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Mario J Rizzo

Malte F Dold, *Pomona College*

Knightian uncertainty: through a Jamesian window

Mario J. Rizzo and Malte Dold[★]

Frank Knight is famous for the distinction between risk and uncertainty. In this paper, we argue that Knight's distinction is different from the one made by those who seek to interpret it within a neoclassical framework. Knight does not reduce 'true uncertainty' to the application of (axiomatic) subjective probability. Instead, Knight highlights the power of intuitive judgement in situations of uncertainty. Moreover, Knight conceptualises uncertainty along a continuum which means that many of our real-world problems must be seen as mixed cases of risk *and* uncertainty. This paper illustrates that Knight's arguments can be more fully understood through the lens of William James's psychology, which deeply influenced Knight's way of thinking. Finally, this paper links Knight's argument to a growing body of recent empirical literature that shows how effective judgemental–intuitive modes of reasoning are in cases of environmental instability. In doing so, this paper begins to fill out the uncertainty framework, which Knight has sketched in *Risk, Uncertainty and Profit* (1921).

Key words: Frank Knight, Uncertainty, Intuitive judgement, Implicit learning, William James

JEL classifications: B10, B41, D91

1. Introduction

The *most important* result of this survey is the emphatic contrast between knowledge as the scientist and the logician of science uses the term and the convictions or opinions upon which conduct is based outside of laboratory experiments. The opinions upon which we act in everyday affairs and those which govern the decisions of responsible business managers for the most part have little similarity with conclusions reached by exhaustive analysis and accurate measurement. The mental processes are entirely different in the two cases. In everyday life they are mostly subconscious. (Knight, 1921, p. 230, emphasis added).

It is, in short, the re-instatement of the vague to its proper place in our mental life which I am so anxious to press on the attention. (James, 1890, vol. 1, p. 254).

Frank Knight's own assessment above of the importance of the distinction between risk and uncertainty is quite different, and indeed more radical, than is often made

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Address for correspondence: Mario J. Rizzo, Department of Economics, New York University, 19 W, 4th Street, New York, NY 10012, USA; email: mario.rizzo@nyu.edu

[★]New York University, USA (MJR) and Pomona College, USA (MD)

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by those who seek to interpret it within a neoclassical framework.¹ One prominent example of the neoclassical interpretation can be found in [LeRoy and Singell \(1987\)](#). They argue that Knight believed that the *pure* case of uncertainty did not exist in the real world. Some type of class could always be constructed to get meaningful relative frequencies. However, even if these objective frequencies are not very useful, uncertainty could be modelled as a subjective probability distribution.² The phenomenon giving rise to profit and loss is actually the uninsurability of outcomes based on asymmetric information and consequent moral hazard and adverse selection. These market ‘imperfections’ have their origin in the inability of potential insurers to distinguish between the exogenous risk in a situation and that brought about by perverse incentives on the part of the bearers of such risk. Such a characterisation is seriously incomplete. Knight was striving after something more profound. We suggest that it is the failure to see Knight in his own intellectual context and the intellectual context of his era that blinds many commentators to the true meaning of Knightian uncertainty. It certainly does not permit us to say, ‘Thus it is evident that Knight did not have mastery over his material’ ([LeRoy and Singell, 1987](#), p. 405).

In this article, our approach is to increase the understanding of Knight’s *Risk Uncertainty and Profit* by filling in the blanks, so to speak. By today’s standards, Knight was not very clear about the sources from which he drew his ideas. His footnotes to other intellectuals—philosophers, psychologists and economists alike—are not copious.³ And yet he does reference a few and uses terminology that points in the direction of certain thinkers. He is also somewhat elliptical in his explanations. He often assumes that his readers have an intellectual background similar to his own. That may have been a problem even one hundred years ago, but it is certainly a problem today. Many of the controversies and conceptual frameworks that were live during his education and early professional career are not any more.

Our task is to engage in a faithful reconstruction of his perspective on true uncertainty and the role of intuition in entrepreneurial judgement. This reconstruction, however, does not arise *ex nihilo*. It is based on and through the lens of the person we believe to be one of Knight’s main influences outside of economics: the philosopher-psychologist, William James. James was a very influential thinker during the late nineteenth and early twentieth centuries. Even today his thought attracts enormous interest and is experiencing renewed appreciation for his ability to presage many trends in (neuro-) psychological thought (see, e.g. [Berlucchi and Buchtel, 2009](#)). We do not

¹ See [McKinney \(1977\)](#), [Lawson \(1988\)](#) and [Yu \(2002\)](#) for a discussion of the ways in which Knight’s understanding of probability and uncertainty differs from (and shares elements with) neoclassical theory.

² [Arrow \(1951\)](#) followed this line of reasoning. However, he is unable to understand why Knight could not have dispensed with the risk–uncertainty distinction. Arrow has two arguments. First, since Knight believes that in the aggregate profits are negative, he could have arrived at that result more simply if he postulated a risk-preferring attitude towards standard probability distributions rather than a genuine uncertainty-bearing preference (p. 428). This is correct on the assumption that Knight was simply seeking an *as-if* rationale for his empirical claim, taken as an isolated statement. However, Knight’s concern was broader and more ‘realistic’. Second, since Knight believes that the Law of Large Numbers applies—at least to a certain extent—to the consolidation of cases of uncertainty as well as cases of risk, Arrow suggests that the uncertainty concept does little work (p. 417). But this ignores the fact that Knight conceives of many real-world cases as impure, i.e. capable of some valid classification but not perfectly so (see Section 3 below). While the Law would not apply to cases of pure or ideal-typical uncertainty, it can apply imperfectly to the mixed cases. However, consolidation of these would not provide the certainty that risk pooling would.

³ ‘In this superficial sketch of the theory of knowledge it has not seemed important to give extended reference to philosophical literature’ ([Knight, 1921](#), p. 200, n.1)

say that James is the only influence on Knight.⁴ However, even where there are other philosophical sources cited, they are to particular ideas that are compatible, even identical, with those that constitute James's framework.⁵ Thus, we believe that the most productive route to understanding Knight more deeply is through the lens of James.

Before proceeding, we must emphasise that James was responsible for at least two streams of thought. The first is the fairly well-known philosophy of 'Pragmatism'. This was further developed, especially after James's death in 1910, by John Dewey, among others. This is not the pragmatism of James nor the one that positively influenced Knight.⁶ The aspects of James's pragmatism that most influenced Knight are the ideas that consciousness is about purposive behaviour and truth is always partial and, in many respects, social (Yu, 2002, pp. 9–11; Hands, 2006, pp. 594–5). The second is 'radical empiricism'. This doctrine has strong links to concepts of novelty, change and uncertainty. This is where the French philosopher Henri Bergson had a great influence on Knight—probably both directly and through James (McKinney, 1977, p. 1439).

As Knight says in the epigram to this article, the significance of his analysis of entrepreneurial decision-making under uncertainty extends to the limits of scientific reasoning. Knight frequently invokes intuition or 'trained intuition' (citing Marshall, cf. Knight, 1921, p. 211, n. 1) as the way in which decisions are made by entrepreneurs. While Knight does not go into any depth of the nature of such decisions, he does make reference to unconscious processes—specifically, he uses the technical term from Hermann Helmholtz 'unconscious induction' in a paragraph discussing the decision-making of entrepreneurs. We shall see that Knight uses elements from these philosophical approaches to build his theory of true uncertainty and to demonstrate the limits of narrowly construed scientific reasoning in understanding judgement and decisions in a world of uncertainty.

2. The intellectual context

As we have said and by his own admission, Knight was influenced by the work of two philosopher-psychologists, Henri Bergson and William James. Knight considers his own writings first and foremost as a contribution to economics, but he admits that '[further] development of the argument in its philosophical bearings ... [is] worked out along what the writer considers the correct lines in the writings of Bergson and James'

⁴ Particularly in his economic thinking, Knight was influenced by John Stuart Mill (Ebenstein, 2015, p. 61) and Max Weber (Yu, 2002, pp. 3–4; Emmett, 2006).

⁵ We indicate in notes below that Knight was influenced by the work of John Stuart Mill (n. 15, 22), Hermann Helmholtz, (n. 14, 39, 41), Henri Bergson (n. 7) and Emil du Bois-Reymond (n. 9). We also discuss briefly the ways in which the thinking of these authors is compatible with the work of William James.

⁶ Knight (1925, n. 4, p. 399) explicitly dismisses Dewey's pragmatism: 'Dewey's position seems ambiguous to me; in so far as it is naturalistic and intellectualistic, I am out of sympathy with it, as I am also with any "idealism" of an absolutistic or monistic tendency'. In an unpublished review article, Knight ([1925] 2011, p. 433, n. 6) again dismisses Dewey's pragmatism and mentions James favourably: 'The most puzzling to me of all philosophers I have read is Dewey, and not least so in his latest volume, mentioned above. He can be quoted directly against himself on practically any question with no visible effort to reconcile contradictions. (I do not say this is not evidence of superior insight and intellectual power.) In this book he carries "radical empiricism" and pluralism so far beyond James that he seems to repudiate thinking altogether; His only answer to the questions as to what is immediate experience or what is man's place in nature is to assert that the questions are unreal'. On Knight's dismissal of Dewey's pragmatism, see also Hands (2006, pp. 584–90).

(1925, p. 399).⁷ Bergson and James were each the subject of widespread discussion during the later years of the nineteenth century and the early years of the twentieth century. Knight would have encountered their work during his education at Cornell both as a philosophy student and as an economics student. At the beginning of the second decade of the twentieth century, an intellectual movement known as ‘behaviourism’ was gaining adherents. It provided an image of the social and psychological disciplines as a ‘science’ similar to the mechanical philosophies that underlay much of the nineteenth (and earlier) century conception of the natural sciences. A science of human behaviour should be based on objectively measurable stimuli and responses that were stable and automatic. Needless to say, ‘consciousness’ was considered an unnecessary, subjective and non-verifiable concept. There would be no room for that idea in a ‘scientific’ psychology and economics (for an overview, see [Staddon, 2014](#)).

On the other hand, James and Knight were clear in their rejection of this perspective. For James, ‘[the] first fact for us, then, as psychologists, is that thinking of some sort goes on’ (1890, vol. 1, p. 224).⁸ For Knight, ‘[the] first datum for the study of knowledge and behavior is the fact of consciousness itself’ (1921, p. 200).⁹ In James’s terminology, the words thinking, mental and consciousness were all synonyms. This seems to be true of Knight as well. But for Knight, ‘unconscious’ mental processes were also important. In fact, they took much of their importance from a contrast between the circumstances in which there was conscious processing and those in which there was unconscious processing. James was more wary of the idea of an ‘unconscious’ mainly because he believed that most of the statements regarding such matters were unverifiable and subject to abuse from a scientific perspective. And yet under a somewhat different perspective, he did not preclude processes operating on a low level of consciousness.¹⁰ This was his idea of the *fringe* of consciousness ([Mangan, 2003](#)). In *Risk, Uncertainty and Profit*, Knight makes references to a key phenomenon through which James illustrates fringe consciousness. This is the tip-of-the-tongue (TOT) experience—which this paper will discuss in Section 5—we have all had in trying to remember a forgotten name ([Knight, 1921](#), p. 211, p. 230, [1924](#), p. 134).

Consciousness for both James and Knight is future-oriented insofar as its function is to enable economic behaviour. James sounds like an economist when he says, ‘*The*

⁷ ‘The writer is in fact a *radical empiricist* in logic, which is to say, as far as theoretical reasoning is concerned, an agnostic on all questions beyond the fairly *immediate facts of experience*’ ([Knight, 1921](#), p. 201, emphasis added). The italicised words echo James and Bergson, respectively. Specifically, the term ‘radical empiricism’ was and is widely associated with James ([Goodman, 2017](#)), as [Knight \(\[1926\] 2011, p. 36\)](#) himself acknowledges: “‘radically empirical” in the happy phrase of William James’. The phrase ‘immediate facts of experience’ echoes the French title of [Bergson’s book \(1910\)](#), *Essai sur les données immédiates de la conscience* (known in English as *Time and Free Will*). In this article, we do not pay much attention to Bergson directly. But James was strongly influenced by Bergson ([James, \[1911\] 1996](#)).

⁸ These are James’s own emphases. Obviously, he meant to stress the point.

⁹ In a discussion of consciousness, Knight very favourably cites two lectures by Emil du Bois-Reymond ([Knight, 1921](#), p. 201). The ideas of du Bois-Reymond that seem relevant here are two. First, ‘science’ on the model of classical physics cannot explain how consciousness arises from matter (the brain). Thus, consciousness cannot be reduced to a material substrate or understood in physical terms. Thus, for Knight, ‘Science can find no place for it...’ ([1921](#), p. 201). Second, even if the world (consciousness included) is some sort of machine, we cannot hope to know the values of *all* the variables in the deterministic equations. Therefore, epistemic uncertainty is ineradicable. On du Bois-Reymond, see [Finkelstein \(2014\)](#).

¹⁰ ‘... psychology has wrongly attributed negative views on unconscious processes to James. Far from disparaging them, James saw unconscious processes as critically important to psychological functioning. ... Psychologists mistakenly ... failed to consider what the term “unconscious” meant to James at the end of the 19th century as compared with the meaning it has since acquired. ... James was actually positively disposed to what we now term unconscious processes’ ([Weinberger, 2000](#), p. 439).

pursuance of future ends and the choice of means for their attainment are the mark and criterion of the presence of mentality [that is, consciousness] in a phenomenon' (James, 1890, p. 8, emphasis in original). In fact, consciousness 'is a fighter for ends... Its powers of cognition are mainly subservient to these ends, discerning which facts further them and which do not' (p. 141, emphasis in original). The selective attention of consciousness is the critical factor in rendering the 'big blooming buzzing confusion' of our sensations and experiences meaningful (James, [1911] 1996, p. 50, p. 113).¹¹ Selective attention is 'for the sake of some subjective interest' on the part of individuals and thus reflects 'partial purposes and private ends' (James, 1890, vol. 1, p. 482).

'Inference' is means by which order and meaning are given to the flux of experience. We start with elemental *sensations* such as light, heat, cold, smell, and pain. From these, we may associate (infer) objects derived from the past experience.¹² Thus, we may *perceive* the lamp as a source of light, the fire as a source of heat, and so forth. At the stage of perceptions, we have already organised (mostly unconsciously) our experiences to a limited extent.¹³ Yet this is not enough for the pursuance of future ends. 'We *perceive* the world before we react to it, and we react not to what we perceive, but always to what we *infer*' (Knight, 1921, p. 201, emphasis in original).¹⁴ This further stage of inference is mediated by concepts. For example, suppose we simply perceive a piece of wood and a knife. As such, we would merely stare 'vacantly' at it (James, 1890, vol. 2, p. 333). But if we are to use the knife as a tool to carve the wood into some shape, we need concepts. We need to identify some characteristics in the objects before us that have properties such as sharpness, certain degree of malleability and the property of our hands to appropriately manipulate these objects. This requires the individual to pick out the relevant essential features in objects of perception and to identify the relevant properties that are conducive to manipulation.¹⁵ Analysis and abstraction are required.¹⁶ The building and use of concepts are essential to what James calls *reasoning*.

¹¹ '...consciousness organizes the "big, buzzing, booming confusion", which is experience in its raw state, into a world of objects...' (Knight, 1924, p. 111).

¹² 'Perception thus differs from sensation by the consciousness of farther facts associated with the object of the sensation' (James, 1890, vol. 2, p. 77, emphasis in original).

¹³ 'They [perceptions] have been called *unconscious inferences*. Certainly, we are commonly unconscious that we are inferring at all' (James, 1890, vol. 2, emphasis in original). The term 'unconscious inferences' comes from Hermann Helmholtz. See note 35 below.

¹⁴ Knight (1921, p. 7, n. 1; [1922] 2011, p. 110) agreed with J.S. Mill and with James that inference is both deduction and induction. The major premise of a syllogism is typically an inductive generalisation. For example, the premise 'all men are mortal' is derived from individual and collective experience. See Mill ([1872] 1936, Bk. II, Chap. IV, Sec. 1 and 2) and James (1988, pp. 122–23).

¹⁵ To see this process as inference, we can use James's own symbolic representation. 'Call the fact or concrete datum S; the essential attribute M; the attribute's property P'. Then, '[i]f we glance at the ordinary syllogism—M is P; S is M; S is P...' (1890, vol. 2, p. 330–31). In words, suppose we faced with datum, a perception (S). The individual identifies what for the purpose at hand in the essential attribute (M) of the datum. Then, based on previous learning, he recalls its 'consequences, concomitants, or implications' (P). Thus, attribute M is or contains property P; the perception S is or contains attribute M; and so we can *infer* that the perception is or contains property P. In terms of the example above: The individual perceives a knife. He identifies what for his purposes is the essential attribute of the knife, say, its sharpness. Then, he associates sharpness with the property of being able to cut. Similarly, for the piece of wood. Compare now Knight (1924, p. 113, emphasis in original): 'All inference is essentially this character. An object perceived to have certain qualities is inferred to have others not open to observation but previously found associated with those which are observed. Most of our ordinary recognition of objects is really on this basis, we perceive relatively little, and infer most of what we think we perceive. Reasoning is the capacity to single out *essential* characteristics, marks from which relatively much can be inferred, and associate with them the qualities really connected'.

¹⁶ This should not be taken to imply that this is a slow process. Familiarity can produce an almost instantaneous inference. 'The first effect on the mind of growing cultivated is that processes once multiple get to be performed by a single act' (James, 1890, vol. 2, p. 369).

While there are important differences between perceiving and reasoning (conceiving), they are nonetheless each instance of inference. The former is relatively simple and based on empirical associations. The latter is much more complex, abstract and based on concepts. Each of these forms of inference is *ampliative*; they enable us to go beyond where we started—the present perception or even the present concept or set of concepts.¹⁷

The connection between consciousness as a fighter for ends and inferential reasoning is critical to the ability to deal with an unknown future. ‘*Let us make this ability to deal with NOVEL data the technical differentia of reasoning*’ (James, 1890, p. 330, emphasis and capitalization in original). Knight says that the ‘role of consciousness is to give the organism ... knowledge of the future’ (Knight, 1921, p. 201). How does this happen?

3. Dealing with novelty

3.1 The basic case

Imagine a person who has never seen a piece of ice melt near a fire. Such an experience would be novel to him. How might he be able to predict it? If he is educated, he could ‘conceive heat as a mode of motion and liquefaction as identical with increased motion of molecules ...’ (James, 1890, vol. 2, p. 341). Thus, the individual having identified an essential property of both heat and melting (molecular motion) he is in a position to predict what would happen if ice is placed near heat.¹⁸ The prediction is mediated by an abstract property or concept and not by a previous experience of this phenomenon. The identification of the abstract property is equivalent to putting the concrete phenomenon into a *class* of phenomena. ‘Think of heat as motion, and whatever is true of motion will be true of heat’ (James, 1890, vol. 2, p. 342). The idea of classification is critically important in Knight’s analysis of knowledge and uncertainty. It ‘must be possible to *infer* from a perceived similarity in the behavior of objects to a similarity in respects not open to immediate observation’ (Knight, 1921, pp. 205–6, emphasis added).¹⁹ Thus, classification enables prediction. This is because at an *abstract level* there are properties that are constant in classes of similar events or things even when at a concrete level these constancies may elude us. Although we have never seen fire melt ice so that this relation eludes us, the abstract properties of heat, motion and liquefaction do exhibit constancy.

It is important to stress that the identification of the essential characteristics is not a matter of logic. The acts of identification are, first and foremost, dependent on our selective attention. They are also dependent, as Knight often argued, on the social

¹⁷ Both Knight and James believe that ‘no sharp division can be drawn between perception and reason’ (Knight, 1921, p. 202). Again: ‘Apparently the higher mental operations of reason are different only in degree, only elaborations of what is inherent in the first spark of “awareness”’ (Knight, 1921, p. 200). James puts it this way: ‘...it is by no means easy to decide just what is meant by reason, or how the peculiar thinking process called reasoning differs from other thought-sequences which may lead to similar results’ (James, 1890, vol. 2, p. 335).

¹⁸ ‘Reasoning power is the capacity to single out *essential* characteristics, marks from which relatively much can be inferred, and associate with them the qualities really connected’ (Knight, 1924, p. 113, original emphasis).

¹⁹ ‘This is the dogma of the “reality of classes”, familiar to students of logic’ (Knight, 1921, p. 206).

communication of knowledge. Modes of conceiving objects are often adopted or borrowed from the successful efforts of others at understanding relationships.²⁰

Beyond that, new concepts ‘come to us as lucky fancies’ or as ‘idiosyncrasies, spontaneous variations, fitted by good luck (those of them which have survived)’ (James, 1890, vol. 2, 630–1). Thus, even where stable abstract relations exist, there is no certainty that they will be discovered and the ability to predict novel events will be realised. Selective attention must be complemented by luck.

The example of a piece of ice melting near a fire represents a relatively simple case where the number of factors is small and the process involved is deterministic. The event is made up of a few types of units (molecules and motion) whose interrelations do not change. And it will ‘always’ be the case that the fire melts the ice. Let us now go beyond this simple case.

3.2 Complex phenomena

There are cases where ‘there are so *many* of these units that the simple changes which they undergo ... give rise to a variety of *combinations* which our minds are unable to grasp in detail’ (Knight, 1921, p. 314, original emphasis).²¹ In terms of James’s framework, this would be a case where a phenomenon has many characteristics and properties essential to understanding it. While the relations between the variables of interest and the phenomenon may be stable taken one at a time, the number and interactions among the variables are very large so that it is too complicated to predict future outcomes in individual cases.

Suppose we are interested in whether a particular building will accidentally burn down. We try to find the characteristics and properties of buildings and their environments that are conducive to fires. There are many factors including the age of the building and its construction materials, whether the electrical system is in good shape, the nature of the neighbouring buildings and so forth. Let us assume that, in principle, *if* we could fully comprehend the relation between these factors and the processes that produce fires as well as the offsetting or compounding effect of the factors on each other, we could predict whether a given building will burn or not. But we cannot. In this case, we are faced with *epistemic* uncertainty. Given that we do know something about the cause of buildings burning down, this is a case of where we are not completely at a loss. We may be able to predict a pattern of outcomes in similar cases based on the causes we do know and the known values of the relevant variables. However, this pattern would only be visible in a class of cases. This leads us to the characterisation of uncertainty as risk.

3.3 Risk

James’s principle of *association by similarity* (1890, vol. 2, p. 345)—which Knight refers to in *Risk, Uncertainty and Profit* (1921, p. 210, n. 1)—is not limited to cases where

²⁰ ‘... very little indeed of any person’s actual knowledge of the world is derived in any way from his own observation and reflection ... an overwhelmingly preponderant portion comes through other persons by a process of *communication*’ (Knight, 1924, p. 116, original emphasis).

²¹ Mill describes this kind of case as one in which ‘the complexity does not arise from the number of the laws themselves, which is not remarkably great, but from the extraordinary number and variety of the data or elements—of the agents which in obedience to that small number of laws, co-operate toward the effect’ ([1872] 1936, Bk. VI, Chap. IX).

the relationship between the essential properties and the outcome is determinate. If the instances of buildings with the same essential fire characteristics are grouped together, even though they may have differences in other characteristics, we may be able to observe stable aggregate effects. Over a large number of such instances, there may be a stable relative frequency of fires.²² Thus, our intellectual desire for stability of relationships may be satisfied in probabilistic terms in this way. Conceiving of phenomena as risky transforms the dogma that ‘*things which, under the same circumstances, always behave in the same way*’ and ‘*the same kind of thing will [always] do the same*’ (Knight, 1921, p. 205, original emphases) to the same kind of thing will always behave with the same relative frequency. And yet even here uncertainty is not completely eradicated in those cases where the relative frequencies are not absolutely stable over time. Either insufficiently understood factors or real indeterminism will enter into the picture.²³ The revised dogma is serviceable but not unassailable. Thus, a person will act on the basis of the degree of confidence he has that the relative frequency calculated will turn out to be correct or stable.

3.4 Uncertainty: meaning and terminology

In order to appreciate what Knight means by ‘true uncertainty’, we must understand how an uncertain event can fail to be a ‘risk’. Knight argued that profit would not exist under perfect competition as long as uncertainty was characterised as foreknowledge in which ‘all of the alternative possibilities are known and the probability of the occurrence of each can be accurately ascertained’ (1921, p. 198). In other words, ‘quantitative knowledge of the probability of every possible outcome can be had’ (1921 p. 199). This implies that there are two ways in which uncertainty can fail to be risk: Individuals may not be able to list all of the possible outcomes (and perhaps fully understand that they cannot) and they cannot reliably ascertain empirically the relative frequencies of the outcomes.²⁴

Before we can continue, however, we must deal with the issue of how Knight defines the word ‘estimate’. In a discussion of a business decision about making a large increase in production capacity, Knight says a manufacturer must make ‘an “estimate” of the probable outcome of any proposed course of action’ (1921, p. 226). Here, estimate refers to a focussed-on *possible outcome*. A little further on, Knight makes a distinction between ‘the formation of an estimate’ and ‘the estimation of its value’ (1921, p. 227). Here, the second estimate or estimation most likely refers either to an empirical *relative frequency* of the outcome or to a *subjective degree of confidence* that an individual has in the outcome. Still further on, Knight writes of a man who acts ‘upon an estimate of the chance that his estimate of the chance of an event is a correct estimate’ (1921, p. 227). This appears to bring the meanings together. The first ‘estimate of the chance’ is the

²² ‘When the conditions are so numerous and confused that we can hardly follow them, we treat a thing as probable in proportion to the *frequency* with which things of that *kind* occur’ (James, [1911] 1996, emphasis in original, p. 226).

²³ Knight ([1922] 2011, p. 113) believes in ontological indeterminism: ‘I personally believe in the reality of chance – that there is “play in the joints” of the cosmic mechanism’. As far as individual decision-making is concerned, however, there is no practical difference between the case of epistemic uncertainty and one in which there is real, ontological indeterminism or underdeterminism. As Knight himself says, ‘[It] is usually quite without practical significance...’ (p. 113).

²⁴ LeRoy and Singell (1987) pay attention to the second but ignore the first. For an effective response, see Langlois and Cosgel (1993) who clearly show that Knight was aware of the problem of ascertaining (‘estimating’) the set of possible outcomes.

degree of confidence; the second ‘estimate of the chance of an event’ is the objective relative frequency of the favourable event (as calculated or simply guessed at); and the identification of *a* possible outcome is implicit in the statement.²⁵ In the simplest case, we have a straightforward belief about objective relative frequencies in a class of events (‘estimates’). In a more complex case, we have uncertainty about the relative frequencies (‘estimates of estimates’). This is a mixed case of true uncertainty about the degree of risk. In the ‘pure’ case, we have a degree of confidence (also sometimes called ‘estimates’) in the occurrence of a ‘unique’ event. We discuss this last case more thoroughly below. Thus, Knight uses the word ‘estimate’ to mean possible outcome, degree of confidence or relative frequency—depending on the context. The important point is that all three meanings are intended.²⁶

The greatest challenge to the application of the probability calculus under conditions of true uncertainty lies in the incompleteness of the probability set. Even apart from that, however, we must deal with the claim—advanced, for example, by [LeRoy and Singell \(1987\)](#)—that Knight thought that subjective probability was the way to characterise uncertainty. On the contrary, Knight’s ‘degree of confidence’²⁷ is a psychological concept and not a statement in the (subjective) probability calculus.²⁸ To see this, we must realise that a key axiom of probability calculus requires that the degrees of belief be assigned *consistently* to the possible outcomes ([Fishburn, 1986](#)). Assuming that the set of possible outcomes is complete, is Knight talking about consistent assignments? For anyone familiar with Knight’s lifetime of work, it is difficult to entertain the claim that he would have presupposed consistent degrees of belief.²⁹ The ‘subjective feeling of confidence’ may be based on an ‘intuitive feeling or “hunch”...’, but, Knight continues, ‘we cannot extend our inquiry to cover all of the grounds on which men, even educated men, actually make decisions or it will degenerate into a catalogue of superstitions’ ([Knight, \[1922\] 2011](#), p. 229).

²⁵ This formulation may be clearer: A ‘man’s opinion or prediction may be an estimate of objective probability, and the estimate itself be recognised as having a certain degree of validity...’ ([Knight, 1921](#), p. 237). It appears likely that ‘validity’ is here referring to confidence.

²⁶ We might excuse Knight because terminology was not regularised at his time. Or, we may not excuse him.

²⁷ In the philosophical literature, the term ‘credence’ is often used to mean degreed belief ([Buchak, 2014](#), p. 285). This is not a standard term in economics where credence is most often used to denote ‘credence goods’ or goods characterised by asymmetric information between buyers and sellers. Therefore, to avoid confusion, we use the terms degree of belief, degree of confidence and weight of the evidence or cognates of those words.

²⁸ Knight refers to the degree of confidence as a *feeling* ([1921](#), p. 235). Furthermore, he says that ‘an estimate or intuitive judgment is *somewhat* like a probability judgment but *very different* from either of the other types of probability judgment already described [a priori and statistical]’ ([1921](#), pp. 223–24, emphases added).

²⁹ Knight wrote before Frank Ramsey did and before his work was published. Ramsey and others believed that rational degrees of belief must be expressed within the framework of the probability calculus. The most famous argument for why this must be is the Dutch Book Argument. The idealisation is this: Degrees of belief are elicited as betting odds. If an individual does not assign odds consistently to the whole array of possible outcomes, a bookie can offer a series of ‘fair’ bets that, if accepted, will in the aggregate ensure a loss to the bettor. Therefore, it is said, inconsistent degrees of belief, conceived as betting odds, are irrational. Against this, we see no evidence that Knight was concerned about *normative* betting odds. He was making reference to *psychological states of belief* which need not be ‘rational’ in this particular sense. Furthermore, the Dutch Book Argument is rather fragile if taken literally—who is making a whole series of bets, where is the bookie, how does he acquire knowledge of the individual’s degrees of belief, etc.? For a more detailed discussion of the problems, see [Hájek \(2008\)](#) and [Glymour \(1981\)](#). Thus, we claim that, even in view of post-Knight developments in probability theory, Knight’s ‘feelings of confidence’ need not be interpreted as subjective probabilities.

When Knight writes of a degree of confidence applied to the estimate of a probability rather than directly to the phenomenon itself, he means something like the weight of the evidence and the related idea of imprecise probabilities (Bradley, 2019).³⁰ Consider, as Knight (1921, p. 220–21) does, an urn with red and black balls in an unknown proportion. Suppose that a person must estimate the probability of getting a red ball on the first draw. He might decide, based on symmetry considerations or a principle of indifference, that there is no ‘bias’ and that the probability is 0.5. However, he knows that he could very easily be wrong; he has no strong reason for his guess. Thus, the confidence he has in his estimate is low. But to collapse confidence as a weight and the estimate into one degree of confidence (or probability), as Knight (1921, p. 227) says Irving Fisher would have us do, is wrong. It would obscure the doubt, the tentativeness of the estimate itself. The same analysis applies to the inherently unique event where it is not simply that we do not know the proportions or probability distribution but that there is none. Again, if an estimate is required, there will be a degree of confidence—a weight—placed on that estimate. Thus, in neither the case of a direct application of the degree of confidence to an event (the previous paragraph) nor in the indirect application is Knight talking about ideas that are captured by the system of axiomatic subjective probability.

3.5 Uncertainty and conduct

Knight believed that the prediction of human conduct was particularly vulnerable to the problems associated with uncertainty. The basis for this view is not well explained in *Risk, Uncertainty and Profit*. However, he has a much better discussion in a lecture delivered in 1922 shortly after the book’s publication. His explanation is closely related to James’s refutation of the ‘mind-stuff’ or ‘mind-dust’ theories (James, 1890, vol. 1, Chap. VI). These are the theories that our more complex mental states are composed of elementary mental states (‘mental atoms’). The elementary units are then somehow combined in a way that creates specific, higher level, awareness, perception, ideas and so forth.³¹ If this were true, then, at least in principle, we ought to be able to make a predictive inference from relatively simple mental states to the more complex and hence to human conduct. Both James and Knight rejected this view. In Knight’s words:

When we say a mental state is a mixture or combination of certain elements or factors we are using words, not necessarily without meaning, but surely in a very different sense from that which they have in discussing physical things. For the patent fact is that in most cases there is no question of actually compounding the resultant from the factors or separating it into them, and where this cannot be done the significance of such ‘analysis’ for purposes of control is necessarily restricted and special ([1922] 2011, p. 112).

‘Purposes of control’ and prediction go hand-in-hand. Thus, there are inherent limits in predicting and controlling human behaviour. These are not completely out of the question because people tend to behave in habitual ways, and in the aggregate, there are sometimes constancies in conduct. Nevertheless, the uncertainty that is encountered by the entrepreneur or more generally in trying to predict human behaviour in novel or ‘unique’ situations is related to a fundamental characteristic of mind or

³⁰ Keynes (1921) discusses the ‘weight of evidence’ as a category separate from probability.

³¹ According to James, these are the theories ‘that our mental states are composite in structure, made up of smaller states conjoined...the theory that our mental states are compounds...’ (1890, vol. 1, p. 145).

consciousness. In today's terminology, we might say that conduct is the *emergent* result of both elementary physical and mental 'units'—not reducible to them and, therefore, hard to predict.

The unpredictability of much human behaviour is a recurrent theme in Knight's work. The present discussion is not, however, a variant of the complexity argument that we discussed in a previous section. There, 'complexity' was a matter of very many factors combining to produce a given result. These complicated situations are not what predicting human conduct is fundamentally about. Knight's criticism of the mind-stuff theory is a *denial* that we have, in principle, the ability to compose complex mind states in terms of constituent parts. And to the extent that our actions are based on subjective states, it is a denial of our ability to completely eradicate this uncertainty.

4. Decision-making under uncertainty: the problem

The fundamental problem of uncertainty is rooted in a paradox: '[T]he existence of a problem of knowledge depends upon the future being different from the past, while the possibility of the solution of the problem depends on the future being like the past' (Knight, 1921, p. 313). The concepts that we use to make sense of the flux of experience are derived from the past. And yet this flux is the source of never-ending novelty. So, in effect, 'We live forward, we understand backward...' (James, [1909] 1947, 244). As a consequence, our conceptual apparatus always undergoes challenges because novel reality is too big: 'It overflows, exceeds, and alters' the 'conceptual ring-fence' (James, [1911] 1996, p. 99).

One way to characterise this novelty is to focus on our inability to conceive of all of the possibilities that we may face as a consequence of our actions, those of others and those produced by nature. We cannot ascertain which, if any, stable abstract relationships ('concepts') might help us understand unthought-of possibilities. When we are aware of the possibilities, when they are 'similar' to those experienced before, we can use our conceptual systems to master *relatively* novel outcomes. But true uncertainty encompasses more thorough-going novelty.³²

The important question is to discover how individuals (entrepreneurs) make decisions under more thorough-going uncertainty. Knight says, '[in] so far as there is "real change" in the Bergsonian (i.e. Heracleitean) sense it seems clear that reasoning is impossible' (1921, p. 209) but, instead, we use "'judgment", "common sense", or "intuition"' (1921, p. 211). Furthermore, there might be 'really very little to say about the subject' (1921). However, Knight does, in fact, have more to say and much of it alludes to William James's ideas.

Let's begin with what Knight means by 'reason' in the scientific sense. Specifically, scientific reasoning, insofar as it is successful in its predictive aspect, must exhibit the following characteristics:

[1.] Knowledge usable for prediction in the guidance of conduct must consist of propositions which state unchanging truth and hence can be made only with regard to data which are ultimately static. (Knight, 1924, p. 117).

³² This is Knight's *ideal type* against which we can compare actual cases of uncertainty. 'There are all gradations from a perfectly homogeneous group of life or fire hazards at one extreme to an absolutely unique exercise of judgment at the other. All gradations [exist]...except the ideal extremes themselves...' (Knight, 1921, pp. 225–6).

[2.] In general, a scientific proposition must hold good for a class of objects or situations: it states a dependable association or numerical probability of an association, between an attribute not open to direct observation and one which is so, and usually expresses a quantitative relation between the two. (Knight, 1924, p. 118).³³

When we compare these characteristics with what is required for successful action, the reasons for the failure of scientific prediction under uncertainty become clearer (Knight, 1921, p. 202): First, ‘we do not perceive the present as it is and in its totality’. Second, we do not ‘infer the future from the present with any high degree of dependability’. Third, we do not ‘accurately know the consequences of our own actions’. Fourth, ‘we do not execute actions in the precise form in which they are imaged and willed’. The first of these problems would arise, even if the world were deterministic in principle, because we do not comprehend the totality of the initial determining conditions. In the second case, we are not dealing with a system of unchanging relations, which enables us to infer (predict) unknown situations from known situations. In the third case, to the extent that the consequences of a person’s decision are the actions of other people, presumed ‘free will’ ultimately puts limits to prediction.³⁴ The fourth case results in part from the tentativeness of our goals and the likelihood of midcourse corrections. Thus, the problems to be overcome are large and the ‘scientific’ standards of success in overcoming them are quite stringent.

But according to Knight, scientific reasoning is not the only kind of thinking that can be effective in guiding conduct or action.

5. Decision-making under uncertainty: unconscious induction and the fringe of consciousness

While Knight does not clearly explain non-scientific or commonsense methods of decision-making, we are not without some guidance in Knight, James and Hermann Helmholtz. Later, we shall also see how more recent developments give us an even better idea of what is going on.

5.1 Unconscious induction

We start with Knight’s use of a technical term: ‘unconscious induction’. This comes from the work of Helmholtz.³⁵ Knight uses the term when discussing the judgement that one man’s ability to predict under uncertainty is superior to another man’s. He says, ‘[I]t is doubtless principally after all simply an intuitive judgment or “unconscious induction”, as one prefers’ (1921, p. 229). Helmholtz ([1910] 1925) initially developed this idea in the case of optics and spatial perception. For example, our undeveloped visual sensation of an object may be that it is small but, in a particular context, we ultimately learn to infer that it is actually distant. This inference is unconscious.

³³ Knight (1924, p. 118) adds a third, which is not of major concern here. ‘The scientific view of experience postulates a world which is independent of observation, and hence is of course really the same for all observers’.

³⁴ ‘Free-will means novelty, the grafting on to the past of something not involved therein’ (James, [1907] 1975, p. 59).

³⁵ The term is sometimes also translated as ‘unconscious inference’. Helmholtz’s words are *Induktionsschlüsse* and *unbewusste Schlüsse*. Meyering (1989, p. 198, n.1) thinks that the translation ‘unconscious conclusion’, although literal, is a mistake. See also note 36 below.

Helmholtz generalises to say that the inferences or inductions that constitute our perceptions have the general *form* of a syllogism in which the major premise is inductively acquired. Crucially, however, we cannot put the syllogism into propositional form; we cannot tell anyone in words how we are doing it. The conception of this process allows for ‘gradations’ of rational activity from ‘numerous functions of the intellect at lower, [to] at sometimes even relatively high, levels of cognitive performance’ (Meyering, 1989, p. 202, p. 194). The process draws on ‘the “confused” perception of general rules and validities which are the aggregate effects of numerous individual experiences whose specific characteristics are blurred in memory’ (Meyering, 1989, p. 202).

Knight sees something akin to this process taking place in the context of business decisions like ‘predicting the course of prices, locating oil wells, or forecasting crop yields’ (1924, p. 117). In these and similar cases, ‘the person makes an *estimate* by a process only in a small degree conscious, and not describable in any considerable detail’ (1924, p. 117, emphasis in original). The estimate is the guess of what outcome(s) is possible. The individual is drawing on images of past experiences, analogies, subliminal experiences and thoughts and, in general, there are ‘unconscious processes of association of ideas going on in the dark background of our memory’ (Helmholtz quoted in Meyering, 1989, p. 197).³⁶

5.2 *The fringe of consciousness*

In discussing ‘ordinary practical decisions’, Knight uses an illustration, often cited by James, of the TOT phenomenon. The specific characterisation is important:

When we wish to think of some man’s name, or recall a quotation which has slipped our memory, we go to work to do it, and the desired idea comes to mind, often when we are thinking about something else – or else it does not come, but in either case there is very little that we can tell about the operation, very little ‘technique’. So when we try to decide what to expect in a certain situation, and how to behave ourselves accordingly, we are likely to do a lot of irrelevant mental rambling, and the first thing we know we find that we have made up our minds, that our course of action is settled. There seems to be very little meaning in what has gone on in our minds, and certainly little kinship with the formal processes of logic which the scientist uses in an investigation (Knight, 1921, p. 211).

What Knight is describing here is a classic Jamesian ‘fringe’ process (James, 1890, vol. 1, p. 251). James was not fond of the term ‘unconscious’ for reasons to which we have alluded but need not concern us here. But he had no problem describing the mental process illustrated above as “indefinite”, “vague”, “nascent”, “dimly perceived”, “shadowy”, [or] “inarticulate” (Mangan, 2007, p. 677). Fringe ‘feelings’ (vague thoughts) surround whatever we are attending to or concentrating at the time. They are feelings of relation. Thus, in trying to come up with a name or quotation, there is a gap surrounded by associations that initially may not quite get us there. There is a sense of memory and of expectation. Detailed information long forgotten is being evoked and an expectation of what is to come arises. Ultimately, if the name or

³⁶ Importantly, Helmholtz believed that there are levels at which induction takes place from the purely perceptual (I see fire coming toward me) to the inductions we make in understanding the ‘bewildering complexities of human life’ (Meyering, 1989, p. 198). In the latter case, artistic induction (‘Art der Induction’) is at work. This intuitive form is contrasted with explicit scientific induction. It is noteworthy that Knight says that business management is an ‘art’ and not science. See Section 6.1 below.

quotation is recalled, we might reconstruct the process as *a kind of inference* from the past to a current state of consciousness. 'In general, the function of the fringe is to represent huge amounts of nonconscious context information in consciousness in *radically summarized or condensed form*' (Mangan, 2003, emphasis in original).

It should be clear that these non-consciousness ways of knowing which Knight calls variously intuition, sympathetic introspection, judgement and commonsense are not 'scientific' ways of knowing. They are not the application of a general abstract framework like contemporary subjective expected utility theory and its complementary tool of subjective probability theory. This is not to claim, however, that psychology in Knight's time had nothing to say about them. This would be false as we have shown by pointing to the psychology of intuitive feelings of confidence and unconscious induction in moments of uncertainty. More importantly, as we will argue in the next section, developments in cognitive science since Knight wrote have shown that he was on to something quite important and yet missed by many commentators.

6. Elements of a Knightian account of decision-making under uncertainty

In this penultimate section, our goal is to show that Knight's philosophical intuitions on the crucial roles of unconscious processes and intuitive judgements in situations of uncertainty are supported by recent findings in psychology and cognitive sciences.³⁷ The conclusion of this literature is that tacit knowledge built over time through implicit learning leads individuals to develop domain-specific intuitions that help them navigate complex and unstable environments by synthesising information quickly and effectively. This section can also be seen as a response to George Stigler's claim that 'Knight made a series of the most sweeping and confident empirical judgments ... for which he could not have even a cupful of supporting evidence' (Stigler, 1981, p. 167). Our goal in this section is also to provide a 'cupful of evidence' for Knight's philosophical intuition about four elements of intuitive judgement.

6.1 Business management³⁸

Knight [1923] 2011 asks the question, 'Business management—science or art?' Before discussing Knight's answer, we note that he divides the management task into two important aspects: first, bringing together and properly assigning experts to their appropriate roles and, second, establishing a workable organisation or system of relations among the various individuals and departments within the firm (Knight, [1923] 2011, p. 50).³⁹ All of this requires judgement of 'judgment of men' in the context of non-repeated conduct ([1923] 2011, p. 51). When the business manager delegates, she replaces 'knowledge of things by knowledge of men' (Knight, 1921, p. 297). Both the manager and, to a certain extent, those the manager hires will have to make decisions

³⁷ For a discussion of the link between Knight's work and modern behavioural economics, see Rakow (2010). However, in this section, we focus on the main takeaways of the tacit knowledge literature (for an overview, see Litman and Reber, 2005). Our aim is not so much to claim that this literature is 'correct' but rather to present it as a development of Knight's intuition about intuition. There is recognition that this literature is not without its problems (see, e.g. Williamson and Stanley, 2001).

³⁸ This is entrepreneurial judgement.

³⁹ Knight mentions a third task—'inspiring confidence, loyalty and interest' in the members of the firm (Knight, [1923] 2011, p. 51). This does not concern us here.

under uncertainty. Both will have to adapt to changing conditions. Moreover, the system of organisation created by the manager must be flexible enough to adapt but not so flexible as to allow unproductive interactions. This is yet another decision made in conditions of uncertainty.

Knight believes that there can be no rules set down in advance that will provide a 'scientific' foundation for these decisions. It is an 'art' (Knight, 1921, p. 164, n. 1; [1923] 2011). As an art, the judgement will be 'direct [and] intuitive' generated by 'an immediate creative process' ([1923] 2011, p. 53). While Knight said little about the nature of this form of judgement and decision-making, he did point to some of its characteristics. These provide us with the elements of a general understanding of intuitive judgements.⁴⁰

According to Knight, the four elements of 'non-scientific' or intuitive judgement are: (E1) The psychological processes involved are *not conscious* (1921, p. 211); (E2) The knowledge they embody or produce is *entirely empirical* (1921, p. 8, n. 1); (E3) The 'truth' to which they lead us is *partial* (1921, p. 202); and (E4) There is a substantial—almost 'irrational'—*emotive optimism* associated with the judgement—a 'will to believe' (James, 1896) in the potential success of a venture.⁴¹ Each of these constitutes Jamesian features of Knight's thought. Furthermore, as our subsequent discussion shows, there is an important contemporary literature that incorporates these elements into a better understanding of intuitive judgement processes in the context of entrepreneurial decisions under uncertainty.⁴²

6.2 Implicit learning

After Knight published *Risk, Uncertainty and Profit*, economists and psychologists largely dismissed the usefulness of intuition for making decisions under uncertainty due to its potential to lead to erroneous or biased decisions and instead argued for the superiority of analytical decision-making methods (see, e.g. Meehl, 1954). However, during the 1970s, a group of experimental psychologists and behavioural economists started to rediscover the power of nonconscious and associative modes of information processing (see, e.g. Simon, 1972; Nisbett and Wilson, 1977; Langer, 1978). This experimental work provided empirical evidence for Knight's claim that a substantial amount of cognitive 'work' goes on outside the logical-analytical range of awareness (E1: '*role of the unconscious*'). In many experiments, subjects did not know what information it was that they had based their decision-making on.

Elaborating on this unconscious or non-rational side of decision-making, psychologist Arthur Reber advanced the idea of *implicit learning* (Reber, 1989, p. 1993). Its central feature is that people extract information about their environment implicitly, that is, more often and to a larger degree than they are aware, and that this knowledge

⁴⁰ There is no question of completely reducing the judgements to 'science' in the narrow way that Knight understands it. It is possible that some progress might be made in this direction in the future (Knight, [1923] 2011, p. 53). However, what we discuss in the sections below is an attempt to understand intuitive decision-making and judgement in general, somewhat abstract, terms. This is along the lines of F.A. Hayek's 'explanation of the principle' (Hayek, 1955).

⁴¹ Knight (1921, p. 366) says 'business men ... are not the critical and hesitant individuals, but rather those with restless energy, buoyant optimism, and large faith in things generally and themselves in particular'.

⁴² We make no claim that Knight influenced this literature in any way. We do say, however, that Knight's intuition about intuition was largely correct or, at least, it can be plausibly argued.

is tacit, that is, it influences thought and behaviour while remaining mostly concealed from consciousness.⁴³ Over the course of the last few decades, researchers have found robust evidence to support the power of implicit learning. For instance, in spite of their loss of the ability to form conscious memories, *amnesiacs* display improved performance on a variety of tasks over time, which suggests that past experiences are unconsciously stored and influence their current behaviour (Glisky and Schacter, 1989). Reber (1993) has demonstrated the power of implicit learning in the context of the acquisition of *artificial grammar rules*: over a short period of time, subjects learn to differentiate (seemingly nonsensical) sequences of letters that follow complex rules from those that violate the rules. Subjects are able to do this despite being completely unaware of the nature of the underlying grammar rules. Another line of research has shown that—without being consciously aware of the commonalities in two sets of problems—subjects display *analogic transfer* from one complex problem to another (Schunn and Dunbar, 1996). Taken together, the literature on implicit learning suggests that a nontrivial part of our knowledge is tacit and experientially acquired in unconscious cognitive processes (see Litman and Reber, 2005 for a review).⁴⁴

Importantly, implicit learning—sometimes also referred to as the process of ‘intuiting’—is *holistic* and *associative* (Dane and Pratt, 2007, p. 37). It is *holistic* since it captures a decision situation’s general features and ‘[monitors] the environment for reliable relationships between events and to encode those patterns of covariation’. (Litman and Reber, 2005, p. 441). And it is *associative* since it involves a process of linking disparate elements of information (Raidl and Lubart, 2001, p. 219).⁴⁵ Due to the holistic and associative nature of implicit learning, fairly sophisticated information about complex environments can be picked up, again largely independently of conscious awareness of the nature of what was learned. However, it is crucial that the individual is experientially exposed to the environment to acquire this type of holistic and associative knowledge (E2: ‘*knowledge is empirical*’).

6.3 Intuitive judgement

Implicit learning can help us explain the cognitive process which Knight describes as ‘irrelevant mental rambling’ (1921, p. 211) that leads to ‘intuitive judgment or “unconscious induction”’, (1921, p. 229) in complex environments. In other words, we can understand implicit learning as the unconscious process that precedes intuitive judgements (Shapiro and Spence, 1997, p. 64). In line with Knight’s observation that an intuitive judgement is a ‘subjective feeling of confidence’ (1921, p. 229), modern psychology understands intuitive judgements as *affectively charged* (Dane and Pratt,

⁴³ Reber’s work on implicit learning is inspired by Michal Polanyi’s work on *tacit knowledge* (see, e.g. Polanyi, 1966). Polanyi referred to *tacit knowledge* when he described the essence of the work of the scientist as building up a stock of knowledge that resisted conscious verbalisation but was still the driving force behind scientific attempts analyse the ‘knowable reality’. Polanyi (1966, p. 1) states that ‘[discovery] must be arrived at by the tacit powers of the mind and its content, so far as it is indeterminate, can be only tacitly known’.

⁴⁴ In fact, there appears to be a consensus emerging in the literature that most of our essential knowledge of the perceptual, sensorimotor, linguistic and social patterns that make up our environment are acquired through this procedural mechanism of implicit learning (Litman and Reber, 2005, p. 442).

⁴⁵ See James (1890, vol. 2, p. 361) on this point: ‘...there are two stages in reasoned thoughts, one in which similarity merely operates to call up cognate thoughts, and another farther stage, where the bond of identity between cognate thoughts is noticed; so minds of genius may be divided into two main sorts, those who notice the bond [“abstract reasoners”] and those who merely obey it [“men of intuitions”]’.

2007, p. 39) given that they involve ‘gut feelings’ (Gigerenzer, 2007) or ‘feelings of knowing’ (Shirley and Langan-Fox, 1996, p. 564).⁴⁶ These feeling of knowing (E1: ‘*role of the unconscious*’ and E4: ‘*emotive optimism*’) help individuals identify essential characteristics of a decision situation (‘what is going on here?’) and apply it moving forward (‘what will happen next?’). Based on implicitly stored memories, at the moment of decision-making, our mind integrates millions of situational clues into coherent patterns that lead to *intuitive feelings* about what to do next (Shirley and Langan-Fox, 1996, p. 573).

In addition to being affectively charged, intuitive judgements must be *domain specific* to generate helpful predictions. As Knight puts it, the capacity to form successful intuitive judgements ‘is far from homogeneous, some persons excelling in foresight in one kind of problem situations, others in other kinds’ (1921, p. 241). Following Knight’s logic, Dane and Pratt (2007, p. 50) point out that individuals who possess intuitive judgement capabilities in one field may not be as effective in making intuitive forecasts in a field that differs substantially from the environment in which the individual’s tacit knowledge was developed (E3: ‘*partial truths*’). This domain specificity of implicit knowledge can be explained by introducing the concept of *schemas*. Schemas reflect the tacit knowledge a person has about a certain domain. They are cognitive structures that represent ‘knowledge about a concept or type of stimulus, including its attributes and the relations among those attributes’ (Fiske and Taylor, 1991, p. 98). Schemas may be simple and contain little domain knowledge, as in the case of *heuristics*. Or they can be complex and comprise a high degree of domain knowledge, as in the case of *cognitive maps of experts*.⁴⁷ In the latter case, cognitive schemas enable rapid and accurate intuitive judgements in highly demanding situations, for example, chess masters engaging in multiple games simultaneously or neurosurgeons making difficult decisions in split seconds (Klein, 2003). This is in line with Knight’s assertion that the ‘specialist’ has better intuitive judgement and is able to reduce uncertainty more effectively; Knight (1921, p. 258) states that ‘the specialist in any line of risk-taking naturally knows more about the problem with which he deals than would a venturer who dealt with them only occasionally’. Finally, it is important to note that the domain specificity of experts’ cognitive schemas does not mean that they can only deal with the exact same problem over time. As alluded to above, implicit knowledge captures general patterns and is abstract in nature, which means it generalises to new situations with similar—but not necessarily identical—features (Reber, 1989).

6.4 Back to uncertainty: the role of intuition in entrepreneurial decisions

In *Risk, Uncertainty and Profit*, Knight links entrepreneurial decision-making to the use of intuitive judgements in situations of uncertainty. This is consistent with insights from recent psychological studies on successful managerial decision-making (Baldacchino, 2019, p. 39–42). In business life, decision situations under uncertainty often share three structural features: they are *complex*, deal with *novel* problems and *time* is of the essence (Dane and Pratt, 2007). For instance, think of corporate strategy adjustments

⁴⁶ James (1890, vol. 1, 255) calls these ‘feelings of tendency’ or ‘premonitory glimpses of schemes of relation [...] consciousness of whither our thought is going’.

⁴⁷ Experts acquire ‘mental representation that [are] richly isomorphic with the structure of the particular domain of reality with which he or she had had experience’. (Reber, 1992, p. 105).

in light of a market crash, takeover decisions when a company's value suddenly drops or the decision to fire or furlough employees during an unexpected recession. During such times of 'environmental instability' (Dane and Pratt, 2007, p. 46), entrepreneurs must analyse a large, and often incomplete, amount of data in a very short time. There is a multitude of plausible alternative scenarios which cannot be analysed by standard operating procedures since the complexity and novelty of the situation make the calculation of probabilities impossible.

In such situations, intuitive judgements are particularly useful. First, since time is of the essence, quick intuitive judgements can help circumvent 'paralysis by analysis' (Mintzberg, 1994, p. 325), which would result in high opportunity costs. Second, to address the complexity of the situation, the holistic nature of intuitive judgements may help integrate the disparate informational elements into coherent patterns, 'tacit knowing will make sense of the event' (Polanyi, 1966, p. 9). Third, to address the novelty of the situation, the associative component of intuitive judgements may help bring past elements of important business decisions together in novel combinations in order to imagine alternative scenarios (Duggan, 2007, p. 152). And, fourth, in situations of environmental instability, intuitive judgements are less motivated by preferred outcomes than intellectual–analytical ones. Contrary to common perception, empirical evidence suggests that when people use the intellectual–analytical mode of reasoning in situations of uncertainty, they are more prone to 'wishful thinking' and exploit the existing vagueness to their favour: they use the fact that there are many possible outcomes as a mental excuse to select criteria for judgements that allow them to justify their desired course of action (Molden and Higgins, 2005, p. 304).

Hence, in 'unstructured' cases of uncertainty, the judgemental–intuitive way of thinking is often more effective (in terms of company performance) than the intellectual–analytical one.⁴⁸ This is especially true for cases where entrepreneurs have accrued significant levels of expertise such that their cognitive schemas are domain-relevant (Dane and Pratt, 2007).⁴⁹ In their empirical study, Khatri and Ng (2000) found support for the claim that in situations of environmental instability successful entrepreneurs (again, as measured by their company's performance) move from the intellectual end of the reasoning spectrum towards the judgemental one.

Before concluding, we want to emphasise a crucial point that Knight himself makes, namely, that environmental uncertainty may lift gradually in the course of a decision problem. Knight states that investors (who bear uncertainty) withdraw from enterprises 'as soon as the prospects of the business become fairly determinate'. (Knight, 1921, p. 257). As time goes by, some outcomes that were originally part of the intuitive judgement can be ruled out, while others become increasingly more likely. When a course of action becomes fairly determinate, more traditional means of operation can take over. The shift from more intuitive–judgemental to more intellectual–analytical modes of reasoning 'in modern economic life ... takes place between the *establishment* or *founding* of new enterprises and their *operation* after they are set going' (Knight,

⁴⁸ The terms *intellectual* and *judgemental reasoning* go back to Laughlin (1980). According to Laughlin, judgemental tasks call for 'political, ethical, aesthetic, or behavioral judgments for which there is no objective criterion or demonstrable solution', whereas intellectual tasks involve a 'definite objective criterion of success within the definitions, rules, operations, and relationships of a particular conceptual system' (1980, p. 128).

⁴⁹ Khatri and Ng (2000, p. 58) argue that for managerial intuition to be effective, it 'requires years of experience in problem solving and is founded upon a solid and complete grasp of the details of the business'.

1921, emphasis in original). This is consistent with empirical evidence that entrepreneurs use intuition at the opportunity stage of their enterprise under conditions of high environmental uncertainty but then shift to more analytical modes of reasoning at a later stage of opportunity exploitation and performance evaluation (Baldacchino, 2019, p. 40).⁵⁰ Since, according to Knight (1921, p. 261), access to more information ‘increases the value of the intuitive “judgments”’, they can still play a role at later stages of business decisions; yet, they may be supplemented by the use of analytical decision mechanisms. Summing up, we think Knight’s argument that effective entrepreneurial decisions lie on a continuum of uncertainty (1921, p. 239) and thus involve the use of *both* judgemental and intellectual modes of reasoning is supported by several contemporary theories with empirical evidence.⁵¹

7. Conclusions

In this paper, we emphasised the important role Knight ascribes to *intuitive judgement*, *unconscious inference* and *implicit knowledge* in decision situations of uncertainty. We argued that Knight’s arguments can be more fully understood through the lens of William James’s psychology. Knight explicitly acknowledged his debt to James, both in *Risk, Uncertainty and Profit* and throughout his work in the 1920s. We also noted the influence, in a more limited way, of Henri Bergson, John Stuart Mill, Hermann Helmholtz and Emil du Bois-Reymond on Knight. Finally, we linked Knight’s argument to a growing body of recent literature in psychology and cognitive science that shows how effective judgemental–intuitive modes of reasoning are used in cases of environmental instability. We think Knight’s emphasis on intuitive judgements in *Risk, Uncertainty and Profit* can be read as a plea for epistemic pluralism (Dold and Rizzo, 2021). In everyday life, people learn and know in ways that do not fit a standard ‘scientific’ paradigm.⁵²

Our emphasis on the ideas that influenced Knight produces a more comprehensive account of what Knight was arguing. This, in conjunction with more recent research, begins to fill out the uncertainty framework that he sketched. Furthermore, we suggest that this reading of Knight is an important contribution to at least three current concerns. First, it pushes back against the claim of some behavioural economists that intuition is mainly a source of decision mistakes. Second, it shows that Knight did not simply reduce ‘true uncertainty’ to a case of the application of (axiomatic) subjective probability. Finally, real-world phenomena are often mixed cases of risk and uncertainty or, more precisely, uncertainty exists along some sort of continuum. It is inherent in every action to a greater or lesser extent. As a consequence, intuitive, unconscious or implicit decision-making is ubiquitous.

Further research should focus on a better understanding of how intuition and rational analysis work together.⁵³ The knowledge of when we can trust our gut feelings

⁵⁰ This is in line with Shapiro and Spence (1997) who argue that, in the context of entrepreneurial decisions, intuition should be recorded first, followed by a more thorough analytical assessment of the problem.

⁵¹ Knight (1921, p. 239): ‘true uncertainties, show some tendency toward regularity when grouped on the basis of nearly any similarity or common element’. Knight’s statement is somewhat cryptic, but we think he is admitting that there is a continuum between radical uncertainty and risk.

⁵² Compare Polanyi (1966, p. 18): ‘[Any] attempt to gain complete control of thought by explicit rules is self-contradictory, systematically misleading and culturally destructive’.

⁵³ ‘Intuitive and intellectual or unconscious and conscious processes are involved and interrelated in ways which go beyond the scope of this paper or the writer’s competence to begin to discuss’ (Knight, 1924, p. 123).

and when we should listen to the statisticians might result in a more complete picture of decision effectiveness in situations of uncertainty. Also, we think that future work should examine the link between Knight's treatment of uncertainty and possible institutional implications to identify social and organisational structures that foster implicit learning in complex environments.

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