

# On the relevance of Knight, Keynes and Shackle for unawareness research

Ekaterina Svetlova<sup>★</sup>

This paper is dedicated to the interpretation of Knightian and Keynesian uncertainty as a situation of *unawareness* in which agents lack perfect knowledge of possible future states (not just of probabilities assigned to those states). So far, a systematic and nuanced debate of unawareness with relation to Knight's and Keynes' legacy has been largely neglected. The paper aims to fill this gap. It discusses in detail how Knight's, Keynes' and also Shackle's ideas about the state space, surprises and ignorance are echoed (but often unacknowledged) in contemporary unawareness research. Parallel reading of these two streams of the literature reveals strong commonalities in argumentation, suggesting that the topic of unawareness could facilitate the dialogue between Post-Keynesians and mainstream economics. The paper concludes with a list of research questions relevant to the development of such a dialogue.

*Key words:* Uncertainty, Unawareness, Knight, Keynes, Ignorance  
*JEL codes:* B21, D81

## 1. Introduction

The last two decades have seen a revival of interest in decision-making under true, or radical, uncertainty in economics (Taleb 2007; Akerlof and Shiller 2009; Skidelsky 2009; Dow 2013, 2016; King and Kay 2020), psychology (Volz and Gigerenzer 2012; Tuckett 2018) and economic sociology (Esposito 2013; Beckert 2016; Beckert and Bronk 2018). Most authors refer to Knight's and Keynes' oeuvre as a source of inspiration and consider the re-introduction of uncertainty into modern mainstream economics as a point of departure for re-thinking and re-building the discipline. They claim that most economists—while widely relying on Savage's axiomatisation and the concept of rational expectations—mistakenly conceptualise agents as omniscient. Thus, it is necessary to depart from narrow formalism and analyse human decision-making in the situation of Knightian uncertainty or Keynesian 'we simply do not know'. Only then, they argue, will unexpected events such as economic crises no longer fall between the cracks of economic theory.

Manuscript received 31 March 2020; final version received 4 June 2021.

*Address for correspondence:* Faculty of Behavioural, Management and Social Sciences (BMS), University of Twente, Enschede, Netherlands, email: [e.svetlova@utwente.nl](mailto:e.svetlova@utwente.nl)

<sup>★</sup>University of Twente. The paper is for the Special Issue "Keynes' Treatise on Probability and Knight's Risk, Uncertainty, and Profit After 100 Years".

This recent revival of interest in uncertainty is a continuation of the prolonged debate that has been evolving since the publication of Knight's *Risk, Uncertainty and Profit* and Keynes' *A Treatise on Probability* in 1921. It is striking, however, that most interpretations of Knightian and Keynesian uncertainty conceive of it as being related to *the nature of probabilities* (objective vs subjective, measurable vs immeasurable, assignable vs not assignable, etc.). Inspired by Knight and Keynes, a lot of research has been dedicated to finding and formalising alternative probability measures such as *sets* of additive prior probabilities (e.g. Gilboa and Schmeidler 1989; Bewley 2002), non-additive prior probability measures (e.g. Gilboa 1987; Schmeidler 1989; Basili and Zappia 2009) or non-probabilistic concepts such as fuzzy logic, possibility measures and weights (Zadeh 1978; Kahneman and Tversky 1979; Dubois et al 2001). Furthermore, at times, Knight's and Keynes' (and also Shackle's) arguments about the limitations of human foresight and various probability measures have been 'translated' into general doubts about optimisation and mathematical formalisation in economic decision-making. For example, Lawson (1985; 2003) and Skydelski (2009) used Keynesian ([1921] 2006, [1937]1973) probability concepts to criticise the economic mainstream.

Without denying the importance of this research, a close reading of *Risk, Uncertainty and Profit* and *A Treatise on Probability* suggests that Knight and Keynes were genuinely concerned with one additional, far less discussed issue. They analysed *the nature of possible future states* or, to be more precise, two interrelated aspects: 1) what future states are and 2) what economic agents can know or are (un)aware of. These are the issues that should be clarified *before* probabilities can be assigned and optimisation meaningfully discussed. This interpretation of uncertainty has been refined by some post-Keynesian economists (Shackle 1949, 1955, 1969; Davidson 1988, 1991, 1996; Dequech 2000, 2006; Dow 2012) who claim that the innovative, ever-changing nature of economic reality prevents agents from perfectly anticipating the future and makes them unaware of possible future states.

A careful observer of the debate might identify the tension between the authors who attribute Knightian and Keynesian uncertainty to the impossibility to assign probabilities and those who relate uncertainty to imperfect foresight of the future state space by economic agents (unawareness).

The paper at hand aims to resolve this tension by 1) revising the insightful discussion about the state space, unknowns and unawareness in the oeuvre of Knight, Keynes and Post-Keynesians as well as 2) considering the relationship between this oeuvre and the contemporary *unawareness literature* in economics that makes interesting efforts to formalise the construction and evolution of the individual state-space which does not include all relevant contingencies (Dekel et al. 1998; Modica and Rustichini 1999; Heifetz et al. 2006; Schipper 2014a, 2014b for an overview).

The reading of Knight's and Keynes' seminal work through the 'lens' of unawareness and not (only) probabilities might, first, as already mentioned, relativise the tensions between both strands of interpreters. Second, the discussion on imperfect foresight of possible future states might be essential for re-thinking modern economics and finance more generally. For example, it could be fruitful to extend theories of expectations to incorporate unawareness issues. Why do economic agents *not* conceive of some possible future states? How to formalise events that had not been even imagined when expectations were formed? How do individual sub-sets of known and unknown events

change over time? These are important questions for central banks, for example, which use expectations and *surprises* as instruments to govern economies. Furthermore, risk management and risk theory might benefit from more profound concepts of unknowns and unawareness. Scenario analyses and stress tests, which are so widely applied today, are nothing else than tools for *anticipating surprises* (Derbyshire 2017). Moreover, *expecting the unexpected* has become an important economic activity in its own right (Clarke 1999). A good example of this is the Division of Financial Stability at the Fed which was established after the last financial crisis (Torres 2020). The employees in the Division try to understand what *the relevant unknowns* are, for example, new amplification mechanisms for the next disaster or risks no one has thought about.

Third, the economic crisis of 2008 (Skidelsky 2009)—and the recent covid-19 crisis (Tuckett et al. 2020b)—necessitated the discussion of *specific types* of ignorance and unawareness. For example, we might conceive of ‘uncertainty concerning the existence of unknown unknowns, where a person is unaware of some gap in knowledge’ (Faulkner et al. 2017, p. 1299) as well as uncertainty as a situation in which a person is aware of such a gap (‘awareness of unawareness’). In other words, there is a *spectrum of unknowingness, ranging from ignorance to certitude* (Townsend et al. 2018) which should be investigated in its own right.

Following this call, the paper at hand presents how some of Knight’s, Keynes’ and Shackle’s nuanced ideas on ignorance, such as *unknowability in the factors, weight of argument* and *potential surprise*, are echoed (but often unacknowledged) in the contemporary literature on *unawareness*. Parallel reading reveals a lot of commonalities in argumentation, indicating that the topic of unawareness might become a bridge between post-Keynesians and mainstream economics. It seems that unawareness research is an example of the field Colander (2007, p. 8) had in mind: In this field, post-Keynesian ideas about uncertainty and unknowability of the future are applied and formalised in the mainstream ‘without any reference to Post-Keynesians’. By making these references apparent, this paper identifies unawareness research as an important direction for the joint debate on the state space and imperfect human foresight initiated in Knight’s and Keynes’ seminal work 100 years ago.

The paper proceeds as follows. I start with a brief review of Knight’s (1921), Keynes’ ([1921] 2006; [1937] 1973) and Shackle’s (1949, 1955, 1969) understanding of the nature of possible future states (Sections 2). Then, I suggest an analytical framework that allows me to explain how and why Savage’s axiomatisation precludes non-trivial forms of unawareness (Section 3). After arguing that a more nuanced debate is necessary, I apply the same framework to discuss the commonalities and differences between Knight’s, Keynes’ and Shackle’s ideas, on the one hand, and contemporary literature on unawareness structures, on the other hand (Section 4). I conclude with a typology of the discussed concepts as well as a list of research questions that could facilitate the dialogue between heterodox and mainstream economics on unawareness issues (Section 6).

## 2. On the nature and knowledge of possible future states

As already mentioned, the literature has discussed Knight’s and Keynes’ probability concepts at length (Ellsberg 1961; Lawson 1985, 1988, 2003; Bewley 2002; Gilboa and Schmeidler 1989; Epstein and Wang 1994). These and other authors have focused

on economic agents' difficulties in devising suitable probability measures, but have not questioned agents' knowledge of the propositions or events to which probabilities are assigned. As I will show, this probability-centred interpretation is also echoed in contemporary unawareness research (Schipper 2014a). However, the reading of Knight's and Keynes' oeuvre solely through the probability lens neglects the fact that Knight and Keynes were also concerned with the imperfect knowledge of future contingencies as a crucial part of economic decision-making. For both, imperfect foresight is the point of departure for understanding why the probability calculus might fail in the first place. Hence, the reading of Knight's and Keynes' work through the unawareness lens has the potential to reconcile *probability-focused* and *contingency-focused* interpretations and thus deserves closer attention.

Knight (1921: 205) relates his criticism of 'the assumption of practical omniscience' on the part of economic agents to the difficulty of classifying outcomes of actions. This classification might be impeded because circumstances are *unique*. 'The practical difference between the two categories, risk and uncertainty, is that in the former, the distribution of the outcome in a group of instances is known (either through calculation a priori or from statistics of past experience), while in the case of uncertainty this is not true, the reason being in general that it is impossible to form a group of instances because the situation dealt with is in a high degree unique' (p. 233). Furthermore, perfect knowledge and foresight are only possible in an invariable world that does not undergo any change: 'In so far as there is "*real change*" [...] it is clear that reasoning is impossible. In addition, we have to make the still more questionable assumption that situational elements or fundamental kinds of object properties [...] are unvarying from one "combination" (i.e. one object) to another' (p. 209, my emphasis). Knight claims that this is not the world of the human condition, particularly not the world of business. The economic realm is non-deterministic; there are no 'invariable and universally known laws' (p. 198), but rather the 'inherent unknowability in the factors' (p. 219). Economic agents possess only 'partial knowledge' (p. 199) about the future as their inferences related to the future based on the past are fallible: 'We do not perceive the present as it is and in its totality, nor do we infer the future from the present with any high degree of dependability, nor yet do we accurately know the consequences of our own actions' (p. 202). Thus, '[...] uncertainty as Knight understood it arises from the impossibility of exhaustive classification of states' (Langlois and Cosgel 1993: 459). This impossibility implies that the space of possible states that economic agents can conceive of is *vague* or *crude* and not completely known to them.

In *A Treatise on Probability*, Keynes developed a similar point of departure. He was also concerned with the problem of induction; it is impossible to infer future generalisations from past particulars with certainty. He explicitly discussed Hume's view that inductive arguments are not necessarily false, but their validity cannot be proved (Keynes, [1921] 2006, Part III); we do not have any direct and reliable knowledge about causal mechanisms that would allow a reliable prediction of the future<sup>1</sup>.

Dow (2013) argues that for Keynes the impossibility to generalise about the future from the past is rooted in the open, organic and complex nature of the economic system. She quotes: 'We are faced at every turn with the problem of an organic unity, of discreteness, of discontinuity—the whole not equal to the sum of the parts, comparisons

<sup>1</sup> See Meeks (1991) and Dow (2002) for a detailed discussion on Hume and Keynes.

of quantity fail us, small changes produce large effects, the assumptions of a uniform and homogenous continuum are not satisfied.’ (Keynes [1926] 1972, p. 262, quote in Dow 2013). In this sense, economic systems are evolving, non-deterministic and subject to unknown influencing factors. Uncertainty exists, for example, regarding the prospect of a European war, the future price of copper or the interest rate 20 years hence, as opposed to uncertainty in a game of roulette or concerning the expectation of life. Wars and prices are uncertain phenomena in the first sense: ‘About these matters there is no scientific basis on which to form any calculable probability whatever. We simply do not know.’ (Keynes, [1937] 1973, p. 113).

Shackle (1949, 1955, 1969) took this argumentation further, claiming that the world frequently produces new types of phenomena, especially because economic agents are creative and imaginative. Economic decisions are *unique* (as suggested also by Knight), *non-divisible* (only a single trial is possible) and *non-seriable* (the events are not statistically important even in the aggregate) experiments. Most importantly, they are also *crucial experiments*; the decisions inevitably alter the conditions under which they were made and might have a severe impact on the decision-maker. As a result, there is no exhaustive list of possible future states and their consequences—or, in Shackle parlance, no exhaustive list of hypotheses—given to an agent. There is always a ‘potential surprise’ which allows the existence of a residual—unknown—hypothesis. This hypothesis permits unknowns to be accounted for as elements of the state space.

This debate about the ‘inherent unknowability in the factors’, ‘we simply do not know’, ‘potential surprise’ and ‘residual hypothesis’ was continued within post-Keynesian literature (Davidson 1988, 1991, 1996; Dequech 2000, 2006; Dow 2012; O’Donnell 2014–15). Davidson (1991, 1996) conceptualised uncertainty as an ontological condition of economic reality in which decision-makers operate. He used the concept of non-ergodicity<sup>2</sup> to argue that, in economics, the future is not merely a statistical reflection of the past. If the economic world were ergodic, there would be no novelty, no choice—and no ignorance. Referring to Shackle’s crucial experiment, however, Davidson argued that—due to creativity, change and complexity—the economic world is unknowable in principle because it is yet to be created and discovered. Hence, ignorance of possible future states is a centrepiece of Davidson’s (1996, p. 491) concept: ‘If [...] the future is uncertain in an ontological sense, then sensible decision makers “know” it will always be impossible to possess at any future date a complete list of prospects for any specific further in the future date’. Thus, the non-ergodic situation should be modelled ‘as a situation where agents “do not know what is going to happen and know that they do not know just what is going to happen”’ (Davidson 1996, p. 482, quoting Hicks 1977, p. vii). The possible future states are unknowable to economic agents, although the latter might be aware (or unaware) of this. In other words, uncertainty can be interpreted as unawareness.

Importantly, Davidson dissociates his concept from epistemological uncertainty (O’Donnell 2014–15) and bounded rationality (Simon 1957) which presuppose that

<sup>2</sup> Ergodicity is a technical term from the theory of stochastic processes. In stochastics, averages play an important role: They constitute the knowledge about past and present. Time averages are calculated from a single fixed realisation over a particular time period. Space averages are obtained from cross-sectional data and refer to a fixed point in time. The stochastic process is ergodic when time statistics and space statistics coincide for infinite realisations and converge for finite realisations (Davidson 1988). In this case, the past reveals the future. If the process is non-ergodic, the future is not pre-determined in this sense.

it is principally possible to know the future states of the world—if only the computational and informational limitations of decision makers are overcome. ‘Fundamental’ uncertainty is not about imperfect information, but a principal unknowability.

The centenary of Knight’s and Keynes’ seminal work might be a suitable occasion to realise that this discussion about the indeterminacy of possible future states, of which economic agents possess only limited knowledge, has seldom been taken seriously. Most of the time, Knight’s and Keynes’ ideas about the unknowability of the future are read as an invitation to discuss whether probabilities exist, can be assigned etc., and not as a call to theoretically deal with unforeseen contingencies. Furthermore, the Knightian and Keynesian debate on imperfect knowledge of the future has been rather trivialised by two movements in economics: 1) the mainstream framework (e.g. [Savage 1954](#)) which reduced the debate to trivial forms of ignorance; 2) behavioural economics which diverted the debate towards ‘animal spirits’, emotions, conventions and heuristics as ways of overcoming uncertainty ([Akerlof and Shiller 2009](#); [Volz and Gigerenzer 2012](#); [Jefferson and King 2014](#)). However, Knightian, the Keynesian and post-Keynesian unknowability of the future, if taken seriously, necessitates the theory of unawareness, unforeseeable events and various types and degrees of ignorance ([Dow 2012](#)). This is why I suggest discussing Knight’s and Keynes’ legacy in light of the contemporary unawareness research which is concerned with exactly these issues<sup>3</sup>.

In what follows, I will briefly summarise [Savage’s \(1954\)](#) framework which was the original point of departure for discussions on unawareness and then move to the analysis of connections between Knight’s, Keynes’ and Shackle’s work and the contemporary unawareness research.

### 3. The ‘small world’, unawareness framework and trivial unawareness

Curiously, the ideas of Knight and Keynes concerning the nature of imperfect foresight and probability published in 1921 paved the way—at least to some extent—for Savage’s seminal subjective expected utility (SEU) axiomatisation. Knight’s and Keynes’ interest in unknowability of the future was circumvented by the introduction of the axiomatic approach to the definition of subjective probability measures by [Ramsey \(1931\)](#) and [de Finetti \(1937\)](#) and the concept of probabilistic sophistication. The latter posits that individuals’ state of knowledge is reflected in a subjective probability measure which they employ in their personal calculations of expected utility. The powerful combination of the expected utility theory ([von Neumann and Morgenstern 1944](#)) with probabilistic sophistication resulted in Savage’s axiomatisation, which became the paradigm for the representation of decision-making under uncertainty in economics.

In this static one-person, one-shot decision-making situation, a decision-maker chooses from a set of alternative actions; the consequences of the actions depend on the relevant states of the world. In other words, a decision matrix maps actions and states of the world, which affect the consequences (or outcomes). For example, if an individual decides to go out without an umbrella (the action) and it rains (the state of

<sup>3</sup> Certainly, behavioural economics also became a prominent way to deal with agents’ imperfect knowledge. However, due to space limits, I will not be able to discuss Knight’s and Keynes’ legacy in light of this development. It might be an interesting endeavour though, keeping in mind the Davidson-O’Donnell controversy. In this paper, I focus on one particular strand in the mainstream literature that aims to incorporate ignorance by departing from Savage’s axiomatisation.

the world), he or she gets wet (the outcome). The decision-maker does not know which consequence-relevant state of the world will occur, but theoretically can assess the likelihood of uncertain events, for example, by means of probabilities. Savage formalised non-knowledge of the likelihood of uncertain events in terms of a unique (finitely additive) Bayes–Laplace prior probability measure.

With respect to the space of consequence-relevant states, Savage introduced an important simplification. He assumed that a decision-maker is concerned only with the “small world” which is a *partition* of the complex ‘grand world’<sup>4</sup>. The ‘small’ world can be depicted by a decision matrix which maps acts chosen by agents to their consequences given the ‘worlds’ (‘the world [is] the object about which the person is concerned’), ‘states of the world’ which an agent considers possible (‘a state (of the world) [is] a description of the world, leaving no relevant aspect undescribed’) and ‘events’ (‘an event is a set of states’) (Savage 1954: 9f.). For example, an individual who is making an omelette cares whether an egg (if any) in a particular dozen which he or she is going to use is rotten (‘the world’). In this case, the cook knows 2<sup>12</sup> possible states. Thus, there are no unforeseen contingencies; *no relevant aspects are left undescribed*. The event that exactly one egg is rotten has 12 possible states. The actual state of the world that will be realised is usually understood as a move by the exogenous world which resolves all uncertainty (nature ‘chooses’ whether and which egg is rotten; Debreu 1959, Hirshleifer and Riley 1992: 7). The decision maker does not know which consequence-relevant state will occur, but (like the modeller) has complete knowledge of all possibilities.

At first glance, Savage’s framework presents an elegant solution to the problem of the complex and open world posited by Knight, Keynes and Shackle. For Savage (1954), the ‘grand’ world cannot in principle be analysed in its entirety (p. 16); thus, the construction of a small-world model might help. It makes sense to assume that an individual who is cooking an omelette cares only about the ‘small’ world in which eggs are either rotten or not (without paying attention to their colour, size and other irrelevant properties which—in their entirety—would make the problem intractable). According to Savage, the ‘small-world’ model is an adequate representation of the ‘grand’ world as long as the probability function and utility function are coherent, or equivalent, in both models (Zappia and Basili 2005; Drechsler 2012 for a detailed discussion).

The review of Knight’s, Keynes’ and Shackle’s oeuvre in the previous section, however, raises doubts as to whether such a reduction is feasible in economic and business situations at all (Binmore 2008). For example, an equity investor cannot care about only one parameter, e.g. the profit of a company. A company’s debt, cash flow, market position, corporate governance and market sentiment towards the particular equity (and many other factors) must also be taken into account. Importantly, each parameter may also assume unexpected values (e.g. a surprisingly sharp fall or rise in profit). Similarly, one might argue that monetary policy committees (MPC) at central banks might care simultaneously about a number of goals (e.g. price stability, unemployment etc.; i.e. they might have many ‘worlds’) and need an overview of multiple economic conditions (e.g. credit conditions, productivity, currencies, trade, etc.) (Tuckett et al.

<sup>4</sup> Savage conceptualised the “grand” world as an indefinitely refined version of the “small” world. The “grand” world takes into account all uncertainties that exist in the real world; however, this definition makes the difference between the “grand” world and the real world quite vague (see Drechsler (2012) for a detailed discussion).

2020a). Is the construction of a ‘small world’ in which an economic agent has perfect knowledge of all states and outcomes therefore plausible?

This question has been a major contentious issue that divides post-Keynesians and mainstream economics. The post-Keynesian stream insists on the importance of unforeseen contingencies due to the open and non-deterministic character of the world; the mainstream supports Savage’s view that the ‘grand’ world is intractable in its entirety and complexity; thus the construct of the well-known ‘small’ world is a reasonable way of dealing with the problem.

However, in the last twenty years, a middle ground for both positions has been developing. Mainstream economic literature on unawareness has started incorporating the notion of the imperfect knowledge of possible future states (Kreps 1979, Dekel et al 1998, 2001; Epstein et al 2007; Schipper 2014a, 2014b, 2018; Karni and Vierö 2017).

Importantly, this literature has provided a useful framework for reading and comparing the concepts of Savage (and the standard state-space model more generally) with Knight’s, Keynes’ and Shackle’s ideas. To this end, it is of interest to pose two questions:

- 1) *What is omitted in the individual state space?* In other words, *what are agents unaware about?* With respect to this issue, Bradley and Drechsler (2014) suggest that the literature describes two major cases. In the first case (Type I), a decision maker is aware of all possible states but omits some relevant details in his or her description of the state space or, in other words, his or her state space is too coarse-grained. In the second case (Type II), a decision-maker fails to foresee a state entirely.
- 2) *To what extent are actors aware of their omissions in the space of possible states?* Here, also two situations are possible. A decision-maker is aware (Type III) or unaware (Type IV) of his or her own unawareness of unforeseen contingencies.

Applying these questions to Savage’s *Foundations* reveals that his concept addressed unawareness of Type I. (Bradley and Drechsler 2014). For example, an agent deciding whether to take an umbrella as he or she leaves home might rely on the ‘small’ world representation {‘sunny’, ‘rainy’}. However, he or she might consider more details: The ‘small’ world could be ‘refined’ towards the more fine-grained ‘grand’ world. For instance, a single state ‘sunny’ could be represented as ‘sunny and windy’ or as ‘sunny and not windy’.

At the same time, the Type II uncertainty—a notion of incomplete sets of uncertain events on the decision maker’s part—cannot be incorporated into Savage’s framework. Surprising events, by definition, cannot be known at the instant of choice and, thus, cannot be part of the set of events possible known to a decision-maker.

With respect to Question 2, Dekel et al. (1998) formally demonstrated that the standard state-space structures of economic theory only allow for trivial forms of unawareness: *Either* decision-makers have complete knowledge of the space of consequence-relevant, mutually exclusive states *or* they have no knowledge of this state-space whatsoever; that is, they don’t know that they don’t know. In the words of Dekel et al. (1998), ‘if [a] possibility is truly unforeseen, it seems absurd to say that the person knows that he doesn’t know about [it]’ (p. 159), thus ‘unawareness of a possibility corresponds to a complete lack of possible knowledge regarding it’ (p. 160). In other words, according to the subjective expected utility theory, decision-makers



know exactly what they know and what they are ignoring<sup>5</sup>: They are ‘naively unaware of their own unawareness’ (Grant and Quiggin 2015, p. 168) (Type IV). Thus, in conclusion, Savage’s concept combines Type I and Type IV in the proposed unawareness framework<sup>6</sup>.

The economic research on unawareness, however, has called for more fine-grained accounts of unforeseen contingencies than those permitted by Savage’s axiomatisation. An important non-trivial form of unawareness, which researchers have been concerned with, is represented by the situation in which decision-makers are aware of potential unforeseen contingencies: *awareness of unawareness* (Halpern and Rego 2014; Grant and Quiggin 2015; Karni and Vierø 2017; Walker and Dietz 2011). These researchers model the situation in which an agent *knows* that he or she is missing a particular characteristic of the world and that there are aspects of the universe yet to be discovered (Type III). Unawareness is understood not as lack of knowledge or information, but as a *lack of conception*. As I will show in detail in the next section, this research corresponds to many aspects of Knight’s, Keynes’ and Shackle’s concepts.

Interestingly, this strand of mainstream literature refers to *induction* as the main reason why one should be concerned with awareness of unawareness and amend the SEU framework. Grant and Quiggin (2013, 2015) suggest that sophisticated agents would be aware of their unawareness because their decision-making is based on inductive reasoning. Inductive reasoning teaches economic agents that the future does not resemble the past; thus, they have to appreciate uncertainty and expect surprises or ‘black swans’ (Taleb 2007; Faulkner et al. 2017). Hence, the very justification for the contemporary unawareness literature is closely related to Hume’s, Knight’s and Keynes’ argument on the absence of deductive certainty (although this proximity has not been mentioned in the relevant texts).

More generally, the contemporary unawareness research does not directly build on Knight’s, Keynes’ and Shackle’s oeuvre. At the same time, it contains some direct quotations, reminiscences but also misunderstandings. In the next section, I will apply the unawareness framework to discuss: 1) to what extent Knight, Keynes and Shackle prepared the ground for a nuanced discussion of state-space uncertainty, ignorance and surprises; 2) how their work resonates in the mainstream literature on unawareness. The discussion will show that both research streams have a lot in common.

#### 4. Groundwork on ignorance and non-trivial unawareness

##### 4.1 Knight: unknowability in the factors and coarse-grained state space

As discussed in Section 2, Knight (1921, p. 197) argued that many ‘economic phenomena ... are connected with the imperfection of knowledge’. According to Knight, knowledge begins with ‘the fact of consciousness’ or ‘awareness’ (p. 200). ‘Partial knowledge’ about the future, or *unawareness*, is an important aspect of the process of anticipating the future and dealing with uncertainty. Some relevant contingencies are

<sup>5</sup> See Schipper (2014a and 2014b) for a detailed explanation on properties of true unawareness: Plausibility, KU-introspection and AU Reflexion.

<sup>6</sup> It seems that *unknown unknowns* (Rumsfeld 2011) and *Black Swan events* (Taleb 2007) correspond to this trivial form of unawareness: Decision makers are fully unaware that they are unaware of their omissions in the state space (Type IV). However, what they omit are “unimagined eventualities” which are completely missed in the narrow (“small”) world (Runde 2009; Faulkner et al. 2017) (Type II).

present to our consciousness and some are not, due to the unique and ever-changing character of decision-making situations and unknowability in invariable and universal laws. Importantly, Knight does not relate unawareness to a lack of information, but to the genuine indeterminacy of the economic world. Thus, we could say that economic agents ‘lack conception’ (rather than information) and do not ‘conceive of all relevant contingencies’ (Schipper 2014a, p. 1). This is the most common definition of unawareness in today’s economic literature that clearly echoes Knight’s work.

Despite these parallels, Schipper (2014a, p.1) claims that Knight was concerned only with situations in which the space of all relevant contingencies is known to a decision-maker and thus did not account for unawareness. According to Schipper, Knight merely distinguished between *risk* as a situation in which the probabilities of uncertain events can be unambiguously and objectively determined and *ambiguity* as a situation in which these probabilities cannot be accurately measured. I would suggest that this reading of Knight’s work is not entirely correct. Unawareness was an important component of Knight’s theory of knowledge in economics. What does Knightian unawareness imply, though?

I would suggest that the unawareness discussed in *Risk, Uncertainty and Profit* is rather the ‘mild’ Type I (the coarse-grained state space). Due to the genuine opaqueness of economic processes and the unknowability of ‘the law of the change’ (p. 37 and p. 47), the situation present to consciousness is incomplete. This incompleteness is understood by Knight as the ‘inherent unknowability in the factors’ and the inability to perfectly classify instances. In my reading, Knight is not concerned with ignorance of possible future states, but rather with the omission of relevant details and distinctions: The partition of the state space is too coarse-grained. Complementarily, for him, a situation in which a perfect grouping of cases is possible represents a situation of ‘complete certainty’ (p. 232).

We find a similar conceptualisation of unforeseen contingencies in the modern unawareness literature: ‘Consider [...] a trader speculating on the price of oil. *Given the large number of factors* that determine the price of oil and the complicated manner in which they interact, it seems highly doubtful that the trader would be able to formulate a full state space as in Savage’s framework. Rather, it is likely that the set of contingencies the trader can conceive of—her subjective state space—*omits certain relevant details or distinctions* and thus does not resolve all of the trader’s payoff uncertainty. Where this is so, we say the trader is unaware of the full state space.’ (Walker and Dietz 2011, p. 2, my emphases) Note that this model is rather static and does not allow beliefs to be updated when awareness increases or decreases.

Finally, the examples used by Knight suggest that, in the business world, a decision-maker is aware of the incompleteness of the situation that is present to his or her mind (Type III). Knight illustrates this with the example of a manufacturer who is considering increasing the capacity of his enterprise (p. 226). Due to insufficient knowledge, the manufacturer cannot classify possible events, but he can make ‘a judgment’ or ‘an estimate’. Importantly, Knight also writes about *the degree of certainty* or confidence in ‘the best estimate’ of possible outcomes (‘an estimate of an estimate’), implying a high degree of awareness about an estimate’s uncertainty (p. 226f.).

#### 4.2 Keynes: weight of argument and awareness of unawareness

Faulkner et al. (2017) suggest that the examples provided by Keynes ([1937]1973) in his famous ‘we simply do not know’ paragraph (European war, future copper prices,

etc.) also refer to possibilities that a decision-maker foresees, but not with enough detail (Type I). He or she might be unaware of exact outcomes that will materialise (breaking out of a war or not, or the precise values of copper prices or interest rates 20 years hence), but will be aware of the fact that there *might be* a war or that copper prices and interest rates *will have* some value. There is rather ‘a lack of awareness about features of the world’ (or ‘influences’) but not uncertainty about the ‘membership’ of an event or outcome in the state space (Faulkner et al. 2017: 1297). This is similar to Knightian *unknowability in factors*.

However, in *A Treatise*, we find a concept that allows reasoning about non-trivial forms of unawareness: the weight of argument<sup>7</sup> (Lawson 1987; O’Donnell 1989; Runde 1990; Dow 2012).

At the beginning of Chapter 6 of *A Treatise*, weight is related to ‘a balance ... between absolute amounts of relevant knowledge and of relevant ignorance respectively’ (Keynes [1921] 2006: 71). Commenting on this notion, Runde (1990: 282) highlights the importance of the idea of *relevant ignorance* and argues: ‘The question is whether it is possible to talk sensibly of knowing something about our ignorance, or, to be more precise, of knowing something about changes of the *extent* of our ignorance, on some or other proposition’. Runde illustrates this *awareness of unawareness* (Type III) by referring to a situation in which we rely on the weather forecast but *know* that better data might be available or a more competent expert could be consulted: ‘we are aware that there are usually relevant factors that we have omitted altogether’ (p. 282).

Importantly, the concept of weight allows a meaningful discussion of *gradations of ignorance* and their dynamics. Exploring the Keynesian approach to evidence, Runde (1990) and Crocco (2002: 13) argue that new evidence does not necessarily increase the weight of an argument and knowledge; on the contrary, it might increase relevant ignorance. ‘A new piece of evidence can show that our previous relevant knowledge was wrong—decreasing the weight—albeit, simultaneously, the knowledge of relevant ignorance is increasing’ (Crocco 2002: 13). In other words, awareness of unawareness could grow or decrease depending on what an agent discovers.

This thinking has been incorporated into the recent work on *awareness of unawareness* (but without reference to Keynes). For example, Mukerji (1997, p. 28) develops a model that ‘takes into account two things: (1) that the decision-maker is aware that he cannot foresee all future contingencies in complete detail and (2) the issue of “weight of evidence” or degree of confidence in his likelihood assessment’. The parallels to Keynes’ concept are obvious although Keynes is not quoted in the paper.

Also, Karni and Vierø (2017) extend the SEU axiomatisation by introducing a *set of conceivable acts* which includes *fully describable* and *imperfectly describable* states. At the same time, the authors maintain the notion of the *finiteness of the state space*: Both sets of fully and imperfectly describable states cover all possibilities. For example, a patient choosing to use a new medicine will anticipate future discoveries of consequences that are inconceivable right now, and his or her state space will include known and unknown side effects. Importantly, the unknown consequences are also assigned utilities (‘utility of the unknown’, p. 303); this formal step allows the discussion to remain within the SEU framework. Decision makers’ awareness of their potential ignorance is manifested in their choice behaviour.

<sup>7</sup> I would like to thank the anonymous reviewer for pointing out the connection between *weight of argument* and *unawareness*.

Similar to the Keynesian concept of weight, the model of [Karni and Vierø \(2017\)](#) advances the discussion about the evolution of decision makers' beliefs with respect to ignorance: '[D]epending on the nature of the discoveries, the sense of ignorance, or the "residual" unawareness, may shrink, grow, or remain unchanged' (p. 303). Hence, the ignorance of a user of a new medicine might *decrease* if he or she learns that particular, hitherto unknown side effects are likely, while it might *increase* if clinical trials suggest that possible unknown (e.g. genetic) effects that are unimaginable today might occur in the long run.

#### 4.3 *Shackle: expecting the surprise*

[Shackle \(1949, 1955, 1969\)](#)—who developed Keynes' ideas—proposed the theory of potential surprise and came closest to conceptualizing a decision-making situation in which an individual is entirely unaware of some possible future states (Type II). According to his theory, the elements of the decision matrix—sets of states, options and outcomes—are determined based on an agent's experience and imagination. Individual choice sets are non-closed: There are contingencies that agents do not even imagine. As a result, the theory of potential surprise postulates *the absence of an exhaustive list of possible states* due to the constant availability of a residual hypothesis.

After constructing the matrix, decision-makers assess the plausibility of the envisaged outcomes by assigning *degrees of surprise* to them ([Shackle 1949](#), p. 9). Thus, what is crucial for Shackle's theory is the fact that 'how a decision is made depends on decision makers' awareness of their own ignorance' ([Packard et al. 2017](#): 81), and this awareness can be measured by a degree of surprise. Individuals ask themselves how surprised they would be if a particular outcome occurred and 'assign degrees of surprise ranging from zero for outcomes that seem perfectly possible, to a maximum representing complete astonishment for outcomes that, under current conditions, seem completely impossible' ([Derbyshire 2017](#): 80). Thus, in Shackle's theory, decision-makers can be *aware of their own unawareness to a varying degree* (Type III).

Shackle distinguished between *the certainty of a hypothesis being true* and *the absence of disbelief* in that hypothesis ([Shackle 1955](#), p. 30). The latter refers to a state of mind in which an individual decision-maker is *unsurprised* to see a particular hypothesis come true. This is not possible in decision-making structures where the future state space is populated by mutually exclusive hypotheses; there, the perfect confidence that one of the hypotheses is true would imply a belief in the falsity of all of its rivals (p. 31). The existence of a residual hypothesis within a set of rival hypotheses allows an individual to *expect to be surprised*. He or she can be surprised only by an *unexpected event*, namely the event that has not been imagined or envisaged in any way; however, an agent can be *aware* of his or her exposure to the unexpected event (p. 57f.). There is a clear correspondence to the modern definition of *awareness of unawareness*; an individual is unaware of the proposition but is aware of the existence of some proposition of which he or she is unaware ([Schipper 2014b](#): 36).

The relevance of Shackle's thinking for unawareness research is astonishing. At the same time, his pioneering work did not receive the recognition it deserved. Shackle's concept shows close parallels to some contemporary unawareness approaches without being acknowledged (or maybe just being genuinely unknown). For example, [Grant and Quiggin \(2015\)](#) augment Savage's standard state space by introducing a set of *surprise states* (conceptually close to [Karni and Vierø's \(2017\)](#) *imperfectly describable*

states). Unforeseen consequences arise in surprise states. Grant and Quiggin (2015) argue that, because no agent can consider all relevant contingencies, ‘it is necessary to limit the set of states and consequences that are considered, leaving the unconsidered elements of the problem as potential “surprises”’ (p. 178, my emphasis). Although the connection is obvious, Shackle is not quoted in this paper.

Shackle’s work is referenced, however, in a discussion of discoveries in *games with unawareness* (Schipper 2018), but for the wrong reason. The paper quotes Shackle, but only as a critic of game theory and its inability to incorporate novelty and surprises. At the same time, Schipper claims that he is able to accommodate novelty in his concept. The idea is that games with unawareness are ‘self-destroying’: An agent’s concept of a situation can change not only through learning about the opponents’ moves but also through surprises and transformative experiences (Paul 2014) in the world, that is, by becoming aware of unknown and even unimaginable events. It remains unnoticed that the paper’s argumentation resonates with Shackle’s idea of crucial experiments: Economic decisions inevitably alter the conditions under which they were made. The evolution of the state space might lead to a change in the game agents play. A reference to crucial experiments would have been more suitable as recognition of Shackle’s work.

5. Discussion and directions for future research

The overview presented in this paper demonstrates how strongly the recent work on unawareness was anticipated by Knight, Keynes and Shackle and how insufficiently it has been acknowledged in modern writings on the topic. Table 1 below summarises the relations between concepts discussed in the paper.

Table 1 can certainly be further amended and expanded, and the framework presented in the paper could be further refined. Let me conclude with a discussion of the directions that future research could take in both heterodox (particularly post-Keynesian) and mainstream economics.

The paper has demonstrated how much importance Knight, Keynes and Shackle attached to considerations about knowledge. Unawareness is a field that might facilitate economic thinking on the meaning of *knowledge*, *awareness* and *beliefs*. So far,

Table 1. The typology of unawareness approaches

		Types of unforeseen contingencies	
		Type I: the coarse-grained state space	Type II: the complete omission of a possible state
Awareness of unawareness about unforeseen contingencies	Type III: an agent is aware of her unawareness	Knight (1921), Keynes ([1921] 2006, [1937] 1973), Walker and Dietz (2011), Mukerji (1997), Karni and Viero (2017)	Shackle (1949, 1955, 1969), Davidson (1996), Grant and Quiggin (2015)
	Type IV: an agent is unaware of her unawareness	Savage (1954)	Rumsfeld (2011), Taleb (2007)

the unawareness literature has not seriously dealt with these issues. Schipper (2014a, 2014b) lists only the possible contexts in which the words ‘aware’ and ‘unaware’ are used. But even this shortlist highlights the necessity to clarify what exactly the expressions ‘to be aware’ or ‘to be ignorant’ about something mean. Knight, Keynes and Shackle considered dealing with such fundamental questions to be a pre-condition for serious work in economics.

Furthermore, their work brings us back to fundamental questions about *the nature* of the sub-sets of the world which economic agents ‘see’ and deliberate on. Where do the possibilities of which actors are aware or unaware come from? Are possible states exogenous or endogenous? How do they evolve over time? Who knows the state space? This paper has demonstrated that these questions are at the core of Knight’s, Keynes’ and Shackle’s work. Also, the father of SEU, Savage (1954) wondered how the ‘grand’ world was reduced to the ‘small world’ (‘How [are] such isolated situations actually arrived at and justified?’ (p. 83)) and admitted that he did not know the answer to this question: ‘I am unable to formulate criteria for selecting these small worlds’ (p. 16). Without any pretence of answering these fundamental questions, let me briefly outline possible approaches to them in light of the discussion developed in this paper.

*Where do the possibilities of which actors are aware or unaware come from?* Drawing on Knight’s, Keynes’ and particularly Shackle’s and post-Keynesians’ ideas, some contemporary concepts claim that the scope of possible states emerges in the creative process of *imagining* the future (Beckert 2016; Beckert and Bronk 2018). Such imaginings can adopt the form of narratives that create a possible *plausible* world in which agents operate (also Holmes 2013; Tuckett 2018; Shiller 2019). Particularly, communication and sharing of stories—and language more generally—can be considered co-determinants of the subjective state space. Here, the issues of persuasion but also of how narratives spread and become influential (Shiller 2019), *politics of expectations* (Beckert 2016, p. 275) and herewith *strategic ignorance* (McGoey 2012, 2019) gain crucial relevance. At the same time, possible states may be simply states of nature. This brings us to the next question:

*Are possible states exogenous or endogenous?* The controversy between realists and constructivists is still not settled, and the question raised by Machina (2003, p. 18) ‘Do individuals making choices under uncertainty face states of nature, or do they create them?’ remains one of the most crucial and controversial in economics. In Savage’s framework, the state space represents nature’s exogenous states. That is, the states’ emergence cannot be influenced by agents’ decisions and actions; an agent merely observes the states and is not an active part of the decision situation. The unawareness literature, however, points out that it makes a difference to conceive of possible states as *states of nature* or as *states of the world* (Schipper 2013, p. 741). The two types of state differ concerning the role of the decision maker. In a ‘states-of-nature’ approach, the decision makers’ beliefs and actions are irrelevant for the construction of the state space. Thus, elimination of the unknowability of the future depends on us improving our understanding of the physical world. If, however, we conceive of the states as ‘states of the world’, where observations of others and interactions with them play a role, the decision maker’s beliefs and actions are a part of the world’s description and can be changed by means of those observations. In this case, our understanding of the social world would be as relevant as our views about the physical world. The relevant sub-set of possible states might be endogenous. Shackle’s idea of the *crucial experiment*

already implied this as well as, more generally, Knight's, Keynes' and Shackle's understanding of economic systems as open and organic entities. Such entities are constantly changing as people decide and act and, by doing so, they influence the set of relevant variables. This thinking is echoed in some modern concepts. For example, the idea of *reflexivity* (Soros 1998) and *observation theory* (Esposito 2013) suggest that every incomplete individual attempt to define a situation (the subjective state space) is part of this situation and contributes to its indefiniteness. Also, the way in which decision makers determine possibilities (e.g. by using mathematical models) also influences and co-creates possibilities (*performativity* in MacKenzie 2006). The establishment of an explicit connection between those ideas and the unawareness literature might provide a fruitful middle ground for a dialogue between heterodox (especially Post-Keynesian) and mainstream economics.

How do the individual sets of possible states evolve over time? How do agents become aware of their own unawareness? As discussed in this paper, Knight, Keynes and Shackle as well as the unawareness literature have paid attention to the *evolution of the state space* through the notions of learning and discovery. Their ideas could complement concepts of learning that prevail in contemporary macro- and microeconomics, which assume that agents adjust their beliefs and behaviour over time as new *information* becomes available, in accordance with the Bayesian rule. In contrast to these concepts, unawareness research shows that agents can already learn without obtaining new information: There is the possibility of fact-free learning (Aragones et al. 2005; Grant and Quiggin 2005). An agent might change his (or her) partition of a state space by acquiring a new view on existing knowledge or finding unexpected regularities or connections in it, for example, or by simply talking to someone who has a different view on the existing set of information (think of Watson listening to Holmes' explanations). Thus, a change in beliefs (a discovery) might happen without acquiring new factual information (although ultimately required in the Bayesian concept). Second, as discussed in this paper, Keynes' concept of weight and the unawareness literature suggest that new discoveries about the world can lead to the expansion of a decision maker's universe (Karni and Vierø 2017). This approach is incompatible with the Bayesian world where becoming accustomed to new possibilities inevitably causes the state space to contract.

*Who knows the state space?* In most unawareness concepts, there is an entity (e.g. a modeller) that possesses a complete view of all states of nature possible, while an ordinary decision maker has only imperfect knowledge of them (the partition). However, as discussed in this paper, Knight, Keynes, Shackle and post-Keynesian (especially in the theory of non-ergodicity) questioned whether anybody possesses such complete knowledge of states at all. A similar challenge was raised in the *psychology of unawareness* research (Felin et al. 2017) where scholars argued that it is important to criticise both the omniscient agent and the idea of an "ideal observer", who has a god-like, all-seeing view. Sticking to the concept of an "ideal observer" merely re-introduces a different form of omniscience. Instead, in the open and complex world, awareness would be rather conditioned by the nature of the local observer.

A more detailed discussion of those concepts would go beyond the scope of this paper. However, what I suggest is further work on the *connections* between the ideas so prominently introduced by Knight and Keynes 100 years ago, unawareness research and its proximal fields.

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