



Uncertainty, Timing and Luck on Quantum terms in Entrepreneurship

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ABSTRACT

Entrepreneurship researches have been curiously silent on luck since luck, itself is elusive and cannot be systematically quantified in any meaningful measurement. An explicit and systematic evaluation of where luck is situated along the spectrum of certainty to absolute uncertainty will be undertaken in this paper. Exploration on the social construction of luck, effect of luck, human interventions relating to luck; the discussion on the operationalization of luck will open potentially rich veins of theoretical inquiry premising on quantum uncertainties, chaos theory, Heisenberg uncertainty principle and Weick's sensemaking. Heisenberg uncertainty principle or Knightian's uncertainty or the chaos theory, they are not competing alternatives and irreconcilable as they are not dealing with the same aspect of the indeterministic phenomenon. This paper will explore the indeterminacy of luck along the processual pathway of entrepreneurial venturing. It concludes by offering a compelling proposition on opportunistic and propitious timing with regards to the eventual rewards.

INTRODUCTION

Entrepreneurs are exposed to many risks. At any moment it is endangered by external perturbations like financial crisis, shift of demands or pandemic which cannot be controlled or at least not sufficiently. Every entrepreneur banks on good luck or hope that luck can mediate in their endeavours. 'Luck pivots on unpredictability' (Rescher, 2001: 20). There is an element of gambling in entrepreneurship. Entrepreneurs can hedge some of the riskier consequences by insuring against the risks. In this sense, the act of insurance banks upon the opposite chances. 'On the part of the insured the insurance is gambling. His premiums were spent in vain if the disaster does not occur. With regard to noncontrollable natural events man is always in the position of a gambler' (Mises, 1949: 112)

Before the exploration of how luck might be studied with relations to entrepreneurship, it is best to underscore a definition of luck or what it is not. Luck as defined by the Cambridge dictionary is the force that causes things, especially good things to happen by chance and not the result of efforts or abilities. The hallmark counterargument or "what luck is not" is those who assert that merit and hard work are the sole determinants to success, not luck (Sauder, 2020: 194). Or according to Merriam-Webster dictionary, luck is a force that brings good fortune or adversity in the events or circumstances that operate

for or against an individual. 'Luck pivots on having things go well or ill fortuitously from the angle of its beneficiaries.' (Rescher, 2001: 8)

Entrepreneurship is a journey that persists through time, situated in differing degree of risks and uncertainties with generative emergence (Lichtenstein, 2020)- the creation of pathways and structures. As entrepreneurs thrive and act by the lure of profits, the notion of luck, particularly the play of luck in their endeavours is crucial, for the least, as it uplifts and sustains them through the entrepreneurial journey with a view that luck will boost their ventures at some point. The science and art of entrepreneurship is fixing the puzzle with the coordination of local available material and social network with the self-organization of activities and actions which will bring about profitable outcomes (Lamine et al., 2019). Entrepreneurial actions involves the coordination of market forces, control of which is limited and with limited, tacit knowledge to generate emerging pathway of possibilities. The key mechanism of the entrepreneurial process is the recognition of opportunities and the potential that exists within the opportunity sets. The role of space and time where this opportunity exists or appears requires the entrepreneur to bear high entrepreneurial alertness (Miao & Liu, 2010) for the coordination of market forces.

This paper aims to explore the two types of forces- luck as "the force that causes things to happen that brings good fortune or adversity' and the market force. The notion of luck as a force, a conception of an existential force that is independent from any purposeful actions and its occurrence. Luck is one that happens by chance and is consequential- either emerging with good fortune or adversity. 'The key definitional point is that luck always includes an element of chance, but it is not the same as chance. Basically, luck has a positive or negative valence, whereas chance does not. Luck, in effect, is chance with consequences.' (Sauder, 2020: 195). This paper will further discuss how the forces, at the different hierarchical levels interact to generate changes to produce the outcome of luck. A critical part in this generative emergence (Lichtenstein, 2020) is how and why some of the potentialities develop from the present to the future while others fail to emerge. The emergence of the particular trajectory among the many possible alternatives pathways occurs as constraints and the force of luck in the hierarchically organized systems attenuate some potentialities while amplifying others (Lord et al., 2015). As the future unfolds with the interactions of market forces and the force of luck, the emergence between the layers of hierarchically nested systems are the superpotentiality (superposition) states. All states collapse except one that will remain to create the new reality.

"Using probability waves as a metaphor for organizational processes, we propose that the amount of certainty for knowing where a particular particle is located at a point in time can be generalized to understanding how social systems create a specific, experienced reality at a particular point in time when they too are guided by processes that are functionally represented by probability waves. This reasoning suggests that there are many possible outcomes that can be represented and enacted as the future exists in a state with many potentialities. Quantum physics defines such a state as a superpotentiality (or superposition) state, in which many possibilities are in an indefinite state but have the potential to occur when influenced by a specific context. However, when conjoined with a particular context, this superpotentiality state would collapse due to experienced constraints to create a specific experienced reality, much like an electron appearing in a defined position in space upon measurement. This perspective also suggests that the present (and our soon to be experienced past) was selected by the confluence of multiple events and processes that occurred across many levels in relevant individual, group, and organization systems." (Lord et al., 2015: 13)

As entrepreneurs move into the processual entrepreneurial journey marked by controllable and uncontrollable internal and external perturbations (constituting different degrees of uncertainty) causing shifts in trajectories, they mostly sustain through the journey with the force of their actions and convictions, over time, in anticipation of a favourable future and the lure of profits. Perturbations such as economic upheavals, cyclical downturns, consolidations or shake-downs or a pandemic, with the unknown and unpredictability being high. "The term entrepreneur as used by catalactic theory means: acting man exclusively seen from the aspect of the uncertainty inherent in every action. In using this term one must never forget that every action is embedded in the flux of time and therefore involves a speculation.' (Mises, 1949: 254). The progression, with new emergent in the journey are unpredictable and speculative. The entrepreneurs are faced with varying degrees of risks as they proceed into each phase and they have to make decisions in either certainty, ambiguity or absolute uncertainty/ignorance. The sense of luck is important at some stages to uplift and to sustain their motivation to carry on the journey.

DEALING WITH UNKNOWABLE – KNIGHTIAN UNCERTAINTY, HEISENBERG UNCERTAINTY PRINCIPLE, CHAOS THEORY

The entrepreneurial process is imbued with known sources of unpredictability to unknown-ignorance (ignorance) along the entrepreneurial journey including the biggest puzzle- the uncertainty of the future which is constantly emerging and explicating (Bohm, 1973). There is a fundamental distinction between the indeterminism of chaos theory and the indeterminism of quantum mechanics or quantum uncertainty. Between Heisenberg uncertainty principle and Knightian uncertainty, there are distinctions that need clarifications; but whatever label that is attached to uncertainty, entrepreneurs are always situated in state of indeterminism, nonlinearity, dynamical, disequilibrium.

“The first is the heavy reliance by economists in their formal theorizing on the notion of ‘equilibrium.’ The other appeal that “biological conceptions” have for many economists, particularly when their focus is on economic change. (Alfred) Marshall clearly believed that our society should aim to understand economic change and not simply the forces molding and sustaining the current configuration of economic variables. His “mechanical analogies” and equilibrium concepts included those of Newtonian dynamics, as well as those associated with the balancing of forces on bodies at rest. Since the time of Marshall and following his lead, economists have developed their own equilibrium concepts. While until recently they were mostly associated with analysis of situations presumed to be at rest, in recent years much of economic theorizing has been concerned with dynamics, and the equilibria, like those of Newtonian dynamics are ones in which the variables under study change over time. But Marshall might observe that the equilibrium concept in these models still somehow has a static feel to it.” (Nelson, 1997: 48-49)

Entrepreneurial studies must therefore not be pivoted on equilibrium or have a static feel to it since it is constantly changing and equilibrating in a state of disequilibrium. In a dynamical, disequilibrated system, Lichtenstein in (Lichtenstein, 2009: 1) identified ‘far-from-equilibrium dynamics that trigger order creation’. Lichtenstein adds that there are two contrasting catalysts of emergent order- far from equilibrium dynamics and adaptive tension. ‘Far-from-equilibrium approaches “elucidate the non-linear mechanisms that actually drive [discontinuous] change forward’ (Lichtenstein, 2009: 1) leading to ongoing emergence with perpetual novelty. Core to his assertion is the far-from-equilibrium processes catalysing the emergent process. McKelvey’s adaptive tension (McKelvey, 2004) is the driver of emergence and order creation that is initiated and caused by “energy differentials” which are imposed on the system (adaptive tension) where the dissipation of the energy differentials bring them from state of disequilibrium to equilibrium. In this model, adaptive tension is the catalyst that drives and initiates the dynamic state that leads to the emergence (Lichtenstein, 2009).

The entrepreneurial process therefore is always uncertain and in a state of ‘far- from-equilibrium organizing leads to nonlinearities and perturbations or experiments that generate novelty. Under continuing far-from-equilibrium conditions, new order will emerge.’ (Lichtenstein, 2009: 2)

On uncertainties, what is distinction of Knightian uncertainty and Heisenberg uncertainty principle? ‘And yet, nearly a century since the unveiling of Knightian uncertainty as a precursor to profit-making, the identification, description, and operationalization of uncertainty as a construct continue to exhibit conflicting definitions, tautological measures, and unwitting conflation with more precise constructs along the spectrum of ignorance and unknowingness.’ (Townsend et al., 2018: 659). Knight’s distinction between measurable risks and unmeasurable uncertainties gave clarity to where risks stand along the spectrum from measurable to unmeasurable, from known to unknown risks (at the end of the spectrum of ‘ignorance and unknowingness’). Knight’s views stem from a functional and practical view of uncertainty where analysis of risks is based on degrees of uncertainty rather than invariance and therefore can be described by probability statements but with no statistical rigour and clarity as there is no formal method of describing uncertainties or estimates. In (Knight, 1921) he referred to “probable” or “improbable” outcomes of events along the spectrum of degrees of uncertainty. ‘...Knight’s uncertainties seem to have surprisingly many of the properties of ordinary probabilities” and that the “.. .degree of uncertainty (is) reducible by consolidation of many cases, analogously to the law of large numbers’ (Arrow, 1951: 417) This distinction is crucial as it suggests that to the extent Knightian uncertainties can be aggregated, they can potentially be mitigated through risk pooling or insurable risk.

Heisenberg uncertainty principle and entrepreneurship

Heisenberg uncertainty principle brought an end to an era of determinism in the strictest sense that on an atomic scale we cannot predict what will happen to a specific atom, nucleus, or elementary particle (Heisenberg, 1949).

“And the zoo of subatomic particles- including electrons, quarks, positrons, antiquarks, neutrinos, pions, gluons, and photons- isn't comprised of simple individual objects occupying specific positions in the vacuum we call space and time: not only is the very idea that they take up determinate positions in space not to be taken for granted, but part of their very nature seems to be wrapped up in the bubbling sea of possibilities that was to be but an inert backdrop for matter's passage.” (Barad, 2007: 354)

Whether the unit of analysis is the atom or the sub-atomic particle, by whatever names, or individual, and in this case, in the study of entrepreneur the crux is the study of the possibilities and understanding possibilities in stages of chaos.

“Democritus's atom is not Newton's is not Dalton's is not Boltzmann's is not Einstein's is not Rutherford's is not Bohr's is not Feynman's. But this is not simply to say that the earlier images were wrong and we know better now, or that atoms are but social constructs that change as our ideas change. There's a much more interesting, and arguably more accurate, story to tell about this statement than either the naive realist account or the social constructivist account suggests. Not only has our image of the atom changed, but our practices of imaging and imagining and intra-acting with them have changed, and so have we.” (Barad, 2007: 353-354)

There are two kinds of indeterminism – one arising from limited knowledge and the other arising from the phenomenon inherent uncertainty meaning the uncertainty is circumstantial (Khalil, 1997). The former variant of indeterminism characterizes market disequilibrium dynamics with the ‘energy differential’ (McKelvey, 2004) that can be bet upon, with tolerable risk and with gradient-manipulation mechanism to derive the profits. The latter variant of indeterminism borders closer to Knight’s notion of uncertainty. In chaos, as in uncertainty whether it is the tolerable Knight’s risk or “unknowable” absolute uncertainty, it is ultimately order creation that needs sensemaking. Operating under conditions of uncertainty can be debilitating without any heuristics process or methods, pattern recognition or bracketing method to make sense of the messiness and sometime senseless emergence.

‘The uncertainty principle states that it is impossible to specify simultaneously a particle's location and momentum.’ (Khalil, 1997: 29) . Heisenberg’s uncertainty principle expresses a certain limitation of operational possibilities imposed by quantum mechanics

Chaos theory and entrepreneurship

The enduring theme in entrepreneurship are chance, change, uncertainty and complexity and entrepreneurs in their venturing process are fundamentally living on the edge of chaos. They have therefore to accept and embrace the boundary of their present “being” and their emerging realities at the edge of chaos (Dubinskas, 1994) and making senses of them. Chaos theory provides a pertinent metaphor for the complexity and unpredictability of entrepreneurship. With changes and transformation along the venturing pathways, the venturing process is in a constant flux with periods of temporary stability (Dubinskas, 1994). Such process is characterized by complexity, interconnection among independent variables in the entrepreneurial ecosystem (Kuckertz, 2019), bounded rationality (Hogarth & Karelaia, 2012), limited knowledge and susceptibility to change. In short, they are complex dynamical systems (Karatas-Ozkan et al., 2014). Complex dynamical systems can self-organize into order, coherence and resilient stability but they are also “sensitive to change in initial conditions” (Bygrave, 1993). Chaos theory produces models in which outcomes are highly sensitive to changes in the initial conditions and this is relatable to entrepreneurship. The force of luck, at any point, in the venture is unpredictable and is a chance event and the incipient of luck can have potentially big shift in outcomes. If small changes, like with the incipient of luck into the entrepreneurial process, it has the potential, as in complex dynamical systems to produce far reaching effects and even phase shifts.

Hence, amidst ambiguities, ambivalences and uncertainties and the apparent chaotic, unpredictable nature of entrepreneurial venturing with phase shifts, transitions or punctuated shifts leading to emergence. In (Lichtenstein, 2011: 475) define an ‘emergence event in a nascent venture as a system-wide shift that transforms the venture ... An emergence event is a coordinated and punctuated shift in multiple modes of entrepreneurial organizing at virtually the same time, which generates a qualitatively different’. “At a critical point the market as a whole will ‘self-organize’, creating new regimes of order through ‘punctuated dis-equilibrium” (Lichtenstein, 2011: 485).

Chaos theory's emphasis on dynamics such as sensitivity to initial conditions, emergence and non-linearity, structure through self-organizing mechanism and networks can constitute a system and processes relevant for an entrepreneurial framework discussing uncertainty and luck. When "complex and dynamical entrepreneurial process is susceptible to change (lucky break) that has characteristics including non-linearity (disproportion between causes and effect), unpredictability (the causal chain is too complicated to be able to identify a single cause-effect sequence), vulnerability to phase shift (the configuration of the whole system's functioning can transform) and emergence (new properties and capabilities of the system develop over and above those of its constitutive components)" (Pryor & Bright, 2007: 380), this validates entrepreneurial process's complexity. In chaos theory where the parameters of existence are the interplay of structure and change, being and becoming, stability and surprises (chance event or luck), the planned and the unplanned, the probable and the possible, routine and opportunity, entrepreneurs are mostly immersed in such conditions. Entrepreneurs must therefore bear the alertness and sharpness so that they can responsively act and react to these contingencies, recognizing their knowledge or lack of it/ information asymmetry and utilizing their potential, like traits including passions and optimism, self-efficacy, creativity and alertness. Entrepreneurs in a complex dynamical environment, self-organize their search for opportunity and lure of profits by making meanings from the chaos through perceiving patterns, making patterns and utilizing patterns. From these patterns entrepreneurs draw inferences about their underlying dynamics and consistencies amidst chaos (Ardichvili et al., 2003).

Thus entrepreneurs developing their pathways and at the same time experiencing punctuated shifts and transitions along the journeys which are complex and dynamical; acting within a matrix of other complex dynamical systems in the entrepreneurial ecosystem (Kuckertz, 2019). Fundamental to understanding how complex dynamical systems function is the idea of attraction. The most fundamental concept in chaos analysis is that of attraction and attractor.

"Chaos theory has its origins in mathematics and the physical sciences. In such contexts the concept of attraction is used to give an account of how natural systems function. That is, attraction can be understood as the process by which a system self-organizes into coherence and adapts to maintain, sustain or recreate such order when subject to change either from internal functioning or external influence. The characteristic pattern of this process is called an attractor." (Pryor & Bright, 2007: 381)

Characterizing attractors in entrepreneurial terms:

- a. **Characteristic trajectories** refers to the typical ways in which systems operate in certain trajectory and long term behaviours. Or the perspective that describes the characteristic trajectory of how the entrepreneurs react and respond within their environment. These can be the habits, predispositions, traits, ability, alertness, self-efficacy, creativity (Pryor & Bright, 2007).
- b. **Feedback mechanisms** refer to the how entrepreneurs endure the chaos and uncertainty and sustain through the journey by responding to perturbations, transitions and changes through sensemaking and actions towards their desired outcomes. Feedback-seeking behaviour are factors that help explain the rate of change in entrepreneurs' intense positive feelings for founding, in dealing with change, ambiguity and uncertainty (Collewaert et al., 2016).
- c. **End states** refer to the direction of actions and motion towards the desired states, and in entrepreneurial terms, the "lure of profit" (Shane & Venkataraman, 2000).
- d. **Ordered boundedness** refers to the limitation of the process within which the entrepreneurs operate. 'Without boundaries to a system, there is no system—just absolute disorder. Attractors in this sense are the limits within which systems operate.' (Pryor & Bright, 2007: 382)
- e. **Reality vision** refers to the envisioning that gives sense and purpose to entrepreneurial venturing. This can also describe the entrepreneurs' imaginative capacity to envision the future with the continuous combination and recombination of resources, the existence of perpetual disequilibrium driven by creative entrepreneurial action against a backdrop of continuously changing knowledge and contexts resulting in varying stages of uncertainty (Chiles et al., 2007).

- f. **Equilibrium and fluctuation** refer to the tendency toward equilibrium or fluctuation. As attractors become increasingly closed systems, they tend more towards equilibrium. As systems move closer to equilibrium they start to exhibit repetitious behaviours until a crisis occurs or an disruptive entrepreneurial event that punctuates a shift or transition. As systems move further from equilibrium they experience more fluctuations due to their increasingly open interactions with their environments (Pryor & Bright, 2007). This is associated with less stability and the state of chaos becoming absolutely unpredictable and this will lead to a greater chance of system reorganization. ‘Thus as attractors more closely resemble open systems the more unstable they become, but the higher the likelihood that adaptation can occur. Thus a system that has the potential to break up into chaotic disorder also has the potential to reorganize in new ways.’ (Pryor & Bright, 2007: 382)

With chaos and in its ultimate inability to deal with unexpected change characterized by a failure to explore recognize or create opportunities, entrepreneurs hope for the best of situation (lucky moment) to shift the course for the better. Absolute chaos render the entrepreneurs’ inability to acknowledge what can and cannot be done or known in response to the complexities within their ‘hierarchical system of entrepreneurial artifact-creating processes, artifact emergence is a sub-process that begins and ends with a phase transition into a new pattern of artifact emergence or a new hierarchical level/degree of emergence.’ (Selden & Fletcher, 2015: 10)

“People are constantly subject to events that are outside of their control that have positive or negative effects on their life experiences and life chances... Luck necessarily involves consequential events and an outcome that is at least partially due to chance... Instead, luck only involves events that have a consequence—either good or bad—for the person involved... Although consequences are necessary for an event to be lucky, it is worth highlighting that even minor or contrived consequences can bring luck into play... In regard to chance, events qualify as lucky only if they involve outcomes that are unpredictable and outside of one’s immediate control... Lack of control is a defining characteristic of luck. Events over which we have complete control do not qualify as lucky or unlucky.” (Sauder, 2020: 195)

When an entrepreneurial event is characterized as due to chance, random factors, largely chaotic, luck is operationalized only through the interactions and interferences of the forces at the different hierarchical levels among the heterogenous variables to generate the generative emergence producing the outcome of luck. Successful entrepreneurial venturing is based on a combination of skills and serendipity which is the play of luck. There are events and environmental and external triggers that have high variabilities and unpredictability and despite skills, there is great uncertainties in the undertakings. Serendipity or luck cannot be precluded in any form of success if it is based on causality ambiguous contexts. How is luck operationalized? Any successful outcome is contingent on a series of actions/ enactments, environment munificence, other supportive social and material network. It is a complex system of many independent variables but these independent variables need to converge to click into a lucky outcome. A convergence event or simply put a lucky convergence – this is where there is an alignment of stars or planetary alignment (Fiore et al., 2019). A critical area of inquiry in this phenomenon of lucky convergence is time and timing of the different ‘hierarchical system of entrepreneurial artifact-creating processes’ (Selden & Fletcher, 2015) coming into convergent and alignment that underpin the lucky event emergence. The different hierarchical level of interactions and interferences begs the question of *welcher Weg* (‘which path’) ‘where the interference is lost by the transfer of momentum to the particle whose path is being determined, the extent of momentum transfer satisfying the position–momentum uncertainty relation.’ (Storey et al., 1994: 626). In short and contextualized to entrepreneurial terms, the convergent lucky event is the path that is determined to emerge as a result of interferences of the market forces and other hierarchical levels of force-interactions; and where there is a transfer of momentum (in a momentum-kick) to the emergent pathway to persist in their lucky streak

KNOWING TIME AND TIMING OF ACTION

“Action always aims at the removal of future uneasiness, be it only the future of the impending instant. Between the setting in of action and the attainment of the end sought there always elapses a fraction of time, viz., the maturing time in which the seed sown by the action grows to maturity.” (Mises, 1949: 476)

Entrepreneurial enactment in chaos and uncertainty are unsettling on two grounds – coping with significant ambiguity and privileging intentional action on the right timing. Timing is everything in entrepreneurial action taking account sensemaking

of the chaos and uncertainty and then determining the timing of the social-material enactments. The sustainability and survivability of any entrepreneurial ventures is privileging on intentional actions in propitious timing (Leong, 2021). The volatility of circumstances with varying degrees of indeterminism is a perpetual teething conundrum for entrepreneurs, hence actions, according to Mises, is the removal of future uneasiness, be it only for the impending moment.

Correlation between luck and circumstances and correlation between circumstances and efforts are not the same. In the first correlation of luck and circumstance, the incipient effect of luck is uncontrollable and unpredictable. On the second correlation, timing of efforts and actions in prevailing circumstance can make or break the endeavour. "Though entrepreneurs cannot control time, they can envisage time-calibrations and even create favourable timing by synchronizing their actions with receptiveness of others to those actions." (Bakker, 2018: 42)

LUCK AS A PHENOMENON

Specifically, what is luck? "Luck accordingly involves three things: (1) a beneficiary or maleficiary, (2) a development that is benign (positive) or malign (negative) from the standpoint of the interests of the affected individual, and that, moreover, (3) is fortuitous (unexpected, chancy, unforeseeable)" (Rescher, 2001: 32). Developing a conceptual framework for studying luck need first a working definition of luck and the influence of luck in the repertoire of entrepreneurial events.

Luck usually features strongly in the more successful entrepreneurial journeys. To understand how luck is featured in the entrepreneurial process under what conditions is necessary. With the randomness and chaotic external environment, entrepreneurs rely on the "feel-good" aspects of impending luck to stay positive or hope for luck to break the chain of unfortunate incidents. The occurrence of luck is beyond the control of the beneficiary or maleficiary. The common idea of propitiating luck's potency in entrepreneurial journey is almost superstitious though popularly embraced by entrepreneurs one time or another. Luck cannot be controlled and is an unpredictable chance event. It belongs in the realm of indeterminism of chaos theory. "While chaos chance probability emerges because of the enormity of the facts pertaining to a phenomenon, quantum uncertainty probability occurs because the particle is not a certain, localized fact to start with" (Khalil, 1997: 30).

The treatment of luck in entrepreneurship has taken a special interest contending that luck is as consequential as they are real. In entrepreneurship, it is about taking specific risks, with affordable loss. Affordable loss is when the entrepreneurs evaluate and estimate what level of risk with accompanying loss are tolerated in order to follow through a course of action (Dew et al., 2009). Such heuristic provides guidance to the entrepreneurs taking a plunge decision – a commitment to the venture. Hence they have to rely on the calculus of chance with optimistic prospect that their venture can persist to succeed. "There is merely epistemic chance, grounded in the imperfections of human knowledge" (Rescher, 2001: 130) or absolute ignorance where the entrepreneurs are in non-measurable, absolute uncertainty. In both cases, entrepreneurs thrive on chaos and disequilibrium to take best bets on the opportunities and their futures. Operating in uncertainty necessitates them to have some positivity and the belief of luck that can have uplifting and sustenance effect. The chance dependence luck provides a unifying framework for explaining many real-world entrepreneurial actions phenomena.

How luck is finally perceived, used, and framed will both inform and expand on the insights into entrepreneurship.

DISCUSSION

Potential theoretical implications

Heisenberg's uncertainty principle's main plank is that it is impossible to simultaneously pinpoint and specify a particle's position and its momentum. As soon as the observer's tool identifies the locality, the observer's tool influences and interfere with the particle's momentum in an unpredictable way and vice versa. The argument is not about the make of the tool and its inaccuracy on making exacting measurement of both the position and momentum simultaneously but rather the actions of interference causing disturbances. The particle does not exist independently with certain traits and properties in a specific locality, in space and in time (Khalil, 1997). The thrust of the argument is that the particle exists inter-dependently and the observer together with the observation tool interact and interfere with the measurement outcome; thus the limitations of the accuracy.

"... limitations on the accuracy of joint approximations of position and momentum, we have found Heisenberg uncertainty relations which quantify the necessary intrinsic unsharpness of two observables that are jointly measurable, provided they are to be

approximations of position and momentum, respectively. Both limitations are consequences of the noncommutativity of position and momentum.” (Busch et al., 2007: 23)

Opportunity, as described in leading theoretical perspectives predicates on the potentiality of profits waiting to be discovered (Shane & Venkataraman, 2000). While others argued on the creation approach where opportunities are endogenously created through entrepreneurial actions (Sarasvathy, 2001), these two definitional lines of opportunity are still debated. Whether it is the discovery of the opportunity that pre-exist objectively and independently waiting to be found or the creation approach involving the a selection of means to create the effect in the effectuation process, both these approaches are contingent on observation of opportunities and the means, locally available socio-material resources and network. Such observations and recognition, in Heisenberg’s terms will interfere with the outcome. So the act of observation of the opportunity, if it has a locality situated in space and in time to be discovered, the opportunity will be influenced by the act of the observer and the tools used to see it.

Schrodinger’s quantum uncertainty is defined with a certain probability distribution with different potential state. Whether the cat is dead or alive, in a box with a radioactive substance which can trigger at any moment the release of lethal poison, in Schrödinger’s famous metaphor, it is in a quantum indeterministic state and the uncertain state can only be determined only through experience and through the act of opening the box chaos (Khalil, 1997). All possibilities arising from observing the opportunity to the enactment on that opportunity are expressed as uncertainty of different potential states in probability distribution. Similarly, they can only be experienced from the entrepreneurial venture process and through the enactment on the opportunity. In short, effect of entrepreneurship can be felt through experience and the actual act of venture creation; through the lived-experience (Morris et al., 2012). Enactment is a purposeful set of actions embracing resources and finding means to achieve the ends in ambiguous and uncertain contexts. The probability distribution arising from the enactment can be expressed in the Schrodinger’s wave function. Schrodinger linked wave and particle properties describe the likelihood of a particle being observed in a certain region, in particular space and with a certain momentum at a particular time. Hence, the probability wave captures the indeterminacy of superposition. “They describe the principle of superposition wherein quanta—prior to measurement—simultaneously hold the potentiality of different possible, but indeterminate states.” (Hahn & Knight, 2021: 17). The central theme in the principle of superposition in quantum physics shifts the attention from discrete, objective physical states to an indeterminate state of varying possibilities. To re-cast this on entrepreneurial terms, the principle of superposition expresses the opportunity physical reality as probabilistic (real and existing, or a co-created through acquired means of the entrepreneurs) and therefore can be interpreted from the probability wave function. The probability wave functions describe the different potentialities of how the realities of the opportunities can be experienced and basing on that experience and subsequent sensemaking, enactment to follow. It follows that quantum objects do not have determinate properties prior to any form of observation and measurement (Hahn & Knight, 2021). In this paper, we are arguing that opportunity as a pre-existing or created object (Alvarez & Barney, 2007) or artefact (Berglund et al., 2020), they are of lesser relevance because their existence are contingent on observation and recognition as objects. These are objects of abstract quantum description that can be expressed in a Schrodinger’s wave function. The crux of entrepreneurship, nonetheless is contingent on actions – persistent, purposely and determined actions.

Entrepreneurial actions and luck in chaos and uncertainties

From the quantum approach, opportunity is constituted by latency –inherent in the opportunity is its indeterminacy. The indeterminate potential within the opportunity is succinctly described in (Ramoglou & Tsang, 2016) with the reference to a seed’s propensity. ‘Just as the blossoming of a flower may require efforts aimed at realizing the flower seed’s propensity to blossom, the possibility of entrepreneurial success may require a multitude of creative endeavors aimed at the actualization of a preexisting opportunity.’ (Ramoglou, S & Tsang, E, 2015: 419). Not every seed will blossom though they have the latency within it or the propensity to blossom. So question is why some blossom and some do not? The subsequent growth of the seed is dependent on the availability of the sun, water and the conditions of the soil. These are structured as hierarchical layers in the system each interacting and interfering with the growth potential of the seed. On quantum terms, the latency within the seed is thus explained as probabilistic depending on conditions and the interferences of other social-material independent variables.

Hence opportunity pre-exists out there prior to recognition in a latent state, enactment in the form of social construction is needed to take it from latent to salient state (Hahn & Knight, 2019). From latency to saliency, opportunity is inherently probabilistic, ‘rooted in the idea that all we can know about reality is the probability of

experiencing a specific instantiation of it. The experience—or in physical terms, the measurement of—phenomena constitutes the discrete and actual physical reality.’ (Hahn & Knight, 2019: 14)

Enactment on those identified and recognized opportunity in a socio-material contexts, deploying whatever means to achieve the profits of the venture influence the probabilistic outcomes. “Successful outcomes from entrepreneurial action may be anticipated by a high and matching combination of enactment and effectual action in a generative co-occurrence... It also potentially reconciles the ambiguity-embracing or risk-taking approach and the ambiguity-reducing or risk-mitigating control approach in understanding entrepreneurial action seeking opportunity in an uncertain and dynamic market.” (Bhowmick, 2015: 515). Social construction is thus constituted through entrepreneurs’ sensemaking and experiences amidst chaos and uncertainty.

Thus, in the treatment of opportunity, we hope to frame opportunity in quantum terms – that latency in opportunity can be expressed in indeterminate potentialities rather than real as they are not yet salient in a state of “yet-to-actualities’. The salience can be subsequently conceptualized through enactment on the opportunity in socio-material context, drawing on the environment resources and social network to effectuate an outcome or actuality. The inherent material factors, from environmental endowments and resource bundle (Lichtenstein & Brush, 2001) and social network (Grebel et al., 2001) can co-constitute opportunity as each of these factors influence and interfere with the emergence of the probabilistic outcome.

Hence, how do luck appear in such probabilistic permutations? The following question is how do luck get featured in uncertainty and chaos? “The coevolution of interacting, heterogeneous agents that are set in motion by small instigation effects” (McKelvey, 2004: 336) and this small instigation can produce luck. An enactment or in this case, a small instigation effect that may lead to a lucky event through the interactions and co-evolution of heterogenous agents and hierarchical level of interfering forces. The convergent lucky event is the path that is determined to emerge as a result of interferences of the market forces and other hierarchical levels of force-interactions. These hierarchical levels of forces are varied and many to include the external economic conditions, self-identity, competitors, imitators, shareholders and co-workers, investors and all these heterogenous agents act upon the situation to produce an interference pattern. This is the intriguing part – how are interferences and luck related. These interferences include the external environmental conditions e.g. pandemic, financial crisis are in the sphere of chaos. “The core of the indeterminism of chaos theory, called interchangeably here “chance” or “risk,” is essentially not different from the indeterminism of coin tossing” (Khalil, 1997: 30). Weather erratic and unpredictable fluctuation and environmental disruptions defy predictabilities. The heterogenous agents’ forces are behaviours of the multitude and hence equally unpredictable and therefore denote risk. The behaviours of the multitude of heterogenous agents, with human’s free will and actions involved, are not perfectly understood or interpreted by entrepreneurs and with limited information which they can formulate chance probability about their occurrence.

Hence, for luck to emerge, in all intents and purposes hinges on chance, in unexpected and unprepared ways particularly so when this lucky event emerges against the odds. “Lucky or unlucky event must go against the grain of rationally substantiable predictability.” (Rescher, 2001: 25). Hence, luck predicates on the infeasibility of prediction and unexpectedness and implicit in that means that it arises not through efforts, diligence, industry, skills or any purposeful exertions by the entrepreneurs.

“Good luck is at hand whenever things go right (our desires are realized or our interests are advanced)-fortuitously, that is, in circumstances where we have no sufficient basis for confidently expecting this, because we cannot securely foresee or control the outcome. The fruits of luck (be they good or bad) are accordingly uncertain.” (Rescher, 2001: 24)

With the different hierarchical level of forces and the heterogenous agents acting in convergence and in alignment at a propitious time to produce the lucky event, such occurrence is therefore contingent on the interfering forces each with their statistical improbability and possibilities to give rise to luck. The different hierarchical level of forces entwine the various entangled heterogenous agents in a perfect “planetary alignment”. The best analogy to describe this alignment is the mechanism in the combination lock to unlock “luck”.

“Most combination locks use a wheel pack; a set of wheels that work together to ‘know’ the combination. All wheel packs are all designed around the same principle. The typical combination lock has a combination dial that is attached to a spindle. Inside the lock, the spindle runs through several wheels and a drive cam. The number of wheels in a wheel

pack is determined by how many numbers are in the combination - one wheel for each number. When you turn the dial, the spindle turns the drive cam. Attached to the drive cam is a drive pin. As the cam turns, the drive pin eventually makes contact with a small tab on the adjacent wheel called the wheel fly. Each wheel has a wheel fly on each of its sides. The drive pin spins the first wheel until it makes contact with the wheel adjacent to it. This continues until all the wheels are spinning. This is known as picking up the wheels. Each wheel on the spindle has a notch cut into it. When the right combination is dialed, all the wheels and their notches line up perfectly. The fence is a small metal bar attached to a lever. The fence prevents the safe door from being opened without the combination being dialed. It does this by resting on the wheels and blocking the path of the bolt that secures the safe door. When all the wheels line up, their notches align to form a gap. In a padlock, this gap allows the hasp of the lock to release. In a safe, there is a piece called the fence resting just above the wheels. The fence falls into this gap under the force of its own weight. With the fence gone, the bolt can slide freely past and the safe can be opened." (Valdes, 2021)

First, the combination of the interacting forces must be aligned, at the same time for the hasp of the "luck" lock to be released. The number of wheels represent the number of hierarchical level of forces including the forces acted by the heterogenous agents. Each wheel has its free spinning freedom (free will). Only when the wheels and notches are lined up perfectly in the correct sequence at the same time, "chance opens the door to luck" (Rescher, 2001: 42). The free rotation and spinning of the wheels are genuinely random and stochastic; hence they are indeterministic and beyond the entrepreneurs to make predictions. Cognitive impediments of the entrepreneurs are the reasons since they are unable to grasp the spin possibilities of a large number of hierarchical level of interacting and interfering forces. The future is epistemically inaccessible as it involves information and data beyond the reach of predictive capabilities.

The entrepreneurial journey is mostly in an environment of certain chaos and uncertainty. Operating in such environment, lucky moments are certainly an disrupter of the ordinary course of event. Luck breaks the regularity of the process or at least change the course of the trajectory through a momentum transfer in a particular direction to another luckier, or unlucky, pathway. The transfer of momentum, or momentum-kick (Wiseman et al., 1997) punctuates and shifts the pathway into a "chancy occurrence of something harmful or beneficial" (Rescher, 2001: 78). In short, with the occurrence of luck there is a transfer of momentum (in a momentum-kick) to that new emergent pathway away from the earlier one.

Probability wave and superpotentiality in entrepreneurship

"In quantum mechanics, the act of measurement is not an objective observation of a preexisting reality, as in classical physics. Rather, measurement constitutes a distinct and observed physical reality from the potentialities of superposition. Consequently, a fundamental axiom of quantum mechanics is that no elementary phenomenon is a phenomenon until it is measured or observed, and an entity is only the object of its measurement. Physical reality is the artifact of observation and measurement; it does not exist unless a measurement is made. Measurement plays a crucial role in quantum mechanics because it delineates the unobserved superposition state (virtual state) from the actual observed macroscopic physical reality (actual state)." (Hahn & Knight, 2019: 18)

Opportunity exists in varying states of uncertainty, when "conjoined with a particular context, this superpotentiality state would collapse due to experienced constraints to create a specific experienced reality, much like an electron appearing in a defined position in space upon measurement." (Lord et al., 2015: 13) With this perspective, the implications is that the "present moment" is the result of the confluence of multiple events and processes in the hierarchical levels of forces from externalities like economy, disruption of environment to the heterogenous agents that are impacting the entrepreneurial event at that moment. The uncertainty is therefore expressed into a certitude as a generative emergence where one of the waves emerge and the rest collapse. In quantum mechanics, any observation and measurement leads to a spontaneous collapse of the probability wave function by forcing a superposition state into a discrete state (Bassi et al., 2013).

"Mathematically, the probability wave function of the location of a particle captures the distribution of all possible states, hence the cumulative probabilities of all possible positions of the particle is 1. A single measurement "selects" and locates one out of the

infinite number of possible positions, rendering the probability of that particular actual state 1. Thus, the wave function is said to “collapse” from a superposition of many possible states to a simple discrete value. Consequently, a single measurement cannot capture the full shape of the probability wave function since it only represents one instance of multiple possible outcomes.” (Hahn & Knight, 2019: 19)

These superpotentiality is the crux of this paper’s advocacy of potentialities in opportunities. The processual logic is this - the entrepreneurial recognition and by that observation of the opportunity and the subsequent enactment, selects and locates one out of the many probabilities and potentialities of future states. That selected one state will pan out to be the actualized reality. “ In the words of Napoleon Hill: “Opportunity has spread its wares before you. Step up to the front, select what you want, create your plan, put the plan into action, and follow through with persistence.” (Hill, 1938: 145)

CONCLUSION

In this paper, a quantum approach is used in the conceptualizing of uncertainty, timing and luck. There are scarce theorizations on quantum probability and quantum state applied to entrepreneurship, in specific. In (Lord et al., 2015), the authors took a quantum approach to time and change and label this paradigm as QATC. QATC provides a novel and innovative perspective grounded in quantum physics to build their theory in organizational science and the part on qualitative process-oriented descriptions of organizational change is particularly relevant to entrepreneurship.

Entrepreneurial journey is full of surprises, punctuations and shifts in trajectories sometime from carefully calibrated strategic manoeuvres or simply from action of luck which is totally unpredictable. Moving forward with the arrow of time in uncertainty and chaos need understanding of emergence- thinking of the present flowing into the future and the pathway or state of reality that becomes actualized. The “present moment” emerges from a superpotentiality state as it is conjoined with a particular circumstances with a hierarchical level of various interfering forces to create an entangled present. Implicit in this approach is that the future-state holds varied potentialities that may each define the “present moment”. The future have infinite potentialities contained within it to unfold into the unimaginable permutation of possibilities. With entrepreneurial enactments and specific actions through recognition of those opportunities, quantum possibilities arise. From a quantum perspective, the variable movement of an electron through space can be abstracted from a probability wave function. Central to this abstraction is that the probability wave characterizes the high degree of uncertainty for knowing where the electron will be when it moves through space (Lord et al., 2015). Similarly, in entrepreneurial venturing, the entrepreneur’s behaviour is similar to that of the electron and its movement plan can therefore be abstracted from the probability wave depending on the actions taken by the entrepreneurs. Using probability waves as a metaphor for entrepreneurship can have interesting generalization- ascertaining where a particular particle is located at a point in space and in time can be generalized to understand how the entrepreneur in the venture experiences reality at a particular point in space and in time when their actions, activities and movement are guided by processes that are functionally and behaviourally like a probability wave. There are many possibilities and outcomes that can emerge through enactment as the future exists in a state with many potentialities. On quantum terms this superpotentiality state can therefore be recontextualized to mean many possibilities are in indefinite state but have the potential to emerge.

“he (entrepreneur) depended upon his efforts alone, in assembling knowledge and expressing it through definite plans in terms of action. If his plans are comprehensive, and if they contemplate large proportions, he must, generally, induce others to cooperate with him, before he can inject into them the necessary element of power.” (Hill, 1938: 176 emphasis added)

By having industrious and purposeful exertion and efforts in entrepreneurial venturing and assembling and expressing them through concretized strategic and tactical activities, under conditions of uncertainty and chaos, the entrepreneurs can induce others to cooperate with him and inject into them the necessary element of power. The hierarchical level of forces from heterogenous agents’ interferences when cojoined with the circumstantial context, accentuate the possibility of a positive emergence; where the rest of the superpotentiality state will collapse.

Luck, is indeterminable and unpredictable and only in a convergent event when the planetary alignment is locked into place, the door to lucky moments opens. This paper therefore concludes that entrepreneurial venturing cannot be contingent on chance operable in uncertain environment and luck. “One must realize that all who have accumulated great fortunes, first did a certain amount of dreaming, hoping, wishing, desiring, and planning before they acquired money.” (Hill, 1938: 37). Alertness and recognition of opportunity matter as it creates quantum possibilities through the process of action. Actions matter. With actions, generative emergence will tend towards the side of better fortune.

About The Author:

David Leong, *PhD* started his entrepreneurial ventures early, soon after he graduated from the National University of Singapore in 1994 with a Bachelor of Business Administration degree. He has founded various ventures from corporate finance, business consultancy, design consultancy, human resources (HR), publication and technology.

David was awarded his PhD from Charisma University in 2020 and is pursuing his Doctor of Business Administration with the University of Canberra for a double doctorate. His research is in entrepreneurship and he is venturing to define “entrepreneurial energy” as the energy field spurring entrepreneurial actions in the light of complex science and quantum science. His other research area is in the Chinese Yijing and he draws the relatedness of Yijing with modern science in particular quantum physics.

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