

# Entrepreneurial Relativity of Rationality: A Theoretical Analysis of Rationality in Entrepreneurship Education

Anh Dinh, TU Dortmund, Germany  
Andreas Liening, TU Dortmund, Germany

## ABSTRACT

*Rationality in terms of maximizing self-interest is at the core of classical and neoclassical economics. However, researchers have questioned the narrow view of homo oeconomicus. Notably in complex problem-solving situations, human beings depend on cognitive shortcuts and judgmental heuristics, which bound rationality and can lead to irrational and erroneous decisions. Severe and undetected errors can generate crisis and cause irreversible failure. Entrepreneurial failures in terms of business shutdowns are real phenomena in practical entrepreneurship. The entrepreneurial environment is characterized by non-linearity, uncertainty, complexity, and the involvement of intense emotional attachment.*

*In this environment, entrepreneurs are primarily confronted with complex situations and, therefore, are forced to rely on cognitive shortcuts rather than rationally planned and scripted behaviors. Despite the substantial growing corpus of studies on entrepreneurial bias and failure, fundamental discussion of prevalent notions of rationality has been limited. This paper analyzes the extent of rationality in entrepreneurship and entrepreneurship education, draws on the imperfect entrepreneurial environment. Furthermore, we discuss the learning potential of illogical and erroneous momentums.*

**Keywords:** Entrepreneurial Rationality, Entrepreneurship Education, Errors and Bias, Cognitive Learning.

## INTRODUCTION

The creation of an idea and its transformation into a functioning business requires decisions and actions from entrepreneurs (Morris et al., 2013). However, for the circumstances under which these decisions are made and actions are executed, existing efficient algorithms are missing (Mitchell et al., 2007). Therefore, entrepreneurial activities are often susceptible to biases, which can eventually result in erroneous judgements and decisions. Unfortunately, it is not a rarity that such erroneous judgements and decisions lead to entrepreneurial struggle and failure (Shepherd, 2003; Amjad, 2020). Historical data in the U.S. Great or Britain show that within the first three years after business launching more than half of entrepreneurial ventures fail (Shane, 2012; Stout, 2012). A growing body of entrepreneurship studies has focused on entrepreneurial bias and failure (e.g., Busenitz & Barney, 1997; Baron, 2004; Zhang & Cueto, 2017). Financial losses, social stigmatization, psychological effects (e.g., depression, stress) and physiological consequences (e.g., sleep deprivation, addiction) are the substantial aftermath of entrepreneurial failure (Cardon et al., 2015; Kollmann et al., 2019). Research on entrepreneurial bias, have identified a strong tendency in entrepreneurs toward overconfidence (e.g., Busenitz & Barney, 1997; Baron, 2004). Other studies have examined the causation between biases and

prevalent constructs of entrepreneurship, for instance, the perception of risk, entrepreneurial intention or opportunity recognition and exploitation (Keh et al., 2007; Wu & Knott, 2006).

On the basis of these research corpuses, we identified a particular issue for investigation. There is a normative understanding of bias, which is defined as systematic deviation from descriptive rationality or norms (Zhang & Cueto, 2017). A scientific discipline is characterized by an “*elaborate and logically well-constructed system of theories*” (Popper, 1957, p. 50) with an established consensus as to what constitutes rational and irrational behavior. Entrepreneurship has been considered an ill-structured environment, however neither a consensus on rationality and irrationality in has yet been achieved yet nor what theories should be taught in entrepreneurship education (McGuigan, 2016). In contrast, studies of entrepreneurial failure have provided insight into the ramifications of failure and crisis, but the discussion on entrepreneurial errors are limited. Artinger & Powell (2016, p. 1048) point out that studies have not investigated if “*entrepreneurial failure stems mainly from random errors under uncertainty.*” From an educational point of view, errors are typically considered in terms of learning potential (Cope, 2011) instead of external evaluation of the extent to which the entrepreneur was responsible for the error and what could have been done to prevent it. Thus, the learning potential of an error defines a distinction between “*good*” and “*bad*” errors (Oser et al., 2012).

Our purpose is to contribute to the emerging body of literature on research bias and entrepreneurial failure by conceptualizing the notions of rationality in entrepreneurship and entrepreneurship education. For this purpose, we use a twofold approach: (1) conducting a theoretical review (Boote & Beile, 2005) of relevant constructs (e.g., rationality, irrationality, bias, error, decision-making in complex situations) and (2) evaluating relevant aspects for the teaching and learning of entrepreneurship by synthesizing “*existing theories and related concepts and empirical research, to develop a foundation for new theory development*” (Rocco & Plakhotnik, 2009, p. 127).

“*As a scientific discipline grows, its body of knowledge also grows;*” however, a discipline faces challenges “*when a field of study is unable to identify or develop a consensus within its body of knowledge as to what constitutes the research program’s set of formal theories*” (Turner et al., 2018, p. 35). Furthermore, the emerging canon of rationality defined in terms of optimal choices ties the role of psychology to diagnosis and explanation, and the role of education to the training of rational behavior and prevention of irrationality. This leads to the following questions, which this study intends to answer: What formal and normative notions of rationality are expedient for entrepreneurship and entrepreneurship education? In a domain where errors are inevitable, is a change of paradigm required? What implications can be drawn from complexity theory for coping with ill-structured systems?

## LITERATURE REVIEW

### Rationality and Reason

Ancient Greek thinkers characterized rationality in terms of insight into human nature. Rationality, which entails the intellectual capacity to develop schemas, defines the human species (Korsgaard, 2008). Most of our behaviors involve reason, motivation, and intention – “*people have reasons for what they do*” (Simon, 1986, p. S210). What is rational and reasonable is determined by the context in which human behavior takes place, deviance from goal

achievement, and the availability of means (Simon, 1986). Reason and rationality are already acknowledged in the Bible, which states that “*in the beginning was the logos*” and this enables the existence of everything (John, p. 1.1, 1.3). “*Logic*” has its semantic roots in the Greek word *logos*, later translated by the English word “reason” (Cellucci, 2012, p. 199). Logic constitutes rationality and has typically been understood in a prescriptive and objective manner. This means that human rationality represents “*our cognitive capacity for logic*” (Hanna, 2006, p. 113) and that human behaviors diverging from the laws of logic are condemned as irrational.

Other theories of rationality have emphasized the relevance of putting action, means, and ends into perspective (Rescher, 1988). According to such an approach, “*reason is the capability of choosing appropriate means for ends which are conformable to human nature*” (Cellucci, 2012, p. 204), and irrationality is the inability to use reason in this way (Amoretti & Vassallo, 2012). In alignment with this perspective, Korsgaard (2008, p. 23) declares reason as the “*active capacity of the mind,*” that enables the contrast to sensation/perception and passion / desire.

Baudin (1954, p. 487) characterized rationality as a “*conscious and logical adaptation of means to coherent ends.*” Amoretti & Vassallo (2012) defined rationality in its simplest form as the “*exercise of reason in exploring, investigating, understanding, controlling, and manipulating both the natural and social worlds*” (Amoretti & Vassallo, 2012, p. 10), which is “*based on rules of logic, probability theory and so forth*” (Stein, 1996, p. 4). A different approach distinguishes between theoretical and practical reason. Theoretical reason is concerned with beliefs as well as with reasoning and prediction, while practical reason is focused on values, intentions, and the desirability of action (Amoretti & Vassallo, 2012). Kahneman (2000) took yet another approach: there is coherence-rationality, which concerns a set of beliefs and preferences, and there is process-rationality, which concerns the process of forming beliefs and decisions. In his works *Economy and Society* and *Collected Essays in the Sociology of Religion*, the German sociologist Max Weber promoted the idea of rationality and “*rationalization*” in the economy and in the societal and civilizational process (Kalberg, 1980, p. 1145). Weber’s conception of rationality implies a systematization of the entire societal process, culminating in a high degree of bureaucratization and a corresponding “*increasing lack of freedom*” (Kalberg, 1980, p. 1146).

Rationality endows the formation of “*modern businessman*” (Kalberg, 1980, p. 1148). Amoretti & Vassallo argued that the “*sciences may be seen as the best product of reason, its highest apex*” (2012, p. 17). What counts as absence of reason and rationality has proved harder to agree on. While the development of “*general principles or norms of rationality*” is pivotal for science and epistemology, it does not work satisfactorily for certain domains, where aesthetic elements play a crucial role (Amoretti & Vassallo, 2012, p. 11). Aesthetic also applies to the discipline of entrepreneurship.

## Rationality and Irrationality

“*Life is complex and, often times, multiple forces exert their influences upon us*” (Chitpin, 2017, p. 150) and, hence, fully rational behaviors are subject to challenge. Deviations from rationality are not entirely random, but appear to be systematic patterns (Fehr & Tyran, 2005). Although human beings behave irrationally at times, they are capable of learning from mistakes. There is even an economic argument that “*interactions in markets will correct or offset individually anomalous behavior*” (Fehr & Tyran, 2005, p. 43). In other words, individual irrationality will be corrected at an aggregate level.

*“Understanding irrationality is important for our everyday actions and decisions in that it offers the hope of overcoming this irrationality when making decisions”* (Chitpin, 2017, p. 151). Rationality and irrationality are often associated with deviation from the norm (Reason, 1990; Senders & Moray, 1991). Bias, on the other hand, is a systematic deviation from rationality (Zhang & Cueto, 2017). However, *“there is a natural tendency to consider as irrational whoever does not conform to the logic commonly accepted in our society. In other words, we tend to confuse nonconformist with irrationality”* (Baudin, 1954, p. 488). Consequently, Baudin points out an important fact: people *“speak of irrationality because they are unaware of the relativity of rationalities”* (1954, p. 488, emphasis in original). Rationality is bounded by the perspective of each involved individual’s evolution (belief, mental model, perception, etc.). The individual is susceptible to cognitive biases and illusions that are highly dependent on heuristics and intuition as coping strategies; however, these strategies are prone to error. Such comprehensions of rationality and bias bind the definitions of those terms to descriptive norms decided by society at the macroscopic level. One microscopic approach that puts the focus on the individual’s perspective is error theory.

### **Rationality and Errors**

Error theory focuses on the nature of human performance and is rooted primarily in the limitations of human cognition (Reason, 1990). On the assumption that human cognition is subject to rationality, *“errors were attributed either to irrationality or to unawareness on the part of the perceiver”* (Reason, 1990, p. 37). Errors, therefore, could be predicted by employing statistical theory (e.g., Bayes’ theorem). Error is used as a generic term to encapsulate all situations where a *“deviation from intention, expectation, or desirability”* takes place (Senders & Moray, 1991, p. 25; see also Reason 1990). It can be defined as a *“human action that fails to meet an implicit or explicit standard”* and that occurs when a *“planned series of actions fails to achieve its desired outcome”* (Senders & Moray, 1991, p. 20). However, as Reason highlighted, the failure to achieve an intended result does not happen by chance, but is caused by human action in a mental or physical way (Reason, 1990). This entails that the outcome is *“not intended by the actor”* (Senders & Moray, 1991, p. 25). Furthermore, as Billet (2012) points out, an error is marked by the perspective of the acting person and by the situation it occurs in. This makes error a subjective construct. Billet argues that *“individuals may or may not view a particular action as being an error, and that error may or may not be recognized as such in the setting in which it is enacted”* (Billet, 2012, p. 19). Hence, the perception of an error always depends on the characteristics of its personal and social dimensions.

From a pedagogical point of view, Billet concluded that the acquisition of new knowledge is often based on experiencing and dealing with errors, thereby *“discovering the inadequacy of our existing knowledge”* (Billet, 2012, p. 18). Thus, *“deliberate efforts to avoid errors”* have a significant influence on intentional learning (Billet, 2012, p. 18). This emphasizes the relevance of including errors in learning settings, since reflection on errors adds to intentional learning. Based on the norms of logic and reasoning, utility and probability theory, and rational decision theory (Polonioli, 2016, p. 789), a bias exists when human behavior systematically deviates from, or violates, the predefined norm (Wilke & Mata, 2012). In contrast, the definition of an error is more closely related to subjective intentions and personal goals than to standardized norms (Reason, 1990). In short, the definition of bias is rule-based, whereas the definition of

error is goal-based. Adaptive rationalists claim that bias research has focused on rule-based rationality; however, bias research is more heterogeneous than this suggests and has taken into account a range of biases (Polonioli, 2016, p. 794).

### RATIONALITY FROM THE COGNITIVE LEARNING THEORY

There is a discrepancy between “*perfect human rationality*” and “*the reality of human behavior observed in economic life*” (Simon, 1992, p. 3). Simon points out that in a given objective world—the real world and the world of the decision-maker are identical—rational decisions are predictable and analysis of perceptions, the reasoning process, and modes of calculation are dispensable (Simon, 1986, p. S211). “*Economics has almost uniformly treated human behavior as rational*” (Simon, 1986, p. S209) and considers rationality as a dilemma of choices, while psychology focuses on both rational and irrational human behavior. Neoclassical economics elaborates on rationality on the basis of an objective and a substantive theoretical point of view (Simon, 1986, p. S211). Rationality in psychology is more concerned with procedural rationality in terms of making reasonable decisions “*in the light of the available knowledge and means of computation*” (Simon, 1986, p. S211). Cognitive psychology is more invested in constructing a theory and testing it empirically, which requires knowledge of the decision-making process and “*the subjective representation of the decision problem*” at a micro level (Simon, 1986, p. S211).

Cognitive learning theories also embrace procedural rationality at a micro level and draws attention to the representation of the mental model and schema (van Merriënboer et al., 2003). It proposes that the limitations of the human mind, notably, in the work on cognitive load theory, enable one to “*empirically replicate studies that describe the human cognitive process*” (Mostyn, 2012, p. 228) and has investigated instructional techniques to enhance the learning of complex tasks (Sweller, 1994). Cognitive load theory “*identifies specific functional elements [data input] of the processes that involve data process sequencing, types of memory used, and universal limiting parameters*” (Mostyn, 2012, p. 227). These elements also represent constraints that lead to cognitive loading (Mostyn, 2012, p. 228).

Cognitive load theory has its roots in cognitivism, a learning approach that mainly focuses on the (re)construction of mental models by describing the mental activities involved in learning (Mostyn, 2012, p. 231). Learning and intellectual mastery are secured if “*the schema acquisition and the transfer of learned procedures from controlled to automatic processing*” are achieved (Sweller, 1994, p. 296). The function of learning is to achieve the storage and organization of elements of information (schemas) in long-term memory. “*Schemas are critical to learning and problem solving*” (Sweller, 1994, p. 299). However, schema acquisition and the transfer thereof reduce the capacity of our working memory, which is responsible for storing and processing items (Sweller, 1994, p. 299). Working memory is able to process “*no more than a few discrete items at any given time*” (Sweller, 1994, p. 299); however, it is able to “*access and treat even large and complex schema as a single element,*” which can be recalled if required (Mostyn, 2012, p. 232). Schema formation occurs in the working memory when limited, complex, and related schema elements are processed (e.g., storage, analysis, synthetization, etc.). Repetition of schemas enable the transfer to the long-term memory, which maintains a great number of complex mental constructs (schemas) for a long period (Chi et al., 1982). The transferred schema is either “*a new schema*” or “*an addition to and/or modification of an existing related schema*”

(Mostyn, 2012, p. 232). The change in existing schema and addition of new schema can be interpreted as a learning process that ultimately lead to changes in long-term memory and “represents development of some level of expertise; that is, long-term memory schema development creates the difference between novices and experts” (Mostyn, 2012, p. 232).

Learning in entrepreneurship education focuses on the change of learners’ mindset. Understanding cognitive changes requires thinking-centered learning, which is characterized by situated learning and the connection between new knowledge and prior knowledge (Krueger, 2009).

## TYPES OF ERRORS AND THEIR LEARNING POTENTIALS

Making errors are inevitable, but errors also offer learning opportunities. Learning through experiencing mistakes are vital for developing expertise. However, for positive outcomes such as productive learning to happen, it requires reflection of committed mistakes. The reflection upon mistakes entails deep analysis of errors including classification of errors and its causes. The classification of error has been attempted by many researchers (e.g., Rasmussen, 1982; Reason, 1990; Senders & Moray, 1991). One of the most common classifications analyzes errors from the behavioral, conceptual, and contextual perspectives. The behavioral classification describes errors in phenomenological terms, drawing on observable actions that the actor(s) carried out and that did not meet the desired end. Behavioral classification is rather superficial and cannot account for cognitive failure (Reason, 1990); it captures formal characteristics or directly visible consequences, and is therefore best suited to verbal and action errors (Reason, 1990). The conceptual classification is more complex. It goes beyond the formal characteristics of an error to focus on the assumptions and conjectures behind it. This classification is suited to explaining errors that are caused by “*cognitive mechanisms involved in error production*” (Reason, 1990, p. 12).

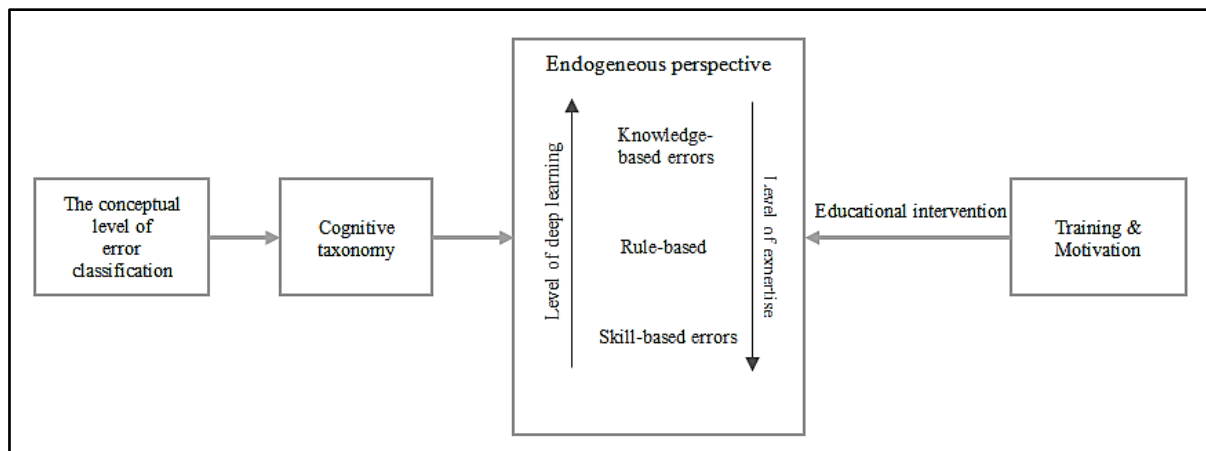
Both the behavioral and conceptual classifications focus on the actor, thus providing an endogenous perspective on error (Senders & Moray, 1991). The contextual level, however, looks beyond the formal error (Reason, 1990). It focuses on the conditions of the system, such as the task-related and situational characteristics (internal and external surrounding circumstances) in which the actor is operating (Reason, 1990). Unlike the behavioral and conceptual classifications, the contextual classification provides an exogenous view of error, and where error is detected, a reconsideration of the system design is required (Senders & Moray, 1991).

Since this research focuses on human fallibility, endogenous errors are relevant for further consideration. Furthermore, endogenous errors can be prevented through training and education. The design of training concepts needs to be considered carefully, and the construct of motivation must be placed under careful scrutiny. Conducting a deeper analysis on endogenous errors, Reason has shown that there is a specific algorithm for distinguishing different types of error, including mistakes, slips, and lapses. In this context, the notion of intention and, accordingly, intentional behavior comes into play (Reason, 1990). Whether an error is a slip or a lapse depends on prior intention to act; actions can be spontaneous (e.g., bumping into someone while walking inattentively) or involuntary (e.g., bumping into someone while suffering an epileptic fit). According to Reason, two elements are required for intention: “*an expression of the end-state to be attained, and an indication of the means by which it is to be achieved*” (Mezirow, 1990, p. 5). If an action does not proceed as planned, then the result is an unintentional action,

also called a slip or a lapse. However, when an action proceeds as planned but does not achieve the desired goal, we call it a mistake (intentional).

Slips or lapses are typically caused by poor execution, and can thus be considered lower-level errors involving routine tasks and the achievement of skilled status (“*familiarity with the environment or task*”) (Reason, 1990, p. 43). These are also referred to as skill-based errors. Mistakes, however, are caused by cognitive planning procedures, and can thus be considered higher-level errors. Two forms of mistake can be distinguished. First, there are mistakes caused by failure of expertise in the sense that using stored rules for problem-solving situations does not achieve the desired end (i.e., there is a lack of storage). This type of failure can arise from the misapplication of the right rules or from the application of the wrong rules; therefore, such mistakes are also known as rule-based errors. Second, there are mistakes caused by a lack of expertise in the sense of planning errors. “*Planning refers to the process concerned with identifying a goal and deciding upon the means to achieve it*” (Reason, 1990, p. 12). This happens in unfamiliar problem-solving situations in which the actor cannot retrieve prior knowledge or past experience; there is no script, and the actor depends on heuristic principles (rules of thumb). Such mistakes are also known as knowledge-based errors.

Following the skill–rule–knowledge framework (Rasmussen, 1982; Reason 1990), these three modes regard the actor as starting in a novel situation in which knowledge-based errors are likely. With increasing familiarity and with the acquisition of expertise in the situation, the actor moves up to the skill-based level (Reason, 1990). Erroneous momentum at the knowledge-based level entails the highest potential for deep learning (Figure 1). At this level, the problem-solving situation is most unfamiliar to the actor and therefore the level of expertise is low. However, the acquisition of novel knowledge (development of mental models) and the revision of naïve theories are mostly to occur at this stage. The more the actor is confronted with the situation (repetition of schemas), the more expertise can be developed. This means that errors at the knowledge-based-level provides implications for the rule-based and skill-based levels, and thereby foster the transformation from novice to expert status. Since the error classification is based on a cognitive and endogenous perspective, error correction and learning from mistakes can be achieved through an intervention in terms of training and motivation is required. For entrepreneurship education, this means that learning settings should include the enabling of error-making, notably the frequent confrontations with knowledge-based problems in order to establish routine handling of complex situations. For entrepreneurship education, educators also postulate a focus on experience-based, simulation-based, and problem-based learning (Yen & Lin, 2020).



Source: Based on Reason (1990)

**FIGURE 1**  
**ERROR CLASSIFICATION AND LEARNING POTENTIALS**

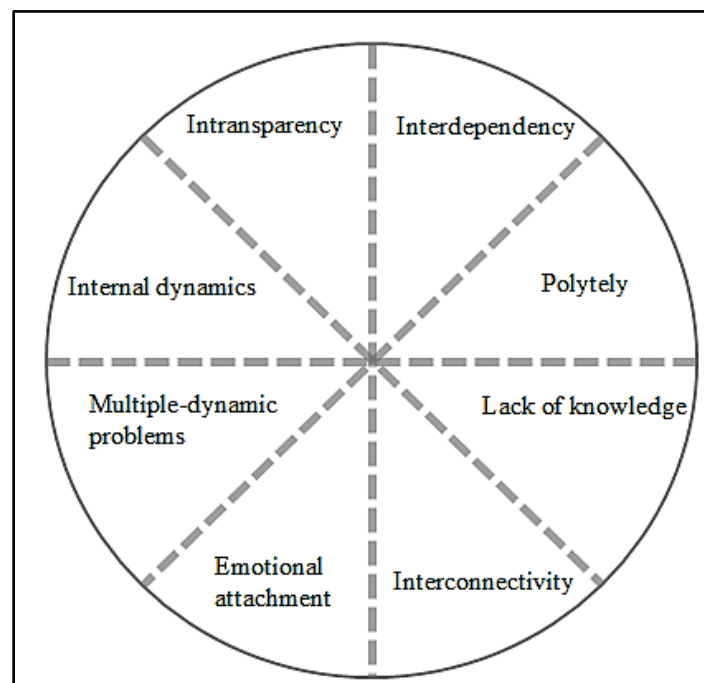
### IMPERFECT ENTREPRENEURSHIP

Critical decisions are often made under arduous circumstances, perhaps in a non-linear environment driven by uncertainty and complexity (Neck & Greene, 2011). There are several components in play in such circumstances, and one of them is risk. In the business venturing process, risk is frequently claimed to be omnipresent (Lichtenstein et al., 2007; Bandera et al., 2018). The notions of risk and uncertainty apply particularly to startups, since they have to deal with unknown circumstances, internal as well as external, and concerning the present as well as the future of the business. Internal strategies have to be developed and tested in terms of the management of the newly founded company. Moreover, although the external market situation can be evaluated on the basis of its present state, its reaction toward the new remains unknown. As Dörner argued, the entrepreneur operates in a non-transparent context (Dörner, 1997). The non-transparency of a situation consists of a lack of information, restricted access to the information available, and the possibility of having incorrect information. In addition, a complex situation is caused by the presence of interdependency, from external and internal corporation partners as well as from dependency on decisions. Dörner (1997) asserts that the entrepreneur's environment is connected in a complex way, and the structure of the system is mostly unknown. The complexity of the situation is also triggered by its internal dynamics. This means that the situation itself is active and does not depend on the entrepreneur's decisions (Dörner, 1997; Dörner et al., 2006). The market is in continual movement, regardless of what the entrepreneur may decide. The entrepreneur is an active element in a complex system of active and passive elements. An active element can change its state without external influences, while a passive element is externally determined; the relations of these elements are certainly also deterministic (Dörner, 1997). In this context, "lack of knowledge" describes the state of not being aware of the existence of certain variables. Non-transparency, in contrast, refers to the awareness that variables entail certain conditions combined with the inability to define these conditions. "Unknowingness" should not be used interchangeably with a distinct "lack of knowledge." Rather, it implies that the clarification concerning a part of a system is too abstract (Dörner,



1997); similarly, the multiple active elements have a complex interconnection. A further factor that contributes to the complexity of a situation is the plurality of goals (polytely), a problem situation for which multiple solutions and goals exist. An entrepreneur can have more than one goal, and these goals may be pursued simultaneously and may be partially contradictory. Monitoring all goals is a challenge, but an even greater challenge is balancing conflicting goals, if necessary sacrificing certain subgoals in order to achieve others. In this context, the set of goals may fluctuate, hence, the goals can be refined, eliminated, or postponed, and new goals can be set. Zhang & Cueto (2017) point out: the entrepreneur himself, whose actions are not necessarily aligned to the nature of a homo oeconomicus.

In conclusion, the entrepreneur operates in an imperfect environment that makes rational decision-making especially challenging. In the course of any action, mistakes and errors are common; a particular error may be an *“inconvenience (often it is not even noticed)”* or it may be *“a genuine catastrophe”* (Senders & Moray, 1991, p. 1). Based on Dörner’s (1997) conception of complexity, error theory (Reason, 1990), and the emotional attachment involved in entrepreneurship, we propose that entrepreneurial complexity comprises a number of components, as set out in Figure 2.



Source: Dörner (1997); Reason (1990)

**FIGURE 2**  
**COMPONENTS OF ENTREPRENEURIAL COMPLEXITY**

### **COMPATIBILITY OF RATIONALITY AND ENTREPRENEURSHIP (EDUCATION)**

Rationality provides orientation; it follows rules and is therefore predictable. Besides the advantages of pure rationality and bounded rationality (Simon, 1986, 1992), both *“reflect a limited view of organizing, one defined by patriarchy as a dominant value system”* (Mumby &

Putnam, 1992, p. 469). Bounded rationality separates decisions from actions and in order to reduce, structure, and control complexity; the actor is required to simplify and fragment decisions, which leads to the compartmentalization of choices (Mumby & Putnam, 1992). Bounded rationality remains a relevant concept for management education (e.g., organizational theory) (Mumby & Putnam, 1992; Jayasinghe et al., 2008).

According to Roberts (1996), there is dominance of Weber's technical and instrumental rationality—"the restless calculation of means in relation to ends"—at business schools, which Weber interprets as "progressive rationalization" (Roberts, 1996, p. 55). Roberts (1996, p. 54) criticizes such conduct that leaves "students' 'practical consciousness'—the usually tacit and habitual knowledge that informs actual practice—both unquestioned and unreformed." The process of rationalization takes the practical understanding of action, what Giddens (1977) refers to as "practical consciousness" in his structuration theory, for granted. He defines this as "what actors know tacitly about the conditions of their own action but cannot articulate" (Bryant & Jary, 1991, p. 8). Teaching routinized managerial techniques that students might be able to undertake leads them to believe that "understanding has been realized if only knowledge can be repeated or regurgitated;" in reality, however, this "reinforces the lack of critical reflection" (Roberts, 1996, p. 61). This approach alludes to the idea of the "rhetoric of objective rationality, while leaving their practical rationality both unexplored and unreformed" (Roberts, 1996, p. 61).

Other authors are concerned with the separation of the roles of teacher and student that the concept of bounded rationality alludes to (Clegg & Ross-Smith, 2017). They emphasize the distinction between the science of object and the science of subject. The latter is considered more appropriate for management education, since it encourages coping with discursive plurality (Clegg & Ross-Smith, 2017). In relation to this notion, entrepreneurship (education) is certainly more related to the science of the subject. But how is rationality compatible with entrepreneurship? Sen (1987) states two prerequisites for rational behavior: consistent choice and self-interest maximization. Rationality based on the behavioral assumptions of orthodox economics is challenged in the context of entrepreneurship (De Bruin & Dupuis, 2000). Due to the influences of economics, psychology, and sociology, rationality is a *modus operandi* in management education. Mainstream entrepreneurship research is based on the traditional Schumpeterian and Kirznerian views, which typically characterize the entrepreneur as a "rational, calculating maximiser attempting to maximise profits through continuous innovation in a process of 'creative destruction' of the equilibrium of the market and the flow of commercial activities" (Jayasinghe et al., 2008, p. 243). Both the Schumpeterian and Kirznerian views have coined the term entrepreneurship (Jayasinghe et al., 2008). While Schumpeter viewed the entrepreneur as an independent actor whose ideas emerge internally (De Jong & Marsili, 2010), who is primarily economically motivated, and is therefore the main driver of the capitalist economy (Jayasinghe et al., 2008), Kirzner compared the entrepreneur with an arbitrageur who explores opportunities based on information asymmetries (De Jong & Marsili, 2010). Schumpeter and Kirzner had a rather functionalist understanding of entrepreneurship, which neglects the complex interwoven relationships in which the entrepreneur operates (Jayasinghe et al., 2008).

The orthodox perspective of logical economic rationalism and the functionalist approach assumes the existence of "objective" reality and thus provides an explanation for social

structures, but it neglects to provide an explanation of the causes of behavior (Bruyat & Julien, 2000). Hence, teaching entrepreneurship is reduced to educating students about these “*objective explanations*,” and obstacles to entrepreneurship seem to be avoidable through education (Jayasinghe et al., 2008, p. 244). Contemporary entrepreneurship researchers distance themselves from the traditional view on entrepreneurship and acknowledge the entrepreneur’s emotions (Baron, 2008), socio-cultural networks (Jayasinghe et al., 2008) and ecosystem, (Audretsch, 2019), and entrepreneurial competences (Morris et al., 2013). For a holistic analysis of the entrepreneur, rationality and bounded rationality are not satisfactory tools (Jayasinghe et al., 2008, p. 250). As an alternative framework to bounded rationality (Simon 1986; 1992), researchers propose the concept of bounded emotionality (Mumby & Putnam, 1992; Jayasinghe et al., 2008). This concept emphasizes the “*emotional aspect of entrepreneurial behavior that operates outside the consciousness of individual agency*” (Jayasinghe et al., 2008, p. 243) and neglects the contribution of emotions to practical consciousness.

Bounded emotionality emphasizes the feeling as well as the expression of emotions (Jayasinghe et al., 2008). On the contrary, the concept of bounded rationality “*isolates and suppresses the emotional/physical self from the organising*” process to reach a decision (Jayasinghe et al., 2008, p. 246). Bounded emotionality was initially employed by Mumby & Putnam (1992, p. 470) in the context of organizational theory. Mumby & Putnam’s (1992) bounded emotionality provides an understanding of human emotions, competences, and limitations. Jayasinghe et al. (2008) apply this idea in entrepreneurship theory with an appreciation of the entrepreneur’s expression of emotions and his or her emotional involvement in interpersonal relationships. The latter is a central aspect in the entrepreneurial setting, since entrepreneurs rely on others—family and micro and small businesses are affected by interpersonal relationships. The expression of emotions is crucial due to the coexistence of multiple and contradictory feelings (anxiety, stress, joy, fulfillment, etc.) (Jayasinghe et al., 2008).

A generic approach to overcoming irrationality is introduced by Chiptin (2017), who takes the philosophical approach provided by Popper (1957). The Popperian approach holds that through the search for and elimination of errors, knowledge construction takes place (Chiptin, 2017). “*In other words, we can improve our present answers by identifying their inadequacies. Once we uncover an inadequacy, we can eliminate it by modifying or refining the original answer. Thus, we improve our answer through criticism*” (Chiptin, 2017, p. 149). Rooted in human fallibility, the Popperian approach brings the centrality of criticism in the focus. Individuals cope with problem-solving through criticism—“It is through criticism that we can revise or replace our ideas so as to improve them” (Chiptin, 2017, p. 149). The critical approach requires a prior “*recognition of some error or inadequacy*,” only this allows us “*critically to refine, change, alter, modify or abandon what exists in order to eliminate a recognized bad habit or irrationality*” (Chiptin, 2017, p. 149). The problem-solving process starts with the identification of a problem, which the individual then tries to solve by applying a tentative theory. The correctness or incorrectness of the theory is part of the error elimination process, which will result in the creation of a new problem that requires a new explanation (Chiptin, 2017, p. 152). In contrast to concepts developed to overcome irrationality, there are approaches that embrace irrational or erroneous decisions and interpret them as providing momentum for learning (Cope, 2011, Pittaway & Cope, 2007). From a learning perspective, errors and the

recognition of them can trigger cognitive conflicts. Dealing with such conflict is crucial for learning and the development of knowledge.

In entrepreneurship studies, failure is mostly viewed negatively and depicted as painful experience. There are researchers who value entrepreneurial failure and see its potential for learning and knowledge (Shepherd, 2003; Shepherd & Patzelt, 2017). Learning from past mistakes, such as critical and discontinuous events during the business venture process, fosters a range of higher-level learning due to its “*transformational*” character (Cope, 2003). The handling of opportunities and the overcoming of crises during the entrepreneurial process represent discontinuous learning events that initiate a distinctive form of higher-levels learning (Cope, 2003, p. 431). Cope identifies various features of lower-level and higher-level learning derived from theorists (2003, p. 434). For instance, some researchers ascribe the term “*adaptive learning*” to lower-level learning (Appelbaum & Goransson, 1997) and “*generative learning*” to higher-level learning. Argyris & Schön (1978) describe higher-level learning as double-loop learning and lower-level learning as single-loop learning. Other researchers consider higher-level learning as the potential for “*transformative or transformational learning*” (Appelbaum & Goransson, 1997). Thus, many researchers plead for experiential learning and reflective practice (Kassean et al., 2015) or simulation-oriented learning (Pittaway & Cope, 2007) to deal with entrepreneurial failure in class. These didactical methods offer room for coping with uncertainty, ambiguity, and emotional exposure (Cope, 2003; Pittaway & Cope, 2007) and reflection-in-action, which is critical to fostering professional practice, which is required in complex and novel situations.

## DISCUSSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

This paper narrows the discussion of internal malfunctions in human behavior to the individual level; however, the integration of an external view at the organizational level, in terms of the malfunctioning of the system (Reason, 1990; Rasmussen, 1989), can provide further insight into the redesigning of erroneous systems and into the implications for designing a less error-prone system. Further theoretical research is encouraged to explore irrational and erroneous decisions at a macroscopic (contextual) level and to contribute to the interdependency of a complex system. Due to high levels of interdependence, entrepreneurial decisions are usually made collectively; there are even claims for the collective cognition for entrepreneurial teams (West, 2007) and for complex interplay with agents outside a system (i.e., investors) that affect modification of the system. Methodologically, emerging empirical methods, such as networking theories from social sciences, can be employed for these purposes.

Furthermore, an integration of emotion-related decisions is a prevalent aspect of entrepreneurship (Baron, 2008). There is a relation between complexity and emotions. Complexity causes fear and fear in turn affects certain behavior (e.g., fight or flight mode). Fear acts as a mediator between complexity and behavior (Dörner, 1980). In the context of entrepreneurship, this relation can be investigated in terms of entrepreneurial crisis and failure. Additionally, in the context of complex systems, fear causes the securing of competences or seeking of competences. The securing of competences can lead to affirmative information collection, that can in turn lead to the encapsulation of reality (Dörner & Gerdes, 2012) and selective perception may occur. Moreover, Dörner (1980, p. 93) sees a negative relationship between one’s own assessment of one’s ability to act and fear of failure, which can in turn lead

to an individual's perception of loss of control. From this perspective, an investigation of complex situations, cognitive biases and entrepreneurial competences is recommended, particularly to derive implications for entrepreneurship education.

Furthermore, despite sound work in these fields, bias and error research take a rather empirical character. Kruglanski & Ajzen (1983, p. 2) point out that bias and error lack an "articulated theory and ... are not explicitly defined". Contemporary research on errors has developed conceptual work that has contributed to the lack of theorization (e.g., Rasmussen, 1982; 1989; Reason, 1990). Nevertheless, such research can be considered a metatheory that can specifically be adapted to entrepreneurship. For this purpose, the entrepreneur's erroneous judgment and decision-making process require empirical investigation. In addition, complexity models and concept, e.g., synergetics (Liening et al., 2016) or cybernetics (Schwaninger, 2009), provide useful strategies to handle complex situations. We recommend an adaption of complexity theory to entrepreneurship, drawing a distinction between different types of ill-structured situations (e.g., risk, uncertainty, complexity) under the consideration of the coping strategies and including the discussion of a heuristic-oriented approach and a strategically calculated approach.

From an educational perspective, learning from mistakes can be implemented through experience-based learning (Mandel & Noyes, 2016) to enforce problem-solving and reflection competences (Boyles, 2012), and to cultivate a learning-oriented mistake culture within entrepreneurial classrooms. A first educational approach for learning from failure in the entrepreneurship are proposed by Cope (2011). Educational research should also include simulation-oriented teaching (McGuigan, 2016). Studies of simulation games provide essential knowledge about the genesis of and reasons for problems in complex situations (Reason, 1990). Moreover, some studies have demonstrated advances in learning: retrospective verbalization of the learning process or the development of heuristics. Entrepreneurship has developed various instruments and techniques (the business model canvas, the lean startup, the minimal viable product, etc.) for founding and running a business; these can be the basis for the creation of computer-simulated microworlds of business ventures.

## REFERENCES

- Amjad, T. (2020). Contemporary challenges in entrepreneurial marketing: Development of a new
- Amoretti, M.C., & Vassallo, N. (2012). *Reason and rationality*. (M. C. Amoretti, & N. Vassallo, Eds.) Frankfurt am Main: Ontos.
- Appelbaum, S., & Goransson, L. (1997). Transformational and adaptive learning within the learning organization: A Framework for research and application. *The Learning Organization*, 4(3), 115-128.
- Argyris, C., & Schön, D. (1978). *Organizational learning: A theory of action perspective*. Boston: Addison-Wesley
- Artinger, S. & Powell, T.C. (2016), Entrepreneurial failure: Statistical and psychological explanations. *Strategic Management Journal*, 37(6), 1047-1064.
- Audretsch, D. (2019). Entrepreneurial ecosystems: Economic, technological, and societal impacts. *The Journal of Technology Transfer*, 44(2), pp. 313–325.
- Bandera, C., Collins, R., & Passerini, K. (2018). Risky business: Experiential learning, information and communications technology, and risk-taking attitudes in entrepreneurship education. *The International Journal of Management Education*, 16(2), 224-238.
- Baron, R. (2004). The cognitive perspective: a valuable tool for answering entrepreneurship's basic "why" questions. *Journal of Business Venturing*, 19(2), 221-239.

- Baron, R. (2008). The role of affect in the entrepreneurial process. *The Academy of Management Review*, 33(2), 328-340.
- Baudin, L. (1954). Irrationality in economics. *Quarterly Journal of Economics*, 68(4), 487-502.
- Billet, S. (2012). *Errors and learning from errors at work*. In Bauer, J. & Harteis, C. (Eds.). *Human Fallibility* (pp. 17-32). Dordrecht: Springer.
- Boote, D., & Beile, P. (2005). On the centrality of the dissertation literature review in research preparation. *Educational Researcher*, 34(6), pp. 3-15.
- Boyles, T. (2012). 21<sup>st</sup> century knowledge, skills, and abilities and entrepreneurial competencies: A model for undergraduate Entrepreneurship Education. *Journal of Entrepreneurship Education*, 15(1), 41-54.
- Bruyat, C., & Julien, P.A. (2000). Defining the field of research in entrepreneurship. *Journal of Business Venturing*, 16(2), 165-180.
- Bryant, C., & Jary, D. (1991). *Giddens' theory of structuration: A critical appreciation*. London: Routledge.
- Busenitz, L., & Barney, J. (1997). Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making. *Journal of Business Venturing*, 12(1), 9-30.
- Cardon, M.S., & Patel, P.C. (2015). Is Stress Worth it? Stress-Related Health and Wealth Trade-Offs for Entrepreneurs. *Applied Psychology*, 64(2), 379-420.
- Cellucci, C. (2012). *Reason and logic*. In Amoretti, M.C., & Vassallo, N. (Eds.). *Reason and Rationality*. Frankfurt am Main: Ontos.
- Chi, M., Glaser, R., & Rees, E. (1982). *Expertise in problem solving*. In Sternberg, R. (Eds.). *Advances in the psychology of human intelligence*. Hillsdale: Erlbaum.
- Chitpin, S. (2017). Overcoming irrationality: The Popperian Approach. *International Journal of Educational Management*, 31(2), 148-159.
- Clegg, S., & Ross-Smith, A. (2017). Revising the boundaries: Management education and learning in a postpositivist world. *The Academy of Management Learning & Education*, 2(1), 85-98.
- Cope, J. (2003). Entrepreneurial learning and critical reflection: Discontinuous events as triggers for 'higher-level' learning. *Management Learning*, 34(4), 429-450.
- Cope, J. (2011). Entrepreneurial learning from failure: An interpretative phenomenological analysis. *Journal of Business Venturing*, 26(6), 604-623.
- De Bruin, A., & Dupuis, A. (2000). Constrained entrepreneurship: An interdisciplinary extension of bounded rationality. *Journal of Interdisciplinary Economics*, 12(1), 71-86.
- De Jong, J., & Marsili, O. (2010). *Schumpeter versus Kirzner: An empirical investigation of opportunity types*. Zoetermeer: Scientific Analysis of Entrepreneurship and SMEs.
- Dörner, D. (1980). Difficulties people have in dealing with Complexity. *Simulation & Games*, 11(1), 87-106.
- Dörner, D. (1997). *The logic of failure: Recognizing and avoiding error in complex situations*. New York: Basic Books.
- Dörner, D., & Gerdes, J. (2012). *Motivation, emotion, intelligence*. *International Conference on Supercomputing*. Yantai.
- Dörner, D., Gerdes, J., Mayer, M., & Misra, S. (2006). *A simulation of cognitive and emotional effects of overcrowding*. *International Conference on Cognitive Modeling* (pp. 92-99). Trieste: Editore Goliardiche.
- Fehr, E., & Tyran, J.R. (2005). Individual irrationality and aggregate outcomes. *Journal of Economic Perspectives*, 19(4), 43-66.
- Giddens, A. (1977). *Studies in social and political theory*. London: Hutchinson.
- Hanna, R. (2006). Rationality and the ethics of logic. *Journal of Philosophy*, 103(2), 67-100.
- Jayasinghe, K., Thomas, D., & Wickramasinghe, D. (2008). Bounded emotionality in entrepreneurship: An alternative framework. *International Journal of Entrepreneurial Behaviour & Research*, 14(4), 242-258.
- Kahneman, D. (2000). A psychological point of view: Violations of rational rules as a diagnostic of mental processes. *Behavioral and Brain Sciences*, 23, 681-683.
- Kalberg, S. (1980). Max weber's types of rationality: Cornerstones for the analysis of rationalization processes in history. *American Journal of Sociology*, 85(5), 1145-1179.
- Kassean, H., Vanevenhoven, J., Liguori, E., & Winkel, D.E. (2015). Entrepreneurship Education: A need for reflection, real-world experience and action. *International Journal of Entrepreneurial Behavior & Research*, 21(5), 690-708.

- Keh, H.T., Nguyen, T.T.M., & Ng, H.P. (2007). The effects of entrepreneurial orientation and marketing information on the performance of SMEs. *Journal of Business Venturing*, 22(4), 592-611.
- Kollmann, T., Stöckmann, C., & Kensbock, J.M. (2019). I can't get no sleep - The differential impact of entrepreneurial stressors on work-home interference and insomnia among experienced versus novice entrepreneurs. *Journal of Business Venturing*, 34(4), 692-708.
- Korsgaard, C.M. (2008). *The constitution of agency*. Oxford: Oxford University Press.
- Krueger, N.F. (2009). *The microfoundations of entrepreneurial learning and ...education: The experiential essences of entrepreneurial cognition*. In: West, G.P., Gatewood, E.J., & Shaver, K.G. (Eds.), *Handbook of university-wide Entrepreneurship Education* (pp. 35-59). Cheltenham: Elgar.
- Kruglanski, A., & Ajzen, I. (1983). Bias and error in human judgment. *European Journal of Social Psychology*, 13(1), pp. 1-44.
- Lichtenstein, B., Carter, N., Dooley, K., & Gartner, W. (2007). Complexity dynamics of nascent entrepreneurship. *Journal of Business Venturing*, 22(2), 236-261.
- Liening, A., Geiger, J.M., Kriedel, R., & Wagner, W. (2016). Complexity and entrepreneurship: modeling the Process of entrepreneurship education with the theory of synergetics. In Berger, E., & Kuckertz, A. (Eds). *Complexity in entrepreneurship, innovation and technology Research* (pp. 93-115). Cham: Springer.
- Mandel, R., & Noyes, E. (2016). Survey of experiential Entrepreneurship Education offerings among top undergraduate entrepreneurship programs. *Education+Training*, 58(2), 164-178.
- McGuigan, P.J. (2016). Practicing what we preach: Entrepreneurship in Entrepreneurship Education. *Journal of Entrepreneurship Education*, 19(1), 38-50.
- Mezirow, J. (1990). *Fostering critical reflection in adulthood: A guide to transformative and emancipatory learning*. San Francisco: Jossey-Bass Publishers.
- Mitchell, R., Busenitz, L., Bird, B., Gaglio, C.M., McMullen, J., Morse, E.A., & Smith, B. (2007). The central question in entrepreneurial cognition research 2007. *Entrepreneurship Theory and Practice*, 31(1), 1-27.
- Morris, M., Webb, J., Fu, J., & Singhal, S. (2013). A competency-based perspective on entrepreneurship education: Conceptual and empirical insights. *Journal of Small Business Management*, 51(3), 352-369.
- Mostyn, G. (2012). Cognitive load theory: What it is, why it's important for accounting instruction and research. *Issues in Accounting Education*, 27(1), 227-245.
- Mumby, D., & Putnam, L. (1992). The Politics of Emotion: A Feminist Reading of Bounded Rationality. *The Academy of Management Review*, 17(3), 465-486.
- Neck, H., & Greene, P. (2011). Entrepreneurship education: Known worlds and new frontiers. *Journal of Small Business Management*, 49(1), 55-70.
- Oser, F., Näpflin, C., Hofer, C., & Aerni, P. (2012). Towards a theory of negative knowledge (NK): Almost-mistakes as drivers of episodic memory amplification. In: Bauer, J., & Harteis, C. (Eds). *Human Fallibility: The Ambiguity of Errors for Work and Learning* (pp. 53-71). Dordrecht: Springer.
- pedagogy model. *Journal of Entrepreneurship Education*, 23(3).
- Pittaway, L., & Cope, J. (2007). Simulating entrepreneurial learning. *Management Learning*, 38(2), 211-233.
- Polonioli, A. (2016). Adaptive rationality, biases, and the heterogeneity hypothesis. *Review of Philosophy and Psychology*, 7(4), 787-803.
- Popper, K. (1957). *The poverty of historicism*. London: Routledge.
- Rasmussen, J. (1982). Human errors. A taxonomy for describing human malfunction in industrial installations. *Journal of Occupational Accidents*, 4(2-4), 311-333.
- Rasmussen, J.L. (1989). Data transformation, type I error rate and power. *British Journal of Mathematical and Statistical Psychology*, 42(2), 203-213.
- Reason, J. (1990). *Human error*. New York: Cambridge University Press.
- Rescher, N. (1988). *Rationality: A philosophical inquiry into the nature and the rationale of reason*. Oxford: Clarendon Press.
- Roberts, J. (1996). Management education and the limits of technical rationality: The conditions and consequences of management practice. In: French, R., & Grey, C. (Eds). *Rethinking management education* (pp. 54-76). London: Sage Publications.
- Rocco, T., & Plakhotnik, M. (2009). Literature reviews, conceptual frameworks, and theoretical frameworks: terms, functions, and distinctions. *Ressource Development Review*, 8(1), 120-130.

- Schwaninger, M. (2009). Complex versus complicated: the how of coping with complexity. *Kybernetes*, 38(1-2), 83-92.
- Sen, A. (1987). *The standard of living*. Cambridge: Cambridge University Press.
- Senders, J., & Moray, N. (1991). *Human error: cause, prediction, and reduction: Their Cause, Prediction and Reduction*. Hillsdale: Lawrence Erlbaum.
- Shane, S. (2012). *Start-up failure rates: The definitive numbers*. Small Business Trends, 17. Retrieved from <http://smallbiztrends.com/2012/12/>
- Shepherd, D. (2003). Learning from business failure: Propositions of grief recovery for the self-employed. *The Academy of Management Review*, 28(2), 318-328.
- Shepherd, D., & Patzelt, H. (2017). *Trailblazing in entrepreneurship: Creating new paths for understanding the field*. Cham: Springer.
- Simon, H. (1986). Rationality in psychology and economics. *Journal of Business*, 59(4), S209-S224.
- Simon, H. (1992). Scientific discovery as problem solving. *International Studies in the Philosophy of Science*, 6(1), 3-14.
- Stein, E. (1996). *Without Good Reason: The Rationality Debate in Philosophy and Cognitive Science*. Oxford: Clarendon Press.
- Stout A. (2012). *The UK start-up economy in numbers*. Retrieved from <http://www.insidestartups.co.uk/blog/>
- Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and instruction*, 4(4), 295-312.
- Turner, J.R., Baker, R., & Kellner, F. (2018). Theoretical literature review: tracing the life cycle of a theory and its verified and falsified statements. *Human Resource Development Review*, 17(1), 34-61.
- van Merriënboer, J., Kirschner, P., & Kester, L. (2003). Taking the load off a learner's mind: Instructional design for complex learning. *Educational Psychologist*, 38(1), 5-13.
- West, G.P. (2007). Collective cognition: When entrepreneurial teams, not individuals, make decisions. *Entrepreneurship: Theory and Practice*, 31(1), 77-102.
- Wilke, A., & Mata, R. (2012). *Cognitive bias*. In: Ramachandran, V. (Eds). *Encyclopedia of human behavior*. London: Academic Press.
- Wu, B., & Knott, A.M. (2006). Entrepreneurial Risk and Market Entry. *Management Science*, 52(9), 1315-1330.
- Yen, W.C., & Lin, H.H. (2020). Investigating the effect of flow experience on learning performance and entrepreneurial self-efficacy in a business simulation systems context. *Interactive Learning Environments*, 1(2), 1016.
- Zhang, S., & Cueto, J. (2017). The study of bias in entrepreneurship. *Entrepreneurship Theory & Practice*, 41(3), 419-454.