliometry of economic historians, statistical analyses help satisfy the aspirations of economists to analyze narratives in a scientific way.

The probabilistic style that maketh also however narroweth today's narrative economist. "Bag-of-word approaches" favor researching phenomena such as stock prices where standardized (or abstractable) data can deliver the statistical significance demanded by scientifically minded journal referees. In one-off discourse, from the great literature and landmark legal judgments studied by Bruner to more prosaic entrepreneurial pitches, reliable standardized data is sparse. Here, scholarly practices going back to Aristotle's *Poetics* and *Rhetoric* remain relevant. Literary devices including figures of speech, the rule of three, sequencing of events, imagined details, and myth and fable provide more understanding of effective discourse than Ngrams. The 271 words of Lincoln's Gettysburg Address teach us more about inspirational oratory than the boundless computer-searchable verbiage of the *Congressional Record*.

Personal experience with Large Language Models (LLMs)—and Wittgensteinian beliefs—makes me skeptical about the probabilistic analysis of human discourse. My repeated efforts to use LLMs to simplify my writing and summarize its contents made me compare the models to mendacious talking horses (Bhidé 2024). I surmise that in interpreting contextually rich narratives, multi-billion variable LLMs are the *expansio ad absurdum* of statistical inference. Probabilistic LLM calculations extrapolate from past texts. Actual understanding of a particular text or utterance is illusory.

LLMs and Google Ngrams are inheritors of Herbert Simon's legacy in computer science and psychology. Besides winning a Nobel in Economics (and propounding neglected theories of satisficing routines), Simon is also considered a father of Artificial Intelligence (AI) and a leader of the cognitive revolution that overthrew the "black box" view of the mind. The contributions are related. Simon modeled the mind as a computer, as mentioned. The computer model inspired the development of AI, including the machine learning used in textual analysis.

Bruner was also considered a leader of the cognitive revolution before he started his narratives project. But his revolution sought to "establish meaning as the central concept of psychology." Bruner envisioned psychology that would "join forces with anthropology and linguistics, philosophy and history, even with the discipline of law." He lamented the cognitive revolution's shift "from 'meaning' to 'information,' from the construction of meaning to the processing of information," with "computation as the ruling metaphor" (as quoted in Bhidé 2025, 262).

The style of Bruner's narrative research reflected his eclectic, humanistic sensibility. Following William James's example of studying "the most religious man at his most religious moment," Bruner assembled a team of literature scholars to examine literary masterpieces. He collaborated with an educational psychologist to study the recorded nighttime monologues of a child in her crib and with a law professor to study the narratives of landmark US Supreme Court judgments.

Eclectic humanism could enrich Narrative Economics—and much else besides—without excluding scientific styles from the discipline. In Rosenberg's histories of innovation, Darwin's "one long argument" for natural selection, entrepreneurs' business plans, and bankers' credit reports, logico-scientific and narrative styles complement each other. Narratives about constructive narratives could similarly combine imaginative interpretations with statistical analyses.

NOTES

1. Bhidé (2020a) clarifies what I mean by "disciplinary economics."
2. See Hill (2004, 2008, 2009, 2010), Davidoff, Steven and Hill (2013), Hill and Painter (2015), Hill and Pacces (2018), and Hill (2020).
3. For Gigerenzer's work see *inter alia* Gigerenzer, Todd, & ABC Research Group (1999); Arkes, Gigerenzer, and Hertwig (2016); Gigerenzer (2018); and, Gigerenzer, Reb, and Luan (2022). For Tuckett, see *inter alia* Tuckett (2022) and Johnson, Bilovich, and Tuckett (2023).

4. An unkind person might say that the utility maximized through subjective probabilities is mainly of the modelers — and behavioral researchers who can debunk an unreasonable benchmark of rationality.
5. Voltaire made a fortune in 1729 through a lottery syndicate (Frankenburg, 2022). Wallace and Sayre (2025) describe a successful contemporary lottery attack. Mathematician Edward Thorp (1966) is considered the father of blackjack card counting.
6. I have belatedly discovered (via Gerrard 2023, 1259) von Mises's (1949) earlier distinction between class and case probabilities. The von Mises distinction is like my distinction between distributional and one-off uncertainties.
7. See Nagel (2014) for an accessible review of skepticism.
8. In principle narrative mode discourse can be a monologue. Tuckett for example has studied the stories traders tell themselves to produce self-confidence. I however emphasize multisided discourse, the give and take between individuals and groups that supports confident collaborative action in entrepreneurship and beyond.
9. Kuhn (1970, 10).
10. Ibid.
11. Okasha (2016, 75).
12. Kuhn (1970, 47).
13. What Kuhn really meant by "paradigm" is more ambiguous than in my summary. Kuhn himself may have regretted the use of the term. See Forrester (2017).
14. I modify it however to reflect my stipulation that in one offs, extensive contextual data rather than statistics, reduces uncertainty and the possibility of profit. Thus, returning to Figure 1, Knight's RUP limits "risk" – which precludes true profit – to the bottom left-hand quadrant. All other quadrants are uncertain and profit-permitting. The bottom right-hand quadrant in my scheme also has low uncertainty, although statistics don't reduce doubts there. And although my book doesn't analyze this, that quadrant would also limit "true" Knightian profit.
15. Knight argued that uncertainty produces profits or losses depending on the correctness of the entrepreneur's judgments—while in the overall economy, total profits depend on how many individuals undertake uncertain projects, not on the correctness of their opinions (Bhidé 2025, 62).
16. Matthew Ford suggested this third possibility.
17. Officials in Weber's idealized bureaucracy make decisions "according to calculable rules." Although bureaucratic procedures can impede "the discharge of business in a manner best adapted to the individuality of each case," in its perfectly developed form, bureaucracy eliminates "love, hatred, and all purely personal, irrational and emotional elements which escape calculation." In contrast, reasonable procedures for evaluating new commercial initiatives cannot disregard "the individuality of each case" and leave at least some room for subjective judgments that "escape calculation" (cited in Bhidé 2025, 247).
18. While contextual evidence is preeminent in one-offs, its interpretation requires broader background generalizations. Conversely, using statistical data to reduce doubts about distributional uncertainties requires contextual interpretations and justifications (Bhidé 2025, 16-17).
19. A physician-mother recalls she was outraged that her family doctor had diagnosed her son as obese. "Why don't you *look* at the boy she complained?"

20. Bhidé (2017b) analyzes differences between US and European use of credit scoring.
21. For example, what holds back entrepreneurship in Bangalore (Bhidé 2008a), why is securitization so much greater in the US than in Europe (Bhidé 2017b) and what caused the 2008 global financial crisis (Bhidé 2010).
22. The generalizations include several publications on startups (notably Bhidé 2000), the globalization of innovation (Bhidé 2008b), the barriers to medical innovation (Bhidé 2017a) and of course the book covered in this special issue.
23. According to historian Joyce Chaplain, Benjamin Franklin used the homely analogy of drafts of air from a fireplace to the door to explain the Gulf Stream. *Harvard Gazette*, 03, 2025.
24. In 1961, according to Reynolds (2022), "the molecular biologists François Jacob and Jacques Monod introduced the metaphor of a genetic program with their operon model of gene regulation, revealing that some genes (or sequences of DNA) act like electronic switches that turn other genes on or off. This further entrenched the discourses of information and computing into molecular biology. Phrases such as genetic code, genetic program, genetic blueprint, genetic circuits, genetic switches, molecular signals, and the book of life have become so second nature that few stop to think how remarkable it is that our language for understanding the fundamental units of life is dominated by metaphors of computers and information."
25. According to Monk (2025) Western philosophy, going back to Descartes ('I think therefore I am') regards the contents of our own minds as foundational —"the rock upon which all other knowledge is built." *Philosophical Investigations* "reverse[s] this priority by reminding us that we can talk about the contents of our own minds only once we have learned a language and that we can learn a language only by taking part in the practices of a community. The starting point for philosophical reflection, therefore, is not our own consciousness but our participation in communal activities: "An 'inner process' stands in need of outward criteria."
26. Taking liberties with the *Tractatus*'s use of 'show' and 'say'.
27. In medicine for example, case histories can refer to detailed compilations of a patient's self-reported complaints, laboratory tests, eating and drinking habits, past and present medications, parental diseases and so on. They can also refer to simple counts of disease outbreaks (16 cases of measles reported in the last month) or in surgical journal research reports, as the number of successful and unsuccessful procedures. My own case writing, going back to 1978, spans a wide range. I have written scores of *teaching* cases, published by HBS for classroom teaching, typically to discuss problems in political economy, entrepreneurship, and transformative medical innovations. My case *research* has addressed general questions—what's the difference between bootstrapped and venture-backed startups?—as well as specific phenomena—how did Marvin Bower establish McKinsey & Co. as a pioneering management consultancy? Or why did Bangalore's Main Street businesses remain moribund amid an IT boom.
28. On distinctive methods of reasoning, Hacking points to the "unusual extent" to which the "historico-genetic" style, exemplified by Darwin's theory of evolution, relies on "abduction or inference to the best explanation."
29. At the same time, Ludwik Fleck's "Thought-Collectives" play pivotal roles in the crystallization of a style. The collectives are networks of investigators "who address a family of problems that they understand in much the same

way, and which they attack using a group of mutually intelligible methods" — you might think of them as cohesive "communities" who share a Kuhnian "paradigm." However, they are also often small, local and "relatively short-lived, for they tend to dissipate as questions become answered or problems prove to be intractable. People move on, and out of the collective (Hacking 2012, 604).

30. "There is much to be said," writes Hacking (2012, 602), "for the iconoclastic opinion of Doron Zeilberger (2010): 'Our mathematics is an accidental outcome of the random walk of history, and would have been very different with a different historical narrative.'"
31. Classification starts in antiquity with Aristotle and then crystallizes as taxonomy around 1775 with Linnaeus. Probability crystallizes in the time of Pascal and historico-genetic explanation "triumphs" with Darwin's explanation of the species by natural selection (Hacking 2012, 603).
32. Relatedly, "styles of scientific thinking & doing have no essence." They are purely descriptive genres of enquiry, and, "If we ask why they persist the answer is more likely to be ecological than logical or pragmatic" (Hacking 2012, 601).
33. Citing Hacking's remark that "styles of scientific reasoning tend to accumulate (Hacking, 1983, 56)" Sciortino writes: "As styles of reasoning have emerged they have often been adopted together in order to solve single scientific problems: the algorithmic, the postulational, the statistical, the historico-genetic, the taxonomic, and the laboratory styles of reasoning are not mutually exclusive. Today scientists switch from the ways of thinking and doing, the methods, the objects, the type of evidence of a style of reasoning to another while they do scientific research." (Sciortino 2023, 244-245)
34. According to Chunglin Kwa (2012) "collectivities"—which include artists as well as the public— sustain styles in Art.
35. Expanding on Kuhn's observations about academic "prestige," Kreps (2004, 115) also notes that professors of economics earn higher salaries than faculty from other social sciences.
36. Recall that, per Hacking, styles are not chosen because they work. They establish standards for truthfulness—what counts as working.
37. My book (Bhidé 2025, 340) also briefly cited Shiller's (2017, 2021) work on "contagious" narratives.

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