Introduction

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The ideal firm has been studied and analyzed by numerous researchers over several centuries. Yet today little is known about what makes one firm successful and another fail. From the perspective of economics, the firm is an entity whose sole purpose is to maximize shareholders' wealth. The firm does so by applying strategic steps using its internal resources and external opportunities to navigate the turbulent seas of the market. While there is nothing specifically wrong with this view, it treats all resources as commodities, each with a particular supply and demand curve that can be manipulated by the firm to its benefit. Although some economic theories ask what the purpose and the processes of the firms are, these theories do not ask much about the purpose and the processes of the people who make up the firm.

Economic theories analyze the employees of the firm in the context of contracts between principals and agents. The principal-agent theory assumes predictable automatons bargaining along the lines of their own supply and demand curves in game-theoretic steps, following mathematical laws of optimization based on axioms that are frozen in *ceteris paribus* moments of time.

Principals and agents maximize their benefits and minimize their efforts for the purpose of maximizing utility to self. They have no emotions or personal lives that may interfere with the goal of the firm any more than what the principal already knows, which is the agent's tendency to shirk at every opportunity. But is this really what a firm is all about? If it were this simple, there would be very little need to model and simulate firm strategy, market ups and downs, and financial crises. Economic theories suggest that complex models are necessary because the markets are uncertain and decision options must be simulated in uncertain environments. And so decision theory has advanced. But decision theory still looks upon the humans within the firm as automatons whose actions can be calculated by simply finding a mathematical optimum of all possible outcomes. It has been believed that humans only care about the outcomes of their choices and that their preferences are thus revealed by the outcomes they choose.

In the late 1970s and early 1980s clever and simple economic games were used to test if humans really do behave in accordance with the maximization concept. One after the other, these games showed that humans appear not to maximize benefits to self but to consider the welfare of others. At first these findings were dismissed. It was suggested that people did not understand the games or that they did not decide the same way in classrooms and computer laboratories as they do in real life; but after 20 years of robust stable results in various cultures and levels of civilization, humans consistently defy the rules of self-maximization in order to consider the benefit of others. When modern technology allowed researchers to peer inside the physiology of the human brain while playing these games, it became clear that the mistake is on the part of those economic theories that considered only the outcome as important. When technologies became available to stimulate the chemical components (hormones and neuropeptides) of some of the decision-making processes, it also became clear that often there is more value found in maximizing the decision-making process than maximizing the outcome itself. Humans are rewarded by giving as well as by receiving, and taking may feel more punishing than rewarding. If giving is as rewarding as receiving, the outcome need not be the one that is maximized; the process itself may be better maximized for a self-regarding rational agent! Emotional states are influenced by hormones and hormone level variations are influenced by the environment. Both hormones and emotions influence the decisions that humans make.

The latest warning about the lack of applicability of mainstream economic theories is the global financial crisis that started in 2007. This event gave pause to economic purists of academia, business and government. Now is a good time to evaluate what really is happening within the firm and why and where does the human fit into the process of forming the firm. This book opens the black box of decision-making by evaluating factors other than outcome that influence what happens to the firm.

THE REASON FOR THIS BOOK

In August 2007 two of the three editors of this volume, Angela A. Stanton and Mellani Day, met by accident at the Philadelphia airport after attending a very hot and humid conference of the Academy of Management (AOM). They did not actually know each other prior to this airport meeting. They ended up sitting next to each other in a cafeteria awaiting their flight and Stanton accidentally bumped into Day's table, nearly spilling her drink. A conversation started and they discovered that they had both left the AOM a day earlier than planned. Stanton complained about

her experience since she found all presentations that she had attended were based on ‘old-fashioned’ research. Everything she saw and heard completely ignored new findings in brain research – the heart of her field of specialty: neuroeconomics. Coincidentally, during the last meeting Day attended, the following comment was made: ‘if only we could peer into the mind of the entrepreneur’. Not surprisingly, their conversation accelerated with hot ideas and great excitement. The chance meeting turned into an online ‘Google document’ collaboration, digging deeper into how neuroeconomics may enhance entrepreneurial research. In this book the terms ‘firm’ and ‘entrepreneur’ are often used as synonyms. Although the prevailing view is that the firm is a legal entity while the entrepreneur is an individual and one might argue that the two are distinct, it is the core aim of this book to realign the widespread concept about the firm as a ‘thing’ to what it really is: the decisions of the individuals within. The firm henceforth gains the personality of the people who make up the firm.

Soon Isabell M. Welpé joined the discussion online. It took little time to decide to present along the concept of neuroeconomics and the firm at the 2008 AOM meeting in Anaheim, California. The editors of this book organized three very successful and well-attended sessions at the conference: a symposium, a workshop and a caucus, each identifying how neuroeconomics may be used for the purpose of identifying the personality, the role and the decision methods of the entrepreneur. Importantly, the word ‘neuroentrepreneurship’ was coined by the three editors of this volume on the last day of the conference. Neuroentrepreneurship is the application of neuroeconomic tools and methods to entrepreneurial research. This book represents the foundation, gives meaning to and defines some of the possible variables used by neuroentrepreneurship to aid the development of this new field of study.

OVERVIEW

The book is made up of five interconnected sections that revolve around the examination of what is inside the ‘black box’ of the human brain and how it works as an economic decision-making and processing center. The ‘black box’ concept is used in many fields and is typically associated with a mysterious object or process. In this volume we evaluate the firm by considering the human decision-making process in the brain as the ‘black box’ and the connection of what is in the ‘black box’ to the success of the firm. Chapters of this volume examine the external forces that act upon this ‘black box’ and how forces inside this mysterious processing machine respond to external stimuli.

In Part 1, we examine the black box from the outside by looking at factors of uncertainty as they affect decision-making. There are three chapters in this part; two discuss how humans feel and relate to uncertainty and the third chapter questions whether all entrepreneurial activities are conducted at a conscious level.

An important factor in the success of the firm is how the firm responds to market uncertainties. The problem with this sentence is that the firm does not respond to anything; people who work for the firm act on their beliefs and they represent the firm in its actions. Thus it is people who respond to market uncertainties and it is they who navigate the market under the auspices of the firm. How do people relate to having to make decisions in an uncertain environment? Do all people relate to uncertainty in the same way? Entrepreneurial researchers have shown the complexity of people's behavior when dealing with uncertainty. Indeed, the definition of uncertainty itself is variable. Two chapters open this volume by introducing the variety of definitions of uncertainties as well as some of the issues the many definitions have caused.

In Chapter 1, Helen Pushkarskaya, Michael Smithson, Xun Liu and Jane E. Joseph describe an extended definition of uncertainty that includes some subjective factors, such as intent and ignorance. They define uncertainty differently from mainstream economic theories. Economic theories view risk as an objective phenomenon that, when it exists, can mathematically be resolved. Pushkarskaya and colleagues show that various perceptions of risk modify how risk is experienced in various ways. For example, they argue based on experimental results that being unaware of something as a result of deliberately withheld information by others is treated differently in the brain of the unaware subject from the situation when information simply does not exist.

By contrast, in Chapter 2 Angela A. Stanton and Isabell M. Welpe define choice under uncertainty in a more classical way. They argue that using a variety of definitions without standardization, research in entrepreneurship results in conflicting findings. In the management literature the talent of the entrepreneur is synonymous with risk handling ability. However, management researchers use the models of economic theories of uncertainty, in which risk is defined as a simple gamble of full information akin to casino roulette or the purchase of lottery tickets. Entrepreneurs seldom have full information and thus seldom play gambles. Rather an entrepreneur is surrounded with ambiguity, a type of risk that arises from having partial information. Entrepreneurial research, in line with the management literature, uses tools that measure risk and conclude solution to ambiguity. Stanton and Welpe question whether this approach is mathematically, logically and epistemologically acceptable and if research

on brain processes can justify the use of risk as proxy for measuring ambiguity. Since neuroeconomics research found that separate brain regions respond to risk and ambiguity and that frequent natural hormonal variations influence perception bias in risk assessment, it is not possible to suggest that ambiguity may be resolved by computing it as risk, as some economic theories suggest and which management research so often applies.

In Chapter 3 Eden S. Blair reviews research on how unconscious processes impact business behaviors and decisions. Unconsciousness is defined as a mental process that is not consciously realized, planned or done. Blair looks at how memory and heuristics allow individuals to make decisions unconsciously. Unconscious processes cannot be measured using conventional social science methods that can be successfully used to analyze the processes of the conscious mind. Blair discusses the pros and cons of the different ways of measuring unconscious processes.

Chapter 4 opens the second part in the book. In Part 2 the authors ‘open the black box’ of the information processing and decision-making brain. The discussion is moving toward human emotions and their influence on decision-making. In Chapter 4 Paul J. Zak and Amos Nadler discuss the importance of trust. Trust in businesses has recently hit an all-time low. Yet trust is essential to effective management. Zak and Nadler present new findings from brain science, much of it from work done at Zak’s laboratory, identifying how managers can build trust. They introduce a simple tool, the O-Factor (O-Factor), and provide suggestions for its use. They suggest the following ingredients of the trust recipe: praise, anticipation, delegation, transparency, empathy, autonomy and authenticity. Zak and Nadler’s studies show how these techniques activate regions of the brain that produce trust. As trust increases, management becomes more effective; higher morale, productivity and profits follow.

In Chapter 5 Donald T. Wargo, Norman A. Baglini and Katherine A. Nelson look at some of the causes of the global financial crisis. Financial markets around the world experienced profound losses in 2008 and 2009 as a result of the worldwide credit crisis. The crisis was caused by the collapse of the market for collateralized debt obligations (CDOs). These CDOs were bonds backed by mortgages on houses in the USA but were bought not only by US banks but also by many municipalities and by European banks. ‘Greed and fear’ appear to be the overwhelming cause of this financial crisis. Wargo and colleagues show a biological cause; the reward and loss system of the brain. They argue that reward is normally counterbalanced by risk perception and greed is counterbalanced by fear of loss. They conclude that as a result of the sophisticated financial engineering tools that purportedly spread the risk, the perception of risks

was removed by making risk invisible or difficult to perceive. The human reward and loss system, the danger-alerting system, was bypassed.

Chapter 6 opens Part 3, in which we start our exploration of what happens inside the black box of the brain and why. In this part we introduce a commonly misunderstood topic: stereotyping. Stereotyping is a 'negative' word, meaning that it implies a particular look, a particular behavior, or a particular ability or lack of ability that is generalized. Although this topic is usually shunned, here we face stereotyping head on. In addition to showing that it exists, we also take it a step further and evaluate the evolutionary roots for the reasons and meaning of stereotyping and how that may impact the firm.

Laura J. Kray, Connson C. Locke and Michael P. Haselhuhn present two experiments in Chapter 6 that explore what stereotypes mean in terms of beliefs about innate ability differences between men and women. As negotiations are important in corporate success, stereotyping might have a significant influence over who is negotiating with whom and with what success. With their first experiment, Kray and colleagues demonstrate that gender stereotype endorsement impairs performance for positively stereotyped negotiators relative to negatively stereotyped negotiators. Stereotyping decreases joint performance by causing both negotiators to overlook commonalities. In their second experiment they explore whether reactions to stereotype endorsement are moderated by negotiators' implicit beliefs about the malleability of performance. Kray and colleagues demonstrate that stereotype reactance (a performance boost by the negatively stereotyped negotiator) is promoted by a belief that negotiating ability is malleable. Fixed beliefs about negotiating ability render negotiators immune to the endorsement of gender stereotypes.

In Chapter 7 Kristina M. Durante and Gad Saad explore factors that are associated with stereotyping women. Women have made significant progress in today's workforce, with an increasing number of women holding senior corporate positions. Research shows that evolutionary and biological factors influence strategic shifts in women's behaviors, cognitions and emotions: the monthly ovulatory cycle. This chapter is not discussing changes in women's behaviors, cognitions and emotions as a result of premenstrual syndrome (PMS). Rather Durante and Saad look at the evolutionary role of those changes, which then manifest themselves in the stereotyped term PMS. As the probability of conception increases by an ovulating egg each month, women experience shifts in their social motives and behaviors. But these shifts are strategic from the perspective of evolution. For instance, research has found that near ovulation women become more attracted to masculine and socially dominant men, and are more competitive with other women. As these behavioral changes have serious

evolutionary strategic roles in terms of ensuring the best possible chance for the mother's and the child's survival, they impact women's decision-making across multiple social arenas – including the business setting. Durante and Saad examine how a woman's fertility status might affect her behavior and performance within the workplace and discuss the implications that these shifts in behavior may have on intra-office relations.

In Chapter 8 Angela A. Stanton provides an unusual look at how men's hormonal variations affect the workplace. While women's hormonal variations and the corresponding physiological mechanisms that influence their mood, motivation and behavior have received significant scientific attention, male hormonal variations are typically only discussed in terms of aggression and dominance without context. Similarly to females, males experience hormonal variations that are shaped by selection forces in response to environmental stimuli. Stanton synthesizes extant literature on male hormonal variation in response to environmental stimuli that manifests itself as competitiveness, aggression, dominance, status-seeking, risk-taking, wealth creation and mate selection and shows how female hormonal cyclicity affects male hormonal variability. Men and women respond to each other's hormone concentrations by subconsciously reading each other's facial cues. As such, hormonal communication between the sexes is constant and is a key element of doing business inside the firm.

In Chapter 9 Donald T. Wargo, Norman A. Baglini and Katherine A. Nelson discuss the importance of understanding the mechanisms underlying the economic model of decision making and the dopamine-mediated reward system, which is the neurological correlate of decision-making. The dopamine-mediated reward system has profound implications for decision-making in the firm. They suggest that there are three interconnected decision-making systems in the human brain and dopamine is the principal neurotransmitter that is involved in these three systems. They present current neuroeconomic research on how the dopamine reward system is used to make economic decisions.

Chapter 10 opens Part 4 of the book. In this part we move from what is in the black box and how it reacts to the environment to how the black box influences the entrepreneur and entrepreneurial proclivity. Since risk is considered to be synonymous with the entrepreneur in most management literature, the brain's functions that identify and respond to risk and the associated strategic decision-making processes are important to understand. In Chapter 10 Theresa Michl and Stefan Taing introduce us to the differences between economic and neuroscientific understandings of entrepreneurial strategic decision making. There are no agreed upon strategic decision-making models in economics that can provide a realistic estimation of risk and ambiguity in light of the brain processes associated

with monetary and social rewards. Although aspects of uncertainty and reward are assumed to be integrated in strategic decision-making processes, the sub-processes are not fully understood. Michl and Taing draw a theoretical comparison of cognitive and affective aspects of uncertainty and reward in strategic decision-making processes through neuroscientific and economic findings. They find the conclusions in these research fields only partly congruent. They apply the similarities and the differences by extending strategic decision-making models in economics and provide propositions for how to evaluate uncertainty and reward in strategic decision-making.

In Chapter 11 Robert Smith provides an overview of emerging research in entrepreneurship and neuroeconomics from a theoretical and practical perspective. He maps and unites research in a narrative that is understandable to economists, entrepreneurship scholars and the social scientific communities. Smith links disparate theories and discusses them at a layman's level. He develops a conceptual model that illustrates linkages with other human drives, such as spiritual fulfillment and libido. He questions whether some people are genetically and psychologically hard-wired to become successful entrepreneurs. Finally, he considers the theoretical contributions, which point to the emergence of a new genre of entrepreneurship research that is both scientifically and empirically rigorous.

In Chapter 12 Frédéric Basso, Laurent Guillou and Olivier Oullier introduce the sensory theory of value (STV) in the context of entrepreneurship. Their theory originates in Friedrich Hayek's seminal work that brought together neurophysiology and political economics. Main elements are discussed in light of recent developments in economic, cognitive and brain sciences. They argue that STV is a theory of mind. They show that determining market prices, as a cognitive mechanism, provides information on the behavior of the entrepreneur. Finally, they discuss the relevance of prices as sensory data, through recent advances in the fields of motor cognition, social coordination dynamics and neuroeconomics.

The final part in this volume, Part 5, is about corporate ethics and the influence of culture. This part opens with Chapter 13 by Donald T. Wargo, Norman A. Baglini and Katherine A. Nelson, who discuss ethics from a neuroeconomic perspective. Recent research in the areas of moral psychology, biological anthropology, neuroscience, game theory, behavioral economics, neuroeconomics and institutional theory present overwhelming evidence that ethical decisions are not made rationally. They are emotional and are typically made under stress.

Chapter 14 by John F. McCarthy, Carl A. Scheraga and Donald E. Gibson discusses cultural differences in negotiation and conflict management from the perspective of neuroeconomics. In negotiation and conflict

management situations, understanding cultural patterns and tendencies is critical to whether a negotiation will accomplish the goals of the parties involved. McCarthy and colleagues suggest that a fine-grained approach is needed that examines cultural differences below the level of behavioral norms. Drawing on recent social neuroscience approaches, they propose that differing negotiating styles may not only be related to differing cultural norms, but to differences in underlying language processing strategies in the brain. They suggest that cultural differences may influence neuropsychological processes, and they anticipate that individuals from different cultures would exhibit different neuropsychological tendencies. Consistent with their hypothesis, they show in an experiment, using EEG measured responses, that native German-speaking participants took significantly more time to indicate when they understood a sentence than did native English-speaking participants of the same sentence (each time the native language of the participant was used). In a second experiment the same phenomenon was observed when participants were presented with positively and negatively framed situations which required decisions to be made. These results are consistent with the theory that individuals from different cultures develop unique language processing strategies that affect behavior. A deliberative cognitive style used by Germans, meaning logical assessment of sentences based on their structures, could account for these differences in comprehension reaction time relative to Americans, who looked more toward the meaning of the sentences rather than their structures. Their findings demonstrate that social neuroscience may provide a new way of understanding micro-processes in cross-cultural negotiations and conflict resolution.

In Chapter 15 the final chapter in this volume, Constant D. Beugré introduces a new discipline that he calls ‘neuro-organizational behavior’. Beugré defines this new discipline as one that studies the impact of brain structures on human behavior in organizations and as a sub-field of organizational behavior. It integrates three levels of analysis: neural, mental and behavioral and considers neural circuitry as a key point in explaining human behavior in organizations. Beugré construes this new discipline as multidisciplinary that draws its knowledge and tools from various established disciplines, such as cognitive psychology, neuroeconomics, neuroscience, organizational behavior and social cognitive neuroscience.

We hope that you enjoy reading every chapter of this book. As the numerous chapters associated with the firm suggest, the firm needs new theories, definitions and models that are more person-centric in order to successfully explain how the firm achieves its goals and how it may optimize its performance using its resources. Both emotional and cognitive factors belong to the resources of the firm. These resources are rich with

potential, but only to those firms who understand the neuroeconomics of the firm: neuroentrepreneurship. Since neuroentrepreneurship is a new field, we hope to have made the readers curious enough to follow new research that will most certainly reshape our understanding of the firm.