



Chance, probability, and uncertainty at the edge of human reasoning: What is Knightian uncertainty?

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Abstract

Research Summary: For more than a century, Frank Knight's *Risk, Uncertainty, and Profit* has significantly influenced entrepreneurship theory development by exploring the nature of uncertainty and the epistemic limits of entrepreneurial action. Knight's work highlights how economic actors cannot fully predict the consequences of their actions. Despite its broad influence, debates persist regarding the nature of Knightian uncertainty. This study addresses these debates through a comprehensive analysis of *RUP* and Knight's other published and unpublished writings to offer new insights into the nature and meaning of Knightian uncertainty, revealing Knight's holistic theory that integrates "real indeterminism," "partial knowledge," and "subjective beliefs." This analysis provides much needed construct clarity to advance contemporary theories of entrepreneurial action and the role of uncertainty in business venturing processes.

Managerial Summary: This article revisits Frank Knight's foundational work, *Risk, Uncertainty, and Profit*, a cornerstone in entrepreneurship research for over a century. We highlight Knight's holistic approach to uncertainty, which integrates the concepts of real indeterminism (the inherent unpredictability of future events), partial knowledge (the

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incomplete understanding of the present and future), and subjective beliefs (individual perceptions and interpretations). The study offers new perspectives on how Knightian uncertainty influences entrepreneurial decision-making and action, highlighting how this unique type of uncertainty plays a critical role in the business venturing process. These insights provide valuable contributions to contemporary theories of entrepreneurship, emphasizing the complexity and multifaceted nature of navigating uncertainty in business.

KEYWORDS

construct clarity, entrepreneurial work, Knightian uncertainty, risk, uncertainty

1 | INTRODUCTION

Frank Knight's (1921) *Risk, Uncertainty, and Profit (RUP)*—written over a four-year period amidst a series of world-shattering events, including a devastating world war and global flu pandemic—represents a crucial contribution to scholarship concerning the role, relevance, and impact of uncertainty within society and the economy (Alvarez & Porac, 2020; Ramoglou, 2021; Ramoglou & Tsang, 2016; Rindova & Courtney, 2020; Townsend et al., 2018; Townsend et al., 2023). For entrepreneurship scholars, Knight's canonical work illuminates the challenges entrepreneurs face in navigating an unknowable future (Angus et al., 2023; Ramoglou, 2021; Townsend et al., 2018) and generates essential questions about the nature of human motivation and the creative role of human action in shaping social and economic environments (Sarasvathy & Dew, 2005; Sarasvathy & Venkataraman, 2011; Venkataraman et al., 2012). More than a century later, Knight's foundational insights in *RUP* remain as relevant and important as ever, reflected in the manner with which contemporary scholars continue to “...take Knight's (1921) insights and push them further... extend them wider (and) update them in light of new developments in the social and behavioral sciences and within management theory itself” (Alvarez & Porac, 2020, p. 735).

As is often the case—perhaps especially with classics—not all of these works reflect the author's original intent. Scholars, especially deceased ones, have limited reign over how succeeding generations receive and interpret their work (DiMaggio, 1995). It was once said that Darwin is more famous for what he never wrote than for what he actually wrote. Knight, one might argue, has experienced a similar fate. Although many contemporary studies continue to draw upon Knight's theorization on the nature of uncertainty—particularly his widely cited dichotomization of risk and uncertainty—the meaning of Knightian uncertainty remains widely misunderstood. Much of the confusion stems from a lack of familiarity among organizational scholars with the philosophical tools and approaches Knight uses to define the nature of uncertainty in *RUP*, including common misunderstandings concerning *how* Knight uses the complementary tools of logic (i.e., classification and dichotomization) to formally define uncertainty, *what* philosophical frameworks he builds on to identify different types of uncertainty (i.e., the Kantian Theory of Judgments—Knight, 1920), and *why* he rejects probability theory as the basis for contending with the problems of unknowable future(s) in entrepreneurship (Knight, 1921).

In this study, we address these questions of *how*, *what*, and *why* through in-depth analyses of Knight's arguments in *RUP* as well as other published and often-ignored unpublished writings. We develop novel theory by analyzing key passages from *RUP* and other contemporaneous work where Knight contrasts true uncertainty (i.e., *What is possible*



or impossible?) with other types of uncertainty (i.e., statistical uncertainty—*What is actual?* or a priori uncertainty—*What is necessarily certain?*). To accomplish this goal, we explore and illuminate the philosophical foundations upon which Knight builds his theory of uncertainty. Knight constructs a holistic approach to theorizing the nature of “true uncertainty” in *RUP* that synthesizes the environmental conditions of real indeterminism with an actor’s partial knowledge and subjective beliefs, thereby formulating a theory of “true uncertainty.” Once properly explicated, Knight’s unique approach to theorizing uncertainty informs and reshapes contemporary conversations on the role and impact of uncertainty in entrepreneurial action and the business venturing process.

Our study also contributes to entrepreneurship theory by addressing the critical limitations governing the use of “scientific approaches” to contending with the problem of uncertainty through entrepreneurial action (e.g., Zellweger & Zenger, 2023). In Knight’s view, the unknowability of the future suggests that an inductive, “scientific process” that is rooted in subjective expected utility theory (e.g., Camuffo et al., 2020) will only go so far in addressing the problem of uncertainty as unexpected changes are introduced into the business environment (Hunt et al., 2024). In dynamic environments where future possibilities evolve in unexpected ways and the future diverges from the past, complementary approaches are necessary to resolve the problem of Knightian uncertainty. Accordingly, we conclude the study by discussing alternative approaches to entrepreneurial action and organizing in the face of unknowable futures.

2 | THEORETICAL BACKGROUND: KNIGHTIAN UNCERTAINTY & ENTREPRENEURSHIP RESEARCH

The central question we address in this study is: *What is Knightian Uncertainty?* For more than a century, Frank Knight’s (1921) foundational work in *RUP* has been instrumental in shaping how economics (e.g., Ellsberg, 1961; Lawson, 1988; Luce & Raiffa, 1989), organizational (e.g., Duncan, 1972) and entrepreneurship (e.g., Busenitz & Barney, 1997; McMullen & Shepherd, 2006; Sarasvathy, 2001; Townsend et al., 2018) scholars theorize the role of uncertainty. In the field of entrepreneurship, Knight’s theory of uncertainty has substantially shaped and informed the development of virtually all of the field’s most prominent theories and literatures; a small sample includes actualization theory of opportunities (McMullen et al., 2024; Ramoglou, 2021; Ramoglou & McMullen, 2024; Ramoglou & Tsang, 2016), entrepreneurial orientation (Miller, 2011), entrepreneurial cognition (Busenitz & Barney, 1997), effectuation (Sarasvathy, 2001), entrepreneurial action (McMullen & Shepherd, 2006), creation theory (Alvarez & Barney, 2007), and judgment-based analysis (Foss & Klein, 2012).

The influence Knight’s theories continue to exert upon entrepreneurship research is also reflected in the escalating rate of citations, even more than a century after *RUP*’s original publication. A tabulation of citation data from Google Scholar indicates that between 1985 and 1997, *RUP* was cited, on average, approximately 100 times per year. However, in the past few years alone (2018–2023), *RUP* has been cited more than 9640 times (and counting). In many of these cases, Knight’s theory is not simply a ceremonial citation (cf. Townsend et al., 2022) but rather has been adopted as a central premise in the logic of the theories, offering definitional guardrails that set the boundary conditions demarcating the field of entrepreneurship (Venkataraman, 1997). In this section, we assess the reception and impact of Knight’s theory of uncertainty on contemporary entrepreneurship theory development and discuss several benefits and limitations of various interpretations of this construct in contemporary research.

2.1 | Theoretical background: Knightian uncertainty in entrepreneurship theory

In entrepreneurship theory, *RUP* remains one of the foundational texts in the field, providing a comprehensive framework to explain the existence of economic profits stemming from entrepreneurial action (e.g., Busenitz & Barney, 1997; McMullen & Shepherd, 2006; Sarasvathy, 2001; Townsend et al., 2018; Venkataraman, 1997). Knight

(1921) builds his arguments upon a fundamental distinction between risk (i.e., known chance) and “true uncertainty” (i.e., unknown chances):

“Uncertainty must be taken in a sense radically distinct from the familiar notion of risk, from which it has never been properly separated.... The essential fact is that ‘risk’ means in some cases a quantity susceptible of measurement, while at other times it is something distinctly not of this character; and there are far-reaching and crucial differences in the bearings of the phenomena depending on which of the two is really present and operating.... It will appear that a measurable uncertainty, or ‘risk’ proper, as we shall use the term, is so far different from an unmeasurable one that it is not in effect an uncertainty at all” (1921b, p. 19).

Knight's categorical separation between risk and uncertainty plays a vital role in Knight's theory since unmeasurable and measurable uncertainties are theorized to exert different effects on the functioning of the free enterprise system. When uncertainties are “unmeasurable,” Knight (1921) contends that market actors can generate economic profits since the mechanisms of perfect competition will not price things accurately. However, if uncertainties are “measurable,” Knight (1921) argues that market actors can use the mathematical tools of probability calculations or insurance to hedge against the underlying risks.

Knight's distinction between risk and uncertainty has played an important role in the development of contemporary entrepreneurship theory. In creation theory, Alvarez and Barney (2007, p. 14) explicitly reference Knight's theory by arguing that “[...] for purposes of distinguishing between the assumptions of discovery theory and creation theory, these terms (risk vs. uncertainty) have distinct meanings (Knight, 1921).” Based on this distinction, they go on to argue that in uncertain environments “[...] no matter how hard an entrepreneur works, all the information needed to turn this decision-making setting into a risky one cannot be collected...(and) for those opportunities that are being formed by the actions of entrepreneurs, such information does not yet exist, and therefore, it cannot be collected or analyzed” (Alvarez & Barney, 2007, pp. 16–17). Effectuation theory (Sarasvathy, 2001) also adopts Knightian uncertainty as a strong premise in theory development. “(The) normative development (of effectuation) is rooted in the conceptual distinction between “risk” and “uncertainty” (Knight, 1921)” (Sarasvathy, 2001, p. 250).

McMullen and Shepherd (2006) draw on Knight's (1921) conceptualization to build their theory of entrepreneurial action under conditions of uncertainty. “Knight addresses uncertainty explicitly. He posits that profit is the reward for those willing to bear uncertainty because unlike risk, uncertainty is inestimable and therefore uninsurable” (McMullen & Shepherd, 2006, p. 138). Knightian uncertainty is also central to foundational perspectives on judgment-based theories of entrepreneurial organizing (e.g., Foss & Klein, 2012) and emerging perspectives on entrepreneurial work (Ramoglou & McMullen, 2024) and the actualization of new opportunities (McMullen et al., 2024; Ramoglou, 2021; Ramoglou & Tsang, 2016). Recent studies have also posited that the problems of Knightian uncertainty play a central role in setting the boundaries for the use of artificial intelligence in entrepreneurship (Townsend et al., 2023).

However, despite the central importance of Knightian uncertainty to entrepreneurship theory, there remains substantial confusion regarding its nature and meaning in contemporary research (Bhide, 2021; Dimand, 2021; Foss & Klein, 2012; Kay & King, 2020; Langlois & Cosgel, 1993; Lawson, 1988; O'Donnell, 2021; Runde, 1998). Eminent commentators on Knight have argued that many of the “...received interpretations—of the risk/uncertainty split and of the Knightian theory—are flat-out wrong” (Langlois & Cosgel, 1993, p. 458). These problems persist because “...Knight (1921) is more widely quoted than read on his eponymous distinction between risk and uncertainty” (Runde, 1998, p. 539). As we noted above, much of the confusion stems from a lack of familiarity with *how* Knight uses the complementary tools of logic (i.e., classification and dichotomization) to formally define uncertainty, *why* he rejects probabilistic approaches to contend with the problems of unknowable future(s), *what* he builds his approach upon to theorize the nature of uncertainty (Knight, 1921b). We now examine each of these questions to highlight critical arguments from Knight's published and unpublished writings that clarify the depth of his thinking on these questions, as well as to highlight some of the open questions that remained unresolved in his work.



2.2 | The logic of risk and uncertainty

The first point of debate we address in the literature stems from the confusion regarding the tools of logic Knight uses to define uncertainty. As we discussed earlier, much of the contemporary work on Knight emphasizes his dichotomization of risk and uncertainty into distinct, bivalent (two-valued) categories, which Knight describes as measurable risks and unmeasurable uncertainty. Knight develops the logical arguments for this dichotomization of risk and uncertainty in Chapter Eight of *RUP*, which he entitles “Structures and Methods for Meeting Uncertainty,” but what is often less clear to contemporary scholars is why Knight dichotomizes these terms in the first place. In Chapter 8 of *RUP*, Knight describes his reasons for dichotomizing risk and uncertainty based on the need to resolve what he refers to as a “fatal ambiguity” in these terms. “But if our reasoning so far is at all correct, there is a **fatal ambiguity** in...(these terms), which must be gotten rid of, and the use of the term “risk” in connection with the measurable uncertainties or probabilities of insurance gives some justification for specializing the terms as just indicated” further arguing that “the practical difference between the two categories, risk and uncertainty, is that in the former the distribution of the outcome is known...while in the case of uncertainty this is not true” (*emphasis added*—Knight, 1921, p. 233).

In this passage, Knight (1921, p. 233) is precisely following the process outlined by his logic professor at Cornell, James Creighton (1909), to resolve the ambiguity of logical terms by dividing uncertainty into two contradictory parts (i.e., A and not-A, or *measurable* vs. *unmeasurable* uncertainty, or risk and uncertainty) based on the logical principle that “a definition should not be expressed in obscure, figurative, or ambiguous language” (Creighton, 1909, pp. 72–73). According to Creighton’s primer, Creighton (1909, p. 72), which Knight first encounters as an undergraduate student at Milligan College and then later as Creighton’s Ph.D. student at Cornell, dichotomization is the primary method for eliminating the ambiguity of terms. Creighton qualifies this by noting that dichotomization “is a purely formal principle of division. Some positive knowledge of the particular facts involved is always necessary...the logical law, in other words, does not help us at all in deciding what may be regarded as not-a...it is merely a principle of order and arrangement” [1908 (1898, p. 72)]. This is a **crucially important** principle for understanding Knight’s reasons for dichotomizing risk and uncertainty. As Creighton (1909, p. 72) notes, using dichotomization to split a term into two distinct contradictory terms is not intended to define the essential nature of the negated, not-A category (i.e., in *RUP*, “true uncertainty”). Thus, when Knight (1921) describes uncertainty as “unmeasurable,” he is not intending to tell the reader anything about the essential nature of uncertainty. This is not an ontological statement. Nor is Knight defining uncertainty based on what it is not (i.e., *not measurable*). Instead, as Creighton (1909, p. 73) notes, “the practical use of this principle (i.e., dichotomization) will depend upon our ability to find some positive value for the negative not-a,” meaning that a logical definition of a term requires a description of what it is and not simply what it is not.

Knight accomplishes this goal of defining the positive attributes of uncertainty in Chapter 7 of *RUP*, which he titles: “The Meaning of Risk and Uncertainty,” thereby clearly identifying his intention to define uncertainty using the tools of logic.¹ Knight builds his formal, logical definition of uncertainty in *RUP* based on the understanding that “to define a term is to state its connotation, or to enumerate the attributes which it implies” (Creighton, 1909, p. 63) using the logical tool of classification to establish the connotative meaning of uncertainty. According to Creighton (1909, p. 76), classification is the primary method used to set logical definitions. The purpose of classification is to identify the underlying qualities or attributes that are the basis of dividing the categories. According to Creighton (1909, p. 67), this is achieved through an inductive “comparison of particular instances, both positive and negative... (to provide) a complete and adequate expression of the nature of all the individuals which share in the class name.” Creighton organizes his approach around several key rules, which Knight applies meticulously in Chapter 7 of *RUP*: “(1) Every division is made on the ground of differences in some attribute (or attributes) common to all the members of the whole to be divided. (2) Every division must be based on a single principle or ground. (3) The constituent species (or groups into which the whole is divided) must not overlap but must be mutually exclusive. (4) The division must be exhaustive, i.e., the constituent species must be equal when added together to the genus.”

With this framework in mind, Knight utilizes *classification* to identify three types of probability situations as the basis of his theory of uncertainty: *a priori*, *statistical*, and *estimates*. There is abundant textual evidence in *RUP* that highlights Knight's use of classification to build these concepts. For example, in a key passage in Chapter 7, Knight (1921, p. 224) argues that “if the term ‘probability’ is to be applied to an estimate—and the usage is so well established that there is no hope of getting away from it—a third species under that genus must be recognized.” Here Knight is clearly applying Creighton's Rule #4 by identifying a missing type of “probability situation” in the *genus*. Knight (1921, p. 224) goes on to write that “we have insisted that there is a fundamental difference between ‘a priori’ probability, on the one hand, and ‘statistical,’ on the other. In the former, the ‘chances’ can be computed on general principles, while in the latter, they can only be determined empirically.” Knight (1921, p. 224) then applies Creighton's Rule #1 by describing the common attribute linking all three types of probability situations together, which Knight defines as “really indeterminate factors:” “This view and our entire theory tend to be confirmed by the attempt to obtain complete homogeneity through more minute classification. The end result of this endeavor would be groupings in which only really indeterminate factors should differ from one instance to another.” Knight (1921, p. 224) then concludes his logical definition of uncertainty by noting that “taking then, the classification point of view, we shall find the following scheme for separating three types of probability situation (sic),” which is where he applies Creighton's second and third rules of classification by identifying how these three types of “really indeterminate probability situations” are differentiated from each other.

In this crucial section of *RUP*, Knight builds on Creighton's (1909, p. 67) classification system to provide a “comparison of particular instances, both positive and negative... (to provide) a complete and adequate expression of the nature of all the individuals which share in the class name.” Here now, Knight differentiates his three types of “really indeterminate probability situations” (i.e., *a priori*, *statistical*, and true uncertainty). Knight's word choices to define these three different types of probability judgments in this passage are deliberate; he builds on Immanuel Kant's *Modalities of Judgment* (Kant, 1788) to provide a “positive theory” to define the properties of “true uncertainty.”

Knight's use of the Kantian framework is an important guide for interpreting the meaning of uncertainty in his theory. In Kant's theory of judgment, “judgments are complex conscious cognitions that...(are) the central cognitive faculty of the human mind” (Hanna, 2022). Creighton (1909, p. 323) describes judgments as “the simplest form of... an act of thought,” further noting that “in accordance with general usage, however, we may use the term ‘Judgment’ for both the act itself and its result.” The Kantian framework identifies three “modalities of judgment” (i.e., apodeictic, assertoric, or problematic), which express different types of an actor's “beliefs” encapsulated within a judgment. For example, apodeictic judgments express an actor's belief that some action or a consequence of an action will *necessarily* happen. Assertoric judgments express an actor's beliefs that an action or a consequence of an action will *actually* happen. In contrast, problematic judgments express the belief that an action or consequence of an action will *possibly* happen.

Textual evidence of Knight's use of the Kantian categories of judgment abounds in this section of *RUP*. Primarily, this linkage is illustrated by Knight's use of “*a priori* judgments” as the baseline category of his emphasis on real indeterminism. “We seem to experience an “**apodeictic certainty**” about the situation of a game of chance, on a level with our confidence of the axioms of mathematics, and quite different from an ‘estimate’” (Knight, 1921, p. 223—*emphasis added*). In addition to these and other explicit references to the Kantian modalities of judgment in *RUP*, hand-written feedback from Knight's dissertation chair, Allyn Young, to Knight on a rough draft of *RUP* notes that “[For myself, I put some of the Kantian “categories” in this empirical rubric.]” (Young, 1922). In response, Knight crosses out the word “some” and changes it to “all” (Young, 1922).

In Knight's scheme, *a priori* probabilities are akin to throwing fair dice, where the possible outcomes are fixed in advance, and the odds of any one side appearing can be calculated because the range of possible outcomes is known *a priori*. In contemporaneous, seldom-analyzed class notes from a 1913 doctoral seminar on Kant, Knight notes that “*A priori* means earlier. Temporal reference. This (sic) not the sense in which Kant used the word. Rather ‘from the inside.’...*A priori* states logically first; not necessarily first in time.” In this foreshadowing glimpse, Knight argues that any temporal aspects of *a priori* uncertainty are rooted in the notion of pre-existing causes. While actors may be



ignorant of these prior causes, the logic of this approach suggests that these necessary prior causes are discoverable *in principle*. Modern science, as Knight painstakingly argues, is based on this notion of a priori causality, and involves the search for and formulation of scientific laws to account for this form of uncertainty. Once these scientific laws are formulated and validated, they become the basis for predicting specific future situations where future outcomes are determined by a priori causes.

In contrast, statistical probabilities are comprised of an unknown set of possible outcomes that can only be known a posteriori (i.e., after the event) or if decision-makers can group choices together to create and analyze a closed set of possible choices using statistical methods. The difference between the two modes of probabilistic choices “depend(s) upon the accuracy of classification of the instances grouped together” (Knight, 1921, p. 217). Knight’s specific language is important and must be interpreted through his application of the Kantian principles of modality—namely, statistical uncertainty as an instance of situations where actors build models based on “actual, experienced reality.” Although Knight does not use the phrase “a posteriori” to refer to this category, it is clear that the inductive process of collecting and categorizing prior experiences into homogeneous groups is precisely what Knight had in mind.

Consistent with this view, Knight further notes that “in the latter type of situation (i.e., statistical uncertainty), we cannot, as we can in the former (i.e., *a priori* uncertainty), calculate the true probability from external data, but must derive it from an inductive study of a large group of cases” (Knight, 1921, pp. 230–231). This is consistent with other descriptions in Knight’s arguments used to describe the “result...reached by the empirical method of applying statistics to *actual* instances (Knight, 1921, p. 214—*emphasis added*).” In other words, statistical probability judgments are constructed through the actual experiences of the actor, reflecting the present-day understanding of these events. Under these conditions, actors can solve the problem of statistical uncertainty through the construction and refinement of models that are designed to provide an accurate description of reality as it currently exists.

It is on this basis that Knight (1942, p. 39) differentiates between a priori and statistical uncertainty when he argues that “there is a categorical difference between such situations as games of chance, in which the probability can be calculated *a priori*, and those, typified by life insurance, in which the distribution can be learned only by observation over time.” Knight (1942, p. 39) further argues that “in the second field...exhaustive knowledge of all the antecedents would lead to correct prediction in the individual case.” Of course, gaining such “exhaustive knowledge” is impossible since all actors are subject to bounded rationality regarding what we can know about the world at any given point in time (e.g., Sarasvathy, 2001), but the critical point is that statistical uncertainties and are at least resolvable in principle (Packard & Clark, 2020).

The final “probability situation” Knight (1921) identifies in *RUP* is the category that scholars now commonly associate with “Knightian uncertainty.” Knight (1921) argues that entrepreneurs contend with this type of uncertainty through the use of “estimates.” The critical difference between “estimates” and the calculation of a priori or statistical probabilities is that “there is no valid basis of any kind for classifying instances” Knight (1921, p. 225). This third category of “true uncertainty” involves “business decisions (that) deal with situations which are far too unique, generally speaking, for any sort of statistical tabulation to have any value for guidance.” We elaborate on the meaning of Knight’s arguments in greater detail below, but the primary point of differentiation he is making here is that actors cannot calculate the probability of an outcome occurring using a priori methods. Nor can they apply statistical methods to calculate these probabilities because the events in question are too dissimilar and, therefore, cannot be grouped into the same probability set as other events. By implication, the critical difference between this third category of “true uncertainty” and the other two categories is that the set of possibilities tied to an event, in Knight’s view, is *unknowable*. Overall, based on Knight’s use of classification to define true uncertainty, the common element (i.e., the genus) in his theory is the “really indeterminate factors” that manifest as a priori, *statistical*, or *true uncertainties*.

In sum, as entrepreneurs pursue novel, unexpected courses of action, the boundaries of what is possible/impossible change with these decisions or actions. By implication, entrepreneurs cannot specify a “fundamental possibility set” because the aspects of decisions that relate to human free will and choice can never fully close off the range of future possibilities.

2.3 | A holistic approach to Knightian uncertainty: Real indeterminism, partial knowledge, and entrepreneur beliefs

In the previous section, we examined how and why Knight utilizes both classification and dichotomization to establish his logical definition of true uncertainty in *RUP*. Toward this end, Knight never intended for the risk-uncertainty dichotomy to serve as the definitional basis for “true uncertainty.” Instead, using the complementary logic tool of classification, Knight (1921) adopts a sophisticated, novel approach to theorizing uncertainty using a trichotomy of probability situations: a priori, statistical, and “true uncertainty.” In a forceful fashion, Knight builds his theory of “true uncertainty” by juxtaposing his approach through a critical analysis of what he refers to as the ignorance theory of uncertainty. The logical structure of an ignorance theory of uncertainty is based on two fundamental premises: (1) the state of the world is objectively determined and (2) actors have imperfect knowledge or information about the true state of the world. Under these conditions, resolving or mitigating uncertainty requires the development of a comprehensive world model: “a description of the world so complete that, if true and known, the consequences of every action would be known” through search, analysis, and rational choice (Arrow, 1966, p. 254). From an ignorance theoretic perspective, the primary problem of uncertainty is viewed solely as an epistemic problem that emanates from an actor’s imperfect understanding of the deterministic causal processes that will determine future world states. Knight’s logic professor Creighton (1909) summarizes the philosophical foundations of “ignorance theory” in *An Introductory Logic*:

“There is, of course, no such thing as ‘chance; regarded as a power which controls and governs events. When we speak of something happening ‘by chance,’ or of some occurrence as ‘probable,’ we are expressing merely a deficiency in our own knowledge...To assert that anything happens by chance, then, is simply to confess our ignorance of the causes which are operative.” (Creighton, 1909, p. 194).

At the same time, Creighton (1909, pp. 229-230) further argues that:

“It is impossible to determine with mathematical precision the chances for or against any events, since the possibilities are indefinite as well as the causes. In cases where the whole series of possibilities does not lie before us, we have to base our calculations for the future on what is known regarding the frequency with which the events under consideration have occurred in the past.”

Creighton builds on these arguments to differentiate the mathematical calculation of probabilities from the use of “statistical analysis” to estimate the probability of future events occurring.

In *RUP*, however, Knight (1921) rejects the deterministic assumptions in ignorance-based conceptualizations of uncertainty. Knight’s misgivings in this regard surfaced early in his academic writings. During his doctoral studies, Knight (1913b, p. 34) penned an essay entitled “Causality and Substance,” where he argues, “we must recognize that objectivity and subjectivity are a matter of degree and of point of view; they are not absolute but relative.” In class notes recorded during the time he wrote the essay, Knight also mused that the “crux of question not so much whether I am free or not, as whether reality is something fixed and final, or whether it is plastic and alternative. Whether anything I can do will make things different from what they would otherwise have been” (Knight, 1913a). But Knight (1913a) also rejected the notion that a “plastic reality” was entirely the product of human thought and action, noting that:

“The world is just what we do not set up nor knock down but what we find ourselves obliged to adjust ourselves to or suffer the consequences. If we change or modify it to suit our purposes, it is to a comparatively limited extent at best and then only by very painful efforts and by taking advantage of its own laws, which we labor to discover and in no sense ‘create.’...(thus) while we control nature through the movement of



matter in space...our significant mastery of (nature) on which civilization is built is released through the release of potential energy stored up in various forms in the world."

These dynamic tensions between subjectivism and objectivism, determinism and voluntarism, and knowledge and ignorance run deeply through Knight's writings at the time, profoundly shaping his primary philosophical stance on the nature of uncertainty. Knight draws on these dynamic tensions in his dissertation when he begins the process of outlining his theory of uncertainty:

"The uncertainty with which we have to deal in economic theory, and which enters into every business decision must be radically distinguished from this objective, mathematical, or gamblers probability. But it, in turn, is anything but simple. It always refers to the character of a human judgment or estimate, either of fact or of real probability, but may do so in either of two ways. It may mean subjective uncertainty, the amount of confidence felt by the person in his own judgment or that of another. But it is more likely to have a quasi-objective meaning, relating rather to an assumed real value or dependability in the judgment in question. The two things are, of course, not distinct but different aspects of the same thing. A degree of confidence in a judgment implies a degree of real dependability in it." (Knight, 1916, p. 189).

Knight's arguments that these "two things are of course not distinct" and that the "degree of confidence in a judgment" is shaped by the "degree of real dependability in it" illuminate how he is bridging these foundational philosophical positions in his work.

In contrast to ignorance theory, which is built on the ontological premise that uncertainty is solely a subjective phenomenon that stems from an actor's ignorance of the causal forces that determine the future, Knight's work in *RUP* reflects his intuitions about the complex nature of uncertainty. At the same time, Knight (1916) recognized that this notion of a "quasi-objective" real world was still vague and undefined, but Knight lacked a clear philosophical category upon which to ground his emerging theory.

Knight's skepticism concerning the deterministic assumptions of ignorance theory has then taken concrete form in his writings, generating fresh insights concerning the nature of chance, probability, and uncertainty. Knight's thinking on the validity of causal determinism in ignorance theory continued to evolve during the 4 years between the completion of his dissertation and the publication of *RUP*. In late 1920 and early 1921, as Knight worked to complete *RUP*, he exchanged numerous drafts of the manuscript and letters with his dissertation advisor, Allyn Young, who challenged Knight to refine his concepts and arguments (Blitch, 2016). One of the key points of these exchanges centered on Knight's evolving views regarding ignorance theory and his philosophical assertions of "quasi-objective" uncertainties. In a hand-written note in the margins of a late-stage draft of Chapter 7 in *RUP*, Allyn Young complimented Knight's refinement of his theory, noting that (Knight, 1921b):

"I am very glad that you have 'come around' in the 'ignorance theory.' I, of course, go along with Poincaré on this altho I think there is another and simpler way of looking at it. But I should stick to 'small' [and unknown] causes."

This handwritten note was included along with an arrow leading from the note to the phrase "real indeterminism," further confirming Knight's rejection of "ignorance theory."

Young's compliment to Knight is notable for two reasons. First, Young's recognition that Knight had "come around" regarding ignorance theory reflects the challenges Knight faced in not just criticizing the dominant approaches to probability theory but in articulating his own alternative perspective regarding the nature of uncertainty that combines conditions of "real indeterminism" with the "partial knowledge and beliefs" of the actor. For Knight, this process of intellectual development was marked by the refinement of his initial use of metaphor (cf. Lakoff & Johnson, 2008) to describe his intuitions about "plastic reality," to his description of a "quasi-objective" real world, to his culminating ontological insights about the world as characterized by "real indeterminism."

Knight's arguments in Chapter 7 of *RUP* reflect the depth of his embrace of real indeterminism: "Are we, then, to assume real indeterminateness, in the cosmos itself? This was the view of Cournot, and the mere ignorance theory common among writers on probability seems inadequate and untenable." (Knight, 1921, p. 220). In addition, he noted, "In the writer's view the doctrine of ignorance or 'insufficient' reason is untrue to the feelings of unsophisticated intelligence. We do not merely feel that we know no reason why the coin shall fall heads or tails; we know in a positive sense that there is *no reason*, and only under this condition do we make the probability judgment with any confidence." (Knight, 1921, p. 222). In a clear sense, Knight's entire argument in this crucial section of text in *RUP*, where he builds his trichotomy of probability judgments/situations (1921, pp. 216-232), is shaped around his critique of probability theory and his construction of a holistic approach that combines real indeterminism, partial knowledge, and subjective beliefs to formulate a comprehensive theory of uncertainty combining both "objective" and "subjective elements."

At the same time, however, the second reason Young's compliment is notable stems from his reference to Poincaré in connection to the notion of "real indeterminism." In response to this comment, Knight (1921) expanded a footnote in this crucial section of text on page 222 in *RUP*, where Knight referenced Poincaré's (1913) incisive critique of ignorance theory, making particular mention of "Poincaré's fascinating treatment of the relations between small causes and large effects." What fascinated Knight was Poincaré's argument that:

"Chance, then, must be something more than the name we give to our ignorance...it may happen that small differences in the initial conditions produce a very great one in the final phenomena. A small error in the former will produce an enormous error in the latter. Prediction becomes impossible."

Knight incorporates these perspectives of "chance" and "real indeterminism" in his theory of uncertainty. It is this recognition of the role of indeterminism that crystallizes Knight's deep misgivings regarding the assumptions of ignorance theoretic approaches to the problem of uncertainty.

For Knight, the unknowability of the future (i.e., "true uncertainty") is rooted in his synthesis of a common-sense view of the indeterminism of the real world with the epistemic limitations such a world state imposes on the ability of an entrepreneur to understand and predict future outcomes. Under the "best of conditions," perfect, predictive certainty about the future in human affairs is never possible. Partial knowledge is the best result economic actors might achieve because the real world of entrepreneur decision environments is a "plastic reality" and in a state of constant flux. The future, in Knight's view, is intrinsically *unknowable*. Table 1 summarizes the distinction between Knight's view of the unknowability of the future rooted in real indeterminism and Creighton's philosophical view of "ignorance theory."

2.4 | Estimates, beliefs, and subjective probability judgments

At the same time, although Knight organizes his theory of uncertainty under the general category (i.e., *genus*) of real indeterminism, the subjective or epistemic dimension of uncertainty plays a vital role in his theory. In Knight's view, the subjective dimension of uncertainty confronting entrepreneurs inculcates the problem of partial knowledge. "It is a world of change in which we live, a world of uncertainty. We live only by knowing *something* about the future; while the problems of life, or conduct at least, arise from the fact that we know so little. This is 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" (Knight, 1921b, p. 199). Knight goes on to identify the central problem confronting the "finite intelligence" of entrepreneurs as the inability to grasp all the possible combinations of factors that may influence a decision or action.

Knight's emphasis on partial knowledge in his theory of uncertainty and his skepticism of the inability of entrepreneurs to generate an "exact knowledge" of future world states clarifies an important distinction between the


TABLE 1 Ignorance and unknowability in *Risk, Uncertainty, and Profit*.

	“Ignorance theory” (Creighton, 1909)	“Unknowability theory” (Knight, 1921)
Overview	<p>“There is, of course, no such thing as ‘chance; regarded as a power which controls and governs events. When we speak of something happening ‘by chance,’ or of some occurrence as ‘probable,’ we are expressing merely a deficiency in our own knowledge...To assert that anything happens by chance, then, is simply to confess our ignorance of the causes which are operative.” (Creighton, 1909, p. 194).</p>	<p>“And if the real probability reasoning is followed out to its conclusion, it seems that there is ‘really’ no probability at all, but certainty, if knowledge is complete.’ The doctrine of real probability, if it is to be valid, must, it seems, rest upon the inherent unknowability in the factors, not merely the fact of ignorance.” (Knight, 1921, p. 219)</p>
Key assumptions	<ul style="list-style-type: none"> • Decision environments are characterized by causal determinism: <p>“...there is no such thing as chance.”</p> <p>“Thus we may say that everything which happens has its cause, and is in turn followed by its effect” (p. 198)</p> • Future states of decision environments are determined by a priori forces: <p>“It is clear that we are in this position regarding many of the ordinary events which belong to the future. Because of my ignorance of the causes at work, I can only say, ‘It may rain tomorrow.’” (p. 194)</p> • Actors are ignorant of these deterministic causal forces: <p>“When we speak of something happening ‘by chance’...we are merely expressing merely a deficiency in our own knowledge” (p. 194)</p> • Thus, uncertainty represents the “ignorance” of the factors which will determine the future: <p>“To assert that anything happens by chance, then, is simply to confess our ignorance of the causes which are operative.” (p. 194)</p> 	<ul style="list-style-type: none"> • Decision environments are characterized by real indeterminism: <p>“Are we, then, to assume real indeterminateness, in the cosmos itself? This was the view of Cournot, and the mere ignorance theory common among writers on probability seems inadequate and untenable.” (p. 221)</p> • Future states of decision environments are not deterministically caused by a priori forces <p>“If there is real indeterminateness, and if the ultimate seat of it is in the activities of the human (or perhaps organic) machine, there is in a sense an opening of the door to a conception of freedom in conduct.”</p> • Actors only partially know the factors that influence the consequences of a decision: <p>“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” (p. 199).</p> • Thus, uncertainty represents the “unknowability” of the factors that influence the future: <p>“And if the real probability reasoning is followed out to its conclusion, it seems that there is ‘really’ no probability at all, but certainty, if knowledge is complete.’ The doctrine of real probability, if it is to be valid, must, it seems, rest upon the inherent unknowability in the factors, not merely the fact of ignorance.” (p. 219)</p>

epistemic versus subjective approaches to contending with the problem of uncertainty. “We have emphasized above that the exact science of inference has little place in forming the opinions upon which decisions of conduct are based and that this is true whether the implicit logic of the case is a prediction on the ground exhaustive analysis or a probability judgment...We act upon estimates rather than inferences, upon ‘judgment’ or ‘intuition,’ not reasoning, for the most part” (Knight, 1921, p. 223). The crucial point here is that the estimates that guide entrepreneurs venturing into an unknowable future differ from the inferential reasoning processes of the logician. Estimates or intuitive judgments are rooted in entrepreneurial beliefs that a future world state will be possible (or impossible) in the future.

However, Knight's development of this concept of “estimates” as a type of subjective probability judgment in the face of “true uncertainty” remains vague in *RUP*. Knight (1921) acknowledges these limitations. “This form of probability is involved in the greatest logical difficulties of all, and no satisfactory discussion of it can be given, but its

distinction from the other types must be emphasized and some of its complicated relations indicated” (Knight, 1921b, p. 37). In hand-written comments on a final rough draft of *RUP*, Young (Knight, 1921b) criticizes Knight's description of “estimates” by first noting that “an estimate may be of one or the other ‘sort’ of (real or statistical) probability. I think you shift your meaning here a little.” Young also suggests that Knight change the text of a sentence in subsequent arguments to “the final result is an ‘estimate’ of the **relative probability of the different possible outcomes of any proposed course of action**” (Young's suggested changes in bold print—Knight, 1921b, p. 38). Along these same lines, Young further criticizes Knight's (1921b, p. 44) argument in *RUP* that “an estimate has the same *form* as a probability judgment; it is a ratio expressed by a proper fraction.” In response, Young draws a box around the phrase “is a ratio, expressed by a proper fraction” and includes a hand-written note “Nonsense! Our opinions (in business life), are rarely matters of ‘heads or tails.’ They may be in some simple sorts of speculation, but in general, our opinion is of the general shape of a *probability field*...” (Knight, 1921b, p. 44). On the final page of this chapter, Young concludes his comments on Knight's theory by further documenting his disagreement with how Knight describes the subjective process of formulating estimates. This is a very able and interesting chapter, despite my fundamental disagreement with your treatment of “subjective” probability (Knight, 1921b, p. 45).

Knight appears to ignore Young's critiques of his approach to theorizing “estimates.” There are no published accounts in Knight's private correspondence with Young as to why he ignores Young's critiques and suggestions, which is important given how many other revisions Knight makes in *RUP* in response to other suggested revisions. Furthermore, Knight does not return to this question in subsequent work to define what he means by “estimates” in more precise terms relative to advances in subjective probability theory, leaving a critical gap in his body of work.

The resulting ambiguity of this term continues to perpetuate contemporary debates regarding the meaning of Knightian “estimates.” George Stigler (1985) suggests that Knight's concept of “estimates” was a rudimentary type of subjective probability judgment. “Knight believed that uncertainty cannot be explicitly and exactly defined, but one could read Bayesian elements into his discussion of probability (compare Thesis, Ch. 6, with *RUP*, Ch. VII)” (Stigler, 1985, p. 4). Other scholars also connect Knight's concept of “estimates” to more contemporary approaches in Bayesian approaches to subjective probabilities (e.g., Langlois & Cosgel, 1993; Lawson, 1988; LeRoy & Singell Jr, 1987; Nash, 2003; Westgren & Holmes, 2022).

However, as our analysis of Knight's published and unpublished writings indicates, Knight draws an essential distinction between his arguments regarding the “meaning of uncertainty” versus the “methods and structures” for meeting uncertainty. Knight (1921) defines “true uncertainty” through an underappreciated synthesis of “real indeterminism,” “partial knowledge,” and “subjective beliefs.” Accordingly, while there are clear Bayesian elements in his theorizing, Knight also acknowledges the central role of “real indeterminism.” In this sense, Knight presents a more holistic theory of uncertainty than is typically acknowledged in contemporary entrepreneurship research. Table 2 summarizes the key properties of uncertainty in Knight's approach. In the following section, we analyze the relevance of a holistic view of the Knightian uncertainty for contemporary entrepreneurship theory.

3 | KNIGHTIAN UNCERTAINTY AND ENTREPRENEURIAL ACTION

The primary objective of our study thus far has been to provide fresh perspectives to a century-old question, one that remains highly relevant to contemporary scholarship and yet stubbornly unanswered: “*What is Knightian uncertainty?*” As our analysis of Knight's published and unpublished writings indicates, answering this question requires careful analysis of how, what, and why Knight formulates a holistic theory of uncertainty, which combines objective and subjective elements to account for the interdependent roles of real indeterminism, epistemic uncertainty, and subjective entrepreneurial beliefs. In this section, we now examine the relevance of a holistic view of the Knightian uncertainty for contemporary entrepreneurship theories of entrepreneurial action and work (e.g., McMullen et al., 2024; McMullen & Shepherd, 2006; Ramoglou, 2021; Ramoglou & McMullen, 2022; Townsend et al., 2018; Townsend et al., 2023), to provide an understanding of how Knightian uncertainty is deeply embedded in making

**TABLE 2** Types of uncertainty in *Risk, Uncertainty, and Profit*.

	A priori uncertainty	Statistical uncertainty	Knightian uncertainty
Definition	Uncertainty regarding what are the probable outcomes of a specific decision or choice.	Uncertainty regarding how well existing models quantify the actual world that exists or will exist.	Uncertainty regarding what is possible (or impossible) in a specific decision or choice.
Knightsian Probability Situations	A Priori Probabilities—use of probabilistic tools to address the randomness of phenomena within defined parameters of known laws of chance that are determined a priori	Statistical Probabilities—use of probabilistic tools to reduce the randomness of natural and human phenomena within defined model parameters that are generated a posteriori	Estimates—non-probabilistic intuitive reasoning reflecting entrepreneurial beliefs about future states of the world
Kantian Modes of Judgment	<i>Apodictic</i> Judgment: what is necessarily certain?	<i>Assertoric</i> Judgment: what is actual?	<i>Problematic</i> Judgment: what is possible?
Source of Ignorance	Actor ignorance of unknown but knowable range of possible outcomes. Emphasis on the discovery of objective prior causes.	Actor partial knowledge rooted in the incompleteness or inaccuracy of model assumptions. Emphasis on the subjective precisiation of the model	Actor (partial) beliefs rooted in the generativity of agentic actions. Emphasis on the ongoing emergence of possibilities
Logical Foundation of Inference for Decision-making & Action	Deduction—thorough understanding of initial conditions/premises determines consequences of choice and action sets	Induction—grouping of cases generates patterns and models to frame choice sets and action sets	Abduction—dynamic and defeasible updating of modal possibilities of choice and action sets

entrepreneurial action related decision, specifically when evaluating the environmental uncertainties (e.g., McMullen & Shepherd, 2006) as well as the ways in which they interfere in actualizing emerging possibilities (e.g., Ramoglou & McMullen, 2022). In doing so, we analyze important areas where a more robust and in-depth understanding of Knightian uncertainty sheds new light on important research questions and problems related to these consequential theoretical perspectives.

3.1 | Background: Knightian uncertainty and entrepreneurial action

As we note above, Knightian uncertainty plays an important conceptual role in numerous foundational theories of entrepreneurship. Indeed, existing theories utilize Knightian uncertainty as a central construct that impacts entrepreneurial action (e.g., Alvarez & Barney, 2007; Foss & Klein, 2012; McMullen & Shepherd, 2006; McMullen et al., 2024; Ramoglou, 2021; Ramoglou & McMullen, 2024; Sarasvathy, 2001; 2009; Townsend et al., 2018). One of the core assumptions in this stream of research posits that uncertainty is not simply an obstacle to be overcome but also a source of new possibilities (e.g., McMullen et al., 2024; Ramoglou & McMullen, 2024; Ramoglou & Tsang, 2016; Townsend et al., 2018; Townsend et al., 2023). These possibilities, in turn, impact the timing of entrepreneurial action (McMullen et al., 2024), and shape the decisions and choices entrepreneurs make regarding whether they decide to pursue these emerging possibilities to generate profits or not (Hunt et al., 2023; McMullen & Ramoglou, 2023; Ramoglou & McMullen, 2024; Townsend et al., 2018). In this sense, foundational entrepreneurship theories advance the premise that Knightian uncertainty is a key source of new possibilities through which entrepreneurs act in often innovative ways to create and capture value for their ventures (Alvarez & Barney, 2007; Sarasvathy, 2009).

3.2 | Knightian uncertainty and entrepreneurial work

One important stream of emerging research in entrepreneurial action theory explores the role of entrepreneurial work (McMullen et al., 2024; McMullen & Ramoglou, 2023; Ramoglou & McMullen, 2024), which is comprised of the “deeds that target the actualization of desirable states of the world and typically involve cognitive, behavioral, and organizational efforts,” that transform new possibilities into real opportunities (Ramoglou & McMullen, 2024, p. 14). The logic of the theory is organized around the ABC model, which posits that “the logical condition of entrepreneurial action (B) is the belief that the world (C) allows the actualization of desirable world-states (A). This process is subject to the constraints of Knightian uncertainty because the totality of conditions necessary for the actualization of desirable world-states can never be known in advance” (Ramoglou & McMullen, 2024, p. 12).

The unknowability of future world-states stems from the problems Knightian uncertainty creates for entrepreneurs in the business venturing process (Townsend et al., 2023). There are often too many factors that connect, interact, and evolve in unexpected ways for entrepreneurs to identify the possibilities that can be actualized (Ramoglou & McMullen, 2024). So, even though the essence of what “...an entrepreneur can achieve [through] A by doing B is determined by the world,” Ramoglou & McMullen (2024, p. 14) express a key insight by positing that “... whether, when, or how such possibilities will actualize is entirely a matter of entrepreneurial choice and work.” At the same time, as we discuss in more detail below, there are important questions regarding how these arguments map onto Knightian theory. Our theorization offers a viable bridge between these emerging perspectives and the core premises of Knight's work. In the following sections, we build upon the role of Knightian uncertainty in theories of entrepreneurial action while also addressing essential shortcomings and limitations of Knight's original approach.

3.3 | Partial knowledge, entrepreneurial beliefs, and Knightian uncertainty

As the foregoing reveals, emerging theoretical perspectives in the entrepreneurial work literature emphasize the importance of entrepreneurial beliefs that a “desirable future world-state is possible.” At the same time, this research also acknowledges the limitations of entrepreneurs' beliefs to motivate entrepreneurial work. “However, to say that ‘specific beliefs and desires caused a particular action is like saying that the earthquake caused the building to collapse’ (Searle, 2003, p. 8). What matters is what sort of *background* understandings underlie the surface beliefs about the possible” (Ramoglou & McMullen, 2024, p. 17).

The tension here between entrepreneur beliefs and “background understandings” (i.e., knowledge) in the entrepreneurial work literature highlights an important epistemological distinction between beliefs (i.e., propositional attitudes where we assume or hold the opinion that something is true) and knowledge (i.e., justified, true beliefs backed by evidence) (Schwitzgebel, 2024). In a foundational sense, when an entrepreneur states that she or he believes a desirable future world-state is possible or if he or she states that “the timing is right” to pursue a specific course of action, she or he is often expressing their opinion about the “truthfulness” of these claims (i.e., McMullen et al., 2024). These belief statements differ in essential ways from knowledge-based claims that are backed by statistical evidence or scientific laws—both of which can affirm or challenge the truth of these claims.

Unfortunately, Knightian theory does not always provide a clear distinction between beliefs and knowledge when theorizing “true uncertainty.” In several of RUP's critical passages we discuss above, Knight (1921) conflates beliefs and knowledge in problematic ways. In several passages in RUP, as we have highlighted previously, Knight argues that entrepreneurs take action based on “opinions” and “partial knowledge” (Knight, 1921b, p. 199), treating these two distinct cognitive factors as a singular thing. The challenge with this approach is that Knight's dual emphasis on partial knowledge and “action according to opinions/beliefs” conflates different types of uncertainty that have been identified in contemporary decision theory. Contemporary approaches to probability theory draw a clearer distinction among the three distinct types of uncertainty that feature prominently in RUP: chances (i.e., “objective uncertainties” “that are real features of the world” and reflect the indeterminism of real events that are by their very



nature, unpredictable—Angus et al., 2023), epistemic probabilities (i.e., “subjective uncertainties” that “measure the extent to which evidence confirms or disconfirms hypotheses about the world”), and credences (i.e., subjective uncertainty that “measure how strongly we believe propositions”) (Mellor, 2005, p. 7). As recent studies note, all three of these types of “uncertainty” impact entrepreneurial action as entrepreneurs can possess strong, “certain” beliefs about the future states of decision environments that are inherently dynamic and unpredictable (Angus et al., 2023).

Although these contemporary categories differ in several ways from Knight's tripartite theory of uncertainty in *RUP*, there are several important conceptual links that reinforce the importance of adopting a more holistic interpretation of Knightian uncertainty in entrepreneurship research. We discuss the clear connections between contemporary perspectives on chance and Knight's views on real indeterminism in *RUP* below. However, for both Knightian theory and theories of entrepreneurial action and work, there is also a clear need to analytically distinguish *epistemic uncertainties* from the *degree of credence* or *confidence* entrepreneurs have in their beliefs. Recent work by Westgren and Holmes (2022) offers an important contribution in this regard by connecting Knightian theory with Frank Ramsey's, 1931 work on partial beliefs as subjective probabilities. At the same time, Westgren and Holmes (2022) do not explicitly acknowledge the extent to which Knight adopts a more holistic approach to theorizing uncertainty that connects all three probability types in his theory of uncertainty.

Incorporating these analytical distinctions between epistemic and credence-based approaches to theorizing Knightian uncertainty helps resolve the “paradoxical confusion” many existing interpretations of Knightian uncertainty create for entrepreneurship theory. For example, as we note above, in creation theory, scholars interpret Knightian uncertainty to mean that “[...] no matter how hard an entrepreneur works, all the information needed to turn this decision-making setting into a risky one cannot be collected...(and) for those opportunities that are being formed by the actions of entrepreneurs, such information does not yet exist, and therefore, it cannot be collected or analyzed” (Alvarez & Barney, 2007, pp. 16-17). What often creates confusion about these interpretations of Knightian uncertainty is that the statement “no matter how hard an entrepreneur works, all the information needed to turn this decision-making setting into a risky one cannot be collected” is not equivalent to stating that an entrepreneur possesses weak beliefs that a desired future-world state is possible. Entrepreneurs can strongly believe a future state of a decision environment will emerge even when existing evidence is weak and/or the environment is characterized by a high degree of indeterminism (i.e., unpredictability—Angus et al., 2023).

However, because entrepreneurship scholars often use the same term to refer to both situations as types of “subjective uncertainty,” a strict application of Knightian theory would imply that an entrepreneur-in-question under conditions of Knightian uncertainty would have no opinion or possess weak beliefs about these future possible world states. This interpretation flies in the face of abundant evidence in entrepreneurship research regarding the prevalence of *overconfidence* in entrepreneur decision-making (i.e., Townsend et al., 2010)—a subjective state where the entrepreneur is not “uncertain” at all about their beliefs and opinions (e.g., Busenitz & Barney, 1997). A holistic interpretation of Knightian uncertainty, which accounts for the interdependent but *independent* roles of chance, partial knowledge, and entrepreneurial beliefs in entrepreneurial action and work theories, provides a more robust foundation for extending Knight's foundational insights about the epistemic limits entrepreneurs face in their decision environments.

In other cases, entrepreneurs may have a significant amount of information about the factors influencing the future consequences of their decisions, and they may possess strong beliefs that desirable future world-states are possible. However, because future environments are subject to both chance and real indeterminism, unexpected deviations from the status quo limit the ability of entrepreneurs to identify all the future possibilities that might flow from a choice or action. In Knight's view, gathering enough information to be able to predict the future with complete certainty is always impossible (1921, p. 219). Even if an individual can access all this information, each decision situation would be shaped by “unknowable causes,” which would limit the ability of the entrepreneur to predict the future. Under these conditions, entrepreneurs act *as if* the environment is indeterministic, thereby acknowledging the important limits and inherent fallibility of their knowledge and beliefs.

3.4 | Predetermined possibilities, real indeterminism, and Knightian uncertainty

In addition to the problematic conflation of knowledge and beliefs in existing interpretations of Knightian uncertainty in entrepreneurship research, contemporary studies often do not account for his theorizing on the role of real indeterminism in entrepreneurial environments. In Knightian theory, the assumption of “real indeterminism” stems from what Knight sees as being a “common sense” view about the nature of uncertainty. Throughout his writings, Knight describes real indeterminism as an inherent characteristic and property of the world or “cosmos,” which consequently limits the extent to which probability judgments capture all relevant possibilities in a decision environment (Knight, 1921, p. 220). In Knight's view, true uncertainty emanates directly from the unknowability of the future possibilities that emerge from environments characterized by real indeterminism. Against this backdrop, Knight's (1921, p. 222) critiques of ignorance theoretic perspectives on the nature of uncertainty imply that “true uncertainty” represents more than a deficiency in our reasoning or overconfident beliefs in the certainty of future outcomes.

The central role of real indeterminism in Knight's theory raises an important problem regarding the nature of “indeterminism”; namely, multiple future states are possible at any given moment in time (Belnap, 1992). “Central to the idea of indeterminism is this: At a given moment in the history of the world there are a variety of ways in which affairs might carry on” (Belnap et al., 2001, p. 134). Real indeterminism builds on the concept of open futures that are connected to but not wholly determined by a priori causal forces (Popper, 1992). For entrepreneurs, the indeterminacy of entrepreneurial environments is reflected in the extent to which multiple future possibilities branch out from any decision or action contemplated by an actor at any given moment in time (cf. Alvarez & Porac, 2020). Essentially, this approach stresses that future states of the world exist in the present only as an undefined set of pathways that are accessible to actors at specific points in space and time.

The problem, however, is that the concept of real indeterminism is ultimately rooted in the situational contingencies that are common in everyday life. As Knight (1913a) argues in class notes penned during his Ph.D. studies: “We soon observe that little or nothing is really fixed but all is a perpetual flux. That which seemed permanent when superficially viewed is seen as the result or product of indefinite transformations; the world of existence is lost in the world of change” (Knight, 1913a; Knight, 1913b, p. 6). The “perpetual flux” of indeterministic environments is what gives rise to the types of “true uncertainty” that cannot simply be predicted based on the present-day or past experiences. Thus, in a Knightian world, future states of an indeterministic world are not just unpredictable (Sarasvathy, 2001) but unknowable (Ramoglou, 2021).

Knight's use of the Kantian modalities of judgment—in particular, his implicit link between the concept of “estimates” with Kant's notion of problematic judgments—provides an important conceptual basis for expanding the logic of the meaning and role of possibilities in contemporary interpretations of his work. As a concept, possibilities feature prominently in theories of entrepreneurial action and work (Ramoglou, 2021; Ramoglou & Tsang, 2016; Townsend et al., 2023). In effectuation theory, the notion of possibilities is conceptually similar to the concept of “effect sets” (i.e., Sarasvathy, 2001), in which possible futures are created through entrepreneurial action (i.e., Dew et al., 2004; Dew et al., 2011; Ramoglou & McMullen, 2024; Sarasvathy, 2001; Sarasvathy & Dew, 2005; Sarasvathy & Venkataraman, 2011).

In other work, the concept of possibilities often refers to the imagined or anticipated consequences of the action pathways that are directly linked to the use of the resources at hand (Klein, 2008). Still, other studies draw a key distinction between imagined and real possibilities (Ramoglou & Tsang, 2016). Emerging research in the entrepreneurial work literature argues that the range and scope of real possibilities are pre-determined by existing world-states. These constraints emanate from the specific features and affordances of resources, technologies, market demand, and other organizational attributes that collectively pre-determine what is possible in any given decision environment (Ramoglou, 2021; Ramoglou & McMullen, 2024). In contrast, as we note above, Knight (1921) explicitly organizes his theory of uncertainty with the concept of “real indeterminism” as a foundational component.



For entrepreneurship theorists, a key question is whether it is essential to resolve the contradiction between the notion of “predetermined possibilities” in entrepreneurial work research and Knight's pragmatic emphasis on entrepreneurs acting *as if* decision environments are indeterministic. Given the lack of scholarly progress to resolve recent “ontological debates” in the opportunities literature, there is (and should be) understandable skepticism of creating a new ontological debate built around a problematic dichotomy that is probably not resolvable. Toward this end, Knightian theory provides a useful path forward to addressing these concerns. Through his work, Knight never intellectually resolved what he describes as a fundamental philosophical tension between the “scientific” view and the “common sense” view of causality and agency. In a later essay entitled “Statics and Dynamics: Some Queries Regarding the Mechanical Analogy in Economics,” written between 1930 and 1935, Knight discusses this unresolved “contradiction” in philosophy:

“A theory which recognizes ends and allows man real initiative in changing himself or his environment is in contradiction with a scientific conception of human nature and transfers the discussion to a different realm of discourse. In the writer's opinion, the contradiction is insurmountable in the present stage of intellectual development. Philosophy and experience have not taught us concepts which enable us to think comfortably in the terms of what experience and common-sense force us to recognize as real and valid.”

As Knight clearly suggests, he was perfectly willing to acknowledge that the “true state” of the world might be completely determined. At the same time, the arguments throughout his writings—both in *RUP* and in previous and subsequent work—are constructed on a pragmatic, “common-sense” approach that entrepreneurs should make decisions and take action in uncertain environments based on the assumption that these decision environments are indeterministic. Under these conditions, entrepreneurs would recognize that there are critical limits to their ability to translate strong beliefs into certain knowledge. We analyze more of the implications of this core assumption in Knightian theory below. Still, in a fundamental sense, this question of determinism versus indeterminism is far from being “academic” in an age where the rapid emergence of “intelligent machines” provides entrepreneurs with unparalleled information processing and analytical capabilities that far exceed the ability of any human actor to resolve critical knowledge problems (Townsend et al., 2023).

3.5 | Future world-states, actualizing possibilities, and Knightian uncertainty

As we discuss above, Knightian theory does not deny the reality of the world, but neither does Knight's approach eschew the important roles of subjective knowledge, belief, and human agency. Rather, Knight's (1921) uniquely holistic theory incorporates ontological (i.e., “real indeterminism”), epistemic (i.e., “partial knowledge”), and subjective beliefs (i.e., estimates) in what aspires to be a holistic theory of uncertainty. Toward this end, Knightian theory attempts to bridge objective and subjective approaches to probability theory by incorporating the use of “estimates” to assess and analyze future possible world-states. However, in Knight's view, the process of forming estimates is not an unguided process solely characterized by blind, groping-in-the-dark. Where entrepreneurs eventually stumble into the “right answer” through sheer luck. Instead, Knight (1921) argues that *estimates* can be informed by and shaped through prior experiences but generated and updated in response to the indeterminism of the environment.

“We hold also that both the objective and subjective types may be involved at the same time, though no doubt most men do not carry their deliberations so far; the man's opinion or prediction may be an estimate of an objective probability, and the estimate itself be recognized as having a certain degree of validity, so that the degree of felt uncertainty is a product of two probability ratios” (Knight, 1921, p. 237).

Estimates reflect the entanglement of the subjectivity of the entrepreneurial process but also reflect the reality of real indeterminism in the environment. In a Knightian universe, there is no “one right answer” to link these

estimates to project out into an unknowable future. Rather, all possible futures exist in a yet-to-be-actualized state. Estimates thus function as a foundational type of entrepreneurial judgment that enables entrepreneurs to address the most fundamental type of uncertainty in the Knightian universe—*what is possible in the future?*

Given the real limits on the ability of entrepreneurs to develop exact knowledge of an unknowable future, the interaction of real indeterminism, partial knowledge, and subjective beliefs raises an important question about the role of entrepreneurial action in shaping or influencing decision environment. At the actor level, the role of entrepreneurial action in activating (or foreclosing) specific action pathways connects directly to the notion of the “actualization” of possibilities through entrepreneurial action (Ramoglou, 2021; Ramoglou & McMullen, 2024; Ramoglou & Tsang, 2016). Under these conditions, as entrepreneurs take hold of “opportunity ingredients” in the external environment, the process of dynamic change stems from the choices or actions (or lack of choices and/or inaction) of entrepreneurs. For example, in technology entrepreneurship, entrepreneurs may apply existing technologies toward unexpected new ends not originally envisioned by the inventor of the technology. In other cases, entrepreneurs may draw upon existing insights from customers to envision brand-new technical solutions to existing problems. In both cases, the future opportunities that are created are *actualized* out of the “opportunity ingredients” that exist in specific places and times. However, these processes of actualization are not solely determined or controlled by past conditions—entrepreneurial action still matters to transform possibilities into actualities (Ramoglou, 2021).

Knight's emphasis on real indeterminism also sheds light on the limits of constructing future world-models. As we note above, a comprehensive world model consists of “a description of the world so complete that, if true and known, the consequences of every action would be known” through search, analysis, and rational choice (Arrow, 1966, p. 254). Building and validating world models is increasingly important in artificial intelligence research (i.e., “a world model is key to intelligent systems”—Matsuo et al., 2022, p. 268). Given the rapid improvement of both computational algorithms and the exponentially growing scale of computational resources, AI researchers have argued that more “scale is all you need” to ostensibly build comprehensive world models (Townsend et al., 2023).

In the context of entrepreneurship, however, Knightian uncertainty imposes important boundaries on the use of AI in entrepreneurship due in no small part to the limits even AI agents face in constructing and validating a “world model” (Townsend et al., 2023). In a Knightian world, future world-states still emerge and evolve based on an “iterative process of action and reaction (Alvarez & Barney, 2007, p. 15)” where “knowledge is not yet formed, and decision making is incremental and experimental (Alvarez & Barney 2013, p. 559).” These actions, in turn, give shape to the possibilities that are actualized into opportunities through entrepreneurial action.

Yet, the agentic action of the Knightian entrepreneur does not require uninhibited “world-making” where *something* is created from *nothing*. Instead, processes of entrepreneurial work extend from the premise that “there is one world and it is modally complex” (Dopfer & Potts, 2004, p. 205). By embracing contingency and chance, entrepreneurial action and agency play an important role in actualizing possibilities in external environments (Belnap et al., 2001). Fueling these agentic acts are entrepreneurial beliefs, which “estimate” whether it is possible to actualize desired future world-states or not through entrepreneurial work. But the final result is an ‘estimate’ of the probable outcome of any proposed course of action (Knight, 1921, p. 226).

These beliefs, which motivate the choice to pursue a “proposed course of action,” extend from “the universal form of conscious behavior is thus action designed to change a *future* situation” (Knight, 1921, p. 201—*emphasis added*) in Knightian theory. Knight (1942, p. 128) elaborates on the role of economic pioneering as a central actualizing force to complete the logic of his approach to theorizing the nature of true uncertainty:

“This suggestion brings us to the functions of the entrepreneur. His (sic) first and primary function, in a progressive society, is that of leadership or economic pioneering; it is to initiate useful changes or innovations. The incentive to new departures is profit in the corresponding sense...it goes without saying that making innovations usually involves substantial cost, and that the innovator himself (sic) cannot predict the results in advance, or even be sure that the innovation will not be a failure...”



These agentic actions “involve perception and, in addition, *twofold* inference. We must infer what the future situation would have been without our interferences, and what change will be wrought in it by our action” (Knight, 1921, pp. 201-202). In this sense, Knightian uncertainty highlights the limits of building a comprehensive world model or framework to interpret a novel and unique situation (i.e., Knightian uncertainty is not the same as ambiguity—Townsend et al., 2018). Nor is Knightian uncertainty rooted in the mindless, actor-less process of random changes in the external environment. Instead, Knightian uncertainty stems in no small part from the agentic choices of human actors, reflecting true uncertainty about the future consequences of one's actions. In this respect, these future possible world-states are *unknowable*—not because the information does not exist, but rather because as entrepreneurs engage in the actualization of possibilities through economic pioneering, these actions deviate from established “world-models” in unique and unpredictable ways.

4 | DISCUSSION AND DIRECTIONS FOR FUTURE RESEARCH

At the beginning of this study, we discussed how, even in the century that has passed since the original publication of *RUP*, Knight's fundamental insights into the nature of uncertainty continue to generate thousands of citations and elicit the active engagement of scholars. We also noted, however, that numerous contemporary studies have built on Knight's categories of risk and uncertainty in problematic ways by employing a special-purpose dichotomy that was meant to provide order and arrangement into a rigid classificatory scheme that elevates the *risk* of creating and perpetuating false dilemmas in contemporary research (e.g., prediction vs. non-prediction; planning vs. non-planning; creation vs. discovery; rational vs. intuitive decision-making, etc.). Misuse of this nature is a common occurrence. DiMaggio (1995, pp. 393-395), for instance, relates his own experiences on this score, lamenting that:

“If the production of good theory requires the utmost care, theory's reception is ordinarily helter-skelter: a process of appropriation driven more by resonance than reason, in which complex arguments are reduced to slogans and related to one another along binary dimensions more redolent of Levi-Strauss' tribal cultures than of graduate theory classes... related to this is a tendency for the field to classify theories on the basis of primordial antinomies (sic) rather than coherent and multidimensional analytic categories.”

For Knightian theory, DiMaggio's invocation of “tribal cultures,” organized based on “primordial antinomies,” is an apt description of the interpretive debates surrounding Knight's work. Knight's theory has resonated within and among contemporary scholars of entrepreneurship and organizations, but often in ways that build upon mythical, incomplete, and often erroneous interpretations of his work. Although scholars have every right to interpret and apply received theories how they see fit, there are often significant downsides to perpetuating incomplete or inaccurate interpretations of foundational work in the field of research. In the case of Knight's theory of uncertainty, there are important aspects to his original work that, if incorporated, will prove to be instrumental to future research. Even at the centenary of *RUP*, Knight (1921) offers new insights for entrepreneurship and organizational scholars; and so, in the following section, we discuss the implications of how Knight's holistic theory of uncertainty contributes to important conversations in entrepreneurship research.

4.1 | Entrepreneurial action, scientific entrepreneurship, and Knightian uncertainty

Our revitalized approach to theorizing the nature of Knightian uncertainty addresses emerging research on entrepreneurs as “proactive opportunity creators...shaping the world in ways to achieve what they want” and that “human agency is a cause of indeterminacy” and that “spontaneous creativity and imagination are keys to ‘managing’ the indeterminacy” (Alvarez & Porac, 2020, p. 742). Knight's emphasis on real indeterminism recognizes the importance

of the external environment in shaping the possibilities (or impossibilities) of action that each moment in space and time affords to entrepreneurs. At the same time, Knight's theory also challenges the assumption that these affordances are solely determined by a set of discoverable causal factors that will determine *one "right" answer!* Under such conditions, it logically follows that the lack of determinism means that there is no one single optimal choice that can always be discovered through search or systemic analysis. Some paths that might be imagined are, in fact, impossible.

But at the same time, real indeterminism suggests that even wrong choices are not always a "death sentence" for a new venture since there might be multiple possibilities that can be identified throughout the process to augment imagination with adaptive choices intended to help capitalize on the dynamic flow of the external environment. In these situations, external factors, including market prices and institutional forces, can help to partially structure the decision environment so that the entrepreneur is not flying blind throughout the process.

The notion of "real indeterminism" implies that there are important limits on scientific approaches to entrepreneurship (i.e., Camuffo et al., 2020). The Knightian decision environment will always be at least partially unknowable since the agentic choices of entrepreneurs can profitably deviate from established courses of action to actualize possibilities emerging through unexpected directions arising in dynamic environments. Under these conditions, the "right answer" changes over time as markets evolve. What a scientific process might reveal as a viable solution to a customer problem at one point in time potentially changes as new products and solutions are introduced to the market (Zellweger & Zenger, 2023). Customer preferences also change in dynamic and unexpected ways. In these situations, the exact knowledge of scientists generated through scientific discovery is less useful than the practical knowledge of entrepreneurs who adapt and pursue these new possibilities through agentic action (Hunt et al., 2024). And yet, even in these situations, the entrepreneur's task is not simply to engage in "Bayesian updating" to sharpen their capacity for logical judgment but rather to give shape to these emerging possibilities through entrepreneurial action.

4.2 | Chance, beliefs, and knowledge in entrepreneurship theory

Knight's integration of subjective beliefs, epistemic uncertainty, and real indeterminism further clarifies the central importance and relevance of both risk and uncertainty in entrepreneurship research. One of the unfortunate legacies running throughout common misunderstandings of Knight's work in the field of entrepreneurship is reflected in the notion that all entrepreneurial action proceeds under conditions of Knightian uncertainty. But this is not what Knight argued in *RUP*. Entrepreneurs face all three types of uncertainty during the business venturing process, necessitating the utilization of different types of judgment to address both known risks and unknowable uncertainties (Hunt et al., 2024).

This holistic approach is important for future entrepreneurship research to help bridge existing approaches to decision-making under conditions of risk and uncertainty with extant entrepreneurship theory. For example, research in real options reasoning (e.g., Li & Chi, 2013; McGrath, 1999; Tong & Li, 2011) emphasizes the role of "stepping-stone" strategies to contend with uncertainty (Hunt et al., 2021). Entrepreneurs may be ignorant at any given point in time about the probability they can successfully achieve scientific or engineering breakthroughs necessary to build technologies (Trigeorgis & Reuer, 2017). However, such ignorance is resolvable *in principle* through the development of real options strategies that incremental "tranche" R&D investments to hedge against these uncertainties (i.e., Levitas & Chi, 2010; Li, 2008).

In other cases, entrepreneurs might not know which opportunities are possible or impossible due to uncertainty about demand-side conditions in future markets (McMullen et al., 2024). Under these conditions, real options approaches can be used to evaluate different options (Li et al., 2007) based on the degree to which different choices open possibilities to attract new customers (Hunt et al., 2021). Understanding how entrepreneurs identify and choose market entry strategies raises critical questions about how entrepreneurs resolve the inherent equivocality of evaluating and judging different possibilities (Townsend et al., 2018).



In some cases, real possibilities evolve in ways that extend from the pioneering actions of entrepreneurs to create new markets (McMullen et al., 2021; Rindova & Martins, 2021). In other cases, these possibilities that emerge in “future markets” evolve in random ways (Packard & Clark, 2020). In both cases, although optimal, perfectly rational choices are not possible, this does not mean that the environment’s dynamism fails to provide information and signals to help shape market entry choices (Ramoglou & Tsang, 2016). Understanding how and why actors incorporate such information into formulating new strategies under real indeterminism and partial ignorance is, therefore, essential in contemporary organizational and entrepreneurship research to consider how the chance, probability, and true uncertainty of real indeterminism shape and inform the intuitive, imaginative judgments that so often characterize the entrepreneurial process.

5 | CONCLUSION

Over a century ago, in a time marked by serial crises and global discord, Knight shared a sentiment in a handwritten note to his former dissertation chair, Allyn Young, that is perhaps well understood today when he noted that “we are all writhing in the clutches of an epidemic...” (Young, 1922). Presently, we find ourselves in a similar predicament as wars, pandemics, and social and political instability threaten the current global order. Yet, even under these conditions, Knight’s prescience regarding the challenges of addressing chance, probability, and true uncertainty is illustrated to great effect, where we must advance into an unknown and unknowable future. Our collective “writhing in the clutches” of global instability illuminates the great costs and considerable challenges that Knightian uncertainty creates for organizations and people who give them life. Knight’s prophetic insights about the nature of true uncertainty remind us even today that the agentic choices of human actors, as well as the evolving indeterminism and dynamism of the environment, remain potent sources of real indeterminism and human unknowingness, but also the inspiration and impetus for entrepreneurial action to actualize a desirable future.

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ENDNOTE

¹ The use of the word “meaning” in the title of this chapter provides a simple but often overlooked clue in determining Knight’s intended goal in this chapter. In his original dissertation work, where Knight first outlined his theory of uncertainty, the comparable chapter was entitled “The Nature of Uncertainty.” Knight’s substitution of the word “meaning” for the word “nature” reflects his shift away from formulating an ontological argument about the nature of uncertainty in his dissertation towards the goal of providing a logical definition of uncertainty in this section of *RUP*.

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