



PONTIFICIA UNIVERSIDAD CATOLICA DE CHILE  
ESCUELA DE INGENIERIA

# **ENTREPRENEURIAL BIASES: A SYSTEMATIC REVIEW AND THE STUDY OF HOW THE APPROACHES OF ENTREPRENEURS ASSOCIATE WITH BIASES**

**JAVIER IGNACIO CUETO SOTO**

Thesis submitted to the Office of Research and Graduate Studies in partial fulfillment of the requirements for the Degree of Master of Science in Engineering.

Advisor:

**STEPHEN X. ZHANG**

Santiago de Chile, March, 2014

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**JAVIER IGNACIO CUETO SOTO**

Members of the Committee:

**STEPHEN X. ZHANG**

**TOMÁS REYES**

**ROSARIO MACERA**

**HERNÁN SANTAMARÍA**

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(To my Parents, sisters, entire family  
and friends, who have supported me  
through this process.)

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## **RESUMEN**

La teoría psicológica de sesgos entrega una perspectiva única, práctica y empíricamente comprobable en decisiones emprendedoras. Académicos utilizan cada vez más los sesgos para explicar una variedad de fenómenos en emprendimiento. Esta tesis desarrolla un marco teórico basado en los antecedentes e impactos de sesgos y en su categorización, revelando los desarrollos existentes, los cuales pueden ser incompatibles o contradictorios entre ellos, por ejemplo, cómo la experiencia afecta los sesgos y como los sesgos impactan la toma de riesgos. Este trabajo entrega una evaluación sistemática, permitiendo a investigadores reflexionar acerca de lo que se ha hecho y las brechas existentes en este floreciente pero fragmentado campo de investigación.

El segundo capítulo considera que dado el robusto desarrollo de efectución y causalidad como heurísticas que utilizan los emprendedores en la creación de emprendimientos, y dado que se aproximan a otros por búsqueda de consejos, es sorprendente que ninguno de estos enfoques han sido estudiados respecto a su asociación con los sesgos. Siguiendo la teoría de heurísticas y sesgos hasta el origen de la economía de comportamiento, este estudio encuentra que efectución, causalidad, búsqueda de consejo externo e interno, incluyen o cambian heurísticas, y por lo tanto afectan su sub-producto, los sesgos. Los sesgos se manifiestan fuertemente en los emprendedores y en distintas maneras en comparación a gerentes de organizaciones establecidas. En este trabajo se construye sobre la teoría de efectución y búsqueda de consejo para proponer como están acompañados por los sesgos de exceso de confianza e ilusión de control. Testeado en 104 emprendedores nacies, encontramos sorprendentemente que varias de nuestras relaciones propuestas son empíricamente comprobadas pero en sentido opuesto. En este capítulo se reflexiona acerca de las lecciones aprendidas, se discuten las contribuciones a la literatura de sesgos de emprendedores, efectución y búsqueda de consejos.

Palabras Claves: Emprendimiento, Heurísticas, Sesgos, Toma de decisiones, Antecedentes, Impactos, Efectución, Causalidad, Búsqueda de consejos.

## **ABSTRACT**

The psychological theory of bias provides a unique, practical, and empirically testable perspective on entrepreneurial decisions. Scholars increasingly use bias to explain a variety of phenomena in entrepreneurship. This thesis develops an integrative framework based on the antecedents and impacts of biases as well as on the categories of bias, revealing extant developments that can be incompatible or clash with each other, i.e., how experiences influence biases and how biases impact risk-taking. This work provides a systematic assessment, allowing researchers to reflect on what has been done and what gaps need to be filled in this burgeoning but fragmented research stream.

The second chapter considers that given the sturdy development of effectuation and causation as heuristics using which entrepreneurs approach new venture creation, and given how often entrepreneurs approach various others to seek advice, it is surprising that none of these approaches has been studied for their association with entrepreneurial biases. Should we follow heuristics and bias theory to its origin in behavioral economics, this study finds that effectuation, causation, internal and external advice seeking either involve or reshape heuristics, and therefore have important by-product of biases. Biases manifest in entrepreneurs a lot and in different manners as compared to managers in established organizations. In this paper, we build upon the literature of effectuation and advice seeking to propose how they are accompanied by the biases of overconfidence and illusion of control. Having tested in 104 nascent entrepreneurs, we surprisingly found many of our proposed relationships are empirically true in opposite directions. This chapter reflects our lessons learnt and discusses the contributions of this paper to the literature of entrepreneurial bias, effectuation, and advice seeking.

**Keywords:** Entrepreneurship, Heuristic, Bias, Decision-Making, Antecedents, Impacts, Effectuation, Causation, Advice Seeking.

## INTRODUCTION

The study of biases in entrepreneurship is an increasing field of research and a very relevant area for entrepreneurship (Krueger, 2005; Schade & Koellinger, 2007). The theory of heuristics and biases (Kahneman & Tversky, 1982; Tversky & Kahneman, 1973, 1974) provides an exceptional and empirically testable perspective on decision-making in entrepreneurship (Busenitz & Barney, 1997; Gudmundsson & Lechner, 2013; Keh et al., 2002; Simon & Shrader, 2011; Zacharakis & Shepherd, 2001). Heuristics are typically studied together with their by-product of bias, known as the heuristics and bias research program in psychology and behavioral economics (Tversky and Kahneman, 1974; Wilcox, 2011).

Entrepreneurs are biased towards action and creation on opportunities evaluation (Baron, 2004). Heuristics (simple rule of thumb) and biases study how entrepreneurial decision makers, such as entrepreneurs and venture capitalists (VCs), are able to process and interpret information facing uncertainty and risk (Baron, 1998; Franke et al., 2006; Hayward et al., 2006; Keh et al., 2002; Simon et al., 2000; Zacharakis & Shepherd, 2001).

Furthermore, in their decision-making, entrepreneurs reveal great variety in their approaches of new venture creations (Gartner, 1985). The approaches used by entrepreneurs either implicate or can redesign the heuristics (Haynie and Shepherd, 2009). For example, the causation and effectuation approaches consist of cohesive sets of practical heuristics entrepreneurs use (Read and Sarasvathy, 2005; Wiltbank et al.,

2006). As well, different approaches to advice seeking frame and structure venture strategies, influencing organizational effects (Alexiev et al., 2010; Bonaccio and Dalal, 2006).

To date, vibrant and spread studies have created comprehensive and unconstrained examination rendering to interests of individual researchers in mapping the intricate relationships between biases and a burst of entrepreneurship constructs, for instance, decision to start a venture, progression of a new venture, social capital, trust, and risk perception. Likewise, the investigation designs used seem to be in an early stage of development, which has led to a rich, but knotty and somewhat disconnected, body of research.

This disconnection and polysemy lead to the first objective of this thesis, the development of a systematic review on entrepreneurial biases, which could be useful to address the state of the art, providing a new theoretical framework based on antecedents and impacts of entrepreneurial biases and guiding future research in new and unexplored theories. The first chapter of this thesis, which has been submitted as a journal article to *“Entrepreneurship Theory and Practice”* (Appendix C) reflects the work done in this topic. This chapter was worked since the first version with Stephen Zhang and the collaboration in the latest version of Alfonso Cruz, professor of the Industrial and System Engineering Department of the Pontificia Universidad Católica.

Additionally, regarding the approaches entrepreneurs used in their venture creation, there is a dearth of studies on how these approaches affect how biased they are. The

second objective of this thesis is to address this issue by empirically testing how entrepreneurs who follow the new venture creation approaches of effectuation, causation, and internal and external advice seeking could be prone to biases, specifically overconfidence and illusion of control, which have been the most studied biases in entrepreneurship literature (Zhang et al., 2014).

The second chapter of this work takes in consideration this problematic by testing with 104 Chilean nascent entrepreneurs that took part of ASECH (Chilean Association of Entrepreneurs) and its stage 0 courses. ASECH organizes stage 0 program in which experienced entrepreneurs transfer and share knowledge to nascent entrepreneurs during seven weeks, who are just beginning to develop business ideas or ventures. It has been found that effectuation, causation, internal and external advice seeking have important and unexpected relationships with biases. Empirical findings show patterns against the theoretical reasoning and empirical findings in general strategy literature. For example, in strategy literature internal (external) advice seeking is reasoned and found to increase (decrease) overconfidence and unexpectedly nascent entrepreneurs experience the opposite effect.

This chapter has been submitted in January 2014 to the Annual Meeting of the Academy of Management as well as the Annual Meeting of the European Academy of Management. It will be submitted to the ISI Journal *“Entrepreneurship Theory and Practice”* on March 2014.

# 1. THE ANTECEDENTS AND IMPACTS OF BIASES IN ENTREPRENEURSHIP – A SYSTEMATIC REVIEW AND SYNTHESIS<sup>1</sup>

## 1.1 Introduction

The study of biases in entrepreneurship has increased rapidly since its inception.

The theory of heuristics and bi

ases (Kahneman & Tversky, 1982; Tversky & Kahneman, 1973, 1974) provides a unique, practical, and empirically testable perspective on decision-making in entrepreneurship (Busenitz & Barney, 1997; Gudmundsson & Lechner, 2013; Keh et al., 2002; Simon & Shrader, 2011; Zacharakis & Shepherd, 2001). Therefore, the study of bias is recognized as a very important area for entrepreneurship (Krueger, 2005; Schade & Koellinger, 2007).

Entrepreneurship scholars have used biases to explain many phenomena in entrepreneurship. To date, vibrant and diversified studies have generated broad and unconstrained exploration according to the phenomena of interests of individual researchers in mapping the complex relationships between biases and a flurry of entrepreneurship constructs, for instance, opportunity evaluation, new venture survival, radicalness of the innovation, trust, and risk perception. Moreover, the research designs employed appear to be in an early stage of

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<sup>1</sup> An earlier version of this chapter was submitted and presented at the International DSI and Asia Pacific DSI Conference at Bali in July 2013. The latest version was submitted to the ISI Journal “*Entrepreneurship Theory and Practice*” on January 3rd, 2014.

development. This has led to a rich, but knotty and somewhat disconnected, body of research.

To generate cumulative progress from the exploration, the field could benefit from a consolidation of the extant research. We intend to tackle this opportunity by systematically reviewing entrepreneurial bias research. This article aims to answer, in a single document, the following questions. What is the state of entrepreneurial bias research? What are the primary research designs employed and relationships examined? What are the relevant findings? What are the unexpected or even conflicting results? What are the gaps? What are the future research opportunities?

We searched for articles from 1973 (the year biases were introduced in psychology) to October 1st, 2013. We found 35 articles studying bias in entrepreneurship. The first article was published in 1997, and 66% of the articles appeared within the last 8 years. The articles generally fell within two themes: (1) the impacts of bias and (2) the antecedents of bias. The two themes together effectively represent the general attempts of scholars to studying biases in entrepreneurship. In addition, we organize the studies using a typology based on how biases arise and depart from normative models (Baron, 2007). Along these lines, we develop an integrative framework that facilitates the synthesis of research and the identification of gaps and future research opportunities.

The contributions of this thesis are threefold. First, we provide a systematic review of entrepreneurial biases, identifying the key phenomena of interest and exposing inconsistent or equivocal findings. Second, we synthesize this literature

based on an integrative framework, revealing open questions beyond those identified in individual articles. Third, we expect this study to serve as a point of assessment, allowing researchers to reflect upon what has been done in this young stream of research, which is growing increasingly important in entrepreneurship. Compared with bias research in other fields: what are the concerns regarding research design (e.g., the need for longitudinal and multilevel analysis) and what are the necessary future improvements?

## **1.2 Bias and Entrepreneurship**

Bias is an effect of human decision-making that is a result of reproducible shortcuts (known as heuristics), motivational factors, or social influence (J. Baron, 2007; Tversky & Kahneman, 1974; Wilcox, 2011). The systematic study of these shortcuts and biases is known as the heuristics and biases program in cognitive psychology (Kahneman & Tversky, 1982; Tversky & Kahneman, 1973, 1974). Biases arise from an absence of suitable mental mechanisms, from a restricted capacity for information processing (Bless et al., 2004) or when timeliness is more valuable than accuracy (Haselton et al., 2005).

Heuristics and biases theory has had an enormous influence, e.g., opening new fields such as behavioral economics (Kahneman, 2003) and behavioral law (Gigerenzer & Gaissmaier, 2011; Jolls et al., 2000) and fundamentally changing many fields – see reviews of biases in medical decision-making (Bornstein & Emler, 2001), auditing (Solomon & Trotman, 2003), accounting (Ashton & Ashton, 1995) and governance and public policy (Rachlinski, 2004), for examples.



Sound decision-making is essential to entrepreneurship. Unfortunately, decisions in entrepreneurship are susceptible to biases, and entrepreneurs display greater biases than managers in established organizations. This disparity can be caused by various factors including, but not limited to, high uncertainty, information overload and velocity, a lack of historical information and organizational routines, time pressure, etc. (Busenitz & Barney, 1997; Baron, 2004; Hayward et al., 2006; Holcomb et al., 2009; Simon et al., 2000; Zacharakis & Shepherd, 2001). Meanwhile, people who are more prone to use heuristics and biases are more comfortable dealing with ambiguous and complex decision contexts; consequently, they have an easier time making entrepreneurial decisions and are more likely to become entrepreneurs (Busenitz & Barney, 1997; Busenitz & Lau, 1996). Another important group of decision makers in entrepreneurship, Venture Capitalists (VCs), are also found to be highly biased in new venture evaluation and investment decisions (Zacharakis & Meyer, 2000; Zacharakis & Shepherd, 2001).

Heuristics and biases are all, to some degree, domain-specific because they involve specific classes of problems (Gigerenzer & Brighton, 2009; Gigerenzer & Todd, 1999). Table I-1 shows the primary biases studied in entrepreneurship literature.

Table I-1: Biases studied in entrepreneurship

Bias	Definition
Overconfidence	Describes the overestimation of one's own ability to affect the expected outcomes of task execution relative to others (Busenitz, 1999; Gudmundsson & Lechner, 2013). This bias may be a result of a poor meta-cognition (Sánchez et al., 2011).
Illusion of control	Refers to a situation in which an individual overemphasizes how much his skill, instead of chance, can improve performance (Langer, 1975).
The law of small numbers	Reaching conclusions about a larger population using a limited sample of information (Haley & Stumpf, 1989).
Similarity	Describes the phenomenon in which individuals tend to more positively evaluate those who are more similar to themselves (Byrne & Griffitt, 1973).
Availability	Occurs when people make judgments about the probability of events based on how easy it is to think of examples (Tversky & Kahneman, 1974).
Representativeness	Describes the use of a comparison with a similar known situation as a cognitive shortcut for making decisions (Wadeson, 2006).

### 1.3 Methods

A systematic review consists of three parts in a transparent and reproducible procedure: data collection, data analysis, and synthesis (Tranfield et al., 2003). Following this procedure, we searched and collected articles (until October 2013) and analyzed their content. We identified two broad themes of research inquiries:

what factors are affected by biases and what factors affect these biases. We introduced a categorization of biases (J. Baron, 2007) to form an integrative framework. The rest of this section documents the details of the procedure employed.

### **1.3.1 Searching**

To systematically report all the pertinent articles, we combined the approaches of Grégoire et al. (2011), Kiss et al. (2012) and Klotz et al. (2014) in a two-stage search process. First, we thoroughly scanned the top entrepreneurship and management journals in the Financial Times journal list: *Academy of Management Journal*, *Academy of Management Review*, *Academy of Management Perspectives*, *Journal of Business Venturing*, *Entrepreneurship Theory and Practice*, *Journal of Business Research*, *Journal of International Business Studies*, *Journal of Management Studies*, *Management Science*, *Organization Science*, *Organization Studies*, *Organizational Behavior & Human Decision Processes*, as well as *Strategic Entrepreneurship Journal* (added by the authors).

Second, we checked the articles found in the first step to identify keywords and then using these keywords searched the *Scopus* database. The database search yielded more articles published in journals including, but not limited to, *Journal of Management*, *Venture Capital: An International Journal of Entrepreneurial Finance*, *Journal of Financial Economics*, *Management Decision and Strategic Change*, and *The Journal of Applied Behavioral Science*. In addition, we solicited

colleagues and friends to provide us with important studies of the topic based on their knowledge.

It is possible that relevant articles may have escaped our sampling procedures, even though we iteratively expanded the search keywords and used a large database (Scopus). One possibility for omission is non-English articles because we used English keywords.

### **1.3.2 Coding and selecting articles**

The selection and coding process aims to select and analyze the studies that are interesting for this review. Following the approach adapted from Grégoire et al. (2011) and Moroz and Hindle (2012), as we collected the articles, we open coded them using the following questions:

- 1) Do the articles study biases as part of their central inquiries?
- 2) Is the investigated decision-making related to entrepreneurship?

If the answer to either of these questions is no, the paper was not included because only articles that addressed entrepreneurial biases as their central inquiry were selected. If both answers are positive, the article was coded with further questions:

- 3) Who have the biases (entrepreneurs or VCs)?
- 4) What is the level of analysis?
- 5) What is the research method?
- 6) What are the independent and dependent variables, if they are distinguishable?
- 7) What are the antecedents and impacts of entrepreneurial biases?

8) What are the findings and proposed future directions?

We also built conceptual maps to facilitate an understanding of the relationships between the biases and other studied constructs. In the case of conceptual articles without explicit models and/or propositions, we identified the concepts and dynamics in those papers and assessed their eligibility for this review. Memos were written throughout the entire process, following the standard procedure in grounded theory (Glasser, 2011).

### **1.3.3 Overview of articles selected**

We found 35 articles using biases as a part of their central inquiry in entrepreneurial decision-making. The number of articles is similar to previous reviews in entrepreneurship (c.f. Moroz & Hindle, 2012; Perry et al., 2012). Almost all of the articles appear in top journals in the field - approximately half of the articles appeared in two journals: *Journal of Business Venturing* and *Entrepreneurship Theory and Practice*.

Table I-2 lists all of the articles. A total of 26 are empirical papers, in which 14 used surveys (54%), 7 used experiments (including conjoint analysis) (27%), 4 used interviews (15%), 3 used a scenario technique in which respondents read hypothetical situations and state their presumed behaviors or attitudes (12%), 1 used case studies (4%) and 5 used secondary data (19%).

Table I-2: Selected Articles Studying Entrepreneurial Biases (the italic denote conceptual papers)

Author	Purpose	Method	Sample	Bias
Busenitz & Barney (1997)	Examine differences in the decision-making processes used by entrepreneurs and managers in large organizations	Survey and scenario technique	124 entrepreneurs and 95 managers in the US	Overconfidence, representativeness
<i>Cable &amp; Shane (1997)</i>	<i>Study the decision to cooperate based on implicit similarities between entrepreneur-VC relationships</i>	<i>Conceptual</i>	-	<i>Similarity</i>
Busenitz (1999)	Examine entrepreneurial risk through the lens of cognitive psychology and decision-making	Survey	176 entrepreneurs and 95 managers in the US	Overconfidence, representativeness
Coval & Moskowitz (1999)	Study the local equity preference in domestic portfolios	Secondary data	10 fund managers in the US	Local bias (similarity)
Simon et al. (2000)	Explore how individuals cope with the risks inherent in their decisions	Survey and scenario technique	191 MBA students in the US	Overconfidence, illusion of control, law of small numbers
<i>Bernardo &amp; Welch (2001)</i>	<i>Analyze how overconfident behavior persists</i>	<i>Simulation</i>	-	<i>Overconfidence</i>
Zacharakis & Shepherd (2001)	Investigate if VCs are overconfident in their decision-making process	Conjoint analysis	51 VCs in the US	Overconfidence
Keh et al. (2002)	Examine opportunity evaluation under risky conditions using a cognitive approach	Survey and scenario technique	77 owners of SMEs in Singapore	Illusion of control, law of small numbers, overconfidence, planning fallacy
<i>Simon &amp; Houghton (2002)</i>	<i>Analyze the relationships among biases, misperceptions, and the introduction of pioneering products</i>	<i>Conceptual</i>	-	<i>Illusion of control, law of small numbers</i>

Shepherd et al. (2003)	Study the relationship between increased experience and the decision processes of VCs	Conjoint analysis	66 VCs from Australia	Overconfidence
Simon & Houghton (2003)	Examine the effects of overconfidence on ill-structured decisions made by managers	Survey and interview	55 managers of small computer companies in the US	Overconfidence
Wickham (2003)	Demonstrate the impact of representativeness on decision quality	Experiment	155 entrepreneurship students in the UK	Representativeness
Forbes (2005)	Examine differences in the degree to which entrepreneurs exhibit the overconfidence bias	Survey	108 managers of new ventures in the US	Overconfidence.
De Carolis & Saporito (2006)	<i>Advance a model suggesting that entrepreneurial behavior is a result of the interplay of environments (social networks) and certain cognitive biases in entrepreneurs</i>	Conceptual	-	<i>Overconfidence, illusion of control and representativeness</i>
Franke et al. (2006)	Analyze biases arising from similarities between a venture capitalist and the members of a venture team	Conjoint analysis	51 VCs in Munich, Berlin and Vienna	Similarity
Hayward et al. (2006)	<i>Develop a hubris theory of entrepreneurship to explain why so many new ventures are created under high risk</i>	Conceptual	-	<i>Overconfidence</i>
Bryant (2007)	<i>Explore the role of self-regulation in the use of decision heuristics by entrepreneurs</i>	Conceptual	-	<i>Overconfidence, representativeness</i>
Burmeister & Shade (2007)	Examine whether the empirical finding that entrepreneurs are more biased than other individuals is generally valid	Experiment	427 students, 135 bankers and 240 entrepreneurs in Germany	Status-Quo (Representativeness)
Koellinger et al (2007)	Study what variables are significantly associated with the decision to start a business	Survey and Secondary Data	40.000 entrepreneurs in 18 countries	Overconfidence
Moore & Cain (2007)	Study overconfidence and understand when and why people underestimate (and overestimate) the competition	Experiment	91 university students in the US	Overconfidence
Grichnik (2008)	Develop a model of entrepreneurial risk-taking behavior in different cultural settings	Experiment and survey	252 entrepreneurship students and entrepreneurs in	Overconfidence.

Parwada (2008)	Analyze the determinants of the decision of firm location and stock selection of fund managers	Secondary data	Germany and the US 358 executives at 207 firms in the US	Local bias (similarity)
Cassar & Craig (2009)	Analyze how previous failure affects hindsight bias concerning the probability of venture formation	Interview	198 nascent entrepreneurs in the US	Hindsight bias (Representativeness)
De Carolis (2009)	Analyze the Influence of Social Capital and Cognition in the progress of new venture creation	Survey	269 students entrepreneurs in the US	Illusion of control
Barbosa & Fayolle (2010)	Examine the effect of new information in risk perceptions and the decision to start a venture	Survey	Entrepreneurs and students (number not indicated)	Availability and anchoring
Carr & Blettner (2010)	Examine the effects of illusions of control on decision quality	Survey	163 small firm founders in the US	Illusion of control
Cumming & Dai (2010)	Examines local bias in VC investments	Secondary data	Investments from 1008 VCs in the US	Local bias
Hayward et al. (2010)	<i>Explain why more confident founders of new ventures that fail are better positioned to start subsequent ventures</i>	<i>Conceptual</i>	-	<i>Overconfidence</i>
Townsend et al. (2010)	Understand better why some individuals decide to start new businesses and others do not	Interview	316 nascent entrepreneurs in the US	Overconfidence
Murnieks et al. (2011)	Investigate the extent to which similarity in decision-making process might bias opportunities	Survey and conjoint analysis	60 VCs in the US	Similarity
Sánchez et al. (2011)	<i>Review and highlight the most important contributions of cognitive psychology to the field of entrepreneurship</i>	<i>Conceptual</i>	-	<i>Overconfidence</i>
Simon & Shrader (2011)	Identify which entrepreneurial actions are associated with an entrepreneur's failure	Interview and survey	55 managers of small computer companies in the US	Overconfidence
Ebbers & Wijnberg (2012)	Analyze if the individual reputations of founders of nascent ventures can function as important signals to investors	Case Study	141 firms' ventures from Netherlands	Similarity



Gudmundsson & Lechner (2013)	Build a multilevel model explaining the interplay of cognitive biases and cognitive make-up and its performance implications	Survey	115 founders of small firms in Iceland	Overconfidence
Toft-Kehler et al. (2013)	Analyze the experience–performance relationship and the impact of contextual similarity	Secondary data	Swedish founder and managers	Similarity

### **1.3.4 An integrative framework**

We found that entrepreneurship literature has studied the relationships between biases and a diverse range of constructs, such as risk perception, decision to start a venture, opportunity evaluation, and start-up team evaluation (Franke et al., 2006; Keh et al., 2002; Simon et al., 2000). In general, the relationships are clustered around two themes: the antecedents of the biases and the impacts of the biases. This division is similar to the model of an inputs-mediators-outcomes framework used in other reviews, e.g., on new venture teams (Klotz et al., 2014), multimarket competition (Yu & Cannella, 2012) and corporate social responsibility (Aguinis & Glavas, 2012).

To analyze and compare the studies, we tried a few categorizations of biases proposed in the psychology literature and chose the categorization of Baron (2007). Baron separates biases into three categories based on how they depart from normative models.

First, the ‘belief’ category covers biases that result from the effects of goals or desires on beliefs. People often adopt beliefs that make them comfortable or happy. For example, people selectively expose themselves to evidence and assimilate positive evidence –happily neglecting neutral or negative evidence, at least before they suffer the consequences of acting on these beliefs. This category of bias addresses cognition and affect and coincides with the recent surge of interest in affect on entrepreneurship (Baron & Tang, 2011; Baron, 2008). One

bias (overconfidence) from this category has been used in entrepreneurship research.

Second, the ‘attributes’ category addresses attending to one attribute when other attributes are relevant. This behavior includes biases in which the attribute in question captures our attention because it is the result of recent or immanent events, because it is usually a good indicator for another attribute, or because it simply is not particularly salient or useful as an indicator. This category of bias is largely cognitive, and many biases (availability, representativeness, the illusion of control, similarity, local, the law of small numbers, status quo) from this category have showed up in entrepreneurship literature.

Third, the ‘psychophysics’ category concerns the relationship between quantitative attributes and our perception of these attributes. Our sensitivity usually diminishes as intensity increases. The archetypal biases in this category include overweighting low probabilities (Kahneman & Tversky, 1984) and framing effects for gains/losses (Levin et al., 2002). Regrettably, no bias from this category has been studied in the entrepreneurship literature, even though they are highly relevant, as will be subsequently explained.

Because we aim to cover how biases manifest in entrepreneurship phenomena, Baron’s categorization was chosen over others such as Tversky and Kahneman (1974) and its updated version in Kahneman and Fredkerik (2002). Baron’s categories are based on how biases arise rather than the methods used to discover biases, as in the other categorizations (Baron, 2007). In addition, the other

categorizations cannot properly account for overconfidence bias, putting it into more than one category (Russo & Schoemaker, 1992; Sánchez et al., 2011).

## **1.4 Findings**

In this section, we will uncover the specific findings in each category of biases. In each category, we present the impacts of the biases and then their antecedents. Subsequently, we analyze and discuss the nuanced connections and differences among the studies. Lastly, we will reveal the specific research gaps and methodological concerns.

### **1.4.1 “Belief” Category of Biases**

#### **a) Impacts of Bias**

##### **i) Overconfidence on risk-taking behavior and new venture decisions**

Overconfidence - an individual's overemphasis on how much his or her own skill, instead of chance, improves performance - has been indicated as key to explaining why some individuals decide to start new ventures while others do not (Sánchez et al., 2011). Busenitz and Barney (1997) found empirically that entrepreneurs are more overconfident than employed managers.

Simon et al. (2000) were the first to propose that overconfidence decreases risk perception and therefore increases new venture decisions. However, the proposed relationships were found not to be significant. Taking a slightly different approach, Keh et al. (2002) followed up and similarly proposed that overconfidence positively impacts risk perception and opportunity evaluation (instead of new venture decisions). They empirically tested this proposal and confirmed the non-significance.

Still hoping to explain why so many new ventures are created in the shadow of high venture failure rates, scholars continued to hypothesize based on overconfidence. *Hayward et al. (2006)* theorized that more overconfident entrepreneurs start their ventures with smaller resource endowments and commit greater resources, thereby displaying risky behavior. More overconfident entrepreneurs underestimate the need to secure and defend intellectual property and key resources and overestimate their ability to do so, also increasing risk. However, more confident entrepreneurs are likely to rebound from failure and start subsequent ventures because they receive better social support and can develop better emotional, cognitive, social and financial resilience when they fail (*Hayward et al. 2010*).

The most recent empirical study is Grichnik (2008). They found a significantly positive relationship between overconfidence and risk-taking behavior; this relationship is associated with risk propensity, personal and situational variables, worry and cultural context, as the sample was from the US and Germany. Previously, Simon and Houghton (2003) used a field study to examine overconfidence across a range of product introduction decisions, varying from lower-risk, incremental product introductions to higher-risk and pioneering introductions. They found that overconfidence was associated with introducing products that were more pioneering than incremental. Their finding is consistent with Grichnik (2008), as overconfidence leads entrepreneurs to take on more risk.

Drawing these conceptual and empirical arguments together, we can see that the extant findings do not appear to be totally consistent. While the relationship between overconfidence and risk perception (an important element of risk-taking behavior) were discarded in Simon et al. (2000) and Keh et al. (2002), other studies attempted to use overconfidence to explain risk-taking and new venture decisions despite the high failure rates (*Hayward et al., 2006; Hayward et al., 2010*), and later Grichnik

(2008) empirically found a positive relationship between overconfidence and risk-taking behavior. Future work should carefully analyze this set of relationships. Measurement could be an issue for past studies, as some authors have pointed out themselves (Keh et al., 2002).

At the same time, future research should examine whether the commonly known antecedents of risk-taking behavior, such as worry, personal and cultural factors, risk perception and propensity, mediate the relationship between overconfidence and risk taking behavior. Studying the mediators can enhance our understanding of the mechanism between overconfidence and risk-taking behavior.

## ii) Overconfidence on performance measures

Because biases are typically associated with negative effects in decision-making (Kahneman & Tversky, 1996), researchers have looked at whether bias in entrepreneurial decisions impacts new venture performance. Simon and Houghton (2003) found that the more pioneering and riskier product introductions, led by overconfidence, were less successful in coping with external technological change, maintaining quality standards, and achieving sufficient demand compared to incremental introductions. It is also proposed that more overconfident founders lower the liquidity of their ventures, which increases the likelihood that their ventures will fail (*Hayward et al., 2006*). Turning to the empirical evidence on this issue, two groups of scholars later found overconfidence to be negatively associated with firm survival (Gudmundsson & Lechner, 2013; Koellinger et al., 2007) because overconfident entrepreneurs tend to have a stronger opportunity orientation and to introduce riskier products, ignoring or underestimating competition, under-resourcing the venture, and relying less on external networks for relational resources.

b) Antecedents of Bias

i) Experience on overconfidence

Scholars have been examining how a variety of experience-related constructs affect overconfidence, and the findings are equivocal.

First, Zacharakis and Shepherd (2001) proposed a positive relationship between experience and overconfidence in VCs but did not find it to be significant empirically. Following this argument, Shepherd et al. (2003) found, in a conjoint analysis, that as the experience of VCs increases, their decision accuracy at first grows and then decreases after an optimal level of 14 years; their reasoning is that VCs become more overconfident as they age. In a complementary vein, *Hayward et al. (2006)* proposed that entrepreneurs with prior experience in founding successful ventures become more overconfident, even if their new ventures differ from their previous ventures.

In contrast, Forbes (2005) found younger entrepreneurs were more overconfident than older entrepreneurs, and Koellinger et al. (2007) found nascent entrepreneurs to be more confident in their skills, knowledge, and experience than serial entrepreneurs.

As a result, the relationship between experience and overconfidence is inconsistent, and the inconsistency could have been caused by how the studies define and measure experience (i.e., the number of past ventures, the number of successful ventures, years of working, age, etc.). It also could have been caused by differences in the nature and the context of the decisions within those studies and in the informants: entrepreneurs, VCs, students in entrepreneurship programs, etc. This relationship between experience and overconfidence appears to offer an ample and interesting avenue for future research.

## ii) Self-efficacy on overconfidence

Entrepreneurial self-efficacy (ESE) is an individual's confidence in his or her ability to successfully perform entrepreneurial roles and tasks (Zhao, Seibert, & Hills, 2005). The definition of ESE is similar to overconfidence, but ESE only concerns confidence in specific entrepreneurial roles and tasks. Forbes (2005) proposed that entrepreneurs with higher levels of ESE would be more overconfident than those with lower levels. However, empirically, this relationship was not significant, and he concluded that the two constructs are conceptually and empirically distinct. In a similar vein, Townsend et al. (2010) argued that confidence causes entrepreneurs to have high expectations for their ability to act entrepreneurially, and this is empirically found to increase new venture decisions.

## iii) Ease of the task on overconfidence

The theory that overconfidence increases new venture decisions was challenged by Moore and Cain (2007), who argued that the ease of tasks affects confidence levels and that prior studies employed easy tasks. Tested in a sample of 91 university students, Moore and Cain (2007) confirmed that people underestimated others' performance on simple tasks but overestimated it on difficult tasks. When a task is simple, people choose to enter markets overconfidently because they believe that they are better than average and when a task is difficult, they are underconfident about entering because they believe they are worse than average.

## iv) Contextual characteristics on overconfidence

Meanwhile, interestingly, a group of contextual factors that appear to increase the difficulty of decision-making have been found to positively relate to overconfidence. The riskiness of the contexts (Simon & Houghton, 2003), unfamiliar contexts (Zacharakis & Shepherd, 2001) and the hostility of the environment (Simon & Shrader, 2012) are found



empirically to be positively related to overconfidence. It was proposed that environmental complexity and environmental dynamism were positively related to overconfidence (*Hayward et al., 2006*).

Thus, a notable point of difference has been made, as these difficult environmental factors are found to increase overconfidence. The question is whether they increase the difficulty of entrepreneurial tasks because when tasks are difficult, people become underconfident (Moore & Cain, 2007). Interestingly, scholars appear to infer contradictory roles for difficulty on overconfidence; further research in this area could study how bias arises from the perceived difficulties and their context.

It is noteworthy that environmental dynamism was proposed as being positively related to overconfidence (*Hayward et al., 2006*). The reason for this proposition is that the greater the dynamism, the greater the tendency for entrepreneurs to commit their resources to their identified success factors, making it less likely that the ventures achieve fit with their environment and thus worsening their performance. Therefore, entrepreneurs exhibit greater overconfidence in more dynamic settings (Hayward et al., 2006); however, empirical evidence has proved the opposite. Environmental dynamism was found to be negatively related to overconfidence in a sample of 55 owners of small computer companies (Simon & Shrader, 2012). This negative relationship between dynamism and overconfidence is unexpected, and the authors themselves explained that the negative findings could be due to the sample used (owners of small new computer ventures). Consequently, there is a need to test this relationship in more industries.

#### v) Trust on overconfidence

Entrepreneurs rely on networks, and it was proposed that the trust the entrepreneurs have in their network increases overconfidence, as trust creates confident expectations (De Carolis & Saporito, 2006). However,

subsequently, Gudmundsson and Lechner (2013) revealed in an empirical test that distrust (a somewhat opposite construct to trust) in others was positively associated with overconfidence. They reasoned that a distrusting entrepreneur is reluctant to delegate tasks to others and to seek assistance from others (Gino & Moore, 2007), which intensifies miscalibration, leading to overconfidence. The contrasting reasoning and results between (dis)trust and overconfidence in De Carolis and Saporito (2006) and Gudmundsson and Lechner (2013) present a research opportunity. The relationship could be studied based on common constructs and measures.

#### vi) Organizational factors on overconfidence

The study of organizational factors is generally common in management and entrepreneurship research. First, it is proposed that the size and age of the ventures influence overconfidence (Forbes, 2005), as entrepreneurs managing smaller and younger ventures would be more overconfident than entrepreneurs managing larger and older ventures; however, these hypothesized relationships were found not to be significant. Second, Forbes (2005) found empirically that entrepreneurs in firms that exhibit higher levels of decision comprehensiveness were more overconfident and entrepreneurs whose ventures have attracted external equity investments are less overconfident than entrepreneurs in firms without these characteristics. Third, *Bryant (2007)* proposed that when entrepreneurs emphasize the use of strategic fit between the opportunity and the vision for the new venture, they tend to exhibit an overconfidence bias.

Fourth, Bernardo and Welch (2001) developed a model to analyze the interaction between entrepreneurial culture in groups and overconfidence. They found that overconfidence could be useful if groups of entrepreneurs are large enough to benefit from positive information

externalities, if individuals have low-precision information, and if overconfidence is moderate rather than extreme.

Lastly, of additional interest are i) the introduction of more pioneering products, ii) actions to reverse poor company performance, and iii) larger-scale launches that involve key resources, which are all organizational activities that were positively related to overconfidence (Simon & Shrader, 2012). In situations when the expected returns are more extreme, VCs are found to be more overconfident (Zacharakis & Shepherd, 2001).

#### **1.4.2 The “Attributes” Category of Biases**

##### **a) Impacts of Biases**

##### **i) Impact on risk-taking behavior and new venture decisions**

In the belief category, we showed that risk-taking behavior had a relevant impact on overconfidence, and biases in the attribute category have also been found to influence this relevant construct. For instance, Simon et al. (2000) showed and verified that the illusion of control and the law of small numbers decrease individuals’ perceptions of the riskiness of new ventures, and those who perceive lower risk are more likely to form ventures. Risk perception is proposed to fully mediate the relationships, but the mediation is found to be partial (Simon et al., 2000).

Advancing Simon et al. (2000), Keh et al. (2002) used opportunity evaluation instead of new venture decisions and showed that the illusion of control has a significant relationship with opportunity evaluation. Keh et al. (2002) proposed and confirmed that risk perception fully mediates the relationship between the illusion of control and opportunity evaluation. Keh found that the law of small numbers has a direct effect on opportunity evaluation, without the mediation of risk perception as in Simon et al. (2000).

Building upon those findings, *De Carolis and Saporito (2006)* built a

conceptual model in which the illusion of control and representativeness decreases risk perception, and the decreased risk perception leads to the exploitation of entrepreneurial opportunities. Later, De Carolis et al. (2009) found empirically that the illusion of control and risk propensity are positively related to the progress of a new venture, addressing the need to test this model while considering representativeness.

This analysis was later expanded to include additional scope. The availability of new information expressed in negative (positive) terms was found to increase (decrease) the perceived risk associated with a new venture, reducing (increasing) individuals' willingness to start the venture (Barbosa & Fayolle, 2010). The author also found that positive (negative) framing of the events required to launch the venture increases (decreases) people's estimation of the probability of the success of the venture.

#### ii) Impact of similarity on the evaluation of new venture teams

When we make decisions involving other people, it is affected by our similarity to them. Similarity between VCs and entrepreneurs in demographic factors, work value congruence, and perceived power equality increases cooperation (*Cable & Shane, 1997*). Similarity between VCs and entrepreneurs in age, type of education, field of training, previous working experience, and leadership experience was proposed to positively impact the VCs' evaluation of the ventures started by the entrepreneurs (Franke et al., 2006), but, empirically, only the type of education and previous working experience were verified using a sample of 26 VC firms. Expanding Franke et al. (2006), Murnieks et al. (2011) found that similarity in the process and nature of decision-making between VCs and entrepreneurs lead to favorable evaluation outcomes. Lastly, Ebberts and Wijnberg (2012) found a positive effect from similarity bias on the decision to invest. Based on these findings, we

foresee that one interesting avenue for future research is to investigate whether similarity bias leads to better or worse returns for the VCs.

### iii) Impact of contextual similarity on performance

One particular type of contextual similarity is a similarity in locations, which is also called local bias. Investment decisions made with local bias were found to perform better (Cumming & Dai, 2010).

Other contextual similarities (industry, geographic, and temporal) were studied as potential moderators between prior startup experience and new venture performance (Toft-Kehler et al., 2013). New venture performance has a U-shaped relationship with prior startup experience. Limited prior startup experience lowers performance, while substantial prior startup experience enhances performance. Contextual similarities among prior startups and current ventures positively moderated the experience–performance relationship. At low to moderate levels of experience, high contextual similarity weakens the negative direct relationship between experience and venture performance. At moderate to high levels of experience, high contextual similarity strengthens the positive direct relationship between experience and venture performance.

### iv) Impact of the illusion of control and representativeness on performance measures

A few studies attempted to link biases with performance measures. One of the first studies is Wickham (2003), who found empirically that representativeness leads to lower decision quality. This finding is consistent with those regarding the illusion of control, which was positively associated with the progression of a new venture (De Carolis et al., 2009) and which negatively influences the quality of opportunity evaluation, especially when time stress and prior experience increase (Carr & Blettner, 2010).

- v) Impact of the illusion of control and the law of small numbers on introducing pioneering products

*Simon and Houghton (2002)* proposed that the illusion of control is associated with underestimating competitive response, and underestimating competitive response increases the possibility of introducing pioneering products. *Simon and Houghton (2002)* also reasoned that entrepreneurs utilize limited amounts of information and may unintentionally allocate more attention toward positive information. Therefore, the law of small numbers is related to overestimating demand, which in turn increases the chance of introducing pioneering products (Simon & Houghton, 2002).

b) Antecedents of Biases

Wide arrays of factors have been identified that influence the use of this category of biases. As seen in Table 3, these antecedents (from information asymmetries, to search activity, to trust in networks, to business models) are diverse, dispersed, and largely unconnected. It is easier, therefore, to present all of the relationships in a table to offer a picture of the current state of the art.

Table I-3: Antecedents studied for biases in the “attributes” category

Articles	Antecedents	Bias	Relationships
Coval & Moskowitz (1999)	Information Asymmetries	Local Bias	Investment managers exhibit a strong preference for locally headquartered firms
Simon & Houghton (2002)	Search Activity	Illusion of Control	Proposed a positive relationship
	Personal Sources	Law of Small Numbers	Proposed a positive relationship
De Carolis & Saparito (2006)	Trust in Network	Representativeness	Proposed a positive relationship
	Shared Codes and Languages	Illusion of Control	Proposed a positive relationship

	Number of Structural Holes	Illusion of Control	Proposed a positive relationship
	Strength of Network Ties	Representativeness	Proposed a positive relationship
Burmeister & Schade (2007)	Business Model (B2C, B2B)	Status-Quo (Representativeness)	Entrepreneurs are more biased in B2C than B2B
Parwada (2008)	Advisory Opportunities	Local Bias	Strongly correlated
De Carolis et al. (2009)	Relational Capital	Illusion of Control	Relational capital of entrepreneurs increases illusion of control
	Extent of Social Network	Illusion of Control	Social network increases illusion of control.
Cassar & Craig (2009)	Failure of Start-Up Activity	Hindsight Bias (Representativeness)	Failing to develop startup activity demonstrates hindsight bias concerning the probability of venture formation.
Cumming & Dai (2010)	Diversity of Network	Local Bias	Wider or more diversified network reduces local bias in VCs
	Reputation	Local Bias	VCs with better reputation exhibit less local bias
	Co-Investors	Local Bias	VCs exhibit more local bias investing alone or when they are lead VCs
	Technology	Local Bias	VCs investing in technological industries tend to have more local bias

### c) Specific Future Work

Given the significant number of antecedents and the impacts studied, we group them based on their conceptual similarity. This grouping facilitates the understanding and synthesis of the work from the extant literature and uncovers areas with research gaps.

Table I-4: Overview of research on the impacts of biases in the “attributes”  
category

<b>Bias</b>	<b>Risk Perception, Evaluation of New Venture Decisions</b>	<b>Performance Measures</b>
Illusion of Control	✓	✓
Availability	✓	✗
Representativeness	✓	✓
Similarity	✓	✓
Law of Small Numbers	✓	✗

Table I-5: Overview of research on the antecedents of biases in the “attributes”  
category

<b>Bias</b>	<b>Individual Factors</b>	<b>Social Capital</b>	<b>Search Patterns</b>	<b>Business Model</b>	<b>Organizational Factors</b>	<b>Environmental Factors</b>
Illusion of Control	✗	✓	✓	✗	✗	✗
Availability	✗	✗	✗	✗	✗	✗
Representativeness	✗	✓	✗	✗	✗	✗
Similarity	✗	✓	✗	✓	✗	✓
Law of Small Numbers	✗	✗	✓	✗	✗	✗

Table 4 presents the overview of studies on the impacts of biases in the attributes category, and Table 5 presents the antecedents of those biases. A tick means that studies have been performed on the topic, and a cross indicates a gap. Tables 4 and 5 can be used to identify the research gaps. We examined all of the gaps, and each one of them appears to represent a future research opportunity. Here, we use three examples to provide a brief illustration.



First, one research opportunity could be to study the impact of experience on the illusion of control. It is known that the effect of experience on overconfidence (which has been studied in conjunction with the illusion of control) has resulted in diverse findings, which to date are inconsistent and contradictory (Hayward et al., 2006; Koellinger et al., 2007; Shepherd et al., 2003). Therefore, the relationship between experience and the illusion of control can be further explored.

Second, the impacts of some biases on performance measures are missing. Future studies of representativeness, availability and the law of small numbers should examine their performance implications.

Third, while in Table 4 or 5, a tick indicates that previous studies have been performed, it does not imply that research is complete regarding that topic. For example, how the illusion of control impacts risk-taking behavior within various contexts (complex, dynamic or hostile) deserves further study because a sense of control and confidence may enhance the use of less essential resources, increasing risk taking behavior (Hayward et al., 2006).

#### **1.4.3 ‘Psychophysics’ Category**

We will use a short example to illustrate this bias. The difference between a prize of \$10 and \$20 subjectively is perceived to be larger than the difference between \$1,010 and \$1,020 (J. Baron, 2007). In an entrepreneurial setting, we could ask “is there a significant difference between a VC investing \$1 million or \$1.1 million in a start-up versus 0.1 million or 0.2 million? What is the impact of this difference?” Investment decisions in entrepreneurship could be subject to psychophysics biases,

such as overweighting low probabilities and framing effects for gains and losses, and future studies could be highly pertinent. Unfortunately, to date, not a single study has studied biases in this category, which we believe is an important gap in the literature.

#### **1.4.4 Findings on the Research Designs and Methods Employed**

The reviewed studies occasionally use a variety of measurements for the same bias. For example, early measurements of overconfidence ask participants to establish a confidence interval for the correct answer when responding to general knowledge questions (Keh et al., 2002; Simon et al., 2000). The confidence interval approach to measure this bias was criticized by Mannes and Moore (2013) because it does not reveal how overconfidence and precision affect people's judgments in daily life. Therefore, these authors developed an experiment in which people estimate using feedback and payoff incentives. However, their experiment does not allow for the direct measure of confidence. Consistent across the issues pointed out by Mannes and Moore, general measurements that lack direct association with the case decision have been lamented as the reason for the insignificant results to date (Simon et al., 2000). Keh et al. (2002) also pointed out that future studies could use measures of overconfidence that are specifically related to the entrepreneurial context. It is important to note that when later studies used more specific measures, evidence of a significant relationship was found between overconfidence and the risk-taking behavior of entrepreneurs (Grichnik, 2008).

The problem of a multiplicity of measurements has appeared for many constructs. The illusion of control has been measured using the perceived accuracy in business prediction (Carr & Blettner, 2010; Keh et al., 2002) and confidence displayed in investment decisions (Langer, 1975; Meissner & Marburg, 2013).

The use of a variety of measures for the same construct does not provide consistency to allow for analyzing, comparing, or synthesizing findings. It is often hard to judge whether these various forms of operationalization are equivalent (i.e., measure the same underlying construct), and the usage of overlapping constructs, such as trust and distrust, lead to equivocal findings (De Carolis & Saporito, 2006; Gudmundsson & Lechner, 2013). For instance, Stefan and David (2013) extensively investigated the illusion of control. Future research would significantly benefit from a more careful consideration of the conceptualization and measurement of key constructs. To facilitate the accumulation and advance of the literature, the constructs should be well grounded in psychology while remaining relevant to entrepreneurship, and the empirical measures should match the context of entrepreneurship.

A notable methodological consideration is the need to theorize and measure uncertainty, not risk. When confronting risk, the decision maker knows the probabilities of all outcomes for all alternatives; however, when confronting uncertainty, probabilities are unknown or unknowable (Knight, 1921), which is the case in entrepreneurship (Baron, 1998; Busenitz & Barney, 1997). On a neurological level, decision-making under risk differs from decision-making under

uncertainty (Volz & Gigerenzer, 2012). Thus, entrepreneurship researchers must adopt uncertainty rather than risk in their research design.

Our review of the empirical literature also reveals that the vast majority of studies have limited themselves to the examination of direct impacts. Only a few have examined the moderating effects of contextual factors, such as risk perception (Grichnik, 2008; Keh et al., 2002; Simon et al., 2000), geographical, industrial and temporal similarity (Toft-Kehler et al., 2013) and prior experience (Carr & Blettner, 2010). The greater use of moderating- and intervening-effects models should provide interesting insights and help improve our understanding of the downsizing phenomenon.

Of additional interest is the possibility of nonlinear effects. One possibility is an U-shaped relationship, as we have found in studies regarding experience with VC's accuracy (Shepherd et al., 2003) and new venture performance (Toft-Kehler et al., 2013). Considering nonlinear effects would allow for greater precision in modeling the relationship.

This emerging field of research can benefit from more longitudinal studies (c.f., Carr & Blettner, 2010; Cassar & Craig, 2009; Townsend et al., 2010) to determine the causality of the relationship between biases and other factors. The overreliance of extant research on cross-sectional designs limits the ability to infer causality.

Multilevel analysis in entrepreneurial decision-making is a promising opportunity for future research (Shepherd, 2010). Multilevel studies can potentially reveal the biases of teams and biases of entrepreneurs in teams to reflect on how recursively

biases operate within a team and feedback on those biases. This topic is very pertinent because teams, rather than individuals, make many entrepreneurial decisions, yet to date almost all entrepreneurial biases studies (see Gudmundsson & Lechner (2013) for the only exception) are on the individual level. Future research can study if and how team-based decision-making is biased; it can also address how individual biases impact team decision-making. For example, recently, Gudmundsson and Lechner (2013) built a multilevel model explaining the interaction between individual cognitive biases and their influence on organizational decisions. Future research can also study how making decisions in a team may alter the biases of individuals, i.e., individuals may exhibit different biases or different degrees of bias when making decisions in a team versus making them alone.

Multilevel research can be used to examine the impact of cultural contexts. Extant research has examined numerous national settings aside from the US, including Singapore (Keh et al., 2002), Germany (Burmeister & Schade, 2007; Franke et al., 2006; Grichnik, 2008), Australia (Shepherd et al., 2003), Austria (Franke et al., 2006), the Netherlands (Ebbers & Wijnberg, 2012), Iceland (Gudmundsson & Lechner, 2013) and Sweden (Toft-Kehler et al., 2013). These studies provide insights into the generalizability of findings across cultural and national borders. Future research can include international samples in their research designs, as in Koellinger et al. (2007), who found that biased perceptions have a crucial impact on new business creation across 18 countries and that some nations exhibit

relatively high rates of start-up activity because their inhabitants are more overconfident than those of other countries. International studies would allow for a direct comparison of the antecedents and impacts associated with cultural and institutional differences.

Another gap is the need to consider sectorial regularities (Pavitt, 1984) because different sectors tend to have varying degrees of technological and market uncertainties (Simon & Houghton, 2002). Zacharakis and Shepherd (2001) identified the need to understand the incidence of biases across sectors. As a starting point, one could study biases in new ventures across sectors characterized by high, medium and low technologies.

#### **1.4.5 Discussion**

In many fields, heuristics and biases have been extensively studied and reviewed in their respective flagship journals, such as in medical decision-making (Bornstein & Emler, 2001; Elstein et al., 2002), jurisdiction (Langevoort, 1998), behavioral auditing (Shanteau, 1989), behavioral economics (Kahneman, 2003), and public governance (Rachlinski, 2004). Comparing those reviews with our review, we identified two important matters that research in entrepreneurial biases has yet to address.

First, debiasing, the study of overcoming bias (Pronin et al., 2002), has been widely studied in medical decision-making (Almashat et al., 2008), accountability (Kennedy, 1993), etc. However, debiasing has received little attention in management (Milkman et al., 2009). Only recently, in the setting of large

organizations, advice seeking (Alexiev et al., 2010; Meissner & Marburg, 2013) was investigated in terms of debiasing the illusion of control. These authors discovered that external advice seeking decreased the level of the illusion of control in top managers, while internal advice seeking increased the illusion of control. Future studies should examine how debiasing techniques, such as external and internal advice seeking, the use of effectuation and causation (Cueto & Zhang, 2014), and accessible content and experiences (Sanna & Schwarz, 2003), may function to improve the quality and accuracy of decision-making in entrepreneurship.

Second, decision aids, from simple checklists to expert systems, have been used in a range of applications involving complex decisions, such as health treatments and screening decisions (A. M. O'Connor et al., 1999; Stacey et al., 2011) and risk communication (O'Connor et al., 2003).

Decision aids are actually practiced in entrepreneurship in many forms. For example, VCs often use a spreadsheet or form containing a list of criteria to allow the systematic evaluation of new ventures (Petty & Gruber, 2011). Entrepreneurs use decision aids to select partners and suppliers. Therefore, the effect of decision aids on biases poses an interesting gap between entrepreneurship research and practice.

Entrepreneurial bias research is new and rapidly expanding, and therefore any pattern identified in this study is preliminary and subject to change as the field continues to evolve. This possibility is compounded by the fact that

entrepreneurial biases have been studied in association with a diverse range of constructs. Although it is not easy to identify clear and static patterns, after 15 years or so of entrepreneurial bias research, the two general themes appear to be the antecedents and the impacts of bias.

To examine entrepreneurial biases and their impacts, researchers contrast how a rational agent ought to behave and how people actually behave, with implicit or explicit prescriptions for how decisions might be improved. Whether a decision needs improvement depends on how a rational agent ought to behave - the notion of “rationality” (J. Baron, 1985). Therefore, understanding rationality in entrepreneurship is a necessary cornerstone for describing biases.

If entrepreneurship biases were derived by comparing against a normative model for unbounded rationality on belief, we would find different biases compared to using a normative model for creating more entrepreneurs or for increasing the success rate of entrepreneurship. The study of entrepreneurial bias must include a deeper philosophical type of reflection about what entrepreneurship ought to achieve, considering the context, the beliefs, the desires, and the bounded rational reasoning of the participants – a central challenge for entrepreneurship scholars.

Entrepreneurship researchers have identified a list of individual, organizational, and contextual factors that affect the emergence of bias. Meanwhile, recent psychology research proposes learning (Rieskamp & Otto, 2006), social processes and individual memories (Gigerenzer & Gaissmaier, 2011) as the basic and universal elements that affect heuristics and biases. Learning, social processes and



individual memories could serve as the important missing links between the identified antecedents of entrepreneurial biases and the usage of biases.

#### **1.4.6 Conclusions**

Most problems that worry the minds and hearts of entrepreneurs are computationally intractable – no machine or mind can find the optimal solution. Therefore, the study of entrepreneurial bias is relevant and interesting. Not only must entrepreneurs be aware of their biases but also those who work with entrepreneurs, such as corporate executives or even policy makers. Given the proactive role of entrepreneurship in the modern business environment, the entire business community could benefit from good research on entrepreneurial bias. In addition, entrepreneurship is the outlier at the fuzzy front end of business (Klotz et al., 2014), hence the study of biases in entrepreneurship has a profound implication for organization research and constitutes a great research opportunity. We hope that the comprehensive review of entrepreneurial bias research in this article provides scholars with a springboard from which they can conduct more systematic research to advance this field.

## 2. HOW DO THE APPROACHES OF ENTREPRENEURS AFFECT HOW BIASED THEY ARE?<sup>2</sup>

### 2.1 Introduction

Entrepreneurs exhibit great diversity in their approaches of new venture creations (Gartner, 1985). The varied approaches used in founding new ventures are often studied in contrast with each other, such as effectuation versus causation; external advice seeking versus internal advice seeking.

The approaches to new venture creation either involve or can reshape the heuristics (simple rule of thumb) of entrepreneurs (Haynie and Shepherd, 2009). The causation and effectuation approaches consist of integrated sets of observed heuristics entrepreneurs use (Read and Sarasvathy, 2005; Wiltbank et al., 2006). Different approaches to advice seeking frame and shape venture strategies, and thereby influencing organizational outcomes (Alexiev et al., 2010; Bonaccio and Dalal, 2006). Heuristics are typically studied together with their by-product of bias, known as the heuristics and bias research program in psychology and behavioral economics (Tversky and Kahneman, 1974; Wilcox, 2011).

However, there is a dearth of studies on how the new venture creation approaches of entrepreneurs affect how biased they are. Such questions deserve theoretical development and empirical examination, because 1) the actual approaches to new venture creation and the heuristics involved is key in unraveling the

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entrepreneurship phenomena, 2) entrepreneurs are highly susceptible to biases (c.f., Busenitz and Barney, 1997; Forbes, 2005; Simon et al., 2000), and 3) heuristics and biases are tightly coupled theoretically in their origin in psychology. We seek to address this issue by empirically examining how entrepreneurs who follow the new venture creation approaches of effectuation, causation, and internal and external advice seeking may be susceptible to biases. We develop theoretical reasoning between the new venture approaches and the biases of overconfidence and illusion of control and tested them empirically in nascent entrepreneurs.

Connecting new venture creation approaches with biases enhances the understanding of actual entrepreneurial processes. The approaches of effectuation, causation, internal and external advice seeking are found to have important and unexpected relationships with biases empirically. Empirical results from nascent entrepreneurs show patterns against the theoretical reasoning and empirical findings in general strategy literature. For example, in strategy literature internal (external) advice seeking is reasoned and found to increase (decrease) overconfidence and surprisingly nascent entrepreneurs experience the opposite effect. The relationships between effectuation/causation and illusion of control are also counterintuitive and against the previous proposals in effectuation literature (Kraaijenbrink, 2010; Ye et al., 2008).

In summary, this article puts forward the idea that the new venture creation approaches bring forth or down the biases the entrepreneurs have in interesting manners – which open ample avenues for further theoretical development and empirical examining in entrepreneurship research.

## **2.2 Theoretical Background and Development**

### **2.2.1 Effectuation/Causation**

The theory of effectuation is arguably the most important emerging theory in entrepreneurship (Fisher, 2012). Entrepreneurs who follow effectuation take goals as ever changing over time in new ventures. Rather than setting and exploiting goals, the effectual approach emphasizes the control over the available set of means, and effectual entrepreneurs starting with *who they are*, *what they know*, and *whom they know* to found ventures (Fisher, 2012; Wiltbank et al., 2006).

On contrary, causation describes an approach in which entrepreneurs set a goal and then choose a means to achieve that goal (Sarasvathy, 2001). Causal entrepreneurs recognize, identify and evaluate opportunities, set an opportunity as the goal, and make a plan and subsequently acquire resources to exploit the opportunity (Fisher, 2012).

The principles that characterize both effectuation and causation approaches are listed in Table II-1.

Table II-1: Principles that differentiate causation and effectuation - adapted from Dew et al. (2009) and Chandler et al. (2011) who developed based on Sarasvathy (2001).

<b>Issue</b>	<b>Causal Approach</b>	<b>Effectual Approach</b>
View of the future	Predictive, the future is framed as a continuation of the past, thus accurate prediction is relevant.	The future is unpredictable; therefore prediction is neither easy nor useful.
Basis for taking action	Goal-oriented. Goals determine actions and events in the venture.	Means-oriented, goals are changing all the time, thus actions are based on given means.
Predisposition toward risk and resources	Expected return. Entrepreneurs pursue the (risk-adjusted) maximum opportunity and raise required resources to do so.	Affordable loss, entrepreneurs follow opportunities without investing more resources that they can afford to lose.
Attitude toward outsiders	Competitive analysis of the market.	Partnership to create new markets.
Attitudes toward unexpected contingencies	Avoiding. Focus on accurate and careful prediction and planning.	Leveraging. Imaginative re-thinking of possibilities and continual transformations of targets.

The principles in both causal and effectual approaches are heuristics that entrepreneurs use in their actual decision making processes (Read and Sarasvathy, 2005). In fact, effectuation was initially proposed as an integrated set of observed heuristics used by experts entrepreneurs (Sarasvathy and Kotha 2001). For instance, the affordable loss principle and the principle of controlling the means are useful rule-of-thumb decision strategies not based on exhaustive-search or classical epistemic rationality (Baron, 2007; Tversky and Kahneman, 1974). In a similar manner, causation involves a set of heuristics (Wiltbank et al., 2006). Together, the two sets of heuristics characterized effectuation and causation form

two commonly-found yet contrasting approaches of founding new ventures (Read and Sarasvathy, 2005).

Heuristics are strategies using readily accessible, though loosely applicable, information to problem solving, when the exhaustive search is impractical. The effect of the heuristics is known as bias (Baron, 2007; Tversky and Kahneman, 1974; Wilcox, 2011).

Heuristics and biases occur in entrepreneurship due to many reasons, including, but not limited to, high uncertainty, information overload and velocity, the lack of historical information and organizational routines, high time pressures, etc. (Baron, 2004; Busenitz and Barney, 1997; Hayward et al., 2006; Holcomb et al., 2009; Simon et al., 2000). The study of entrepreneurial bias is a very important area in entrepreneurship (Krueger, 2005; Schade and Koellinger, 2007; Zhang et al., 2014).

Surprisingly to date, how effectuation and causation, as sets of heuristics, lead to entrepreneurial biases have not been studied much -only two conference papers have touched upon this issue conceptually.

Ye et al. (2008) conceptualized the relationships between effectuation and the degrees of threat biases, over-trust bias and illusion of control of entrepreneurs. Kraaijenbrink (2010) proposed that effectuation and causation to be associated with different types of biases, and he aggregated the biases into ‘effectuation-type biases’ and ‘causation-type biases’. For example, the author suggested that entrepreneurs particularly susceptible to an illusion of control, anchoring bias, loss

aversion, herd behavior, and/or availability bias use an effectuation approach more often than a causation approach (Kraaijenbrink, 2010). While both articles recognize the new venture approaches could be associated with different types of bias, they did not pick out, either through specific theoretical reasoning or empirical tests, the particular entrepreneurial bias that accompany effectuation and causation, as pointed out by the authors themselves.

The most studied biases in entrepreneurship are overconfidence and illusion of control (Zhang et al., 2014). Overconfidence describes the overestimation of one's own ability to affect the expected outcomes of task execution relative to others (Busenitz, 1999; Gudmundsson and Lechner, 2013). Illusion of control refers to the fact that an individual overemphasizes how much her/his skill may improve performance in situations where chance is the most responsible for the outcome (Langer, 1975).

Now we will elaborate how overconfidence and illusion of control accompany effectuation and causation specifically.

#### a) Hypotheses Development

Effectuation is characterized by a constant experimentation and feedback from external sources (Chandler et al., 2011; Sarasvathy, 2001). As part of the experimentation, the need for flexibility is essential (Sarasvathy, 2001) to take advantage of these new opportunities that could arise (Chandler et al., 2011).

Due to the experimentation and the flexibility associated with effectuation, entrepreneurs face different opportunities, decision frames, and business models using a diverse set of assumptions, and as a result, their confidence levels about their actual abilities and knowledge can be better calibrated. Entrepreneurs might

discover that their abilities and background are not as essential or useful as they thought to solve specific encounters before getting exposed to such diversity.

The effectual approach also lead to more concrete and tangible evidences, and allow entrepreneurs to better acknowledge their business environment, and therefore making the environment more familiar and less complex, factors that have been identified as antecedents of overconfidence in entrepreneurial decision-making (Hayward et al., 2006; Zacharakis and Shepherd, 2001; Zhang et al., 2014). The more concrete and tangible evidences also allow entrepreneurs to calibrate more accurately their expectancies with the outcomes of their ventures, lowering their possibility of overconfidence.

*Hypothesis 1a: Higher level of effectuation would lead to less overconfidence*

First, effectuation is not focused on prediction but instead on control. Effectual entrepreneurs always work with things that they can control (Sarasvathy, 2001).

Second, entrepreneurs following effectuation approaches conduct experimentation whose risks are well-controlled (Sarasvathy, 2001).

Third, following the heuristics of affordable loss, effectual entrepreneurs are less likely to approach uncontrollable projects and instead pursue those they can afford to lose (Chandler et al., 2011). This heuristic limits the chances that entrepreneurs may be out of control.

Taking together, the emphasis on control, the well-controlled experimentation, and affordable loss heuristics in the effectuation approach can lead entrepreneurs to believe they have good control of the tasks as well as the eventual outcomes of their ventures, thus higher levels of illusion of control.

*Hypothesis 1b: Higher level of effectuation would lead to more illusion of control.*

Entrepreneurs following causation approach engage in the forecasting, analysis and selection of long run opportunities, as well as designing and planning of business strategies (Chandler et al., 2011). Finer business plans show more



elaborate scenarios and contingency planning, which render decision makers more confident about their abilities to meet plans regardless of whether the planning and strategies help them to actually complete tasks (Buehler et al., 1997). Also Hayward et al. (2006) proposed that business planning by entrepreneurs intensifies the positive relationship between the environmental complexity and entrepreneurs' overconfidence. This can be due to the fact that forecasting, planning, and strategy formulation, unlike experimentation, do not produce evidence for entrepreneurs to calibrate their confidence upon.

Considering this logic, we claim entrepreneurs who follow causation approach experience higher levels of confidence.

*Hypothesis 1c: Higher level of causation would lead to more overconfidence.*

Entrepreneurs using an effectuation approach use experimentation to resolve firm specific uncertainty between firm actions and firm outcomes better than those following causation. When entrepreneurs know what specific firms actions lead to what specific outcomes, they may have a sense of control on their new ventures. Causal entrepreneurs who are less 'doers' than 'planners', and while detailed plans on paper can inflate the sense of overconfidence, they do not give people a strong sense that they are in control of the ventures.

Because causation does not involve regular trial-and-error but rather the prediction of an uncertain future based on pre-existing knowledge, it can be harder for entrepreneurs following this approach to feel the progresses of new ventures. The progresses of new ventures increase the illusion of control of the entrepreneurs (De Carolis et al., 2009).

*Hypothesis 1d: Higher level of causation would lead to less illusion of control.*

Note that in our study, we follow the heuristics and bias research program in psychology, taking effectuation and causation as sets of heuristics (rule of thumb) and study biases as their by-product.

However this does not rule out the fact that some preexisting biases in individual entrepreneurs can affect their approaches of founding new ventures. In Kraaijenbrink (2010), he proposed the relationships in both directions. Still in effectuation literature, the general approach is to take effectuation and causation as entrepreneurial expertise and approaches, and it is interesting to examine whether these expertise and approaches produce the by-product of biases.

### **2.2.2 Advice Seeking**

The approaches of new venture creation not only depend on the entrepreneurs but also get heavily influenced by people surrounding the entrepreneurs, such as mentors, partners, VCs, other entrepreneurs, their families and friends, etc. (Franke et al., 2008; Robinson and Stubberud, 2009; Vissa and Chacar, 2009).

Advice seeking is a top management team function. It (re)frames and (re)shapes firm strategies, and different approaches to advice seeking are known to influence organizational outcomes (Alexiev et al., 2010; Bonaccio and Dalal, 2006). Strategy literature has shown that external and internal advice seeking provide knowledge and new perspectives that could change the status quo and therefore are important determinants of a firm's exploratory innovation (Alexiev et al., 2010; Jansen et al., 2006). Internal advice seeking as well as advice seeking from executives in similar firms increase comfort as decision makers' beliefs are less likely to be challenged (McDonald and Westphal, 2003).

Advice seeking involves task-related information exchange, which improves the likelihood of accurate decisions (Bonaccio and Dalal, 2006; McDonald and Westphal, 2003). Additionally, advice seeking could suggest decision makers fresh

alternatives and new views that might have not been contemplated earlier (Alexiev et al., 2010).

Because of these properties, advice-seeking can serve to debias management decisions in established organizations (Meissner and Marburg, 2013). External advice seeking decreases the level of illusion of control, and internal advice seeking increases the illusion of control of top managers (Meissner and Marburg, 2013).

For entrepreneurs, advice seeking supports them with information and social capital from their networks (De Carolis and Saporito, 2006). The information from advice seeking is critical for creating or recognizing entrepreneurial opportunities (Klotz et al., 2014; Ozgen and Baron, 2007; Shane and Venkataraman, 2000) and the progresses of new ventures (De Carolis et al., 2009).

The social capital helps the entrepreneurs to be able to receive support for their new venture creation (Liao and Welsch, 2005). Social capital is known to impact entrepreneurial biases (De Carolis et al., 2009; De Carolis and Saporito, 2006). The characteristics of the social capital of the entrepreneurs, such as 1) the trust they have in their social networks, 2) the shared codes and languages with others in the networks, as well as 3) the structural holes and 4) ties in the social networks could impact the biases of overconfidence and illusion of control (De Carolis and Saporito, 2006).

To date, no studies have examined the relationship between the approaches of advice seeking and biases in new venture creation. Below we build theoretical

reasoning on why external and internal advice seeking can influence the degrees of biases of nascent entrepreneurs.

a) Hypotheses Development

External advice seeking increases new knowledge on environmental changes and opportunities and provides new perspectives challenging existing points of view (Alexiev et al., 2010; McDonald et al., 2008). When entrepreneurs seek for advice from experts, venture capitalists and other entrepreneurs, they get new knowledge and perspectives about the environment they are involved in as well as their ventures. The new knowledge and perspective may let them feel that they are not as prepared, leading to less overconfidence.

With new knowledge and perspectives, the environments become more familiar and less hostile for the entrepreneurs, and more familiar and less hostile environments reduce the overconfidence of entrepreneurs (Hayward et al., 2006; Simon and Shrader, 2012; Zacharakis and Shepherd, 2001).

*Hypothesis 2a: External advice seeking has a negative impact on overconfidence of entrepreneurs.*

External advice reduces the perceived control over decisions (Meissner and Marburg, 2013). External advice equip entrepreneurs with new information and perspectives about both the environments and their ventures (Durand, 2003), which may make the entrepreneurs feel that they no longer control the new venture creation as they used to believe before asking for advice.

We contemplate that external advice seeking would enable entrepreneurs to calibrate using multiple perspectives their sense of control and how much their skills can help them to control the results.

*Hypothesis 2b: External advice seeking has a negative impact on illusion of control of entrepreneurs.*

Internal advice from co-workers and personnel inside the ventures are known to lead to greater confidence of the capabilities in established firms (Meissner and

Marburg, 2013). Internal information in companies tend to have similar viewpoints and may be biased by not only neglecting outside information, but also discounting minority opinions from company insiders (Meissner and Marburg, 2013; Phillips, 2003).

As a consequence, the approach of using internal advice would not question but instead reinforce the existing knowledge and perspectives of the decision makers. Entrepreneurs face high levels of uncertainty in new venture decisions (Keh et al., 2002; Simon et al., 2000), so for them approaching internal source for advice can increase comfort as their beliefs are less likely to be challenged (McDonald and Westphal, 2003), increasing their levels of confidence. Meanwhile, the entrepreneurs can feel their environments remain unfamiliar and hostile, which increase the level of overconfidence (Simon and Shrader, 2012; Zacharakis and Shepherd, 2001).

Thus we argue that entrepreneurs who employ internal advice seeking approach are more overconfident.

*Hypothesis 2c: Internal advice seeking has a positive impact on overconfidence of entrepreneurs.*

Internal advice seeking utilizes internal information and perspectives within a firm, and may cause an overreliance on internal information and under utilization of important external information (Alexiev et al., 2010). This approach increases the sense of certainty, and increases the perception of control for the decision makers (Meissner and Marburg, 2013).

We argue similarly that relying on internal advice would make entrepreneurs believe that they can control the outcomes of their decisions, increasing the illusion of control.

*Hypothesis 2d: Internal advice seeking has a positive impact on illusion of control of entrepreneurs.*

## **2.3 Methods**

### **2.3.1 Sample and Data Collection**

We tested the model using a sample of entrepreneurs in ASECH (Association of Chilean Entrepreneurs). ASECH organizes stage 0 program in which experienced entrepreneurs transfer and share knowledge to nascent entrepreneurs during seven weeks. The nascent entrepreneurs in the stage 0 program are just starting to develop business ideas or ventures.

All the entrepreneurs enrolled in stage 0 courses from October to December 2013 were included in the sample. The initial targeted sample size was approximately 200 nascent entrepreneurs from three different cities, Santiago, Rancagua and Valparaíso. They received printed surveys in the first week of the stage 0 program. The questionnaire gathered data on the entrepreneur's experience levels, his or her decision-making processes and cognitive processes. We received 131 responses (65.5% of 200). Discarding incomplete surveys, our final data set consists of 95 responses for the model regarding overconfidence (47.5% of 200) and 104 responses for illusion of control (52% of 200).

The mean age of the sample is 33.2 years (s.d. 8.7); 43.5% are male and 56.5% female; and they have started in average 1.7 start-ups (s.d. 1.37). Regarding the level of education, 5.3% have only finished high school, 16.8% got technical degrees, 55.7% finished undergraduate studies, 18.3% achieved graduate degrees (masters or Phds.) and 3.8% are in the process of doing their undergraduate studies (neither completed or dropped out).

### 2.3.2 Measures

#### a) Independent Variables

- i) Effectuation and Causation: These constructs were measured using Chandler's et al. (2011), on a 5-point Likert scale. Effectuation was measured through three sub dimensions (experimentation, flexibility and affordable loss) in eleven items ( $\alpha=0,93$ ). Entrepreneurs were asked to answer based on the start-up phase of their venture and indicate the degrees to which they agree or disagree with each of the statements. For example, one item states: "We experimented with different products and/or business models." Causation was measured with seven items in the same procedure as effectuation ( $\alpha=0,91$ ). For example, one item states: "We developed a strategy to best take advantage of resources and capabilities".
- ii) External and Internal Advice Seeking: These constructs were measured with the 7-point Likert scales from Alexiev et al. (2010). Each measure has 3 items ( $\alpha=0,92$  and  $\alpha=0,96$ ). Respondents rated, for instance, the "frequency of external/internal advice seeking" as well as the "degree to which external/internal advice is sought regarding the current" and "future strategy" of the organization.

#### b) Dependent Variables

- i) Illusion of Control: This construct was measured based on Langer (1975) and Meissner and Wulf (2013). Participants were asked to decide in a hypothetical investment scenario of US\$70.000 in stock options. The questionnaire provided two investment alternatives: (1) Buying a portfolio of three stocks that are selected by an investment consultant and (2) purchasing a portfolio of three stocks selected by the decision maker himself in a situation that cannot be influenced by individual ability. A tendency towards self-selecting the portfolio

indicates an illusion of control bias, because the decision maker has the illusion to believe that he or she can impact the performance of the portfolio. From our sample, 40% presents higher levels of illusion of control and 31% moderate levels.

- ii) Overconfidence: This construct was measured based on Simon and Shrader (2012). It is a well-established format in entrepreneurial studies to measure overconfidence (Busenitz and Barney, 1997; Keh et al., 2002; Russo and Schoemaker, 1992; Simon et al., 2000). It contains 7 general knowledge questions related to entrepreneurship, technology and economy. For each question, the participants had two alternatives to choose from, and they had to choose one of the two as well as report the confidence level of their choice, between 50 and 100% (50% if they just guessed with any idea 100% if they are completely sure). Overconfidence is derived by subtracting the percentage of correct answers from the average percentage of confidence. The higher the difference, the more overconfident an entrepreneur is. From our data, we found that 86% of our sample was overconfident, consistent with previous findings that nascent entrepreneurs are overconfident (Forbes, 2005; Koellinger et al., 2007).

c) Control Variables

Control variables include: age, sex, level of education, number of start-ups that the entrepreneurs have been involved before the stage 0 program, including the ideas or ventures that they are developing at the moment, the phase of the start-up (Baron and Shane, 2007; Gielnik et al., 2014). Lastly, we control for risk propensity, a common control variable in numerous entrepreneurial bias research (Keh et al., 2002; Simon et al., 2000).



## **2.4 Results**

### **2.4.1 Descriptive Statistics**

Table II-2 presents the descriptive statistics for all the variables (mean and standard deviation) and the correlations among them.

### **2.4.2 Multiple Regression**

We performed two regression models to test our hypotheses. The first model considers the effect of causation, effectuation and advice seeking on overconfidence, testing Hypotheses 1a, 1c, 2a and 2c. The second model takes in account the effect on illusion of control, testing Hypotheses 1b, 1d, 2b and 2d. In order to verify the assumptions of multiple regression, we conducted a robust regression to analyze the presence of heteroscedasticity and outliers in the sample. The standard errors for both models in the normal regression and robust regression are similar, indicating that heteroscedasticity is not an issue in our model. In Table II-3 we show the results for the robust regression as we detected outliers in both models, which could have distorted the least squares estimation in the regression model (Verardi and Croux, 2008). Given our relatively small sample of nascent entrepreneurs, we chose  $p < 0.10$  as the level of significance, as in similar studies on entrepreneurial biases (Simon and Shrader, 2012).

Table II-2: Descriptive statistics and variable correlations

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1. Gender	0.57	0.50											
2. Age	33.2	8.89	-0.005										
3. Level of Study	3.0	0.87	-0.07	0.20 <sup>*</sup>									
4. Start-Ups	1.74	1.39	-0.08	0.07	-0.06								
5. Phase Start-Up	3.86	2.52	0.01	0.12	-0.006	0.29 <sup>***</sup>							
6. Risk Propensity	1.61	1.60	-0.05	0.03	0.16 <sup>+</sup>	0.003	-0.06						
7. Illusion of Control	2.84	1.16	0.04	-0.01	-0.09	0.07	0.04	-0.08					
8. Overconfidence	20.9	19.29	0.05	0.16	0.002	-0.02	0.08	-0.07	-0.10				
9. Causation	25.42	5.20	-0.07	-0.07	-0.01	0.02	-0.05	-0.14	-0.20 <sup>*</sup>	0.08			
10. Effectuation	39.82	6.82	0.10	0.03	0.14	-0.15 <sup>+</sup>	0.02	0.10	0.005	-0.17 <sup>+</sup>	0.43 <sup>***</sup>		
11. External Advice	15.72	4.2	0.10	0.11	0.16 <sup>+</sup>	0.09	-0.09	0.15 <sup>+</sup>	-0.17 <sup>+</sup>	0.17 <sup>+</sup>	0.29 <sup>**</sup>	.10	
12. Internal Advice	15.46	4.39	-0.05	0.05	-0.001	-0.10	0.15 <sup>+</sup>	-0.03	-0.07	-0.02	0.32 <sup>***</sup>	.20 <sup>*</sup>	0.50 <sup>***</sup>

<sup>+</sup> p < 0.1; <sup>\*</sup> p < 0.05; <sup>\*\*</sup> p < 0.01; <sup>\*\*\*</sup> p < 0.001

Table II-3: Robust regression results for overconfidence and illusion of control

Variables	Model 1 Overconfidence (n=95)			Model 2 Illusion of Control (n=104)		
<b>Controls</b>						
1. Gender	-	3.14	-	-0.20	-0.17	-0.2
2. Age	0.25	0.31	0.25	-	0.02	0.02
3. Level of Study	-1.93	-	-	-0.06	-	-
4. Start-Ups	-	-	-1.44	-	-0.10	-0.11
5. Phase of Start-Up	1.28 <sup>+</sup>	0.93	1.65 <sup>+</sup>	-0.01	-	-
6. Risk Propensity	-2.02	-1.11	-2.33 <sup>+</sup>	0.04	0.08	0.07
<b>Main Effects</b>						
1. External Advice Seeking	1.57 <sup>**</sup>		1.56 <sup>**</sup>	0.05 <sup>+</sup>		0.02
2. Internal Advice Seeking	-1.18 <sup>**</sup>		-1.18 <sup>*</sup>	-0.01		-0.02
3. Effectuation		-0.69 <sup>*</sup>	-0.63 <sup>*</sup>		-0.03 <sup>+</sup>	-0.02 <sup>+</sup>
4. Causation		0.62 <sup>+</sup>	0.58		0.05 <sup>*</sup>	0.05 <sup>*</sup>
F	3 <sup>*</sup>	2.08 <sup>+</sup>	2.32 <sup>*</sup>	1.26	2.06 <sup>+</sup>	1.32
R <sup>2</sup>	0.13	0.11	.18	0.05	0.09	0.1
Adj. R <sup>2</sup>	0.07	0.05	0.11	-0.005	0.04	0.02

<sup>+</sup> p < 0.1; <sup>\*</sup> p < 0.05; <sup>\*\*</sup> p < 0.01

Analyzing Model 1, we found significant support for Hypothesis 1a, which means that higher level of effectuation leads to less overconfidence. Hypothesis 1c was not supported, regarding causation increasing the level of overconfidence. We uncovered that external advice seeking is positively related to overconfidence ( $p < 0.01$ ) and internal advice seeking negatively related to the bias ( $p < 0.05$ ), which is opposite to what Hypothesis 2a and 2c predict. From our data, we discovered that from external sources, 52,7% of our total sample had higher preferences for asking family and 58,8% friends, while 79,4% other entrepreneurs, 48,1% mentors,

27,5% academics and 17,6% venture capitalists. Regarding internal advice seeking, 66,4% highly preferred advice from partners, 35,9% from high ranked employees and 25,2% from low ranked employees.

We found partial evidence regarding the fact that the phase of the start-up is positively related to overconfidence ( $p < 0.1$ ), as well as partial evidence that risk propensity was negatively correlated ( $p < 0.1$ ). Concerning the control variables, we removed gender and level of study, because they are not significant and the removal of them improves the adjusted  $R^2$ .

As shown in Table 3, we found that Hypothesis 2b and 2d are not supported, which means that the relationships between external/internal advice seeking and illusion of control are not significant in an entrepreneurial setting. We discovered a positive significant relationship between causation and illusion of control, opposite to what Hypothesis 1d predicts. We found partial support ( $p < 0.1$ ) for the relationship between effectuation and illusion of control (H1b), however in the opposite direction as predicted, which means that effectuation approach would lead to less illusion of control.

Regarding the control variables, we did not find any of them to affect significantly the model. Level of study and phase of the start-up are not correlated with the dependent variables at all, and without them, the adjusted  $R^2$  increases, so we removed those two.

## 2.5 Discussion

Our study investigated the effect of advice seeking and effectuation/causation on illusion of control and overconfidence.

We observed that effectuation leads entrepreneurs to decrease their levels of overconfidence as we expected. We identified several unexpected relationships (affecting the biases in the opposite directions) in our findings that we will discuss now.

We did not find support to the relationship between causation and overconfidence, and the results between effectuation/causation and illusion of control are totally unexpected. We uncovered relationship between causation and illusion of control to be positive and the relationship between effectuation and illusion of control to be negative –the opposite directions as we hypothesized. We argued that entrepreneurs following an effectuation approach will like to focus on what they can control and likely have an increased sense of control, similarly as proposed in previous literature (Kraaijenbrink, 2010; Ye et al., 2008). However, even effectual entrepreneurs tend to focus on control, and they likely have more control of their new ventures, they may not have an increased sense of feeling that they are in control. Rather it is the causal entrepreneurs who emphasize less control may have an inflated sense of feeling that they are in control.

Future research could try to untangle the ‘actual control’ versus the sense of feeling in control, which may be key to further understand the new venture creation.

Unexpectedly, we found that in entrepreneurship context external advice seeking is positively related to overconfidence and internal advice seeking is negatively related to the bias, which are the opposite as past findings of advice seeking and overconfidence (Alexiev et al., 2010; Meissner and Marburg, 2013; Sieck and Arkes, 2005).

One possible explanation rests on the differences in advice seeking between entrepreneurial and large organization settings. Entrepreneurs seek external advice often from people who they trust such as friends and family (Klotz et al., 2014) and people who like their ideas (such as other similar entrepreneurs and mentors who support them). These people tend to share common languages and codes, which increase their confidence levels (De Carolis and Saporito, 2006). Family is known to be a provider of emotional and moral support/encouragement (McKeever, 2005) and its feedback, likewise friends advice, is unlikely to be as useful as those from more professional sources (Robinson and Stubberud, 2009). The positive feedback leads to higher entrepreneurial expectancies, increasing overconfidence (Gatewood et al., 2002).

Internal advice seeking can differ a lot between those in new ventures and those in established firms as well. In new ventures, entrepreneurs seek advice from partners or early employees. Partners are often asked to join an entrepreneurship because they provide diverse and complementary backgrounds, capabilities, resources, and viewpoints. They cover important functions in new enterprises. They also usually have stake (stocks or options) in the company. In addition, dominating viewpoints may have yet to emerge and there is a lack of established hierarchy in a startup.

These make the partners and early stage employees to be more responsible, honest, forthright, and perhaps critical about expressing their concerns in the startup settings.

On top of that, there could be many internal functions that are yet to be setup (properly) in a startup, and internal advice seeking may reveal or even is intended to solve these critical issues. Internal advice seeking could often reveal the harsh reality inside a startup, and therefore lowers overconfidence. Future research should measure the main sources of external and internal advice seeking, in order to verify these possible explanations.

Seeking advice from this group of people can be very different from top management teams in a large established companies seeking advice from their managers deep in the hierarchy. Internal advice seeking in entrepreneurship therefore appears to be a uniquely different phenomenon from that in established firms.

The relationships between external and internal advice seeking and illusion of control are not significant in our small sample of nascent entrepreneurs. We built on Meissner and Marburg (2013), who found that external advice seeking leads to a decrease of illusion of control in top managers of large organizations, as they perceive a reduced control over the decision because of the new information and perspectives from the external sources, meanwhile internal advice seeking intensifies this bias, as internal information might be biased not only by overlooking outside information, but also by disregarding minority opinions from firm insiders. Even though we used the same measures as Meissner and Marburg

(2013), our results do not conclude whether advice seeking is associated with illusion of control in entrepreneurship. We performed an independent regression only considering external and internal advice seeking, and we still found that internal advice seeking was not significant and external advice seeking only partially significant (see Table 3). Possibly as the new venture context is very uncertain (Baron, 1998; Simon et al., 2000), the advice does not change much the sense of control. The level of uncertainty is still high independently of the advice and information received, thus the sense of control could be in generally unrelated. Still, there is a need to breakdown the types of advice seeking in entrepreneurship beyond external and internal as in the strategy literature. The breakdown could be on the role of the persons (mentors, family, friends, customers, suppliers, VCs, partners, early stage employees, etc.) and the type of advices entrepreneurs seek (investment, operation, marketing, technology, collaboration, etc.). This breakdown enables more delayed analysis on entrepreneurial advice seeking.

### **2.5.1 Contributions**

We contribute to the effort of analyzing new venture creation approaches as set of heuristics and analyze them using the lens of heuristics and bias research program from behavioral economics. Specifically, this study adds to the identification of antecedents of entrepreneurial bias, a burgeoning stream of literature (Zhang et al., 2014). Effectuation, causation and advice seeking have intricate connections with many antecedents of entrepreneurial biases identified to date, such as social capital (De Carolis et al., 2009; De Carolis and Saporito, 2006), experience (Hayward et



al., 2006; Koellinger et al., 2007; Shepherd et al., 2003) and familiarity, complexity and hostility of environments (Hayward et al., 2006; Simon and Shrader, 2012; Zacharakis and Shepherd, 2001). Understanding the heuristics and biases in entrepreneurship is important for both descriptive science and possible prescriptive science (the possibility of debiasing).

Taking effectuation and causations as heuristics and following the theory of heuristics and biases research program in behavioral economics allow us to examine the bias accompanying the sets of heuristics. We identified the relationships between effectuation and causation with overconfidence and illusion of control, the most notably entrepreneurial biases. In addition, our work is the first to take the relationships between effectuation and entrepreneurial bias to an empirical level, advancing the previous conceptual works (Dew and Sarasvathy, 2002; Kraaijenbrink, 2010; Ye et al., 2008). In the process, we found many unexpected findings, e.g. the proposed negative relationship between causation and illusion of control (Kraaijenbrink, 2010). We confirm that the new venture creation approaches have interesting relations with the biases the entrepreneurs have.

Finally, we encountered surprising results in entrepreneurial advice seeking, getting empirical results on the opposite directions to the previous results in large organizations (Meissner and Marburg, 2013). This provides evidence that entrepreneurial advice seeking is different from advice seeking in established firms as in general strategy literature. We analyze the possible explanation of the

unexpected results and proposed a breakdown of advice seeking based on entrepreneurship phenomena.

### **2.5.2 Limitations and Future Considerations**

We completed our study with rigor and care, however it has limitations. The cross-sectional design of the current study constrains our ability to make causal inferences empirically. Additionally, another limitation of our study is common method variance. We utilized several design solutions, such as careful wording of the questions, collection of the data during a three month period for different classes and cities and diverse response formats for different variables, as suggested by Pace (2009) to minimize problems that might arise from common method variance or the use of subjective measures. However, the use of longitudinal studies and more experimental settings, and the incorporation of appropriate marker and instrumental variables could help address this issue (Podsakoff et al., 2012).

## **2.6 Conclusions**

The venturing processes of effectuation and causation and the patterns that entrepreneurs seek advice have intricate relationship with the biases the entrepreneurs exhibit. The relationships are found to manifest differently in nascent entrepreneurs as compared to managers in established firms. Effectual processes lead to less overconfidence and causal processes increase the illusion of control, while external and internal advice seeking affect overconfidence in unexpected manner, on contrary to findings on managers in large organizations.

Not only do the surprising results arise from studying advice seeking on biases formation in entrepreneurship, this study also refines the understanding of effectuation and causation principles as a set of heuristics and unveils their associated bias. In doing so we hope to contribute to the knowledge for both researchers and practitioners on how new venture processes and practices may lead to specific biases.

(2.2)

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## **APPENDIX**

# APPENDIX A: STATA OUTPUTS MODEL 1 – OVERCONFIDENCE

. regress overconf effect caus consext consinter age startups phase riskprop						
Source	SS	df	MS	Number of obs = 95		
Model	5817.66545	8	727.208181	F( 8, 86) = 2.38		
Residual	26269.2398	86	305.456277	Prob > F = 0.0229		
				R-squared = 0.1813		
				Adj R-squared = 0.1052		
Total	32086.9053	94	341.350056	Root MSE = 17.477		
overconf	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
effect	-.6261768	.2926174	-2.14	0.035	-1.207881	-.0444727
caus	.5806229	.3988759	1.46	0.149	-.2123162	1.373562
consxt	1.563922	.5715995	2.74	0.008	.4276199	2.700224
consinter	-1.182382	.558948	-2.12	0.037	-2.293534	-.0712303
age	.2477356	.2387126	1.04	0.302	-.2268092	.7222805
startups	-1.435843	1.378251	-1.04	0.300	-4.175716	1.304031
phase	1.652725	.7508245	2.20	0.030	.1601358	3.145315
riskprop	-2.333423	1.237015	-1.89	0.063	-4.792527	.1256816
_cons	16.05545	14.95254	1.07	0.286	-13.66922	45.78011

Figure A-1: Stata Output Multiple Regression Overconfidence



<b>. regress overconf effect caus consexter consinter age startups phase riskprop, vce(r)</b>						
Linear regression			Number of obs = <b>95</b>			
			F( 8, 86) = <b>3.49</b>			
			Prob > F = <b>0.0016</b>			
			R-squared = <b>0.1813</b>			
			Root MSE = <b>17.477</b>			
overconf	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
effect	<b>-.6261768</b>	<b>.2909176</b>	<b>-2.15</b>	<b>0.034</b>	<b>-1.204502</b>	<b>-.0478518</b>
caus	<b>.5806229</b>	<b>.3513679</b>	<b>1.65</b>	<b>0.102</b>	<b>-.1178732</b>	<b>1.279119</b>
consexter	<b>1.563922</b>	<b>.4809301</b>	<b>3.25</b>	<b>0.002</b>	<b>.6078646</b>	<b>2.519979</b>
consinter	<b>-1.182382</b>	<b>.4781305</b>	<b>-2.47</b>	<b>0.015</b>	<b>-2.132874</b>	<b>-.2318901</b>
age	<b>.2477356</b>	<b>.3001568</b>	<b>0.83</b>	<b>0.411</b>	<b>-.3489563</b>	<b>.8444275</b>
startups	<b>-1.435843</b>	<b>1.521293</b>	<b>-0.94</b>	<b>0.348</b>	<b>-4.460073</b>	<b>1.588388</b>
phase	<b>1.652725</b>	<b>.9087046</b>	<b>1.82</b>	<b>0.072</b>	<b>-.1537194</b>	<b>3.45917</b>
riskprop	<b>-2.333423</b>	<b>1.325228</b>	<b>-1.76</b>	<b>0.082</b>	<b>-4.967888</b>	<b>.3010429</b>
_cons	<b>16.05545</b>	<b>15.79021</b>	<b>1.02</b>	<b>0.312</b>	<b>-15.33446</b>	<b>47.44535</b>

Figure A-2: Stata Output Robust Multiple Regression Overconfidence

## APPENDIX B: STATA OUTPUTS MODEL 2 – ILLUSION OF CONTROL

<b>. regress ill_control effect caus sex age startups riskprop</b>						
Source	SS	df	MS	Number of obs = <b>104</b>		
Model	<b>12.2302011</b>	<b>6</b>	<b>2.03836686</b>	F( 6, 97) = <b>1.68</b>		
Residual	<b>117.990953</b>	<b>97</b>	<b>1.21640157</b>	Prob > F = <b>0.1351</b>		
Total	<b>130.221154</b>	<b>103</b>	<b>1.26428305</b>	R-squared = <b>0.0939</b>		
				Adj R-squared = <b>0.0379</b>		
				Root MSE = <b>1.1029</b>		
ill_control	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
effect	<b>.0255137</b>	<b>.0176378</b>	<b>1.45</b>	<b>0.151</b>	<b>-.0094924</b>	<b>.0605199</b>
caus	<b>-.0517725</b>	<b>.0225754</b>	<b>-2.29</b>	<b>0.024</b>	<b>-.0965783</b>	<b>-.0069666</b>
sex	<b>.1691325</b>	<b>.2232489</b>	<b>0.76</b>	<b>0.451</b>	<b>-.2739549</b>	<b>.6122198</b>
age	<b>-.0218981</b>	<b>.0141829</b>	<b>-1.54</b>	<b>0.126</b>	<b>-.0500471</b>	<b>.006251</b>
startups	<b>.0963404</b>	<b>.0881635</b>	<b>1.09</b>	<b>0.277</b>	<b>-.0786397</b>	<b>.2713205</b>
riskprop	<b>-.0814074</b>	<b>.0709361</b>	<b>-1.15</b>	<b>0.254</b>	<b>-.222196</b>	<b>.0593811</b>
_cons	<b>3.727623</b>	<b>.8603481</b>	<b>4.33</b>	<b>0.000</b>	<b>2.02007</b>	<b>5.435176</b>

Figure A-3: Stata Output Multiple Regression Illusion of Control

. regress ill_control effect caus sex age startups riskprop, vce(r)						
Linear regression			Number of obs = <b>104</b>			
			F( 6, 97) = <b>2.06</b>			
			Prob > F = <b>0.0644</b>			
			R-squared = <b>0.0939</b>			
			Root MSE = <b>1.1029</b>			
ill_control	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
effect	.0255137	.0142642	1.79	0.077	-.0027968	.0538242
caus	-.0517725	.0213208	-2.43	0.017	-.0940883	-.0094566
sex	.1691325	.2285369	0.74	0.461	-.2844501	.622715
age	-.0218981	.0143745	-1.52	0.131	-.0504275	.0066314
startups	.0963404	.0739354	1.30	0.196	-.0504009	.2430817
riskprop	-.0814074	.064611	-1.26	0.211	-.2096423	.0468274
_cons	3.727623	.7907187	4.71	0.000	2.158266	5.296981

Figure A-4: Stata Output Robust Multiple Regression Illusion of Control

**APPENDIX C: LETTER OF SUBMISSION CHAPTER 1 OF THE THESIS TO  
THE ISI JOURNAL “ENTREPRENEURSHIP THEORY AND  
PRACTICE”**

03-Jan-2014

Dear Mr. Cueto:

A manuscript titled The Antecedents and Impacts of Biases in Entrepreneurship – A Systematic Review and Synthesis (ETP-2014-01-OA-0003) has been submitted by Dr. Stephen Zhang to the Entrepreneurship Theory and Practice.

You are listed as a co-author for this manuscript. The online peer-review system, Manuscript Central, automatically creates a user account for you. Your USER ID and PASSWORD for your account is as follows:

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Thank you for your participation.

Sincerely,  
Entrepreneurship Theory and Practice Editorial Office