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Effectuation and Rational Choice Theory: Implications for our
conception of rationality

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"But wherever our rational argument, like the wind, takes us, that's where we should go"

- Platoⁱ

"There must be a Zen-like art to reawakening fresh perception of reality in individuals attached to particular formalisms, formulas, and abstractions, but it would require considerable skill, because you have to enter into the formalism while retaining awareness of the ontological context it supposedly represents: you have to reach the heart of the conceptual labyrinth where the reifier of abstractions is located, and then lead them out, so they can see directly again the roots in reality of their favorite constructs, and thereby also see the aspects of reality that aren't represented in the formalism, but which are just as real as those which are."ⁱⁱ

ⁱ(Badiou, 2013)

ⁱⁱ(Porter, 2012)

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Abstract

Effectuation is a bottom-up empirical theory of how expert entrepreneurs make decisions. Rational Choice Theory is a top-down mathematical theory of how rational agents make decisions. It appears that Effectuation Theory is precisely the inverse of Rational Choice Theory.

This inversion entails that successful, expert entrepreneurs behave in the way that is arational, or more irrational than less successful entrepreneurs. This is one of the possible consequences of Effectuation Theory for Rational Choice Theory (RCT). In this thesis we explore this possible consequence of Effectuation Theory for Rational Choice Theory, and for our conception of what it is to be rational.

After having provided a formal argument that if the implication above holds RCT is an incomplete theory of rational behavior, we propose a solution to the problem it generates by redefining rationality as a contextual endeavor, that is, an endeavor dependent on the particular problem-space an agent finds itself in.

Keywords: rationality, rational choice theory, effectuation, effectuation theory, decision technology, decision making, heuristics and biases, heuristics, fast and frugal, ecological rationality, naturalistic decision-making, entrepreneurial cognition, entrepreneurship studies, judgement and decision-making, meta-rationality, contextual rationality

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Pai e Mãe: Isto é para vocês, literalmente.

Notes on Terminology

In what follows two streams of literatures will be analyzed. One comes from Entrepreneurship Cognition and the other from Judgement and Decision-Making (See sections 2.2 and 2.3 for the main sources of literature analyzed for each respective field.. Although these fields share concepts, they treat them at different levels of granularity. Hence, it is important to clarify at what level we are treating them.

In effectuation theory literature causal rationality, causal logic, and causal thinking are used as synonymous that refer to the type of thinking that RCT is a formal example of. Effectual logic and effectual thinking are used to refer to the thinking that the theory of Effectuation describes.

Likewise, in effectuation theory literature, the difference between Expected Utility Theory (how to follow Rational Choice Theory in the context of decisions that are probabilistic and not certain) and Rational Choice Theory is not made. Both are treated under the umbrella of Rational Choice Theory.

In this work we follow these conventions.

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1 Introduction

1.1 Rationality, Effectuation, and Rational Choice Theory.

Imagine the following situation: John is a serial entrepreneur, who is in his office. He is surrounded by a team of scientists with their stereotypical lab coats and writing pads. John is talking on his smartphone to a long-time partner, and comments on how we would like to start a new venture based on (among other considerations) the fact that if it fails, he can afford the loss. At the moment he utters these words the scientists exchange looks and the head-scientist mumbles “*mhmm very irrational mhmm*”. John had made 6.5\$B selling his most recent venture.

The scenario strikes as absurd. John is a *very* successful entrepreneur and yet is deemed as irrational by the scientists. “But wait!”, you protest: “Aren't we just being fooled by randomness? (Taleb, 2004) Is it not the case that John is indeed irrational, but also lucky, and thus the seeming absurdity?” A splendid point, but no.

Johns' behavior is not only the result of a sort of survivorship bias in which we select winners and then see how what they do differs from what they should (probabilistically) have done and then use that as a counterpoint to the theory of how one should behave rationally.

In fact, this is how John's behavior was found, but it seems like it is not an artifact of the law of large numbers, but instead an internally consistent framework of behavior that leads *in a predictive fashion* to better results within the domain of entrepreneurship.

And hence, the absurdity is maintained. We have a theory that claims to be a total theory of what is rational behavior in the form RCT. But, the behavior of (in expectation) successful entrepreneurs falls outside of the domain of and contradicts this theory. That is, the theory cannot account for this behavior and its success.

That is the problem we set out to solve: “*If Effectuation Theory shows that RCT is not a total theory of rational behavior, what implications does that have for our conception of what is and is not rational?*”

At the risk of spoiling the rest of the work, in the next following bullet points we sketch out our answer to this question.

- V Both Effectuation and RCT are theories of rational behavior.
- V (The previous point implies that) Rationality is context-dependent, or *contextual*.

We argue the points above in chapter 3. One should note that this conclusion entails a problem: *the impossibility of rationality*. If RCT and Effectuation Theory are both theories of rational behavior *and* they recommend different, mutually incompatible,

actions for the same problem, then one will always be at best irrational according to one theory and rational according to the other. This is the *second problem* that Effectuation causes, being a theory of rational behavior. In chapter 4 we attempt to solve it by reconstructing the framework of rationality and we suggest that:

- V To be rational is not to conform to *the* theory of rationality, but to apply the proper decision-technology to the environment in which the agent finds itself.
- V The above consists in being Meta-rational.
- V The (proposed) theory of Meta-rationality fulfills important desiderata for a theory of rationality that RCT does not (in the face of the implication of Effectuation derived before).

Together, these five bullet points form our theoretical answer to the question of what Effectuation Theory implies for our conception of rationality, *if* indeed it causes a contradiction between what the existing formalized theory of rationality specifies as rational and what our intuitions say is and is not rational.

Following we provide a short overview of the context of the problem: we describe RCT and Effectuation Theory, and their significance.

1.2 Effectuation Theory and Rational Choice Theory: counterintuitive implications

A theory of rational action defines what behaviors are rational (Spohn, 2002) by deriving the consequences of our reflected and equilibrated intuitions about what behaviors are rational (Norman, 2013). The foremost normative theory of rational action is rational choice theory (Hands, 2013).

Effectuation is a theory of how entrepreneurs act in their environment. It is noteworthy that effectuation can be summarized as being an inversion of Rational Choice theory (Dew & Sarasvathy, 2002) ¹.

Despite the fact that effectuation is not formalized yet, the fact that it is an inversion of Rational Choice Theory entails one of two things:

- (a) People following effectuation theory are arational
- (b) People following effectuation theory are less rational (on a continuum) than those following RCT (and hence more irrational).

¹ A “reasonable” inversion that is. For example. RCT implies gain maximization, and Effectuation implies loss minimization. Unreasonable inversions would be gain minimization and loss maximization, but these would be arational - that is, not even irrational - not lacking *in*, but beyond the scope of reason.

(“Rational” is used in at least two meanings in the literature. First, “rational” is a category of behavior; “rational” characterizes behavior that is due to choices that aim at goals, norms or values. According to this categorical sense, “rational” contrasts with “arational”, that is behavior that is due neither to choice nor thought (Dew, Read, Sarasvathy, & Wiltbank, 2009). The other way in which “rational” is used is characterized by its opposite “irrational”. “Irrational” means behavior that is due to choice or thought but that fails to conform to the standards of rationality (Baron, 2000).)

Effectuation Theory was derived from protocol analysis of how successful expert entrepreneurs problem-solve, with an expert entrepreneur operationalized as a “person who, either individually or as part of a team, had founded one or more companies, remained a full-time founder/entrepreneur for 10 years or more, and participated in taking at least one company public” (Sarasvathy, 2008, p.21)

Given that Effectuation Theory was derived from successful expert entrepreneurs, and that it commits one to act in a way that is the inverse of RCT (Dew & Sarasvathy, 2002), then a consequence of the current formalization of Rational Choice Theory (Chater & Oaksford, 2012) is that the people that succeed and become experts in entrepreneurship are less rational than those that do not succeed and do not become experts.

This consequence follows from effectuation being the inverse of RCT. Being the inverse, it will provide the inverse principles for decision-making, and, hence, one following them will be either outside the scope of RCT (and thus arational, according to RCT) or as far off from RCT as possible whilst still being within its scope (and thus irrational, according to RCT).

According to RCT, behavior closer to its maxims is more rational. According to Effectuation Theory, in entrepreneurship this behavior will lead to failure. And conversely, the behavior that leads to success in the domain of Entrepreneurship (according to Effectuation Theory) is irrational or arational (according to Rational Choice Theory).

And hence the problem. It seems intuitively wrong to claim that - in the domain of entrepreneurship - expertise and success, on the one hand, and rationality, on the other, are inversely related. Our intuitive sense of what is rational implies that rational people are more likely to succeed, not less likely; that experts are more likely to be rational, not irrational. (That this intuition is present is seen by the backlash to the research implicating experts to be irrational. See “A history of “Rationality” on Chapter 2.)

It is this crucial contradiction between what RCT says is rational, and how Effectuation Theory says entrepreneurs behave that we aim to eliminate in this thesis. We do so by proposing that what Rational Choice Theory is not a total theory, but

just a special theory, applicable to a special problem-space.

In the same way that Newtonian Physics was “correct” for objects that were slow and large, and was incomplete, and in fact a special case of a larger theory, we claim that RCT is a special case of a larger theory, as is Effectuation Theory.

Our proposal is thus: *Both* Effectuation Theory and Rational Choice Theory are theories of rational behavior. Each is a special case of a more general theory. Each is defined by a particular problem-space, with specific characteristics.

This proposal solves the apparent contradiction between successful entrepreneur expert behavior and our current definitions of rationality, by redefining rationality as a contextual endeavor (That is, what is rational is not acontextual, but is differently defined for different environments). It opens, in turn, a new problem. One of the benefits of RCT was that it was applicable to all situations: if one wanted to be rational, one just had to follow RCT. If there are various theories, each applicable in a particular problem-space then we need to know what theory each problem-space calls for. We name this idea of how to know which theory to apply to which problem-space the theory of Meta-rationality.

1.3 The theories

In this section we briefly overview Rational Choice Theory, Effectuation theory, and their significance. (And, hence, the significance of this thesis)

Rational Choice Theory

Rational Choice theory is a normative theory choice of judgement and decision-making. That is, a theory of how people *ought* to make choices and judgments. (Shafir & LeBouef, 2002)

It imposes consistency conditions on choices, values, and beliefs. According to it, one is rational to the extent that one abides to these conditions.

RCT holds that if agent's preferences respect certain axioms, then people are behaving as if they were maximizing a utility function u over which their preferences are defined. That is, to say, given a set of options, they choose their preferred option.

An extension of RCT is Expected Utility Theory which treats rational choice in uncertain scenarios (Baron, 2000). In this case, EUT claims, one *ought* to multiply the utility (desirability) of a certain scenario over the likelihood of the scenario occurring. And after making this calculus, one should decide for the point with the highest value.

An example is in order. Going back to John, making his first appearance in

section 1.1, we should have (according to EUT) multiplied the utility of success (let's say a reasonable estimation for his gains was 10.000 dollars) times the probability of success (let's say 50%) and subtract from it the (dis-)utility of failure (let's say 12.000 dollars) times the probability of failure (50%). This would lead him to see that his expected utility in going forward with the venture is of minus 1000 dollars, and thus that it is *irrational* for him to participate. (Hence our scientist's mumbling.)

RCT's significance

The importance of Rational Choice Theory cannot be overstated, within the context of economics and social sciences. It has been extremely generative as a model for social and economic behavior (Baker & Welter, 2014); it is one of the theoretical cornerstones of neoclassical economics (Weintraub, 2010) ; it is a crucial consideration for international rela and law (Guzman, 2008); it is the basis of game theory (Neumann & Morgenstern, 1947), and of the field of Judgement and Decision-making.

As Tetlock and Mellers (2002) write about the Heuristics and Biases program of Judgement and Decision-Making - which takes Rational Choice Theory as a normative ideal: “For better or for worse, and opinions are divided on this score, the research program of Daniel Kahneman and the late Amos Tversky now represents psychology’s leading intellectual export to the wider academic world. Scholars with little else in common, from such far- flung fields as medical diagnosis, the law, public opinion, international relations, and microeconomics, share some working knowledge of the principles that Kahneman and Tversky have invoked to explain why people stray from classic benchmarks of rationality for judgment and choice: principles such as heuristics, framing, mental accounting, and the psychophysics of gain, loss, and probability-weighting functions.”

Effectuation

Effectuation (Sarasvathy, 2001b) is a theory of how expert entrepreneurs act. It originated due to a think-aloud study that aimed to answers the questions of “What commonalities and differences exist in the decision making processes of a group of expert entrepreneurs who start with the same idea for a new venture and face exactly the same set of decisions in building it?” and “What makes entrepreneurs entrepreneurial?”.

The two questions happened to share an answer. What makes entrepreneurs entrepreneurial is that they adopt a unique approach to problem solving, and this

unique approach can be summarized by the precepts of Effectuation Theory.

Importantly, besides being a descriptive theory of how entrepreneurs decide, Effectuation also happens to be a direct inversion of the problem framing, solution process, decisional principles and underlying logic of Rational Choice Theory (Dew & Sarasvathy, 2002). We expand on these in the second Chapter “Literature Review: ET & RCT”.

An example is in order. John, our serial entrepreneur, having heard of the possibility of a new venture reasoned that whilst his downside is bounded by his original investment his upside is unknown. He thus makes use of two of the fundamental principles of Effectuation – Affordable Loss and Bird-in-Hand. He looks at what he stands to lose, not what he stands to gain, and focuses on limiting the former, and he starts from means, and not ends, he starts with a mutual commitment with his long-time partner to start a venture, with the means he has, not with a goal to be met by assembling means as in RCT.

Note how there is no calculus going on, but just the following of decision-making guiding principles.

Effectuation's significance

Effectuation hasn't had the time to establish itself that RCT has had. Nonetheless, it is a fertile avenue of research in Entrepreneurship studies (“Entrepreneurial effectuation: a review and suggestions for future research,” 2012), having been co-created by one of the most influential researchers in the field of rationality and decision-making - Herbert Simon.

Moreover, the proposed theoretical relationship between its core constructs (effectuation and causation, and uncertainty) has recently been validated (Chandler & DeTienne, 2011) and a meta-analytic review of close to 10,000 new ventures found a positive relation between the principles of effectuation and new venture performance (S. Read, Song, & Smit, 2009). (As the theory predicts would happen.)

1.4 Counterintuitive implications

We now proceed to illustrate how the descriptive claims made by the theory of Effectuation cast doubt over the possibility of RCT being a comprehensive theory of rational behavior. We do not aim to provide a strict demonstration (that is provided below, in chapter 3 “Contextual Rationality”) but rather to illustrate the problematic.

Looking at the examples provided above, we saw how according to RCT, John – mentioned first in the introduction - *ought to* create logically possible scenarios of how to go about a new venture – in this case “Venture” vs “No-Venture”. He then should assess the probability of each scenario coming about, and its desirability.

Finally, he ought to multiply the probability of each scenario by its desirability and use the new values to order the possible scenarios by preference. He then *ought* to attempt to bring the scenario with the highest value into place (Chater & Oaksford, 2012). Doing so, he would follow the rules of RCT, and of normative theories of rationality more generally (Assuming his scenarios were logically possible, and that his probability distribution was consistent.)

This approach entails (1) the possibility of anticipating scenarios and (2) the existence of preferences for different scenarios. (Otherwise there would be no scenarios to order, and no ordering possibility.)

According to Effectuation Theory (Sarasvathy, 2001b), neither of these *necessary entailments* of RCT is available to entrepreneurs. They cannot and indeed they do not try to predict future scenarios; nor do they have pre-existing goals or preferences through which they could be ranked.

What entrepreneurs actually *do*, according to Effectuation Theory (Sarasvathy, 2001b), is to *leverage* the existing means available to them to *allow* goals to *emerge*. These goals are turned into interactions and strategic commitments that generate further means and further goals, this cycle then repeats itself.

From the difference between what RCT says entrepreneurs *ought to do* and what Effectuation Theory *describes* entrepreneurs as doing two possible implications follow. Either (a) it is the case that the entrepreneur behavior doesn't conform to the precepts of RCT, and hence it is outside its scope: it is arational behavior; or, (b) it is the case that it is merely irrational, but more irrational than someone who followed RCT precepts.

This is the counterintuitive implication that the empirical work of Effectuation Theory causes:.. Either (a) it is the case that the behavior that defines successful, expert entrepreneurs - according to Effectuation Theory - is, according to RCT, arational; or, (b) it is the case that the behavior that Effectuation Theory describes as being characteristic of successful expert entrepreneurs is considered by RCT as more irrational than the behavior of - in expectation - less successful non-expert entrepreneurs, acting in a way that resembles RCT more closely.

1.5 The importance of this work

On the importance of rationality research

"But why stress the motivational aspect at the beginning of a scientifico-philosophical thesis? Should not a work of this kind be devoid of all motivation and be purely "rational"?

Alas, these are but common misconceptions of what science and rationality are

about.

Science, as every human endeavor, is performed by living, breathing, in-the-flesh human beings, motivated by very human traits such as curiosity, ambition, creativity, pleasure, spirituality. Thus, *whatever rationality and science are about, they are certainly never without vibrant life.*" (Greindl, 2010, preface)

There is a common misconception that rationality, logic, and science generally are cold, and lifeless. Whilst this may be the case for some fictional characters like Mr. Spock, it is certainly not the case for those that care about rationality.

Richard Larrick wrote in the "Debiasing" chapter of the 2004 the Blackwell Handbook of Judgment and Decision Making: "(...) the sincere desire of many people in this field is to discover flaws not for their own sake, but with the intention of improving decision making." (Larrick, 2004)

Reading through authors that want to improve decision making, it is clear that the values behind it are deeply, characteristically *human*.

Keith Stanovich, one of the most industrious contemporary researchers of rationality (K Stanovich, 2011) is adamant about why studying rationality and how to increase it is essential. He lists various costs for irrationality: from a worse quality of living, to an increased chance of death, to having a society collapse (KE Stanovich, 2009). (The last being a historical example referring to Albania where in 1977 *one half of the adult population* had fallen victim to Ponzi schemes. Eventually both the scheme, the economy, and the government of Albania collapsed. Between 1,700 and 2,000 people died ((Jarvis,, 2000))

Lilienfeld *et. Al* (Lilienfeld, 2009) published a position paper "Giving Debiasing Away - Can Psychological Research on Correcting Cognitive Errors Promote Human Welfare?". The paper argues that psychology should take a stand to combat ideological extremism, inter and intragroup conflict; and that it could do so by working to increase human rationality thus *promoting human welfare*. Milkman *et al.* (Milkman, K. L., Chugh, D., & Bazerman, 2009) wrote on "How can Decision Making be improved" in which they have a section detailing why decision-making improvement is necessary. They write "decisions shape important outcomes for individuals, families, businesses, governments, and societies, and if we knew more about how to improve those outcomes, individuals, families, businesses, governments, and societies would benefit." and "errors lead decision makers to undersave for retirement, engage in needless conflict, marry the wrong partners, accept the wrong jobs, and wrongly invade countries."

Gunther Greindl (Greindl, 2010), explored in his doctoral dissertation, *Living in a Natural World*, the idea that "(...) Contrary to what many people believe, a rational, (...) view of the universe is not detrimental to, nay, even encourages creative thought and compassionate action."

One may disagree with the means, but the examples above make one thing

clear: decision-researches want to improve decision-making and increase rationality in an attempt to reduce human problems, promote human welfare, and help human values be achieved.

The study of rationality and decision-making is therefore motivated by a *deep* reflection of the researchers humanity, manifested in the desire to contribute to improving the welfare of others.

On importance of solving this contradiction

The desire of promoting human welfare and the acceptance of Rational Choice Theory as a *normative theory* of rational behavior have led to numerous interventions attempting to bring observed behavior closer to RCT normative ideals.

Within the Heuristics and Biases tradition of JDM (described in detail in the following section), it is hypothesized that deviations from normativity are caused by the failure of cognitive shortcuts which, by failing, create biases. Biases are the result of mental shortcuts (heuristics) leading to normatively incorrect decisions (Kahneman & Tversky, 1974). (See (Nisbett & Ross, 1980) (Kerr, MacCoun, & Kramer, 1996) (Arnott, 2006) (Carter, Kaufmann, & Michel, 2007)

Efforts at avoiding biases are “debiasing” interventions - “(...) approaches and sets of actions aimed at reducing the detrimental influence of decision biases and as such to enhance the rationality and effectiveness of decisions” (Kaufmann, Michel, & Carter, 2009, p. 86).

RCT aims at being a total theory of rational behavior. For a total theory, the existence of exceptions is lethal. These exceptions can be excused when it is a minor detail that is being overseen, but not when it is a pattern of behavior so large (the behavior of expert entrepreneurs) that another theory (Effectuation Theory) has been created solely to explain it, as is the case.

We claim that the fundamental contradiction that Effectual Theory causes (That successful expert entrepreneurs are irrational and that rational people would - in expectation - do worse in the domain of entrepreneurship.) is a critical blow to RCT.

Whatever questions the validity of RCT risks the potential of current efforts of increasing human welfare by teaching people to decide in a fashion that is more similar to what RCT prescribes. (Under the assumption that RCT totally captures rationality, and that increased rationality will lead to increased welfare.) This being the case, it is vital to generate conceptual clarification - or run the risk of having our efforts at increasing human welfare be misguided at best, and counterproductive at worst.

In the next section we describe in more detail the proposed solution to the dilemma pointed to before. We expand on how it is that we will solve the contradiction between our intuitions and our formal theories, hence generating the

necessary conceptual clarification.

1.6 Contextual Rationality

We will demonstrate that an elegant way of dealing with the problem is to propose that RCT is not *the* theory of Rational Action and, instead, to claim that it is *a* theory of Rational Action *for* a particular problem-space defined by some precise characteristics. That is, to contextualize it. And, conversely, that Effectual Theory is a (non-overlapping) theory of Rational Action for a different, non-overlapping problem-space with precisely different characteristics.

This proposal contextualizes rationality. Rationality shifts into being the adequate mode of action for a *certain context*.

1.7 Outline

The thesis proceeds as follows: In the first part of Chapter 2 we perform a selective review of the literature on RCT and on rationality. We provide an overview of RCT and trace the history of rationality in three fields: philosophy, mathematics, and rationality. We end with a summary of the approach in Judgement and Decision-Making that accepts RCT as a normative theory of rational behavior. In the second part of Chapter 2 we provide a short history and overview of Effectuation Theory. These give the reader sufficient background to understand the impact of Effectuation Theory on Rational Choice Theory.

In chapter 3, having reviewed the theories, we derive 2 arguments and one lemma. The first argument claims that “RCT violates our desiderata for a normative theory of rational action” and is a formal version of the intuitions that were appealed to in the introduction. The first lemma claims that “There are two different theories of rational action, and one cannot behave in according to both concomitantly” and is used as a stepping stone to the second argument that concludes that “Rationality is contextual”. We alternate arguments with analysis's of the premises, and interpretations of the argument's consequences.

In its totality, this chapter serves as an analytical description of the implications of the findings of Effectuation Theory for Rational Choice Theory. It further serves as an the exploration of the problems that are generated through the idea of contextual rationality: the suggestion that there are different theories of rational action depending on the characteristics of the problem-space in which the agent finds itself.

In chapter 4, we derive more fully the consequences of the arguments that have been made. We propose desiderata for a theory of rationality, after having

shown in the previous chapter how RCT fails these reasonable desiderata. We also explore the consequences of the concept of contextual rationality. The fundamental problem that it opens is that if, in fact, theories of rationality are dependent on the context – the characteristics of the problem-space – one finds itself in, then there is the need of a (meta-)theory of rationality that specifies which (object-)theory of rationality is to be used at each time.

To solve this problem we propose a theory of meta-rationality that fulfills the named desiderata, to a greater extent than RCT does. Further, to avoid possible confusion between meta (which theory to choose) and object theories of rationality (how to act) we introduce the concept of “Decision Technologies”, - a set of rules and tools that help us make better decisions (Edwards & Fasolo, 2001) - and use it to rebrand existing (object) theories of rationality.

We then build off this scaffold to define meta-rationality: “An agent is meta-rational to the extent that it uses the appropriate decision-technology for the problem-space the agent finds itself in.”.

In chapter 5, we summarize what has been done, point to limitations of the work, and suggest future avenues of research. We conclude the work with a brief investigation of why one should care about rationality, and about what is and isn't rational. (Or rather, a brief justification of why we do.)

In the Appendix we have inserted three figures. We do so to provide a sort of visual guide to the thesis and facilitate understanding. The first elucidates the relationship between the various components of contemporary theories of choice, the second illustrates how Effectuation highlights a need to consider something that hasn't been considered thus far, the third relates the proposed relationship of meta-rationality to the concepts of the previous figures.

2 Literature Review: RCT & ET

2.1 Introduction

This chapter is divided in two parts. The first part provides an overview of RCT and of the history of rationality. The second part illustrates the history of Effectuation Theory and provides a summary of it.

In the first part we begin by providing an overview of Rational Choice Theory. We define it and make its axioms explicit, show how it differs from Expected Utility theory, and replicate some existing arguments in its defense as a theory of rational choice.

After that, we trace the history of rationality through philosophy, mathematics and psychology. We do so because rationality in some sense lives in all of these disciplines, at different levels of abstraction in each. Some philosophical intuitions about rationality were formalized within mathematics into Rational Choice Theory which was then adopted by most, but not all, of the research programs within the Psychology of Judgement and Decision-Making (Gigerenzer, 2008). Questioning the existing formalization of rationality - as this thesis will do - requires stepping back and look at what it was that the formalization was attempting to formalize. This being the case it is crucial to have a historical sense of the development of the concept.

We finish the first part by overviewing the most successful program of Judgement and Decision-Making- This program has taken RCT to be a normative theory, and, over the years, provided numerous examples of how humans fail to act in the way it prescribes.

We dedicate the second part of the present chapter to tracing the history of effectuation, from the original research motivation and study to the state of current research in the field, ending with a summary of what effectuation is. This is the case since understanding the theory of effectuation and its origin as a descriptive theory is crucial to understanding the argument that is to be made in the next chapter.

2.2 Decision-Making Frameworks, RCT, and Rationality

(This section does not aim at being an encompassing review, but just at giving the reader enough context to understand the problems the thesis aims to solve. For more encompassing reviews see (Hammond, McClelland, & Mumpower, 1980) (Fischhoff, 1988) (Yates, 1990)(Koehler & Harvey, 2008) (Highhouse, Dalal, & Salas, 2013) (Highhouse et al., 2013))

2.2.1 RCT and Rationality

Some traditions have equated rationality with optimal goal fulfillment (KE

Stanovich, 2012). Rational Choice theory is a *normative theory of judgement and decision-making* that aims at *formalizing optimal goal fulfillment* (KE Stanovich, 2012). That is, it is a theory of how people *ought* to make choices and judgments to optimize goal fulfillment.

RCT is part of an ensemble of normative theories of Judgement and Decision-Making, which include logic and probability as well. Logic provides consistency conditions on sets of beliefs (One cannot believe A and $\sim A$); probability theory enumerates consistency conditions on degree of belief (One cannot believe A with 70% certainty and $\sim A$ with 50% certainty); and rational choice theory imposes consistency conditions on choices, values, and beliefs. (Chater & Oaksford, 2012)

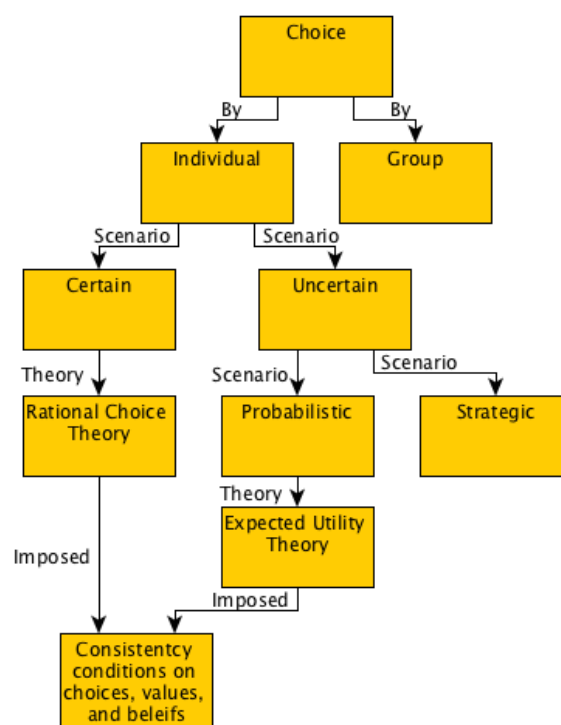
RCT was created in virtue of the refinement of the notion of *goal fulfillment* into the notion of *expected utility* (Baron, 2000). Expected utility means, intuitively, to choose in such a way that our most preferred result follow (Normalizing preferences by likelihood). Von Neumann & Morgenstern demonstrated that if people's preferences followed certain pattern, then they were behaving *as if* they were maximising expected utility.

Rational Choice Theory imposes the conditions on preferences such that if one fulfills them one is behaving as if maximising expected utility, and Expected Utility theory defines was maximising expected utility is.

This discovery meant that rationality could be operationalized. Rationality meant optimizing goal fulfilment. *Optimizing goal fulfilment meant maximising expected utility*. And certain patterns in preferences (as revealed by choices) meant that expected utility was being maximised.

Following, one could measure how far one's preferences were from those that meant that one was behaving *as if* maximising utility, and hence measure one's degree of irrationality (and conversely, of rationality).

In the following figure we illustrate the domain of choice and how rational choice theory and expected utility theory (How to follow RCT when the outcome is not certain) relate. They are both theories of normative choice and decision-making.



(from (Allingham, 2002))

Figure 1: The relationship between RCT and EUT

The figure above illustrates the relationship between RCT and EUT and specifies the scenarios to which each applies. It is relevant to gain an understanding of the problems that these theories were designed to solve.

As can be seen in the figure, both RCT and EUT impose consistency conditions on choices, values and beliefs. Both are normative theories of individual choice, the former being applicable for scenarios where outcomes are certain and the latter for scenarios where outcomes are uncertain and probabilistic.

2.2.2 RCT Axioms

RCT is a formal mathematical theory. It is composed by 4 axioms. We proceed to define the axioms. (Neumann & Morgenstern, 1947)

V Completeness

- For any two possible options, A, B; out of the choice set $\{A, B\}$, either A is preferred, or B is preferred, or there is no preference

V Transitivity

- For any three possible options, A, B, C; out of the choice set $\{A, B, C\}$, if A is preferred over B, and B is preferred over C, then A is preferred over C. Likewise, for the lack of preference. (If one has no preference between A and B, and no preference between B and C; then one has no preference between A and C)

V Continuity

- For any three possible options, A, B, C; out of the choice set $\{A, B, C\}$, if A is preferred over B and B over C, then there must be a mix of A and C such that this mix is indifferent to B.

V Independence of irrelevant alternatives

- For any three possible options, A, B, C; if A is preferred over B out of the choice set $\{A, B\}$, then introducing a third alternative C, thus expanding the choice set to $\{A, B, C\}$, must not make B preferable to A.

If the axioms above hold, then one's options can be ranked from the most favored to the least favored in an internally consistent fashion (with possible ties). This rank can then be placed onto a number line. (Conventionally with the highest ranking items having the highest numbers and these numbers are called utilities.)

And from this axioms and the ranking we have the condition for rationality: Given a set of option choose the one with the highest utility. Which is a formalization of a very intuitive sense of rationality: "Given a set of options choose the option you prefer the most".

If the axioms of RCT are respected, then an individual can be modelled as if maximising a utility function: such an individual's preferences can be represented on an interval scale and the individual will always prefer actions that maximize expected utility.

2.2.3 Expected Utility Theory

RCT has provided consistency criterions on choices of certain outcomes. But, how does one choose rationally when in situations of risk or uncertainty - respectively, where the outcomes are modeled by a known probability distribution and an unknown - but inferable - probability distribution)?

The answer came in 1960 with John F. Muth's (Muth, 1961) rational expectation principle. The rational expectations principle claims that agents' predictions of the future value of economically relevant variables are not systematically wrong in that all errors are random. Equivalently, this is to say that agents' expectations equal true statistical expected values. Accordingly, an agent should evaluate each possible course of action by multiplying the desirability of any achievable end - world state times the probability one believes it will be achieved given a course of action and beliefs about the current world state (Baron, 2000)

This is the essence of Expected Utility Theory. An agent multiplies the original utility values by the probability of that outcome coming about and is left with a new option set to which the RCT conditions apply.

A simple example follows in the figure bellow.

Scenario	Rain	No Rain
Take umbrella	100 utility	-50 utility
Don't take umbrella	-50 utility	100 utility

Probability	Rain	No Rain
	70%	30%

Figure 2: Utility Calculation

In this scenario option take umbrella has an expected utility of 55 ($=100*0.7-50*0.3$), and don't take umbrella has an expected utility of -5 ($=-50*0.7+100*0.3$). Hence, the rational option *according to EUT* would be to take the umbrella.

2.2.4 Arguments for RCT

There exist various arguments for the mathematical feasibility and intuitive plausibility of RCT. Most of these come from the canonical source of the formalization of the theory (Neumann & Morgenstern, 1947) and are in the form of *reduction ad absurdum* arguments.

For example, RCT proposes that agent preferences hold transitive preferences. Now, imagine an agent A_1 with preferences that violates transitivity (e.g.: It prefers, A to B, B to C, and C to A). Since preferences can be reflected in monetary values, you could imagine this Agent holding A and making a trade with a second agent A_2 for B. Agent A_1 would give A and a non-zero sum of money - X -, and agent A_2 would give B.

Now Agent A_1 possesses B, and Agent A_2 possesses A and X. The trade could be repeated, with Agent A_1 giving up B and a non-zero sum of money, and Agent A_2 giving C.

Now Agent A_1 possesses C, and Agent A_2 possesses A,B and 2X (the conjunction of the two sums of money it received). The trade could be repeated, with Agent A_1 giving up C and a X, and Agent A_2 giving A.

And we find ourselves back in square one except Agent A_1 is 3X poorer. Since X can be said to be a non-zero value, iterating this cycle would lead to A_1 eventually having all of it's money sucked out, which is why this is called the "money pump" argument - what you, don't want to, but will become if you violate the axioms of rational choice.

For the axioms of continuity and of independence of irrelevant alternatives, similar arguments can be constructed. One should note that the main arguments behind RCT where it's explanatory power in the context of mathematical analysis of behavior. Although RCT began as a theory of how humans behave (that is, a descriptive theory) it is widely taken to be at best a normative theory today, given the counterexamples and counterarguments collected, mainly in psychology. In the next section we survey this history.

2.2.5 A selective History of “Rationality”

(This section draws on several secondary sources, which are cited only when giving direct quotes, namely (Rutgers, 1999), (Nickerson, 2012) (Blume & Durlauf, 2008). For a more comprehensive review see (Nickerson, 2012))

RCT was not generated *ex nihilo*. It was the (mathematical) culmination of the intellectual history of the idea of rationality, and it produced a vantage point from which to further analyse the idea. As such, to understand the cluster of ideas around rationality and RCT it is important to understand the history of the concepts.

The idea of rationality originated in ancient philosophy, was formalized in contemporary mathematics, and was adopted by several fields. A particular tradition in psychology - in reaction against economics theory taking RCT to be a descriptive model of behavior - proved this was not the case, and “reduced” the theory to a normative model

In this section we trace the history of the idea as it moved through these three fields: philosophy, mathematics, and psychology. We trace the history of rationality through (only) these three fields for very precise reasons. RCT is a *mathematical* formalization of *philosophical* notions of rationality that – we maintain - is questioned by *psychological* evidence coming from Entrepreneurship Studies.

In the same way that, if altering the end of a book one needs to go back and review the middle and the introduction to make them consistent, if our empirical psychological evidence (the end) contradicts our existing mathematical formalization then we need to review this formalization (the middle), and the philosophical intuitions (the introduction) that originated it. Which is why we need to read the book, as it were, we need to know the history of how we came to the current formalization by surveying the origin in philosophy, the formalization in mathematics, and the use in psychology.

One must keep in mind that there is no attempt to provide a complete or even comprehensive view of the history of rationality through these fields. The history provided here is only provided as a guide map for illustrating certain positions to be taken later in the thesis. A complete history of the term is outside of the scope of this thesis.

Rationality in Philosophy

According to Rutgers (Rutgers, 1999), the roots of rationality can be found in Greek philosophy. He traces “rationality” as being a successor of the Greek term “*logos*”. *Logos* was used by the Greeks to refer to a cosmic principle that was related to the structure of the universe and human thought and activity. This original term *logos* was adopted by the Romans, transformed into the term *ratio*, and eventually became the English term “rationality”.

Rutgers (Rutgers, 1999) claims that the meaning of “rationality” had its most significant change at the beginning of the sixteenth century. This was when “rationality” lost its previous theistic association with the divine, to become solely about the human faculty of reason. This claim is supported by the works of Francis Bacon (1561-1626) and René Descartes (1596-1650). By the time of these works, the existing concept of rationality was detached from its earlier theistic and moral interpretation, and thus seen to be value-free.

In 1781, the philosopher Jeremy Bentham created the concept of “utility”. He defined utility as “that property in any object, whereby it tends or to produce benefit, advantage, pleasure, good, or happiness, or to prevent the happenings of mischief, pain, evil, or unhappiness to the party whose interest is considered (...)” (Bentham, 1879).

Under Bentham’s concept of utility, *good* is defined purely as being advantageous for the party under consideration, despite the particularities of the advantage or the party, at hand. That is, what is *good*, or what provides utility, only does such *for someone*, is only good *for someone*.

Bentham’s proposed concept of utility became associated with rationality as an indicator of value (D. Read, 2007) Through this change, *rationality* became completely detached of the metaphysical and cosmic notions that it was attached to before. Rationality became instead associated with a relative axiology, and in turn, utility became associated with a way to assess decisions in a normative fashion (D. Read, 2007) (This association led system of moral decision-making of Utilitarianism. The theoretical boundaries on the concepts of moral utility and decision utility in the literature are often fuzzy. For the purposes of this thesis we speak only of decision utility, and every time utility is mentioned, decision utility is meant. For more details see (Kahneman, Wakker, & Sarin, 1997))

In 1814, the mathematician Pierre-Simon Laplace explained the then current metaphor for rationality by creating a fictional creature that embodied rationality - the Laplacean Demon. Laplace created a thought experiment in which he described a demon that knew everything about past and present and thus could deduce the future with certainty (Pierre-Simon, 1814). This demonic superintelligence represents the then prevalent rationality *ideal*: an omniscient, omnipotent being that is capable of *optimizing* choices. According to Gigerenzer this has been the animating metaphor for thinking about rationality up to the present days (Gigerenzer, 2008).

Gigerenzer (2008). distinguishes further philosophical conceptions of rationality. Unbounded rationality (“How would people behave if they were omniscient and have all necessary time and computational power needed to optimize?”), Optimization under constraints (How does one optimize given the lack of omniscience and time and computational power (Sargent, 1993)).

One thing unites the two previous conceptions. They propose that rationality is attained when one behaves according to some normative systems, be they logic, or

probability, or others.

At a different level of abstraction, two other contemporary uses of rationality in philosophy are relevant to this thesis. One is epistemic rationality - *knowing things that are true*-, and the other instrumental rationality - *knowing what to do* (Manktelow, 2004).

Instrumental rationality is rationality of behavior. How can an agent act such that it gets what it wants?

Epistemic rationality is rationality of beliefs. An agent is more epistemically rational than another one if its beliefs are a better map of the actual structure of the world. The most rational beliefs are those that are true (Baron, 2005).

Instrumental rationality is, then, dependent on epistemic rationality. For an agent to act in a way that fulfills its goals, this agent needs to have an appropriate map of the world (Baron, 2000).

Rationality in Mathematics

Rationality came into mathematics in 1947, John von Neumann and Oskar Morgenstern mathematically formalized the “axioms of rationality”. According to these axioms, any agent satisfying them is as if it had a utility function which it is aiming to maximize.

They proved that an agent is Von Neumann & Morgenstern-rational if and only if there exists a real-valued function u defined by the possible outcomes so that every preference of the agent is characterized by maximizing the expected value of u - the agent’s utility.

That is, if people’s preferences follow the axioms then they behave as if they maximize utility in a way that is as if they were unboundedly rational agents (Neumann & Morgenstern, 1947)

The theory of von Neumann and Morgenstern theory is in effect a formalization of the Laplacean Demon, although contemporarily it is known as *Homo Economicus* instead. This being always behaves according to the (normatively) best choice by always choosing the actions that achieve its goals as measured by its capacity of maximizing its utility function. The theory that describes this idealized agent is referred to as Rational Choice Theory.

Psychologists became interested in utility theory due to the mentioned publication of Von Neumann and Morgenstern (Neumann & Morgenstern, 1947). In 1953, the economist Maurice Allais made the first argument for Rational Choice Theory not being a normative model of decision-making (Allais, 1953).

Allais (1953) was the first but not last scholar to question the normative aspect of expected-utility theory. In fact, since 1953, there is a gap between scholars that accept expected-utility theory as normative and those that do not do so.

RCT has been the major influence behind JDM. Chater & Oaksford write that

“exploring apparent departures from the predictions of rational choice theory and probability in human behavior has been a major field of research over the last 50 years - to a fair approximation, the entire field of judgement and decision making is devoted to this topic.”(Chater & Oaksford, 2012, p.18) . Hence the necessity of understanding RCT and how it connects to the history of rationality. Below we expand on how RCT connects the field of JDM.

Rationality in Psychology

As mentioned, some scholars have questioned the normative of validity RCT. The foremost is Herbert Simon. In 1955, Simon developed a theory of how to model agents through the concept of bounded rationality, which was a reaction against the perfectly rational utility-maximizing *Homo Economicus* (Gigerenzer, 2008).

Simon postulated several propositions aimed at making the RCT model more realistic, without sacrificing formality:

1. That human computational time and capacity are limited. This means that complex calculations would be problematic. (EUT might require one to assess the probability of various scenarios, each with multiple free variables - which entails up to time and resource consuming calculi) (Gustafsson, 2006)
2. Recognizing the costs of gathering and processing information
3. The suggestion that economics agents decide via heuristics, instead of strict mathematical rules of optimization. (As a consequence of 1 and 2.)
4. That real-life decision-makers seldomly optimize but instead satisfice. That is, they don't take the optimum choice, but that the first (suboptimal) choice that satisfies some set of criteria. (Simon, 1972)

Simon's postulated refinements added up to the concept of Bounded Rationality. The idea was very well received.

The influence of Simon's ideas about Bounded Rationality can be demonstrated by the fact that the two contemporary research paradigms within Judgement and Decision-Making both claim to be successors to the idea, and can be defined by their differing reaction to it.

One is the *Fast and Frugal Heuristics* framework (Gigerenzer & Goldstein, 1996), and the other the *Heuristics and Biases* framework (Tversky & Kahneman, 1974). The former program doesn't accept RCT neither as a normative nor a descriptive theory, and thus it falls outside of the scope of the argument produced in this thesis. The latter program accepts RCT as a normative theory, and thus is within the argument to be produced. In what follows we analyse the H&B program.

In the heuristics and biases tradition normative standards of instrumental rationality are equivalent with the RCT axioms. That is, the ideal rational agents behaves in a way that conforms to the axioms at all times. Descriptively, it agrees with Simon that humans happen to have bounded rationality.

Given (descriptive) bounded rationality, according to the H&B framework, research is to be directed on how decisions may be crippled by limitations to rationality, or how to model people's inability to follow RCT's axioms.

The Heuristics and Biases approach was initiated by the research of Amos Tversky and Daniel Kahneman in 1974 (Tversky & Kahneman, 1974). This framework for rationality focuses on the unveiling of situations in which humans fail to attend to the axioms of rationality that turn one into a utility-maximizing agent and which are assumed by the Rational Choice Theory (Kahneman & Tversky, 1996) (Gilovich, Griffin, & Kahneman, 2002) .

The heuristics and biases program is a program of psychology, foremost (Tversky & Kahneman, 1974). The underlying assumption of the program can be stated through an analogy. If we have a mechanism in which we cannot see the inside, it is a black box of sorts; then we can only infer what is inside by analyzing the relations between the outputs and the inputs of the mechanism.

The program takes the human mind to be a black box and takes RCT as a normative theory of rational behavior, or of how humans *ought* to behave. It adds the assumption that, as Simon described, humans use cognitive rules of thumb - heuristics - for making decisions. Then it searches for instances in which the black box of the human mind "fails" by failing to follow RCT, and uses this instances to reverse-engineer the cognitive heuristics that the mind must be composed of.

The *Heuristics and Biases* program enables an explicit way to measure rationality by suggesting that the more humans comply to the norms of rationality, the more rational they are. Thus, this program facilitates measuring rationality by using the fictional *Homo Economicus* as a standard, with both number and severity of biases being criteria of measuring the deviance from it.

Based on the above, there is a pre-set standard of rationality expressed in the axioms of rationality and if an agent fails to meet it, it falls prey to a bias.

Two examples of the program are in order. The Linda problem (Tversky & Kahneman, 1983) and the Asian disease problem (Tversky & Kahneman, 1981) follow.

The first asks:

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination

and social justice, and also participated in anti-nuclear demonstrations.

Which is more probable?

1. Linda is a bank teller.
2. Linda is a bank teller and is active in the feminist movement.

The second asks:

"imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume the exact scientific estimate of the consequences of the programs are as follows."

(Presented to half of the participants)

In a group of 600 people,

- Program A: "200 people will be saved"
- Program B: "there is a one-third probability that 600 people will be saved, and a two-thirds probability that no people will be saved"

(Presented to second half of the participants:)

In a group of 600 people,

- Program C: "400 people will die"
- Program D: "there is a one-third probability that nobody will die, and a two-third probability that 600 people will die"

In the first example, the majority of people choose option 2. This is normatively wrong, according to logic, given that the second option entails the first, then first must be at least as likely (and since it has less conditions) it is more likely.

In the second example, in the first group 72% of the participants choose program A, and in the second group 22% choose program C. Programs A and C are identical and thus this preference reversal illustrates a violation of the axiom of transitivity. Which is a violation of Rational Choice Theory._

(Kahneman & Tversky's approach also makes prescriptive recommendations on how to best conform to the norms of rationality. A significantly accessible review is provided by Larrick (Larrick, 2004).)

2.2.6 Section Conclusion

As we have seen, “rationality” has a long history, from a philosophical notion in Ancient Greece, that kept being refined and redefined, to a mathematical formalism consisting of axioms and theorems that claimed to define *precisely* what is and what isn't rational.

We have further seen the continuing impact of this formalism: the two contemporary research paradigms within Judgement and Decision-Making can be defined by their attitude towards RCT. One ignores it altogether, the other takes it to be a normative standard and *actively tries to find ways to shape people's behavior as to conform to this standard*.

It will be important to remember the history of the idea of rationality when, after showing in section 3 how RCT is incomplete as a theory of rationality, in section 4 we attempt to retrace from the formalism to the philosophical intuition as to rebuild a new formalism that can embrace the implication of Effectuation Theory.

Further, it is important to hold in mind that RCT is *to this day* used as a normative ideal and that there are *active interventions* to push people closer to this ideal (Thaler & Sunstein, 2008), especially if RCT is an incomplete theory. This highlights the importance of having a coherent concept of rationality.

2.3 Effectuation – the inverse of Rational Choice Theory ²

This section draws on several secondary sources, which are cited only when giving direct quotes: (Sarasvathy, 1998) (Sarasvathy, 2001b) (S. Read & Dolmans, 2014) (Mirvahedi, 2014) (Lehman & Fillis, 2014) (Perry et. al, 2012).

The most recent review are (Mauer, 2014), (S. Read & Dolmans, 2014); and the seminal resource is (Sarasvathy, 2008a).

2.3.1 History

Original question

Research on entrepreneurship may be understood as an attempt to answer the question of “What makes entrepreneurs entrepreneurial?” (Sarasvathy, 2001b). Within the field there exist two main perspectives on how to answer this question within the field: (1) the personality view - in which the success or failure of the firms the entrepreneur creates is explained by their personality traits (Llewellyn & Wilson, 2003) , and (2) the environmental view, in which it is explained by a set of circumstances or attributes of the project and its environment (Thornton, 1999).

These two approaches lend themselves to different answers to a related field question: "How to make someone entrepreneurial?". In the former approach one must cultivate the adequate combination of personality traits, and in the second approach must learn to assess and exploit the environment for situations with a potentially high reward.

It was within this context that, in 1998, Sarah D. Sarasvathy sought out to answer the question of "What makes entrepreneurs entrepreneurial?" (Sarasvathy, 1998) through a cognitive-expertise approach. She focused on (1) the thinking of entrepreneurs, and (2) treated entrepreneurship as a particular form of expertise.

Her approach crystallized into two particular questions and a methodology to go about answering them. The questions were: (1) *"What commonalities and differences exist in the decision-making process of a group of expert entrepreneurs who started with the same idea for a new venture and face exactly the same set of decisions in building it?"* and (2) *"In the face of non-existent or not-yet-existent markets, what underlying beliefs about the predictability of the future influence the decisions expert entrepreneurs make as they build a new venture?"*.

The methodology used was that of think aloud studies. The same that had been used years before by Allen Newell to create a theory of problem solving (Newell & Simon, 1972) in collaboration with her mentor and the creator of Bounded Rationality - Herbert Simon.

2.3.2 The "Venturing Scenario" Study

Methods

For the "Venturing Scenario" study (Sarasvathy, 1998) Sarasvathy assembled 27 expert entrepreneurs. An expert entrepreneur was operationalized as an entrepreneur 1) with over 15 years of experience as such 2) who had founded multiple ventures 3) including both successes and failures and 4) had taken at least one company public (ranging in market capitalization of \$250M - \$6.5B).

Sarasvathy had the expert entrepreneurs work through a problem set, which spanned 17 page, of 10 typical questions encountered by entrepreneurs as they build a venture. (E.g. question: "How will you find out this information? What kind of market research will you do?") They were asked to think-aloud whilst they solved the problem-set. All of the responses were taped, transcribed and analyzed by Sarasvathy and her team of researchers.

Results

During the study Sarasvathy found that only four out of the 27 subjects used any

kind of predictive analysis. At that point, the focus of the analysis shifted: 23 subjects were not using any sort of predictive analysis. Then what were they using to make decisions?

Six elements of decision-making were induced from the quantitative coding analysis of the relationship between what experts thought-aloud and their observed decisions to the problems. When these principles were put together as a process model Sarasvathy found that the expert entrepreneurs were making decisions using causal reasoning, except they inverted each principle of causal reasoning. She named this decision-making model "Effectuation".

(Below, in this section, in "Effectuation Summary" we differentiate causal reasoning from effectual reasoning. We revisit and expand on this difference in "Effectuation is the inverse of Rational Choice Theory" in Chapter 3 – "Contextual Rationality")

Observing the data Sarasvathy found out that 65% of the respondents had used this "effectuation" decision making model 75% of the time. From this observation she inferred that there is a common logic to how expert entrepreneurs solve entrepreneurship problems.

These elements or sub-constructs included (1) beginning with means, instead of a given goal, (2) focusing on affordable loss, over expected returns, (3) emphasizing strategic alliances and precommitments, over competitive analyses, (4) leveraging environmental contingencies, over exploiting preexisting knowledge, (5) controlling the future, over predicting it.

(Below, in "Effectuation Summary" we precisely explain what these principles are about.

These elements might already give the reader familiar with RCT a sense of where the contradiction arises. (1) is the inverse of means-end rationality, (2) is the inverse of utility maximization, (3) comes from the opposite direction that game theory comes from, (4) and (5) come from the opposite direction that RCT comes from)

Theoretical innovations

Sarasvathy progressed her investigation by identifying the intellectual foundation for the heuristics that were being used (S. Read & Dolmans, 2014). She summarized the heuristics that she found expert entrepreneurs using as follow.

The unpredictability of the scenario in which entrepreneurs decide was defined by Knight (1921) - Knightian uncertainty.

The idea that the agent can change the outcomes and rules of the game whilst playing it had been provided by Weick (1979) (Weick, 1979) - Weickian enactment.

Finally, March (1982) (March, 1976) had provided the theoretical starting point, connecting Knightian uncertainty and Weickian enactment with a situation in which a decision-maker was unsure of their preference and goals - Marchian goal

ambiguity.

Empirical support

Sarasvathy original Venturing Scenario (Sarasvathy, 1998) is extremely recent. Nonetheless, it has since then received some amount of support.

Dew et. al (Dew et al., 2009) replicated it with a sample of novice managers. They asked 27 expert entrepreneurs and 37 MBA students to think aloud continuously as they solved typical decision-making problems in creating a new venture. Transcriptions were analyzed using methods from cognitive science. Results showed how expert entrepreneurs problem framing and MBA student's problem framing were dramatically different, providing support for Effectuation Theory,

Read et al. replicated the marketing-related questions in a study composed by a sample of executive (S. Read, Dew, & Sarasvathy, 2009). They used protocol analysis to evaluate how 27 expert entrepreneurs approached the problem of marketing in the face of uncertainty, compared to 37 managers with little entrepreneurial expertise. All 64 subjects were asked to think aloud as they make marketing decisions in exactly the same unpredictable situation. The study found that “While those without entrepreneurial expertise rely primarily on predictive techniques, expert entrepreneurs tend to invert these. In particular, they use an effectual or non-predictive logic to tackle uncertain market elements and co-construct novel markets with committed stakeholders.”(S. Read, Dew, & Sarasvathy, 2009) Again, providing support for Effectuation Theory.

Further, Read et. al(S. Read, Song, et al., 2009) also conducted a meta-analysis articles published in the Journal of Business Venturing, summarizing data on 9897 new ventures. They found that three of the principles of effectuation correlated positively with new venture performance.

2.3.4 Effectuation Summary

Effectual reasoning *originally* refers to the particular type of thinking and decision-making that entrepreneurs engage in when they are to start and continue a new business, opportunity, market, or product (S. Read, Dew, et al., 2009; S. Read & Sarasvathy, 2005) (Sarasvathy, 2001b).

In the seminal text of Effectuation, Sarasvathy (Sarasvathy, 2001) distinguishes an approach to decision-making that contrasts with what had been taken as necessary previously. She distinguishes “Causation” from “Effectuation” (Sarasvathy, 2001) (alternatively called “causal rationality” or “causal thinking”; and “effectual thinking”):

- V Causation processes *take a particular effect* as given and focus on *selecting between means to create that effect*.
- V Effectuation processes *take a set of means* as given and focus on *selecting between possible effects that can be created with that set of means*.

According to Sarasvathy, effectual reasoning is the logic used by entrepreneurs to discover new market opportunities and leverage their means to exploit them (Sarasvathy, 2001b) (Shane & Venkataraman, 2000). More broadly, it is the *reasoning behind human design of artefacts, products, firms and markets* (Sarasvathy, 2003) (Sarasvathy, 2008).

Below we summarize Effectual reasoning based on its problem, process, principles, and logic.

The problem

Causal rationality begins with pre-determined goal(s) and means and aims to identify the optimal route to the goal. Effectual reasoning begins with a set of means and allows goals to emerge over time from the imagination and commitments of the stakeholders.

The process

According to Sarasvathy (Sarasvathy, 2001b) all entrepreneurs start with three types of means: (1) Who they are, (2) What they know, and (3) Whom they know. Using the aforementioned means, entrepreneurs start imagining and implementing what can be created. In this process *goals are allowed to emerge as actions are taken and further means are gathered*.

“Who I am refers” to the collection of traits, characteristics, dispositions, and abilities of entrepreneurs. “What I know” refers to the knowledge, experience, and possible expertise of the entrepreneur. The third mean, “Whom I know”, refers to the social and business networks of the entrepreneur.

The principles

The Affordable Loss Principle

Causational logic suggests that decision-makers *ought* to maximise their expected value, which in the entrepreneurial context would amount to attempting to maximise profit and potential returns. Instead, Sarasvathy maintains that, entrepreneurs focus on minimizing loss. This principle makes sense of how entrepreneurs decide what they can and are willing to lose (S. Read, Dew, et al., 2009).

The Crazy Quilt Principle (Strategic Partnership)

Effectuation outlines a reduction of competition and uncertainty through the use of strategic partnerships. Accordingly, it has been shown that entrepreneurs select partners from their networks and that extremely successful portfolio entrepreneurs were disposed to form partnerships (Morrish, 2009)

The Make-Lemonade Principle (Leverage Contingencies)

Effectuation is a logic for environments with Knightian uncertainty (That is, true unpredictability). According to Sarasvathy (Sarasvathy, 2001b) (Sarasvathy, 2008) entrepreneurs explore these spaces by leveraging surprises instead of seeing them as impediments to a goal-oriented search process focused on the exploitation of pre-existing knowledge.

That is, entrepreneurs manage the many risks of the environment by using their managerial and entrepreneurial competencies and personal and business networks (“Small business owner-managers and their attitude to risk,” 2004) to exploit surprises.

The logic

The logic of effectual reasoning is different from that of causal reasoning. In causal reasoning, *To the extent that we can predict the future, we can control it* (Sarasvathy, 2001a). In effectual reasoning, *To the extent that we can control the future, we do not need to predict it* (Sarasvathy, 2001a). The belief that one can control the future in turn entails several different beliefs: *That the future is created, not discovered; that the future is shaped by humans; that stable stakeholder commitment are the key to controlling the future.*

2.4 Summary of Differences between Effectuation and Causation

Issue	Effectuation	Causation
Where to start	Means Available.	Goals Desired.
Risk, return, and resources	Affordable loss.	Expected return.
Attitude towards others	Partnership.	Competition.
Surprise	Leverage surprises.	Avoid surprises.
Underlying logic and what to do	Co-create. Cannot predict: Control.	Plan. Predict to control.

Based on (S. Read & Dolmans, 2014)

Figure 3: Differences between Effectuation and Causation

The figure above summarizes the differences between Effectuation (the type of thinking that Effectuation Theory originates from) and Causation (the type of thinking that Rational Choice Theory originates from). It contrasts the different, inverse, attitudes to various issues; and can be used as a guide map to keep the differences in mind.

The most important takeaway to hold in mind is how effectuation is a straight inversion of causal or predictive rationality (S. Read & Sarasvathy, 2005).

For each thing that defines causal rationality (where to start; the attitude towards risks, others, surprise; and the underlying logic) effectuation is defined by precisely the opposite.

2.5 Conclusion

After the previous sections of the present chapter we now hold an historical awareness of how the idea of rationality has developed and transversed fields. We have a sense of what it aims at capturing, and we have seen a particular formalization for it - Rational Choice Theory - that imposes consistency conditions on preferences, and that subsumes a theory - Expected Utility Theory - of how to properly decide.

We have also gained an understanding of the origin of Effectuation theory and how it describes the behavior of expert successful entrepreneurs. By having seen what the (formalized, normative) theory of Rational Choice implies about how one *should* act to be rational, and seeing what the (unformalized, descriptive) theory of Effectuation describes as how expert successful entrepreneurs *do* act, one may start having a sense for how exactly the contradiction mentioned in the introduction comes about. In the next chapter we provide a numbered argument that aims at making this sense explicit.

3 The implication of Effectuation Theory for Rational Choice Theory

3.1 Introduction

In the present chapter we will present an explicit version of the argument that was suggested in the introduction. We will provide an argument that concludes that “*RCT violates our desiderata for a normative theory of rational action*”, thus making the contradiction that was suggested in the introduction a consequence of the argument to be presented here.

This argument provides a formal description of the implications of Effectuation Theory for Rational Choice Theory: it spells out the implication of the former for the latter – providing a proof of principle that the latter is – at best – incomplete as a theory of rational action.

We then provide a lemma concluding that “There are two different theories of rational action & one cannot behave in according to both concomitantly”.

This lemma demonstrates the further problem opened by Effectuation Theory. If both Effectuation Theory and Rational Choice Theory are theories of rational action then it must be the case that rationality is contextual, that is, that it is context-dependent. We conclude this in our second argument, building off the previous lemma.

We first present each argument as a numbered argument. After each argument, and lemma, we analyze and argue for each premise in order of appearance, ending with an interpretation of what the argument signifies.

By the end of this chapter it should be clear a) why and how Effectuation Theory shows that RCT is incomplete as a theory of rationality, b) how Effectuation Theory is also a theory of rationality and thus, c) that rationality is contextual.

3.2 Making the problem explicit

3.2.1 “RCT violates our desiderata for a normative theory of rational action”

Argument #1

Argument for - “**RCT violates our desiderata for a normative theory of rational action**”

1. Part of the desiderata of a normative theory of rational action is that it defines what behaviors are rational through respecting our (reflected, equilibrated) intuitions about what behaviors are rational
2. RCT is the normative theory of rational action.

3. Therefore, RCT defines what behaviors are rational through respecting our (reflected, equilibrated) intuitions about what behaviors are rational. [1,2]
4. Claiming that entrepreneurs that are successful are more irrational or arational violates our intuitions about what behaviors are rational
5. RCT entails successful entrepreneurs are more irrational or arational.
6. Therefore, RCT violates our intuitions about what behaviors are rational [4,5]
7. Therefore, RCT violates the desiderata for a normative theory of rational action [1,6]

Analysis

The first proposition can be argued for via *reduction ad absurdum*. One can be asked to define a normative theory of rationality and respond with a theory that does not specify what behaviors are rational (thus not being a normative theory of rationality), or with a theory that says that what is rational is to eat CornFlakes three times every hour (thus violating our intuitions about what is rational). One can further imagine a theory that contradicts itself (that says that A is the criteria for rationality and that $\sim A$ is the criteria for rationality). In different ways these all violate the original request. These *intuition pumps* show that as a bare minimum – to be a theory of rationality - a theory has to specify rational behaviors, respect our intuitions about what is rational, and not contradict itself.

The fourth proposition cannot be argued further than through an appeal to intuition and to (pre-formalized) notions of rationality. Before we described the philosophical notion of instrumental rationality as acting in such a way that one gets what one wants. Then, how could we call successful entrepreneurs arational, or less rational than unsuccessful? The only possible answer is so twisted as to bend the limits of credibility: that in fact entrepreneurs don't want success at entrepreneurship. We consider this suggestion the sketch of a second *reduction* argument.

The fifth proposition follows from RC and Effectuation theories. The first gives a series of constraints on how to choose (order preferences, multiply their desirability by their likelihood and act as to reach them). The second gives a description of how entrepreneurs actually act (take what you have, act, see what goals emerge, go after what you can afford to lose). One can imagine an unsuccessful entrepreneur following RCT perfectly, and he would be "rational" whilst the successful ones are either outside the scope of RCT being arational, or inside and being irrational (according to RCT).

3.2.2 There are two different theories of rational action & one cannot behave according to both concomitantly

From the fact that the previous claims hold, and from proposition 5 especially, one can deduce that the only possible mistaken premise is proposition 2. That is, that it could be the case that its negation is in fact correct: RCT is not the theory of rational action. This allows both the option (a) that it is *not* a theory of rational action and (b) that it is *a* theory of rational action, among many. Because of the *reductio* arguments replicated in chapter 2 that give weight to the position of RCT being a theory, we follow option (b).

Lemma #1

Argument for - “**There are two different theories of rational action & one cannot behave according to both concomitantly**”

1. A choice is an action
2. Rational Choice Theory is a theory of rational choice
3. Therefore, Rational Choice Theory is a theory of rational action [1,2]
4. Effectuation is a theory of rational action
5. Therefore, both Rational Choice Theory and Effectuation are theories of rational action [3,4]
6. Effectuation is not Rational Choice Theory.
7. Therefore, there are two different theories of rational action [5,6]
8. Theories of rational action specify what action-set is rational in a given circumstance
9. Therefore, there are two different theories specifying what action-set is rational in a particular circumstance [7,8]
10. Rational Choice Theory and Effectuation will specify different action-sets as rational in a given circumstance
11. One cannot execute different action-sets concomitantly [9,10]
12. Therefore, one cannot behave according to Rational Choice Theory and Effectuation concomitantly [11,12]
13. Therefore, there are two different theories of rational action, and one cannot behave according to both concomitantly [7, 12]

Establishing the claims

Effectuation is a theory of Rational Action

Providing evidence for this claim will involve a bit of bootstrapping. By

existing definitions, rational choice theory is the only theory of rational action, since rational choice theory defines what is rational action and is the only theory defining it (according to its own terms).

Given this we cannot provide formal arguments within the framework of RCT, but can provide various reasons, outside of this framework for believing that effectuation is a theory of rational action. We provide these reasons in what follows.

Firstly, to echo Sarasvathy and Simon (Sarasvathy & Simon, 2000) , effectuation is the answer to the question of: “Where do we find rationality when the environment does not independently influence outcomes or even rules of the game (Weick, 1979) , the future is truly unpredictable (Knight, 2012) , and the decision maker is unsure of his/her own preferences (March, 1976)?” That is, effectuation is a theory of rational behavior in a problem space that is outside of the scope of Rational Choice Theory. (Rational Choice Theory cannot be applied to a space where the environment does not independently select the outcomes, prediction is impossible, and goals are not pre-determined. In fact, just one of these aspects would render Rational Choice Theory unusable.)

Secondly, Effectuation captures some part of the notion of rationality. (The pre-formalized notion of rationality, not RCT’s reified notion.) We aim to show this below.

The idea of rationality is, at its very basis, an attempt to pin down what is agreeable to reason. It has as its opposite irrationality (what departs from being perfectly agreeable to reason) and it is placed in a continuum between maximal rationality and maximal irrationality. (Being maximally agreeable to reason, and being minimally agreeable to reason, respectively). Arationality concerns what is outside the domain of reason (Sousa, 2007).

Effectuation, in turn, is a description of what experts in a selected domain do, in the form of a non-formalized descriptive theory of action. It seems intuitively reasonable to believe that what experts in a field do, is closer to being agreeable to reason, than what novices do.

Thirdly, consider the opposite: What experts in the field of entrepreneurship do is not more agreeable to reason. Experts in entrepreneurship are in expectation the people that have spent more time reasoning and practicing the field. And yet their practices are not more agreeable to reason. They are more successful, but not through the refining of their practices to make them agreeable to reason. And hence, reasonability and success are two uncorrelated concepts. This proposal seems to stretch the limits of suspension of disbelief.

To resume our two options:

- a) Rational Choice Theory is the only theory of rational action; and, experts in entrepreneurship *do not* have a better reasoning process than non-experts, and

acquired their expertise *without* relying on improved reasoning; and a perfectly rational agent will *systematically lose* against an irrational entrepreneur

- b) Rational Choice Theory is not the only Theory of Rational Action, Effectuation is another. This then allows one to claim that experts in entrepreneurship *do have* a better reasoning process than non-experts, acquired their expertise relying on improved reasoning; and a perfectly rational agent will systematically win against an irrational entrepreneur. (Since now irrational means something different than “Not perfectly following the rules of RCT, since RCT is not the only Theory of Rational Action anymore)

As a fourth reason, the principle of parsimony seems to suggest that the second option is the correct one. It respects our intuitions of what it means to be rational - *being agreeable to reason* -, and it does not go against our understanding the relationship between reasoning and expertise (Ericsson, Krampe, & Tesch-Römer, 1993).

Having established that Effectuation is a theory of Rational Action, we proceed to establish that Effectuation is the inverse of Rational Choice Theory.

Effectuation is the inverse of Rational Choice Theory

(This section builds on (S. Read & Sarasvathy, 2005) (S Sarasvathy & Kotha, 2001) (SD Sarasvathy, 2008) (Dew & Sarasvathy, 2002). References are given when direct quotes are used.)

Wheres rational choice theory starts with a set of goals and tries to predict the future as to choose the scenario with the highest expected utility (utility of that scenario x probability of that scenario happening (Mongin, 1997), effectuation starts with the means available and uses these to allow goals to merge as further stakeholders are added to the endeavor. The adding of stakeholder augments means and locks the future into a certain position (given that the future is shaped by the various wilful agents' decisions) and uncertainty is leveraged into opportunities of creation: of new goals, new stakeholders commitment, and new scenarios, instead of avoided. We further expand on how exactly this is the case in what follows.

Sarasvathy, the originator of the theory, says “Effectuation is a straight inversion of *rational choice theory* (also referred to as *causal or predictive rationality*)” (S. Read & Sarasvathy, 2005) and “*Causal rationality is goal-driven; effectuation is means-driven.* Rational choice rests on a logic of prediction – i.e. To the extent we can

predict the future, we can control it. Effectuation rests on a logic of *non-predictive control* – i.e., To the extent we can control the future, we do not need to predict it. Causal rationality takes the environment as largely outside the control of the decision-maker, and therefore seeks to predict it and adapt to changes in it. Effectuation considers the environment endogenous to the actions of effectuators and therefore seeks to fabricate it through pre-commitments from stakeholders. Effectuation is enactive and exaptive where causation is reactive and adaptive.

The overall inversion of the problem space and solution logic of rational choice is implemented through a series of effectual heuristic principles, each of which inverts causal heuristics. In entrepreneurial settings in particular, (1) While causal rationality suggests *using expected return as a decision criterion*, effectuation prescribes the *affordable loss principle*; (2) Instead of competitive analyses, effectuation involves building partnerships through precommitments from stakeholders; and (3) In contrast to rational choice that seeks to avoid unexpected contingencies in order to efficiently achieve pre-determined goals, effectuation seeks them out and leverages them to create novelty. “

In what follows we will describe the problem definition, problem space, solution process, decision principles and logic of Effectuation and clarify how it differs from RCT in each of these aspects. One should take special attention to how effectuation inverts RCT – that is why RCT can't account for what effectuation can: because the latter is the inverse of the former.

Problem Definition

Whilst causation focuses on answering the question of what one *ought* to do *given* goals, effectuation focuses on answering the question of what one *can* do given the *existing possible means* and *imagined ends*.

That is, there are two shifts occurring, from *given goals* to *given means* (that is from what one *wants to happen* to what *already is the case*) and from what one *ought* to do to what one *can* do (that is from an attitude of maximization to an attitude of exploration).

The Problem Space

Newell defines a problem space as “(...) a set of symbolic structures (the states of the space) and a set of operators over the space. Each operator takes a state as input and produces a state as output, although there may be other inputs and outputs

as well. The operators may be partial, ie, not defined for all states. Sequences of operators define paths that thread their way through sequences of states.” (Newell, 1993, p.2)

In RCT the problem space is characterized by risk or uncertainty (each action leads to an outcome with a known probability distribution, or an unknown probability distribution that can be sampled and converted into a known probability distribution), stable goals (goals that are pre-given at the moment of decision, that is, there is, at the moment of decision, a set of states that is a solution set), and a stable environment (the possible paths through the sequences of states are pre-given at the moment of decision).

Contrast this with the problem space of entrepreneurship. There is Knightian uncertainty: the future is not only uncertain but unknowable (Knightian uncertainty (Knight, 2012), that is, it is unknowable what each operator over an input outputs; the goals are not pre-given, but emerge (Marchian goal ambiguity (March, 1976)), that is, the set of states that is a solution set varies and changes through the process of transversing the problem-space; and finally every action alters the environment and original goals (Weickian enactment (Weick, 1979)), that is, every operator used over an input, every decision alters the problem space, and the set of states that belong to the solution set.

Owing to the names of the originators, the Effectuation problem space is a Knightian-Marchian-Weickian problem space. The future is), and

Solution Process

Whilst causal reasoning is inward directed, effectual reasoning is outward directed. The former decomposes goals into sub-goals and so on up to the level of specific individual tasks. The latter moves outward, from individual actions and individual tasks to emerging outcomes and goals that only become evident looking back.

Decision Principles

1. Minimizing Affordable losses, rather than maximising Expected Return

Whilst RCT (through EU) orders options by desirability times likelihood, entrepreneurs act in a way that reveals the use of a heuristic that is minimizing losses.

2. Pre-commitments from key stakeholder-partners, rather than competitive analyses

Game Theory, derived from Causal Rationality, is essentially adversarial. Entrepreneur behavior is such that it eliminates competition by creating strategic commitments. Hence, the adversarial outlook of Game Theory is not applicable.

3. Contingent knowledge, rather than pre-existent information

RCT depends on pre-existing beliefs and preferences. The axiom of completeness entails that all actions can be ranked in an ordering of preference. This means that the decision-maker has, prior to the decision, imagined scenarios, and a ranking among them. The former correspond to pre-existing beliefs, and the latter to pre-existing preferences. These are assumed to be available to the decision-maker by RCT.

In contrast, in effectuation, neither pre-existing beliefs about future scenarios nor preferences are assumed to exist and the theory describes entrepreneurs as taking advantage of contingencies and uncertainty to leverage themselves into the creations of new goals and means

The Logic

The logic for causation processes is focuses on *predictive control* - “To the extent that we can predict the future, we can control it.” (Sarasvathy, 2001a)

The logic for effectuation is focused on *non-predictive control* - “To the extent that we can control the future, we do not need to predict it” (Sarasvathy, 2001a)

Effectuation is relevant, exactly by virtue of being the inverse of Rational Choice Theory. It takes advantage of every aspect that would render Rational Choice Theory unusable.

It takes advantage of Knightian uncertainty (Knight, 2012) through it’s underlying logic - that the future cannot be predicted is leveraged into the opportunity of creating it.

It takes advantage of Weickian enactment (Weick, 1979) through it’s solution process - the notion that when people act they bring structures and events into existence and set them into action stops being problematic when one is not trying to achieve a certain outcome given means but is searching for possible outcomes and means.

Finally, it takes advantage of Marchian goal ambiguity through it’s problem (re)definition: it allows goals to emerge.

Effectuation is then an inversion of the principles of rational choice theory. The following three tables summarize and make explicit the differences between

Rational Choice Theory and Effectuation Theory. Figure 3 refers to the underlying *logic* of the theories (causal vs. effectual), Figure 4 refers to the *decision-making process* of the theories (causal vs. effectual), and Figure 5 to the *reasoning style* (causal vs. effectual) underlying the theories.

LOGIC

	Causal Logic	Effectual Logic
Premise	Predict to control.	Create to control.
View of the future	Predictive.	Creative.
Basis for taking action	Goal-oriented.	Mean-oriented.
Predisposition towards risks and resources	Expected returns.	Affordable loss.
Attitude towards outsiders	Competitive analysis.	Partnerships.
Attitude towards contingencies	Avoiding.	Leveraging.

Figure 4: Causal vs. Effectual Logic

DECISION-MAKING PROCESS

Category	Causation Process	Effectuation Process
Givens	Effect	Means
Decision-making selection criteria	Choose between means to achieve effect. Choose using expected returns.	Choose between effects that can be created with means. Choose using affordable losses.
Competencies employed	Exploiting knowledge.	Exploiting contingencies.
Context of relevance	Nature. Static, linear, independent environments.	Human action. Dynamic, nonlinear, ecological environments.
Nature of unknowns	Predictable parts of uncertain future.	Controllable parts of unpredictable future.
Underlying logic	Predict to control.	Create to avoid needing to predict

from (Nienhuis, 2010)

Figure 5: Causation vs. Effectuation Decision Process

REASONING

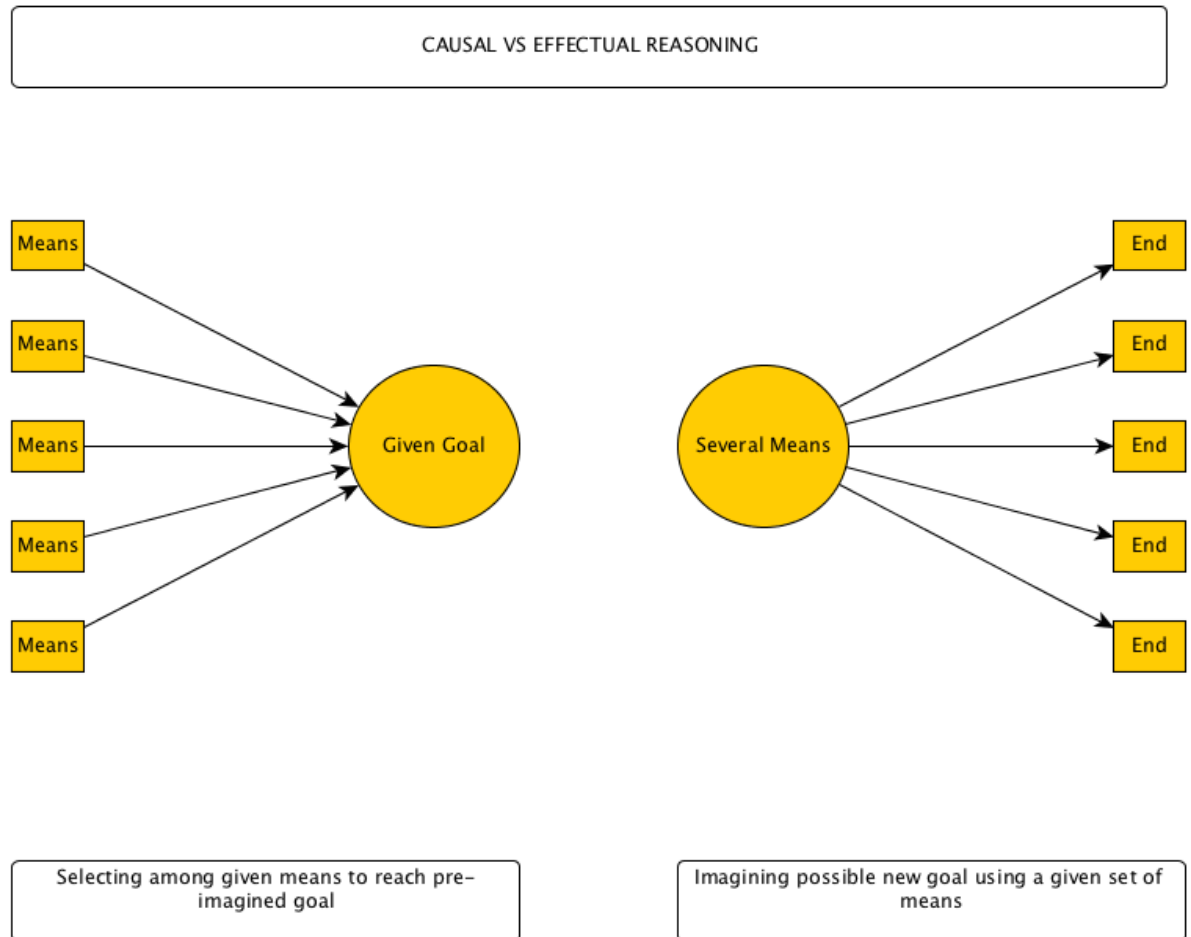


Figure 6: Causal vs. Effectual Reasoning

Theories of rational action specify what action-set is rational in a given circumstance

This was argued for above, in the discussion of the first argument.

Rational Choice Theory and Effectuation will specify different action-sets as rational in a given circumstance

This proposition follows as a direct consequence of the fact that one theory is

the inverse of the other. Different principles, problem framing, logic, and solution process lead to this.

A proof of principle will be enough to make the general statement, since it introduces the problem of how to choose between *different, incompatible*, albeit both *rational*, set of actions:

“ Furthermore, many ravishing empirical regularities suggest that the way research portrays people thinking under situations of Knightian uncertainty is not how they actually conceive of the decision problem and its possible solutions. First, it is rare that entrepreneurs are involved in more than one venture at once, yet by the logic of predictive rationality they ought to diversify. This had led to frequent suggestions that entrepreneurs prefer risk (Khilstrom & Laffont, 1979) but this suggestion does not appear to be supported by the empirical evidence gathered to date (Miner and Raju, 2004). Second, while rational action would prescribe entrepreneurs generate subjective probabilities as the basis for optimal forward-looking choices, data suggests that expert entrepreneurs consciously shirk prediction (Sarasvathy, 2001b).” (Dew & Sarasvathy, 2002)

As the quote illustrates, in the same situation, each theory will make a suggestion that is incompatible with the suggestion of the other theory: 1) Diversify vs Do not diversify, 2) Aim to predict the future vs Relinquish trying to predict the future.

(Note that a counterargument could be leveraged arguing that Effectuation Theory applies *only* to a specific context (that of starting and continuing a new business, opportunity, market, or product). Even if that were true, the argument misses the point. The point is that RCT claims to be an acontextual theory, that is, a theory that can be applied in any context and always outputs the correct answers, so to speak. Since, as the figure below demonstrates, Entrepreneurship is a proper subset of *all possible contexts* then, if RCT is to be acontextual, it must apply to this context as well.)

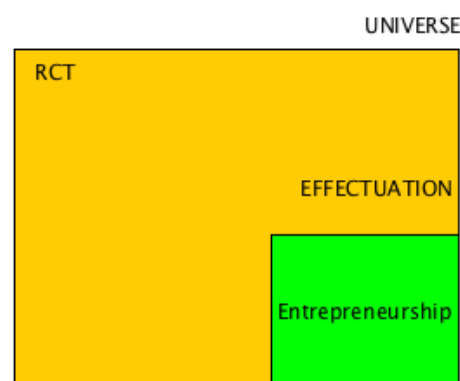


Figure 7: RCT and Effectuation domain of application

One cannot execute different action-sets concomitantly

This claim is a strong version of something that is true in a weaker sense, but which would have derailed attention to make precise in an explicit manner. In virtue of that, the clarification is better made at this point.

Whilst it is trivially true that one can breathe and eat at the same time, but one cannot optimize for maximizing expected utility and minimize losses at the same time.

Let us imagine the following situation, where we have three options all with different utilities and losses. Let us further assume our maximal affordable loss is 15.

OPTION	EXPECTED UTILITY	EXPECTED LOSS
A	25	5
B	50	10
C	100	20

Figure 8: Maximising utility vs. minimizing affordable loss

Maximising expected utility leads us to choose C. Minimizing affordable loss (within the upper bound of 15) leads us to choose A. Assuming A and C are discrete options such that only one can be chosen in the time period from t_0 to t_1 leaves us with the impossibility of performing the actions concomitantly. This example proves the claim's weak version (which is the one that is relevant to the argument in place), in principle.

3.2.3 Section Conclusion

Three things have now become clear: RCT does indeed violate our desiderata for a normative theory of rational action, *both* RCT and Effectuation are theories of

rational action, and one *cannot* follow both at the same time.

In this section we have provided formal arguments for the intuitions we alluded to in the Introduction. RCT banishes *successful, expert* entrepreneurs to irrationality or arationality, thus violating our desiderata of a theory of rational action.

Secondly, Effectuation Theory, by describing what experts in the field of entrepreneurship do approximates what is rational to do *in that field*, thus being a theory of rational action.

Finally, the third conclusion, that one cannot behave in accordance to both theories follows from the truism that some things cannot be performed at the same time (for example, accepting and not accepting a venture proposal).

Now, where does that leave us? What does it *mean* to say that there are two theories of rational behavior and that they will not always recommend the same action-set? In the next section we answer that precise question.

3.3 Making the implication explicit

In what preceded we have argued at length that effectuation is a theory of rational action, characterized by being the inverse of RCT. We have further argued that they will lead to different normative prescriptions for the same situation, which one can not follow at the same time. Below we explore the consequences of this lemma, starting with an argument building on it.

Argument #2

Argument for “**Rationality is contextual**”

1. If one wants to be rational, then one has to conform to theories of rational action.
2. Different theories of rational action imply different action-sets
3. Therefore, if one wants to be rational, the one has to conform to theories with different behavior sets. [1,2]
4. If one must conform to different behavior sets, at the same time, then one must have criteria to choose between them.
5. Therefore, if one wants to be rational, one must have criteria for selection a particular theory of rational action at a particular time in a particular circumstance [3, 4]
6. If, to be rational, one must select selection a particular theory of rational action at a particular time in a particular circumstance, then rationality is contextual
7. Therefore, rationality is contextual. [5, 6]

Establishing the claims

If one wants to be rational, then one has to conform to theories of rational action.

A normative theory of rational action specifies under which conditions a set of behaviors is or is not rational. That is, it gives ideals such that if one's behaviors conform to them they are deemed rational, and if they do not, then they are not.

It follows that if one wants to be rational, then one must act in the way that normative theories of rationality define as rational.

Different theories of rational action imply different action-sets

See "Rational Choice Theory and Effectuation will specify different action-sets as rational in a given circumstance" in the previous section where we have shown for this to be the case, at the very least, in principle.

If one must conform to different behavior sets, then one must have a criteria to choose between them.

This claim is a consequence of a) having a set of possible discrete actions to take and b) having a time period limitation on what action to take. We proceed to illustrate it.

We can imagine having actions $A_0, A_1, A_2 \dots A_n$ and having a time period t_0 to t_1 that admits of only one action being performed. If this is the case then we need a principled way of choosing between actions.

If, to be rational, one must select a particular theory of rational action at a particular time in a particular circumstance, then rationality is contextual

This proposition seems to be intuitively valid. We contrast contextual and not contextual theories of rationality.

A theory of rationality is not contextual if it gives us an ideal of rationality such that can and ought to always be followed, *independently* of the situation (or context) one finds himself in. (Like RCT aims to).

In contrast, a theory of rationality is contextual, if it gives us an ideal

according to which one is rational in a particular circumstance, in a particular time. That is, as one changes situations, the ideal to which one has to conform changes as well. And thus the ideal is dependent on the context on which one finds itself. Which is to say that it is contextual.

If the ideal is contextual, then it follows that the theory that uses the ideal is contextual as well since it will suggest different ideals (possibly opposing) ideals for different situations.

3.3 Conclusion

We have now argued at length for the premises of each of our arguments. We have attempted to show how exactly it is that the seemingly contradiction between RCT and Effectuation arises: Effectuation's descriptive claims cause RCT normative claims to violate our intuitions about what is rational, *deriving from the fact that RCT does not apply to the problem-space to which Effectuation does*. We have tentatively concluded that RCT is not *the* theory of rational behavior, and suggested that it is a theory among many.

This conclusion is problematic. It is problematic because, if there are different theories of rationality, and they specify different, even contradictory behaviors, then whilst acting one is rational according to one theory but not the other. *This renders the concept of rationality useless*.

We suggested a solution to this problem in the next chapter.

4 The problem of Contextual Rationality

4.1 Introduction

In the present chapter we take several steps to solve - and clarify the rationale behind our solution to - the problem mentioned at the conclusion of the previous chapter. The problem can be framed as “If there are many theories of rationality, and they specify different things - possibly non-overlapping or contradictory things - as rational, doesn’t that render “rationality” useless?”. We agree that such a state of affairs would render the concept useless. (Hollis & Lukes, 1982) In the introduction we referred to this problem as the (implication of the) *impossibility of rationality*.

We now outline how our solution and rationale will be exposed in this chapter. We begin by analyzing what are the implications of what was done for the concepts of rationality first mentioned in Chapter 2. We then clarify at a higher level of abstraction what was done in the previous chapter. We proceed by suggesting desiderata for a theory of rationality, framing the original problem in terms of this desiderata, showing how the proposed solution solves that problem, and show - through the desiderata - how it creates a second problem. Finally, we outline our method for solving the problem generated and present our solution.

(For an overview of the psychology literature on the question of what is rationality see Samuels, Stich & Bishop (2012). There is no such summary of the philosophical debate, but see (Bunge, 1987) for an alternative philosophical approach.)

It should be kindly noted that this chapter is highly speculative and almost independent from the previous one, in logic and tone. The previous chapter provided a *demonstration* of the implication of Effectuation for RCT. This chapter is a collection of not-informal, but not-yet-formal statements of our intuitions about how to solve the problem that these implications generate.

4.2 Reconceptualizing rationality

4.2.1 Existing definitions of rationality

In the section on the philosophical history of rationality we mentioned two current definitions in philosophy. One, more abstract defined rationality as “Behaving in a way that is consistent with normative systems” (Chater & Oaksford, 2012). The other, instrumental rationality, was defined as “*knowing what to do*”.

Within certain traditions these two notions have been conflated. Baron defines instrumental rationality as “(...) the part of rationality that deals with behavior; it refers to behaving in the world in a way that an agent gets what it wants, given its resources. Behaving in a more instrumentally rational way is acting in a way that is

more likely to optimize the individual's goal fulfillment. The most instrumentally rational actions are those that are the best means towards our goals (Baron, 2005)."

It is thus clear that RCT is being taken as a normative system against which to measure behavior. We have argued in the past chapter that doing so will lead to worse outcomes in a particular domain - and hence be a non-satisfactory answer as to what to do. It follows that Rational Choice Theory cannot be a theory of rational choice *by itself*, and that a definition of instrumental rationality based on it is, at best, incomplete.

4.2.2 The possibility of a pluralized rationality

Greindl (Greindl, 2010) writes the following about rationality: "I will not attempt to lay down "definite" methods of rationality, simply because I don't think they exist – that is, at any given moment and for a given person – simply because there is probably always something more to discover which will also change our perception of what it means to be rational. But for a person who has to decide, at a specific moment in space and time, there will be a current set of principles of rationality. (...) For every tool of reasoning one can find a problem for which it won't work. The question now arises: which method do we employ to decide which methods are rational and which ones are not (the meta-method)? Why use this rule and not that one? We need some answer, but giving a definite answer will immediately violate the first desideratum of not laying down final dogmatic rules. Thus, in this case, it is good to avoid premature formalization and stick with "fuzzy" words. Our most helpful linguistic servants will be "open minded", "skeptical" and "coherent". The trick is to leave the definition of these words to the acting community of scientists and researchers, who have to solve the problems at their hands, problems of which we may yet not even know anything. (...) Delegating this responsibility to the community of scientists is not an excuse – it is unavoidable. "The price of freedom is eternal vigilance", and permanent active critical thinking can't be dogmatized or institutionalized. It is the curse of the enlightenment project that it will never be completed. But the least we can do is to try to improve on our rationality. As such, the enlightenment will also never be defeated, as long as there exist beings who enjoy the method of reason." (p.19)

The definition of rationality, as instrumental rationality, first described when reviewing the history of rationality in philosophy, claimed that rationality was behaving in the world as to get what one most wants given available resources. This simple intuitive intuition had then been technically refined into optimizing individual goal fulfillment and then formalized into the technical notion of expected utility maximization.

We have shown, how expected utility maximization fails to apply to the problem-space to which Effectuation applies. Maximising expected utility works, within the context of “Rational Choice Theory” *because the context is a very specific problem-space* where 1) the future is predictable, 2) goals are pre-given, and 3) the environment stays constant.

But using Expected Utility Maximization in the Effectuation problem-space will lead one to *not* get what they presumably want (to succeed as entrepreneurs), and hence, at the very least, RCT is incomplete as a theory of how to get what one wants.

We have claimed that Effectuation is also a theory of rational choice, albeit for a different problem-space, the inverse problem-space. If the future cannot be predicted then one cannot assess different scenarios for likelihood and if goals are not-pregiven one cannot assess different scenarios for desirability. Thus there is not probability to be multiplied by utility, and thus no expected utility.

Even the notion of optimizing individual goal fulfilment is unfeasible since there are no goals yet, at this level of description. Effectuation takes it upon itself to describe the process goal emergence.

By demonstrating that the claims above hold, what we have in fact done is to pluralize rationality. We did so by showing that there are at least two theories of rationality, each applicable to a particular problem-space.

With this we have attempted to place ourselves in the acting community of scientists and researchers that refine, and thus, redefine “rationality” and “what it is to be rational”.

This pluralization leads with a second problem. We now have two theories of rational behavior, which specifying different behaviors as rational. What does that mean for rationality?

We attempt to start answering this question in the next section by laying out desiderata of a theory of rationality.

4.2.3 Proposed Desiderata for a theory of rationality

Following we present our desiderata for a theory of rationality, and argue, in turn, for each desideratum. It is based on 6 conditions. The first three are weak conditions, which are trivially fulfilled, and which any theory that aims to be a theory of something should aim to fulfill. The latter 3 are desirable but not necessary conditions, conditions through which to compare candidate theories. We proceed to define them.

1. No-contradiction

This proposition has been argued for above, via a *reductio* argument. A theory that contradicts itself (A is rational, also $\sim A$ is rational) is as useful as no theory (All things are rational; no things are rational).

2. Specifiying

This proposition has been argued for above, via a *reductio* argument. A theory that does not specify behaviors as rational seems to miss the mark. This seems to be one of the *sine qua non* of a theory.

3. Consistent with intuitions

This proposition has been argued for above, via a *reductio* argument. A theory that fails to meet our intuitions seems to miss the mark.

4. Type of theory

Ideally, we would desire our theory to be normative. That is, to provide a standard against which to measure behavior. This was the reason that RCT had such a strong appeal, it provides a way of classifying behaviors as more or less rational by comparison to the normative rules it proposes.

5. Scope of theory

Ideally, we would desire our theory to have as broad a scope as possible. A theory of what is rational to do every time one is playing chess seems entertaining, but not useful. The broader the scope, the higher the usefulness of the theory.

6. Usefulness of the theory

Ideally, we would like our theory to be useful. That is, that applying the theory actually brings about better outcomes than not applying it.

4.2.4 The problem explained

How RCT fails desiderata of a theory of rationality

Having made our desiderata explicit we can better analyse the original contradiction proposed. On the one hand we had *a theory of successful expert entrepreneur behavior*, and on the other *a theory of rationality claiming that the behavior enacted by these experts was either irrational or arational*. This seemed to be a gross violation of intuitions about what is and isn't rational.

This violation was solved by limiting the scope of the theory, so that it did not apply to the domain of entrepreneurship, and therefore could not make claims about what is and isn't rational *in that domain*. This left us with the problem of having a domain in which we have no theory of what is rational, which was immediately solved since Effectuation is such a theory.

This solution created the problem explained in the next section.

How the proposed solution fails desiderata of a theory of rationality

Our proposed solution was to consider both Effectuation and Rational Choice Theory, theories of rational behavior. This is problematic, as it violates our first desideratum of non-contradiction.

The theories establish different behaviors as rational and thus some behaviors that are rational according to a theory are not according to the other one and vice-versa. This would lead to a contradiction.

In the next section we explain our method to resolve this issue.

4.2.5 Moving forward: Reawakening from the formalism

By this point we have claimed that RCT is not a complete (in scope) theory of what is rational, but instead that it has a specific domain of application. We have also claimed that Effectuation is a theory of rational behavior, with a specific, non-overlapping domain of application.

Doing so, we have in some way broken through the formalism. RCT was meant to capture what rationality is, and we have demonstrated that in fact it does not capture it fully, because it leads to contradictions with our intuitive sense of what it is that the formalism is trying to capture.

Because we have broken the formalism, we need to step back and look at the “roots in reality” of the construct of rationality.

For the sake of the argument we suggest two particular texts that can be used to again see the roots in reality of the construct of rationality. These two texts are chosen because one is from one of the founders of psychology, and the other from a contemporary research of rationality. Further, the second text provides a conception that is very consonant with the existing conception of instrumental rationality used in (some parts of) cognitive science. The first piece quoted is “The Sentiment of Rationality” by William James, and the second “Rationality is Systematized Winning” by Eliezer Yudkowsky.

“What is the task which philosophers set themselves to perform; and why do they philosophize at all? Almost every one will immediately reply: They desire to attain a conception of the frame of things which shall on the whole be more rational than that somewhat chaotic view which every one by nature carries about with him

under his hat. But suppose this rational conception attained, how is the philosopher to recognize it for what it is, and not let it slip through ignorance? The only answer can be that he will recognize its rationality as he recognizes everything else, by certain subjective marks with which it affects him. When he gets the marks, he may know that he has got the rationality.

What, then, are the marks? A strong feeling of ease, peace, rest, is one of them. The transition from a state of puzzle and perplexity to rational comprehension is full of lively relief and pleasure.

But this relief seems to be a negative rather than a positive character. Shall we then say that the feeling of rationality is constituted merely by the absence of any feeling of irrationality? I think there are very good grounds for upholding such a view. All feeling whatever, in the light of certain recent psychological speculations, seems to depend for its physical condition not on simple discharge of nerve-currents, but on their discharge under arrest, impediment, or resistance. Just as we feel no particular pleasure when we breathe freely, but a very intense feeling of distress when the respiratory motions are prevented,--so any unobstructed tendency to action discharges itself without the production of much cogitative accompaniment, and any perfectly fluent course of thought awakens but little feeling; but when the movement is inhibited, or when the thought meets with difficulties, we experience distress. It is only when the distress is upon us that we can be said to strive, to crave, or to aspire. When enjoying plenary freedom either in the way of motion or of thought, we are in a sort of anaesthetic state in which we might say with Walt Whitman, if we cared to say anything about ourselves at such times, "I am sufficient as I am." This feeling of the sufficiency of the present moment, of its absoluteness,--this absence of all need to explain it, account for it, or justify it,--is what I call the Sentiment of Rationality. As soon, in short, as we are enabled from any cause whatever to think with perfect fluency, the thing we think of seems to us *pro tanto* rational.

Whatever modes of conceiving the cosmos facilitate this fluency, produce the sentiment of rationality. Conceived in such modes, being vouches for itself and needs no further philosophic formulation." (James, 1896)

"Rationalists should *win*," I said, and I may have to stop saying it, for it seems to convey something other than what I meant by it.

Where did the phrase come from originally? From considering such cases as [Newcomb's Problem](#): The superbeing Omega sets forth before you two boxes, a transparent box A containing \$1000 (or the equivalent in material wealth), and an opaque box B that contains either \$1,000,000 or nothing. Omega tells you that It has already put \$1M in box B if and only if It predicts that you will take only box B, leaving box A behind. Omega has played this game many times before, and has been right 99 times out of 100. Do you take both boxes, or only box B?

A common position - in fact, the mainstream/dominant position in modern

philosophy and decision theory - is that the only *reasonable* course is to take both boxes; Omega has already made Its decision and gone, and so your action cannot *affect* the contents of the box in any way (they argue). Now, it so happens that certain types of *unreasonable* individuals are rewarded by Omega - who moves even before they make their decisions - but this in no way changes the conclusion that the only *reasonable* course is to take both boxes, since taking both boxes makes you \$1000 richer regardless of the unchanging and unchangeable contents of box B.

And this is the sort of thinking that I intended to reject by saying, "Rationalists should *win!*"

Said Miyamoto Musashi: "The primary thing when you take a sword in your hands is your intention to cut the enemy, whatever the means. Whenever you parry, hit, spring, strike or touch the enemy's cutting sword, you must cut the enemy in the same movement. It is essential to attain this. If you think only of hitting, springing, striking or touching the enemy, you will not be able actually to cut him."

Said I: "If you fail to achieve a correct answer, it is futile to protest that you acted with propriety."

This is the distinction I had hoped to convey by saying, "Rationalists should *win!*"

There is a meme which says that a certain ritual of cognition is the paragon of *reasonableness* and so defines what the *reasonable* people do. But alas, the *reasonable* people often get their butts handed to them by the *unreasonable* ones, because the universe isn't always *reasonable*. Reason is just *a* way of doing things, not necessarily *the* most formidable; it is how professors talk to each other in debate halls, which sometimes works, and sometimes doesn't. If a horde of barbarians attacks the debate hall, the truly prudent and flexible agent will abandon reasonableness.

No. If the "irrational" agent is outcompeting you on a *systematic* and *predictable* basis, then it is time to reconsider what you think is "rational".

For I do fear that a "rationalist" will clutch to themselves the ritual of cognition they have been taught, as loss after loss piles up, consoling themselves: "I have behaved virtuously, I have been *so reasonable*, it's just this *awful unfair universe* that doesn't give me what I *deserve*. The others are *cheating* by not doing it the rational way, *that's* how they got ahead of me."

It is this that I intended to guard against by saying: "Rationalists should *win!*" Not whine, *win*. If you keep on losing, perhaps you are doing something *wrong*. Do not console yourself about how you were so wonderfully rational in the course of losing. That is *not* how things are supposed to go. It is not the Art that fails, but you who fails to grasp the Art." (Yudkowsky, 2009)

Because our argument has, if successful, pitted RCT against our intuitions of what rationality is, we have had the need to further pump our intuitions (Dennett, 1995) (Brendel, 2004) about what it is that we are trying to pin down via

“rationality”.

These texts, as an example of a possible way forward, aim to pump the intuition of rationality being both the process and the result of a process. They aim to have us developing a sense for the sentiment of rationality, for a sentiment of relief, fluency³, and comprehension; for having the picture “fall into place”, a sense of fit.; of what it's like to have our experience ordered (Cernigoj, 2010) and legible (Rao, 2010); to winning.

But can we be more systematic about these notions?

4.2.6 A proposed solution: Meta-Rationality

We propose that we can, and in this section attempt to take the first steps in that direction, keeping in mind that the pieces above are being used to merely attempt a first sketch of a solution, of a possible reconceptualization of the formalism of rationality, a possible or suggested direction, and not a mandatory problem solution.

The concept of decision technologies is available in the literature as decision technology as the rules and tools that help us make wiser decisions (Edwards & Fasolo, 2001). “Wiser” is fuzzy enough as to fit for our purposes. Another definition could be “rules and tools to help us decide better”. Or, in line with (Dew & Sarasvathy, 2002) “a method for solving problems in a particular problem-space”. We build off this concept of decision-technology, to define rationality in a way that more systematically captures the intuitions pumped above.

Rationality is no more than “Using the appropriate decision-technology”. This notion is fuzzy enough to be generative, and strict enough to limit what is and isn't rational.

The notion can be unpacked as “Using the rules and tools that succeed for the problem-space an agent finds itself in”. This concept reframes RCT and Effectuation theory as decision-technologies, each appropriate for a particular problem-space. This solves the problem of having two contradictory, non-overlapping theories of rational behavior.

It also provides headway to the solution of the problem which decision-technology to apply at which time. The solution is going to depend on the environment and on the decision-makers capacity to recognize the problem-space it finds itself in.

Note that, with regards to the proposed desiderata, the theory is non-contradictory, specifies behaviors as rational and irrational, and is consistent with intuitions about rationality (by virtue of subsuming other existing theories and contextualizing them). Besides, it also provides a scaffold for normative criteria. In the form of “An agent is rational to the extent that it acts as if following a method

³ interestingly this has been taken by metacognition research. See (Alter & Oppenheimer, 2009)

that, in expectation, solves the the type of problems existent in the problem-space the agent finds itself'. Such an agent would solve problems in the environment, its picture would fit to the world, and its understanding would be fluent and its problem-space legible. This fits with the intuitions of what it means to be agreeable to reason, to be rational.

We call this concept the theory of *meta-rationality*. According to the theory of meta-rationality (1) since decision technologies differ in application value, because of different problem spacesl problem-space characteristics should define the use of the correct decision-technology, and (2) a decision-maker is meta-rational, to the extent that it uses the appropriate decision-technology for the problem-space the agent finds itself in. (This criterium entails having a reliable process - in expectation - through which to recognize the characteristics of the problem-space, and a reliable process - in expectation - that leads to the application of the appropriate decision-technology.)

4.3 Conclusion

In the preceding chapter we have specified in an analytical fashion our arguments against the existing dominant conception of rationality spearheaded by RCT, given the existence of effectuation theory. We have explained how we have pluralized rationality and how it opened a problem of having contradictory definitions of rationality simultaneously. To resolve this problem we proposed desiderata for a theory of rationality, and used the desiderata to understand the original and the current problems. We also proposed to get back to the intuitions behind rationality and aimed to use two texts to pump them further. Finally, we made an explicit proposal of how to capture those intuitions, whilst solving the aforementioned problems. This proposal was the theory of meta-rationality.

In the next chapter we conclude the work by summarizing what was done, enumerating limitations, and suggesting avenues of further theoretical exploration that were made possible by the theoretical innovations suggested in the present chapter.

5 Conclusion

5.1 Introduction

If successful, the arguments made in this thesis have demonstrated the incompleteness of RCT as an encompassing theory of rationality and the need for broader theories of what it is to be rational. We have also suggested a concept that provides the needed encompassing theory.

This final chapter begins with a list of the limitations of the preceding work. After, we propose avenues of development for further work on the theoretical innovations exposed. We end by synthesizing the contributions of this thesis to our understanding of rationality.

5.2 Limitations

One of the essential limitations of this work is that it is written from within the border of the perspective of and to the Heuristics and Biases paradigm of Judgement and Decision-Making. At least two other well-developed contemporary programs exist, the Fast and Frugal Heuristics program and the Naturalistic Decision-Making program. This was as part a reflection of the authors' ignorance of the details of these paradigms, as of the fact that neither of them accept RCT as normative (and thus the argument laid out does not apply to them).

Another limitation is that we have presented a fundamentally philosophical argument against the fact that an existing formal, mathematical model captures a concept. We have developed no mathematical model of what our proposal of rationality looks like, and how it encompasses and contextualizes RCT, formally.

This is in part because effectuation itself is not yet at the level of a formal theory, and as such the implications can be inferred but not deduced.

We have also avoided repeating other criticisms of RCT as a theory of rationality - except for the bounded rationality criticism - and most recent contentious issues in JDM. These come from an orthogonal direction such that approaching them would derail attention from the points made.

We have also failed to develop the implications of what this redefinition of rationality entails. It suggests many connecting points for existing literatures, and recontextualizations and interpretations of previous literatures, and an upheaval of the field of debiasing, but we have not analysed these to great detail.

In the next section we make further suggestions for future research directions at a greater level of granularity.

5.3 Future Directions

In this section we divide proposals for future directions in three parts: 1) “Connecting literatures” – ways of using the postulated constructs to unify streams of literature -; 2) “Needed conceptual clarification” – theoretical questions left open by the proposals of the thesis-; and “Needed empirical clarification” - a first attempt at an empirical question deriving from the work done. To facilitate readability proposals have been divided over bullet points with a proposal per bullet point.

(This section assumes some familiarity with other theories of Decision-Making. The unfamiliar reader is suggested the following introductory resources: (Lipshitz & Klein, 2001) for Naturalistic Decision-Making, and (Gigerenzer & Goldstein, 1996) for Fast and Frugal heuristics)

5.3.1 Connecting literatures

The definition of decision technology postulated (“Methods for solving problems in a particular problem-space.”) provides the opportunity of connecting the decision-making and the problem-solving literatures. The concept allows one to reconceptualize decision-making as problem-solving, two streams of literature that have remained mostly separated. Further, it provides a bridge through which to integrate expertise literature into decision-making literature, as decision-technologies are what experts develop over the time in which their domain-expertise is constructed. (The connection between expertise, NDM, and H&B has been very lightly touched on in (Kahneman & Klein, 2009))

The concept of meta-rationality, as well, provides a unifying point for the literatures in decision-making and problem-solving. Although some research has been done in this junction point (Smith, 1988), much more could be achieved.

- Meta-rationality & Existing research programs of rationality

Heuristics and Biases: H&B has been, to a large extent, the study of when people violate RCT (Kahneman, 2003) and the creation of theories to account for these violations (Tversky & Kahneman, 1992). If, as claimed, RCT is not the theory of Rational decision-making, but a theory, then this makes it necessary to reanalyse all of the empirical results of H&B: (1) What does the suggestion that RCT is *a* theory and not *the* theory of rational behavior imply for existing empirical results of the H&B tradition?

(2) How does this suggestion affect the aim and processes of debiasing?

F&F heuristics: The idea of using various decision-technologies as the problem-

space requires it, appears to be similar to the F&F idea of the adaptive toolbox - to use heuristics in environments where they work (1) How do they relate?

NDM: NDM studies recognition-primed decision-making (Klein, 1997b). Meta-rationality entails a reliable process - in expectation - through which to recognize the characteristics of the problem-space. (1) What can the theory of meta-rationality take from what has been learned by NDM with regards to cue-recognition, and problem-space recognition?

- Meta-rationality & research on Expertise

Meta-rationality entails that experts in a field are more rational than non-experts. ("An agent is meta-rational then, to the extent that it uses the appropriate decision-technology for the problem-space the agent finds itself in." encompasses experts since an expert is someone that has a reliable process - in the form of the features of their trained cognitive systems- that outputs methods and rules that solve the kind of problems they find in the field in which they are expert). Does this mean that Meta-rationality claims that successful expert entrepreneurs are more rational than those that are not successful and are not experts. This theoretical move opens the gates for the harvesting of theories of rationality through the analysis of expert behaviors. (1) Can meta-rationality be summarized as "For each problem-space do what an ideal expert would do?" (2) If so, what can be taken from expertise literature into the normative, and other parts of meta-rationality?

- Unifying constructs: Expertise

It appears that one perspective of JDM approaches could use ideals and tempo as unifying constructs. For each approach (H&B, F&F, NDM) an ideal can be defined (Homo Economicus in the RCT problem-space, mind/environment fit, and in-field experts in their problem-space)

This idea of expertise as a unifying construct find support in Simon's account of what factors to study in decision-making: "the type of task, the characteristics of the environment; and the *distinct features of the cognitive system that makes the decision*. The latter includes the previous knowledge or expertise of the decision maker." (Campitelli & Gobet, 2010) This is a very parsimonious framing, since Effectuation is the study of how experts in the entrepreneurship problem-space choose.

- Relating the fields

We summarize how the different fields of JDM and Effectuation may relate in the figure below:

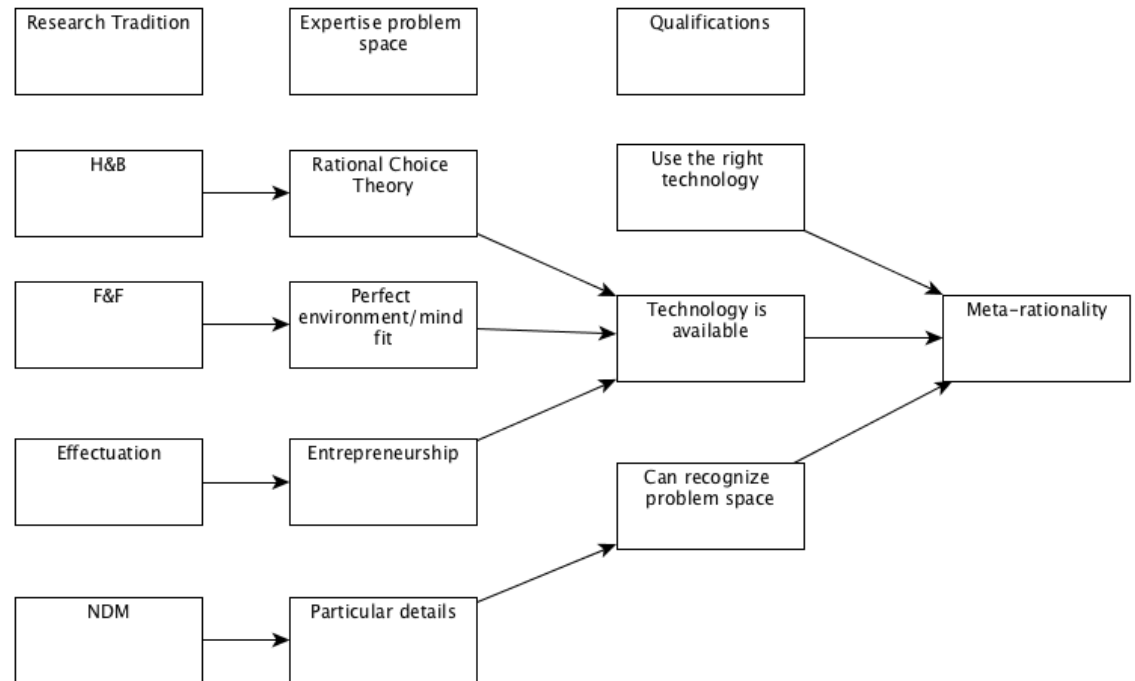


Figure 9: The relationship between JDM research traditions and meta-rationality

The figure above provides a possible suggestion of the relationship between the fields. The traditions of H&B, F&F, and the literature on scholarship all work on different problem-spaces: the first in the one where RCT is the ideal solution, the second in the one where there is a fit between the environment and the mind of the agent, and the third in that of entrepreneurship. On the other hand NDM focuses on how agents recognize the characteristics of the problem-space they find themselves in.

This being so, each field provides a piece of what is needed for the study of meta-rationality. Meta-rationality has been defined as using the appropriate decision-technology for the problem-space the agent finds itself in. Conveniently, 3 traditions have been studying different decision-technologies for different problem-spaces, and one has been studying the recognition of a particular problem-space in real time. Thus they all have potentially synergistic research foci through the concept of Meta-rationality.

5.3.2 Needed conceptual clarification

- Decision-technologies

(1) How does one shift from one decision-technology to another? It seems reasonable to assume that entrepreneurs are not always in entrepreneur mode, as it were. If that is the case, how to they shift between decision-technologies? (Of course, the fact that entrepreneurs are *always* making decisions according to Effectuation Theory's decisional principles would be notable by itself.)

(2) Can decision technologies be characterized by normative ideals? The Homo Economicus has long been the paradigm of RCT - a perfectly optimizing being. Could a similar one be defined for Effectuation Theory? (A theoretical being that follows the theory rules at all times). Why or why not?

(3) Do Decision-technologies fall within the concept of the adaptive toolbox (Gigerenzer & Selten, 2002) concept of the F&F heuristics paradigm? Or within the mental models t(Huang & Hutchinson, 2013) concept of OODA?

(4) How does one assess the characteristics of the problem-space one is in? (NDM might be especially useful to help addressing this question.)

- Formalization

RCT is a formalized normative theory of how to choose given preferences, beliefs and a samplable future. Effectuation is a descriptive theory of a different environment. (1) Can effectuation be formalized? (2) Can meta-rationality be formalized in a way that subsumes effectuation and RCT? (3) Can other theories be formalized by harvesting the decision principles of experts in different domains?

- Onto-philosophical analysis

One way of looking at RCT is as a reductionist, acontextual, atemporal theory. (Sandberg & Tsoukas, 2011) Effectuation, in turn seems to be a temporal theory. Meta-rationality seems to be a contextual theory. (1) What would a reductionist and holistic view of meta-rationality be like? (2) What would a temporal and atemporal view of meta-rationality be like?

RCT is deeply atemporal: goals are stable, and the environment is stable. Effectuation is a somewhat atemporal account of dynamism, although it does include Weickian enactment (Weick, 1979): the idea of feedback loops from actions to the

environment and to the goals of the one taking actions. Future research could investigate the temporal cycle of goal discovery, goal setting, how goal discovery and goal setting affect the environment, performance, and further goals.

- The assumptions of various theories of rationality

(1) Can we create a taxonomy of the assumptions RCT makes? (2) Can we use this taxonomy to remove each assumption and see what theory emerges? RCT assumes infinite computing time and computing capacity, preexisting preferences, a predictable environment; it is also a normative, atemporal theory. By removing the first assumption we have the theory of bounded rationality. By removing preexisting preferences and a predictable environment we have Effectuation. Effectuation is descriptive and atemporal. (3) Could we have a normative temporal theory of rationality? (4) What other assumptions are there to be explored? (3) What other theories can be generated by questioning these assumptions? (5) What is the theory of rational behavior in a dynamic, temporal environment, in which there are preferences?

- How meta-rationality relates to other frameworks

(1) Meta-rationality seems to be a theory at the same level of abstraction as that of the Adaptive Decision Maker (Payne, Bettman, & Johnson, 1993); how are they theoretically related? (2) OODA has in it the ideas of Observing and Orientation. These seem similar to the idea of recognizing the characteristics on the problem-space and using the appropriate decision-technology. How do these ideas relate? (3) NDM has the concept of Recognition primed decision making. How does it relate to recognizing the environment characteristics? (4) How do F&F ideas of ecological rationality connect to the idea of meta-rationality? (The definition of ecological rationality to some extent seems, to some extent, to cover the same ground that meta-rationality does: “adaptive behavior resulting from the fit between the mind’s mechanism and the structure of the environment in which it operates.” (Todd & Gigerenzer, 2000))

- Relation to other fields

RCT and game theory came to life together (Neumann & Morgenstern, 1947).
(1) What does a game theory based on the principles of meta-rationality look like?
(2) How do fields that have been created on the assumption of RCT change given an effectuation, and meta-rationality?

5.3.3 Needed empirical clarification

- Consequences of using one theory over the other

(1) What are the empirical consequences of framing problems effectually versus causally in various contexts? (2) What are the consequences of reasoning through effectuation versus reasoning through RCT in various contexts? (3) What are the consequences of using RCT or Effectuation Theory in various contexts?

5.4 Synthesis

The goal of this thesis was to (1) derive the implications of Effectuation Theory for Rational Choice Theory, and hence, for our conception of rationality, and (2) to suggest a theoretical solution to the intuitively paradoxical nature of these consequences: that successful expert entrepreneurs are more *irrational* than the ones that are neither experts nor successful, or that they are arational.

In this process we have generated various original contributions:

- An explicit argument for the existence of a contradiction. A lemma implying the existence of two different theories of rational action, and the impossibility of behaving according to both concomitantly, and an argument that implied that rationality is contextual.
- A pluralization and redefinition of rationality, introducing the concept of meta-rationality and having RCT and Effectuation subsumed by this theory, as decision-technologies.
- We proposed desiderata for a theory of rationality, and saw how they explained the original contradiction.
- We proposed a solution - which was problematic according to the given desiderata – and further showed how meta-rationality solved both the original problem (the paradoxical implications of RCT) and the “new” problem of having two theories of rationality, thus being a better fit to the proposed desiderata than RCT.

In this process we have seen what Effectuation implies for RCT, formalized

that implication, and solved the problems it originated. Our proposed solution of meta-rationality and decision technologies is solely that – a proposal – and further proposals that deal with the original problem are made possible by *having this thesis making that problem explicit*. Further, should there be an agreement that the solution proposed is workable, then the various suggestions in the previous section propose ways forward.

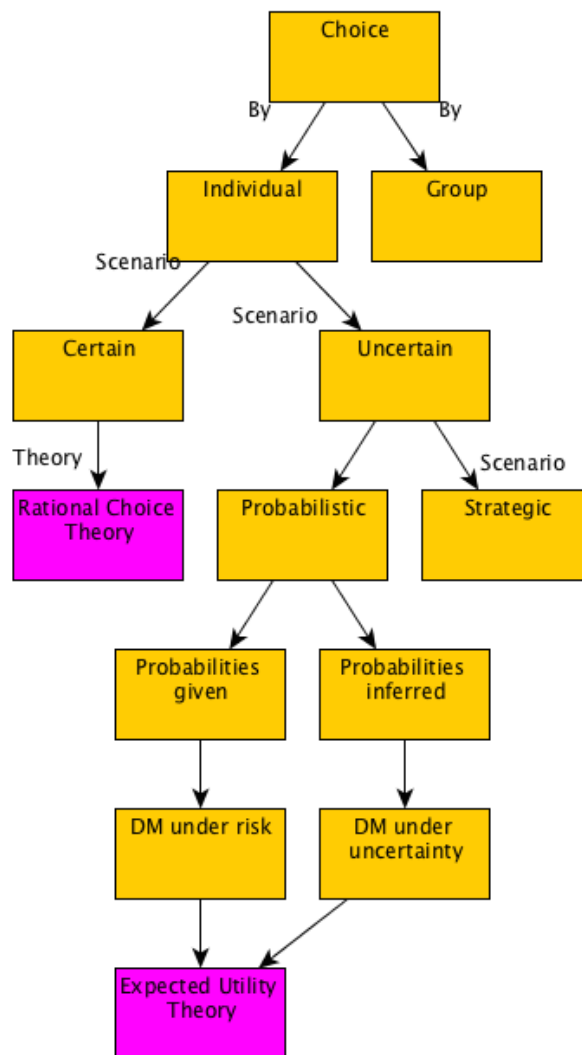
The fact is that, despite being the various problems it causes us, from the theological disputes over freewill, the dilemmas of absurdism, the doubts of behaviorism, and claim of determinism (March, 1976), we cannot but interpret human action as being due to choices.

We alluded to in the Introduction when we attempted to elicit how tragic it feels that well-intentioned researchers might be failing at bringing human welfare to new heights by using the wrong theory of what rational behavior is^{4 5}. Hopefully we have set the stage for better theories of human action to emerge, so that we can make sense of what we could not before – in virtue of having an incomplete theory – and provide researchers with better tools to enhance welfare.

4 This might help explain the failures of debiasing and the general pessimism of the field (Larrick, 2004)

5 This might help explain the passion behind the rationality wars and the voluminous literature they have produced. (KE Stanovich & West, 2000) (Tetlock & Mellers, 2002) (Sturm, 2012) (Rysiew, 2008)(Gigerenzer, 2008)

Appendix A – Choice Theory



(from (Allingham, 2002))

Figure 10: Choice Theory

Appendix B – Choice Theory, including Effectuation

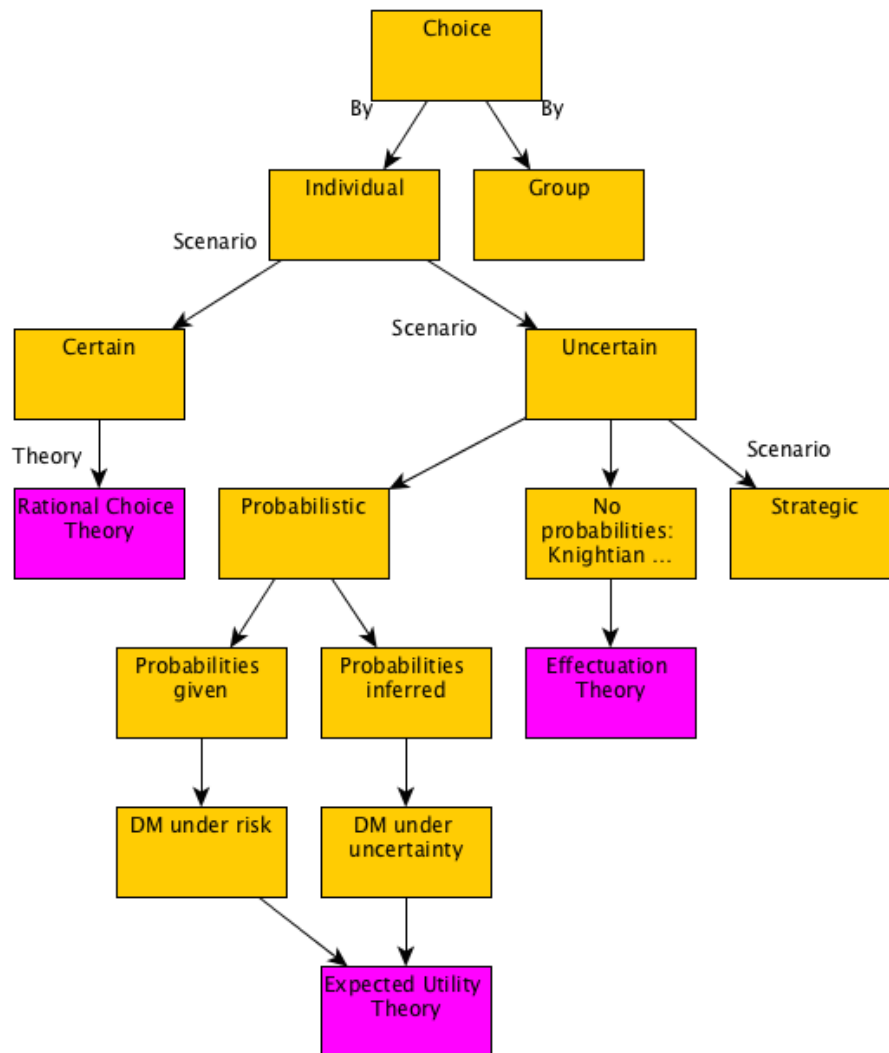


Figure 11: Choice Theory, including Effectuation

Effectuation Theory is the response to a problem space in which – among others - probabilities cannot be known.

Appendix C – Choice Theory, including Effectuation and Meta-Rationality

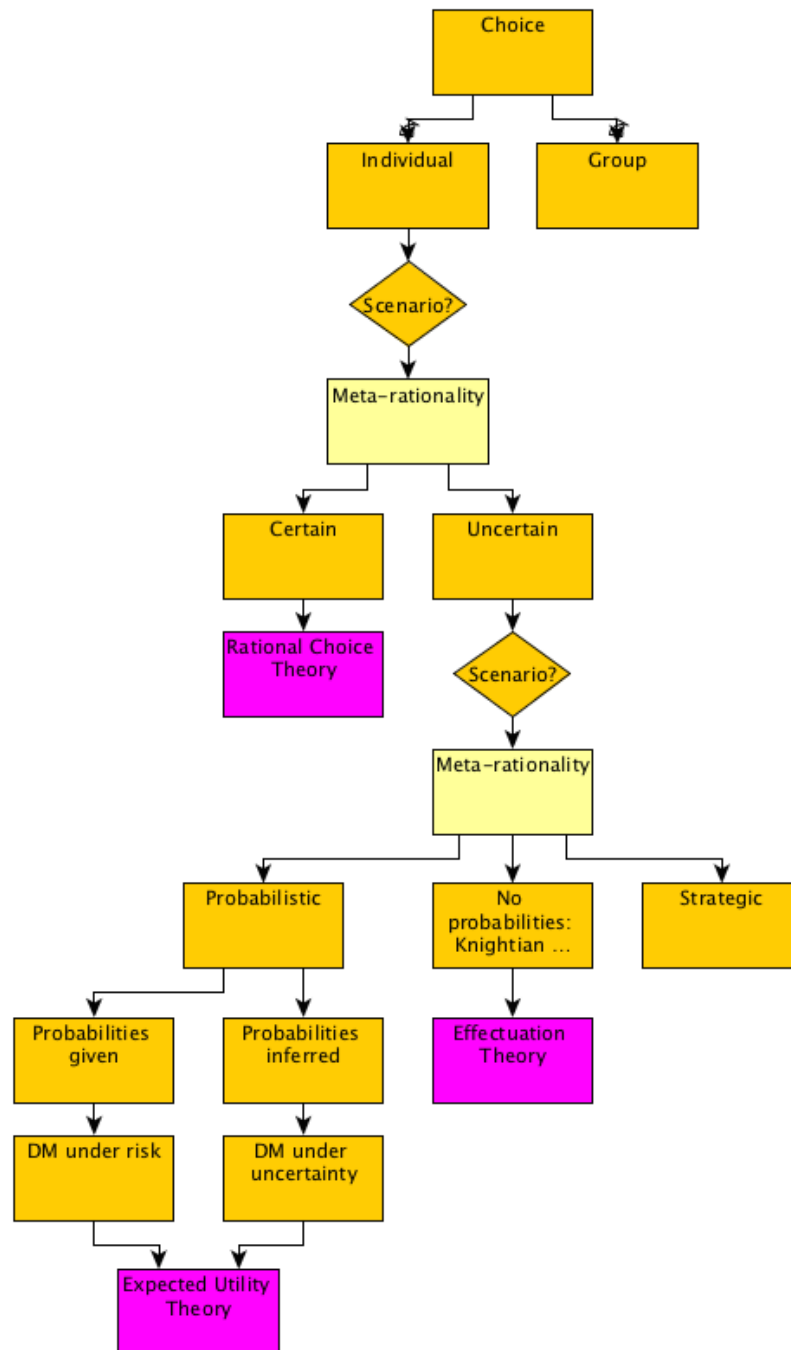


Figure 11: Choice Theory, including Effectuation and Meta-rationality

Meta-rationality is the response to the need of analyzing which scenario (problem space) an agent finds itself in. Before this was not accounted for. There is only one theory of meta-rationality, it is separated here for ease of apprehension of the figure.

Appendix D: English Abstract

In this thesis we analyse Rational Choice Theory in the light of the empirical findings of Effectuation Theory.

We begin by describing Rational Choice Theory - a top-down mathematical theory of how agents ought to make decisions to be rational. We then analyse its influence since it was devised in 1954. Secondly, we cover Effectuation Theory - a bottom-up empirical theory of how expert entrepreneurs make decisions.

After having described both theories we then derive one fundamental complication that Effectuation Theory entails for Rational Choice Theory, by virtue of being its inverse.

The fact that Effectuation Theory claims that successful, expert entrepreneurs use the inverse of Rational Choice Theory for deciding implies, according to *Rational Choice Theory*, that successful, expert entrepreneurs behave in the way that is arational, or more irrational than less successful entrepreneurs, according to *Rational Choice Theory*.

We take this implication *seriously* and thus do not hand wave it away by claiming that Effectuation Theory is not a theory of rational behavior. We claim that both theories are theories of decision-making and then provide formal arguments that show how the suggested entailment is obtained.

By taking it *seriously* we derive what seems to be the only possible conclusion: that rationality is contextual. This redefinition of rationality as an endeavor dependent on the particular problem-space an agent finds itself in, solves the problem that had been obtained but creates a new one, namely, if there are two theories of rationality that recommend different, mutually incompatible, actions for the same problem, then one will always be at best irrational according to one theory and rational according to the other, and thus the concept of *rational* becomes meaningless.

We attempt to solve this second problem by refactoring rationality not as conforming to one particular theory at all times but to apply the proper decision-technology to the environment in which the agent finds itself. We call the ability to do so “Meta-rationality”. We further argue that this proposed theory of meta-rationality fulfills important desiderata that Rational Choice Theory does not, given the implication first derived.

We show the fruition of the theory by suggesting where conceptual clarification would be useful, and how it could be connected to existing literature streams. We finish with considerations about the importance of having an appropriate theory of rational behavior.

Appendix E:Academic CV

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Education

MSc ‘Middle European Interdisciplinary Master Program in Cognitive Science’

September 2012–Present

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Master of Sciences Thesis Supervisor: ao. Univ. Prof. Dr. DI Markus F. Peschl

University of Ljubljana (ERASMUS)

2013-

2014

Project work:

- *When do emotions enhance or undermine the normative rationality of judgments under uncertainty?*
- *How do individual differences in executive functions relate to the ability to perceive both states of visual bistable perceptual phenomena on command?*
- *A comparison of epistemological accounts*

University of Vienna, Medical University of Vienna & OFAI (The Austrian Research Institute For Artificial Intelligence)

2012–2013

Project work:

- *Debiasing the framing effect in medical decision-making: A comparison of methods*
- *Towards a Methodology of Human Problem Difficulty Analysis*
- *The metaphoric framing heuristic*

BA Management

University of Lisbon, Institute for Economics and Management

2009-

2012

University of Fortaleza, Brasil (ERASMUS MUNDUS)
2012

Test of English as a Foreign Language TOEFL

2012

Test score: 114/120 points

Academic and related Achievements

Scholarship / Grants:

University of Vienna, Department of Philosophy, Austria 2014
750€ Performance Scholarship, MSc MEi:CogSci

Effective Altruism Summit, California, USA 2013
2000\$ Summit participation

CFAR (Center For Applied Rationality), California, USA 2013
2000\$ Workshop participation

IK Conference "Wicked Problems, Complexity and Wisdom" 2013
340€ Conference participation

Conferences:

Mei:CogSci Conference 2014 Krakow –Presentation: Effectuation and Rational Choice
Theory: Implications for our conception of rationality1
2-14/06/2014

Mei:CogSci Conference 2013 Budapest – Poster Presentation: Debiasing the framing
effect in medical decision-making: A comparison of methods
18-21/06/2013

IK Conference 2013 Guenne "Wicked Problems, Complexity and Wisdom"
15-20/03/2013

Additional relevant information

Rationality Vienna / LessWrong 2012–present

Research assistant. Organizer. Workshop teacher.

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Student's Association Pedagogical Department Coordinator in Institute for Economics and Management

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