Veronica Gustafsson

Entrepreneurial decision-making

Individuals, tasks and cognitions
Entrepreneurial decision-making: Individuals, tasks and cognitions
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If you can dream – and not make dream your master;
If you can think – and not make thought your aim;
If you can meet with Triumph and Disaster
And treat those two impostors just the same…

Rudyard Kipling, “If”
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Jönköping, den 9 juni 2004

Veronica Gustafsson
Abstract

The aim of the present study is to gain a deeper understanding of decision-making of individuals involved in the entrepreneurial process. It is achieved by comparing entrepreneurs with different level of expertise in contexts that are more or less entrepreneurship-inducing. The issues of learning and expertise – investigation of what entrepreneurial knowledge is and how it is applied – are also addressed.

This is an attempt of a multidisciplinary study based on entrepreneurship theory and empirical research as well as cognitive psychology. The cognitive perspective provides a link between the entrepreneur and the new venture creation through focussing not on the personality traits, but on an individual’s cognitive behaviour.

The study’s contributions to the field of entrepreneurship are as follows: Expert entrepreneurs do recognise the cognitive nature of the decision task and are able, to a high extent, to match their decision-making techniques with the nature of the task. It means that the entrepreneurial decision-making is not an inborn aptitude but a skill, which is expressed through the adaptable behaviour of experts. Novice entrepreneurs, however, do not possess this ability, even though they might acquire it in the course of their business lives.

Thus, one of the most important implications of the study is the idea that adequate decision behaviour in entrepreneurial context can be taught and learned. To provide optimal methods of learning is a challenge faced by entrepreneurship education.
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1. Introduction: Entrepreneurship Research and Decision-Making

1.1. Entrepreneurs and entrepreneurship

Does entrepreneurial personality exist? More than thirty years of research have witnessed that differences in personality traits provide little explanation to the fact that some entrepreneurs are successful whereas others are not. Thus, there is almost no support to the popular idea that success in entrepreneurship is about having the right psychological traits. Entrepreneurs do not constitute a homogenous group; they are dissimilar, and classification attempts have been numerous. One of the best-known typologies was introduced by Smith (1967), who categorised entrepreneurs into craftsmen and opportunists, the two archetypes representing the continuum poles.

Although Smith’s typology was relatively well-developed theoretically, it did not hold. According to Davidsson (1988), Smith’s archetypes could indeed be found among entrepreneurs, but they were not exhaustive: certain percentage of entrepreneurs could not be assigned to any of the groups basing on the criteria provided by Smith. This conclusion was further supported by Woo et al. (1991), who confirmed that the craftsman – opportunist typology possessed relatively low predictive power and was far from universal. Moreover, according to Woo et al. (1991), none of the typologies they examined would demonstrate sufficient predictive power and comparability.

So, entrepreneurs are dissimilar, yet the dissimilarity does not seem based on their personality. Could their behaviour provide an explanation? What if novice entrepreneurs (those without previous start-up and management experience) behave differently from habitual, or experienced, entrepreneurs? This assumption has been tested by Westhead and Wright (1998) and the results are somewhat ambiguous. On the one hand, the researchers have found seven significant differences between novice and habitual entrepreneurs. On the other hand, there is no significant difference in performance of firms established by novices, compared to the firms established by habitual entrepreneurs.

Ucbasaran et al. (2003) approached the potential difference in novices’ and habituals’ behaviour from the cognitive perspective; in other words, the authors tried to investigate if novice and habitual entrepreneurs would employ different decision-making styles in opportunity identification. Since their article is conceptual, it provides no empirical evidence, yet the tentative conclusion is that such differences are likely to exist.
So, novice and experienced entrepreneurs, apparently, think differently, and make decisions in a different way. This is an important assumption, which will be further developed and investigated in the present study.

Another important assumption is that these decision-making differences concern opportunity identification. According to Shane and Venkataraman (2000), opportunity is one of the central concepts in the field of entrepreneurship research. Based on Casson (1982), the authors define opportunities as “those situations in which new goods, services, raw materials, and organising methods can be introduced and sold at greater than their cost of production.” (Shane and Venkataraman, 2000, p.220)

This definition can be complemented by several important considerations. Opportunities do not recognise themselves; neither do they produce goods or services, nor bring them to the market. All this is done by an agent, an entrepreneur, who is able a) to identify an opportunity, b) to evaluate it (i.e. decide whether a potential product or service can be produced and sold profitably), and c) to exploit it, i.e. to produce and sell. Opportunities, such as a possibility of a technical invention or a new source of raw material, exist independently of an entrepreneur. However, one needs an entrepreneur, who possesses a subjective ability to recognise the profit potential of this invention or raw material source, in order for it to be brought to the market (Shane and Venkataraman, 2000). Thus, starting from objective opportunities, an entrepreneur may (or may not) identify a subjective venture idea (Davidsson, 2003).

An inherent property of this process is uncertainty (and, therefore risk), which arises by definition due to the novelty involved (cf. Schumpeter, 1934; Knight, 1921; Sarasvathy et al., 2003). This uncertainty factor also precludes decision-makers (entrepreneurs) from using optimisation algorithms, i.e. performing mathematical calculations with the given set of alternatives (Baumol, 1993; Shane and Venkataraman, 2000). Besides, opportunities are not all alike: they differ by their level of uncertainty. According to Sarasvathy et al. (2003), based on Knight (1921), opportunities can be characterised by any level of uncertainty, starting from ultimate (“true” uncertainty by Knight (1921) which presumes opportunity creation) to moderate (opportunity discovery) to low (opportunity recognition).

It is possible to assume that entrepreneurs would differ in their subjective ability to identify a venture idea depending on its level of uncertainty. One might wish to investigate whether these differences are caused by entrepreneurs’ individual inborn abilities, or if they result from the differences in competence acquired throughout individuals’ business life. One may also ask questions of whether the nature and level of entrepreneurs’ education would affect their ability to identify venture ideas. So, cognitive properties, which entrepreneurs demonstrate in order to make opportunity identification decisions correctly, is an issue worth researching.

Cognitive psychology and entrepreneurship theory can provide guidelines in this endeavour. Cognitive psychology contributes concepts and theories for theoretical framework, as well as methodological basis. Examples include the concept of decision-

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1 Opportunity identification is used, since it is regarded as an established term in the literature. However, the author here implies identification of a venture idea.
1. Introduction: Entrepreneurship Research and Decision-Making

Making as a skill, as well as the notion that skills can be learned, and that development of expertise would bring individuals to the expert level of skill performance.

This general contribution is further honed by application of more focused theories and concepts. The naturalistic paradigm, which presents the theoretical framework of the study, claims that everyday decisions are task dependent and are usually made under uncertainty. The cognitive continuum theory (CCT) (Hammond et al., 1987; Hammond, 1988) introduces the concepts of task continuum, where tasks vary according to their uncertainty level (from very high to very low) and cognitive continuum, where cognitions range from intuition (one pole) to quasi-rationality (middle) to analysis (another pole). According to the theory, every task within the task continuum is able to induce certain cognitive processes, in order for the decision to be appropriate. Thus highly uncertain tasks induce intuitive cognition, moderately uncertain tasks induce quasi-rationality and low uncertainty tasks induce analysis.

The correspondence-accuracy principle (CAP), which is a corollary to cognitive continuum theory, asserts that no decision is good or bad per se; a decision can be solely regarded as appropriate or inappropriate depending on whether cognitive processes employed correspond to the nature of the task for which a decision is made. According to CAP, the ability to make adequate decision is a skill demonstrated by expert decision-makers.

So, it is possible to assume that habitual entrepreneurs, by virtue of their long and varied experience, have become expert decision-makers, capable to match their decision-making mode with the cognitive nature of the situation. On the other hand, novice entrepreneurs are unlikely to possess this skill.

Since we study decision-making of entrepreneurs, it becomes necessary to identify the cognitive nature of the entrepreneurial task, namely, opportunity identification. As we have seen, opportunities may occur within the entire task continuum: from the conditions of ultimate uncertainty (opportunity creation) to moderate uncertainty (opportunity discovery) to low uncertainty (opportunity recognition). Thus, it is quite logical to assume, in accordance with CAP, that opportunity creation would induce intuitive decisions, opportunity discovery would induce quasi-rational decisions and opportunity recognition would be analysis-inducing.

Cognitive psychology is able to provide suitable methodology. The task under consideration involves a number of cognitive processes; as such, it is very difficult to study in the field. It needs to be re-created through experiment/simulation. Since the attempts are being made to investigate whether people possessing different level of expertise differ in their decision-making, it becomes necessary to sample subjects from two groups: experts and novices. The next step in the research will involve creating tasks calibrated by their levels of uncertainty and presenting them to the subjects. In other words, both expert and novice entrepreneurs should perform opportunity creation, opportunity discovery and opportunity recognition. In order to observe their cognitive processes and collect data verbal (think-aloud) protocols are used, according to the methods established in psychology. Data analysis is based on both research tradition in psychology (qualitative methods of analysing verbal protocols), and the quantitative methods established in entrepreneurship. Thus, the nature of the task
(opportunity identification) and cognitive processes employed while performing the task would determine the dual nature of the research attempt.

Opportunity identification has been widely researched (cf. Bhave, 1994; Long and McMullan, 1984; Shane and Venkataraman, 2000; Gaglio and Katz, 2001; Ardichvili, Cardozo and Ray, 2003; Davidsson, 2002); neither is psychological approach in entrepreneurship research a virgin ground. Yet cognitive approach to opportunity identification is a novel take on the topic, since it presumes that opportunities differ by their uncertainty levels and cognitive processes of decision-makers depend on both the level of uncertainty (nature of the task) and the decision-maker’s level of expertise.

Thus, the present study is an attempt to investigate the entrepreneurial process of opportunity identification by comparing the cognitive processes of expert and novice entrepreneurs. The theoretical framework for the study is jointly provided by cognitive psychology and entrepreneurship theory; the study’s methodology is lent by cognitive psychology.

There exist several reasons to conduct the study:

1. **Theoretical reasons:**
   - So far, major theoretical contribution to the field was made by economists; Schumpeter (1934), Kirzner (1973) and Baumol (1993) ought to be named as the champions once economists’ contribution to entrepreneurship research is mentioned. Significant contribution to the field was made by Cantillon (1999) and Shackle (in Batstone & Pheby, 1996) who discussed evaluation and exploitation of opportunity. Knight (1921) has introduced the concept of innovation as inherent of entrepreneurship and discussed the important distinction between risk and uncertainty. In general, all the economists point out that entrepreneurship would include decision-making under risk and uncertainty. However, the previous treatment of the opportunity and decision-making under risk and uncertainty in entrepreneurship leaves several gaps:
     a. The cognitive processes of decision-makers engaged in opportunity identification (entrepreneurial task) have not been previously explored, although this category is considered theoretically important by the economists and entrepreneurship researchers (Ucbasaran et al., 2003).
     b. There exist several models of entrepreneurial task, yet its cognitive nature has not been previously explored regarding risk and (varied) uncertainty as its inherent characteristics.
     c. The possible differences in decision-making depending on the nature of the task have not been explored. Can it be assumed that successful and experienced entrepreneurs (experts) make decisions differently from novices? Theoretical framework and methodological tool-kit of cognitive psychology make possible to answer these questions.

2. **Potential practical benefits of the study:**
   - They could be derived from the third theoretical reason above. If indeed expert entrepreneurs make better decisions than their novice counterparts, and this dif-
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Entrepreneurship is a skill possible to master, the implications for practitioners and entrepreneurship education can be numerous and far reaching. Making education of students or aspiring entrepreneurs theoretically sound and empirically grounded would substantially decrease the trial-and-error process of acquiring entrepreneurial experience. As a result, it might be possible to expect the increase of the survival rate of the new companies.

Improving expert decision-making can be another important aspect. As cognitive psychology claims, expert decision-making is quite often good enough (satisficing, cf. Simon, 1953) and seldom optimal. Improving practitioners’ decision-making skills can be expected to prove very beneficial.

3. An implied question is why a study of this kind has not been conducted before, since it possesses important theoretical and practical implications. One of the possible explanations may be that the theoretical constructs derived from both cognitive psychology (the cognitive continuum theory and the correspondence-accuracy principle) and entrepreneurship proper (the nature of opportunity) are quite novel still, whose developed started in the late 80s (cf. Hammond et al, 1987) and is still going on (cf. Shane and Venkataraman, 2000; Davidsson, 2003; Sarasvathy et al, 2003; Ucbasaran et al., 2003).

Another possible explanation can be found in the recent shift towards the study of behaviour in entrepreneurship research which has replaced the previously dominating trait approach. Individual differences in discovering, evaluating and exploiting opportunities do exist, and to ignore them completely would be rash and counterintuitive (Kruieger, 2003). However, during almost 30 years, beginning from McClelland’s (1961) study the psychological approach to entrepreneurship focused on discovering individual personality traits in order to explain these differences. Unfortunately, this kind of research could not confirm the existence of statistically significant differences between “entrepreneurial” and “non-entrepreneurial” personalities. Consequently, this school of thought became the object of sharp criticism (Cooper, 2003). Already in 1988 Gartner pointed out that behaviour, not personality traits would be the likely source of the differences.

The recent development of the methodological base in the field of entrepreneurship could also be considered a reason to embark on a study like this. Although still uncommon, according to Chandler and Lyon (2001), experiments as a general framework, and verbal protocol as a method of data collection, start being used in the field. Sarasvathy’s (1999) pioneering research can be mentioned as an example.

1.2. Research question

The present study aims at investigating cognitive processes necessary to identify entrepreneurial opportunities depending on their level of uncertainty and decision-makers level of expertise.
The research question above is derived from the set of research questions which Shane and Venkataraman (2000, p.218) consider most important in the field: "(1) why, when and how opportunities for the creation of goods and services come into existence; (2) why, when, and how some people and not others discover and exploit these opportunities; (3) why, when and how different modes of action are used to exploit entrepreneurial opportunities" as a primary source of new knowledge generated in the field of entrepreneurship.

The study is of dual nature. Since it deals with the tasks entrepreneurs perform in the process of venture creation, and the cognitive properties of these entrepreneurs, it was quite natural for the author to turn to both the field of entrepreneurship and cognitive psychology for theoretical as well as methodological support. The study is thus theory-driven; its theoretical and methodological sources of the study, as well as its contribution to the field of entrepreneurship are presented in Figure 1.1:

**Figure 1.1. Sources and contribution of the present study**
1.3. Outline of the study

Chapter 2 presents the literature review in cognitive psychology. The first section concerns the paradigm in decision-making research. It introduces and discusses paradigms in decision-making research within cognitive psychology domain: traditional (rational, analytical) and naturalistic. Further it discusses joint nature of naturalistic decision-making as function of the task and competence of decision-maker. Finally, it introduces and discusses decision-making of entrepreneurs as naturalistic and the Correspondence-accuracy principle (CAP) as a research instrument to judge decision quality.

The second section dwells upon expertise in decision-making. It discusses the nature of decision-making competence and development of expertise in decision-making, whereas CAP seems to be a reliable theoretical tool to judge the quality of decision-making in natural settings; task nature and expertise in performing this task affect the quality of the decision-making.

Chapter 3 provides the literature review of entrepreneurship theory. The first section talks about entrepreneurship as a field of research, its close connection to other disciplines as well as its unique contribution. The distinction between entrepreneurship as a field of research and an empirical phenomenon is also touched upon.

Section two introduces and discusses the psychological approach to entrepreneurship research: the “trait approach”, the behavioural approach concerning primarily motivation and the latest behavioural trend – entrepreneurial cognition, which constitutes a part of the theoretical framework of the present study.

Entrepreneurial task is discussed in the third section of the chapter, where the task of entrepreneurs is defined as opportunity identification. Further the opportunities are categorised according to their levels of uncertainty and induced cognitions.

Section four is about entrepreneurs’ cognitive processes: intuition, analysis and “things in between” – heuristics, or quasi-rationality. It discusses connection between decision-making modes and uncertainty levels. It also discusses quasi-rational nature of effectuation as one of entrepreneurial heuristics. The section identifies and discusses other cognitive processes involved in opportunity identification according to the Correspondence-accuracy principle (CAP).

In the final section of Chapter 3 the propositions are revised and the hypotheses are formulated. The discussion in the previous sections of the chapter comes to the conclusion that due to the nature of the task (varied uncertainty) entrepreneurial decision-making is a special case. Intuitive decision-making is observed when decision to exploit the opportunity is made through an expert judgement; quasi-rational tasks may be carried out through a specific entrepreneurial heuristics – effectuation; analytical tasks are carried out through analytical reasoning proper.

Chapter 4 elaborates on research methodology. The first section talks about research methods in cognitive psychology and entrepreneurship discussing the nature of opportunity identification and its methodological implications. Further it discusses methods of investigating processes in cognitive psychology and entrepreneurship, such
as longitudinal research, simulations and experiments, as well as methods of recording data.

Section two discusses the experiment’s setting and participants. Construction of scenarios are discussed and defended according to Hammond. Theoretical descriptions of the points of the Cognitive continuum are also provided: intuition-inducing tasks, quasi-rationality-inducing tasks and analysis inducing tasks. Also the sampling of participants is discussed.

The final section of the chapter speaks about collecting and processing verbal protocols. It discusses coding and provides an example of coding protocol. It looks for intuition (through expert judgement about exploiting the opportunity) in high uncertainty task (initial discovery), and for effectuation in medium uncertainty tasks. Finally, it looks for (financial) analysis in LBO task and a filling station take over task (low uncertainty), kind of business planning (marketing planning) in computer game task (moderate uncertainty). The validation of coding is also discussed.

Chapter 5 is about testing hypotheses and demonstrating results of these tests. The first section presents the hypotheses and provides a brief explanation of the analytical procedure.

Section 2 is devoted to cognitive patterns of novices. It provides the test results of the hypotheses pertaining to novices’ cognitive behaviour and discusses whether cognition in novices is analysis or heuristics based; fixed or adaptable.

Section 3 concerns cognitive patterns of experts and provides the test results of the hypotheses pertaining to experts’ cognitive behaviour. It also identifies experts’ dominant cognitions in each task.

Cognitive differences between experts and novices are described and discussed in section 4, which provides the test results of the hypotheses pertaining the differences between experts’ and novices’ cognitive behaviour. It discusses the use of intuition, heuristics and analysis by experts and novices across tasks and provides the brief summary of the results of hypotheses testing. It claims that the theoretical premises behind the hypotheses can be considered empirically grounded.

The final section provides a brief summary of findings and preliminary conclusions to be complemented by more interpretative approach in Chapter 6.

Chapter 6, unlike the preceding one, introduces a post-hoc analysis. Although most of the hypotheses, as described in the preceding chapter, have strong support, the results indicate certain deviations from the theory. Analysis in Chapter 6 is an attempt to investigate reasons of these deviations.

The first section investigates potential correlation between types of education and cognitive patterns in novices. It explains that novices are more prone to analytical cognition regardless of the nature of the task. Since novices represent a heterogeneous group, the section investigates whether conditioning towards analysis is an inherent property of business education or a characteristic feature of the novice stage during expertise development.

The second section discusses potential correlation between cognitive patterns and venture idea discovery in experts and novices. It investigates whether cognitive patterns differ in the situations when the subjects discover venture ideas or reject situa-
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tions as unpromising: experts and novices as a single group; experts separately; novices separately.

The last section provides tentative explanations of the fact that experts, unlike novices, seem to employ different cognitive patterns in accepting and rejecting a venture idea.

Chapter 7, the final chapter of the dissertation, elaborates on the results presented in the Chapters 5 and 6. The chapter also provides extended conclusions as well as implications for future research, practitioners and entrepreneurship education.

Section 1 provides hypotheses test results, general conclusions and contribution of the study.

Section 2 elaborates on the implications for future research as well as for entrepreneurial education and practice. It reflects upon the possible research implications of the study, both immediate and within broader context of entrepreneurship research. It concerns such issues as whether entrepreneurial expertise can be taught and how; if "the best practice" is indeed the best; whether it can be improved and how; if modern business education can be considered entrepreneurial.

Discussion concerning the limitations of the study is introduced in the Section 3. It discusses why the observed cognitive behaviour of experts and novices deviates from theoretically predicted, and the extent of this deviation. Further the discussion dwells upon the ability to position a task within the task continuum as a component of entrepreneurial expertise. The section discusses potential faults in theory and methodology, including threats to validity and reliability of the study and presents the measures taken to counteract such threats.

Section 4 provides a brief summary of the study.
2. Decision-making research in cognitive psychology

People make decisions all the time; "decision-making" is one of the most common expressions in English as well as in many other languages. But what happens when a decision is actually being made? Apparently a decision-maker would undertake certain mental activities, which may result in a delivered judgement or a set course of actions. In both cases the results are as likely to be successful as disastrous.

People do make decisions in a number of ways, and they do achieve different results. It is possible to make an assumption concerning the dual nature of decision-making, it being a strategy, a course of action while performing the task, and a competence. Strategy concerns with what people actually do while making a decision, the mental operations they perform. Competence refers to the fact that some people consistently make remarkably better decisions than others and almost anyone can improve his or her decision-making by training.

Decision-making as strategy has a long history of research. "A respectable research library may hold hundreds of books and thousands of articles on various aspects of decision-making. Some will be highly mathematical, some deeply psychological, some full of wise advice about how to improve." (Orasanu and Connolly, 1993, p.5). Viewed differently, decision-making may be seen not as a separate form of cognitive activity, but as belonging to the domain of problem structuring and problem solving, and thus be treated as a specific competence. In this case cognitive psychology can offer a solid theoretical fundament for the researchers aiming to understand how decisions are made and how decision-making can be improved (cf. Anderson, 1990; Dreyfus & Dreyfus, 1989). The following chapter provides a literature review of decision-making as treated by cognitive psychology research.
2. Decision-making research in cognitive psychology

2.1. Paradigms in decision-making research

2.1.1. Analytical decision-making:

Human reasoning while making decisions has been an object of research since Socrates and Plato (Dreyfus & Dreyfus, 1989; Cohen, 1993). At that time it was found fault-prone and inconsistent; philosophers then believed that improvement of decision-making results could be achieved by following appropriate mental procedures. Since Descartes, one of the favourite methods has been to replace intuitive leaps of thought by short, logically self-evident steps.

Since the early 18th century and up to the late 1960s, research on decision-making was both normative and descriptive. In other words, theories and models should both fit the empirically observed behaviour and have normative plausibility (Cohen, 1993). If the behaviour did not seem consistent with the model, the latter was regarded as inadequate, not the former as irrational. A researcher’s task was to provide a rationale for such behaviour, bringing out its good features (Beach, Christensen-Szalanski and Barnes, 1987).

This school of thought, which Cohen (1993) calls “formal-empiricist”, focussed on behavioural testing of normative models, rather than on cognitive processes underlying decisions. Its most important achievement has been the development of a normative model called maximisation of subjective expected utility (SEU) created by De Finetti (1964) and Savage (1972). SEU does not imply procedures for decision-making; probabilities and utilities are defined by decision-maker, according to a choice among gambles, and do not guide the choice (Cohen, 1993). In other words, the decision-maker is free to choose the desirable outcome of a gamble (utilities) and assign the probabilities of the desired outcome (weigh them) before making a decision.

The preferred method of study has been experiment, in which subjects are asked to make choices in sets of interrelated gambles varying in their uncertain events and pay-offs (Davidson, Suppes and Siegel, 1957). The experimental environment is rather artificial; the researchers do not make much use of, for example, verbal protocols while subjects are making decisions. Nor are the subjects interviewed afterwards about the reasons of their choices. The models being tested impose mathematical consistency constraints on a subject’s judgement but make no reference to actual mental procedures. So, some psychologists have questioned the cognitive plausibility of SEU even when the model fits behaviour. According to Lopes (1983), for example, the real decision-makers are less concerned with an option’s average outcome than with the outcomes that are most likely to occur.

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2 Certain terminological clarification is necessary. Although this approach is widely known as rational, which is also what it is called by its creators, the author of the present study believes that this term implies a negative connotation in regard to other approaches (as considered irrational). To avoid this negative connotation and stress the equal value of different approaches in decision-making research, the author refers to this approach as analytical, except for the direct quotations where original terminology is preserved. See even Simon (1987).
In general, "the formal-empiricist paradigm: (a) allowed human intuition and performance to drive normative theorising, along with more formal, axiomatic considerations; (b) used the resulting normative theories as descriptive accounts of decision-making performance; and (c) tested and refined the descriptive/normative models by means of systematic variation of model parameters in artificial tasks" (Cohen, 1993, p.43).

The formal-empiricist paradigm in decision-making research has been succeeded by another approach, the most often called rational. In fact, it is possible to trace it back to works of Plato and Aristotle, but during the last 20 years it has become especially influential (Cohen, 1993).

The rational, or analytical, approach to decision-making is critical of ordinary (intuitive, unaided) reasoning and promotes more valid methods of decision analysis, originating as a system of techniques for applying decision theory in management consulting (Ülvila and Brown, 1982). Unlike decision theory that provides purely formal constraints for decision-making, decision analysis specifies procedures: Bayesian inference (for drawing conclusions or making forecasts based on incomplete or unreliable evidence), decision tree analysis (for choices with uncertain outcomes), and multiattribute utility analysis (for choices with multiple competing criteria of evaluation) (Brown, Kahr and Peterson, 1974; Keeney and Raiffa, 1976). The problem-solving strategy is to decompose a problem into elements, to make the appropriate experts or decision-makers subjectively assess probabilities and/or utilities for the components, and then to recombine the components by the appropriate mathematical rule (Cohen, 1993). Simplified analytical model of decision-making is presented in Figure 2.1:

Figure 2.1. Rational model of decision-making with the control element (Hatch, 1997)

Research of decision biases represents the other side of analytical approach – studies of errors in unaided decision-making. Compared to formal-empiricist paradigm, errors are given a much more important role in analytical research. This change demonstrates a paradigm shift between normative and descriptive research. The analytical approach regards decision theory as a norm fully justified by its formal properties and not by the way decisions are actually made. Discrepancies between behaviour and the model are
attributed to the irrationality of the behaviour, not the flaws of the model. (Cohen, 1993).

The reason underlying this paradigm shift is, as, for example, Kahneman and Tversky (1982) put it, striving for making psychology of decision-making more cognitive. While formal-empiricist research has combined normative and descriptive functions in the same formal model, the analytical approach separates the functions. The behaviour is cognitively described or explained and formally evaluated. Unlike formal-empiricist paradigm, where a model could always be revised, "analytical" researchers, in order to reinforce their cognitive approach to explanation, have promoted the idea of a normative theory as a fixed benchmark, free from descriptive influences. As a result, actual human decision-making is seen as prone to irrationality (Cohen, 1993). On the other hand, statistically valid decision-making techniques are found counter-intuitive (Kahneman & Tversky, 1982). This means that decision-makers, even if they are trained statisticians or other experts trained in using analytical techniques, normally refrain from using the rules of statistics while making a choice, if the decision task does not explicitly prompt the use of those rules.

Guided by strictly normative models imposed by the rules of mathematical statistics (consistency constrain from probability theory or decision theory), "analytical" researchers have found biases in virtually every aspect of unaided decision-making. The examples of biases compiled from the works of Einhorn and Hogarth (1981); Hogarth and Makridakis (1981); Slovic, Fischhoff and Lichtenstein (1977); Tversky and Kahneman (1974) by Cohen (1993) can be found below:

**Assessment of probabilities** including overconfidence and overestimation;

**Inference** – base rate neglect; belief bias; the conservatism bias; the conjunction fallacy etc;

**Choice** - Ellsberg’s paradox; the certainty effect or common ratio effect; the pseudocertainty effect; Allais’ paradox or the common consequence effect etc.

Methodologically "analytical" researchers seem more "true to life" than their "formal-empiricist" counterparts. In their experiments everyday problems replace artificial choices about gambles. A few simple variants of the same problem, sufficient to demonstrate inconsistency replace previous systematic variations of model parameters (Lopes, 1988). Still, the realism of those experiments is limited. Although the stimuli are drawn from real life, the situations would be unfamiliar to the subjects (usually, college or high school students) and are only briefly explained to them. The situations are also static rather than dynamic, often prestructured and prequantified, requiring a single response. In other words, the problems specify numerical frequencies, probabilities, and/or payoffs, and subjects are asked to make one-time decisions about explicitly identified hypotheses or options. The primary goal of these experiments is simply to compare rival hypotheses of normatively "correct" versus "incorrect" behaviour. In fact, like in formal-empiricist experiments, very little effort is made to explore cognitive processes more directly – by means of verbal (think-aloud) protocols, interviews, or other process-tracing techniques (Cohen, 1993).

As a result, the analytical approach, too, has failed to successfully integrate decision-making research with cognitive psychology. Its main attention is focused on clas-
sification of constantly growing list of biases, defined as deviations from the normative theory (Anderson, 1990). Insufficient effort was made to provide alternative psychological explanations (Shanteau, 1989), to study systematically how and when the postulated biases occur (Fischhoff, 1983), or to develop underlying theoretical principles and links with other areas of psychology such as problem solving and learning (Wallsten, 1983). Few existing exceptions (cf. Klayman and Ha, 1987) do not affect the general trend.

The positive contribution of the analytical approach is to promote a transition to cognitively oriented theories of performance. Unfortunately, its tactic of creating a rigid normative concept has been less successful: experiments that these researchers designed would rather discredit the concept (Cohen, 1993). Generally speaking, “the rationalist paradigm (a) adopts a static and purely formal view of normative standards, (b) gives an explanatory account of reasoning in terms of a diverse set of unrelated cognitive mechanisms, and (c) experimentally demonstrates errors with prestructured and prequantified “real-life” stimuli” (Cohen, 1993, p. 48).

2.1.2. Naturalistic decision-making

Traditional decision-making research, being quite formal, considers decision-making a discrete, isolated decision event. It means that the crucial part of making a decision occurs when a decision-maker (usually, a single individual) surveys a known and fixed set of alternatives, evaluates them statistically, weighs the consequences and makes a choice. The evaluation criteria would include goals, purposes and values that are stable over time, and are clearly known to the decision-maker. Besides, all the necessary information is available, and the decision-maker is capable to process it according to the specified rules (Orasanu & Connolly, 1993).

Decisions made in real-life situations can seldom be singled out as decision events. Usually, they are imbedded in a context of a larger task that a decision-maker tries to accomplish. Dynamic decision-making would be imbedded in a task cycle, which consists of defining what the problem is, understanding what a reasonable solution would be, taking actions to reach the goal, and evaluating the effect of the action. According to Brehmer’s (1990, p. 26) description of dynamic decision-making, “the study of decision-making in a dynamic, real time context, relocates the study of decision-making and makes it part of the study of action, rather than the study of choice. The problem of decision-making, as seen in this framework, is a matter of directing and maintaining the continuous flow of behaviour towards some set of goals rather than as a set of discrete episodes involving choice dilemmas.”

According to the Naturalistic Decision-Making (NDM) perspective, a newly emerging approach, decisions in everyday situations represent a joint function of two factors: features of the task and the subject’s knowledge and experience relevant to the task (Orasanu and Connolly, 1993). It calls for studies in realistic, dynamic and complex environment, by adopting research methodology that focuses more directly on decision processes and their real-world outcomes (Woods, 1993).
The NDM has a completely different view on biases and heuristics, as well as on the normative models, as compared to analytical decision-making (ADM) research. The naturalistic perspective does not regard the analytical normative standards as unquestionably applicable, because decision-makers in the real world would use qualitatively different types of cognitive processes. In order to evaluate these decisions other standards, not those of probability/decision theory may be appropriate. (Cohen, 1993).

NDM perspective agrees with the analytical approach regarding the explanatory emphasis of cognitive processes. However, NDM theorists believe that analytical normative models fail not because people irrationally violate them, but because the models themselves fail to capture the adaptive features of real-world behaviour (Cohen, 1993). In other words, normative analytical models are not incorrect by themselves but their application fields are more limited than their advocates might like to admit. Several studies have already confirmed that analytical models, even when they are taught in professional educational programs, are not used on the job by most business managers (Mintzberg, 1972), financial analysts (Paquette and Kida, 1988) or medical experts (Alemi, 1986). By focusing on the way people actually act in complex environments, NDM approach illuminates the functions that cognitive processes serve. As a result, this perspective strives for developing a successful and comprehensive set of explanatory models.

The last statement is supported by very important although unanticipated results of a study Hammond et al. (1987) conducted on expert highway engineers. Each of their subjects had to carry out a variety of tasks requiring analytical, intuitive or quasi-rational (combining certain features of both approaches) cognition in order to be accomplished successfully. The striking result of the study demonstrated that intuitive and quasi-rational cognitive processes were often superior to analytical cognition, because they lead to more accurate judgements, whereas errors, although more numerous, were less severe.

However, the naturalistic perspective does not claim that people always make faultless decisions, or that these errors might be systematic. Making decisions in natural settings, when options, hypotheses, goals, and uncertainties may all be unspecified, is often in many ways more difficult than accomplishing laboratory tasks. There still exists a need to both evaluate and improve decisions, and the concept of decision bias may still be useful for both perspectives. The NDM approach may also retain, and even expand, the reciprocity between the descriptive and the normative side that characterises the formal-empiricist paradigm, in case that normative modelling will incorporate both cognitive and behavioural criteria (Cohen, 1993). Normative theories are intellectual tools and their use is justified in part by how well they fit a particular decision-maker’s goals, knowledge and capabilities of the task at hand (cf. Shafer and Tversky, 1986).

Table 2.1 provides a concise comparison of differences and similarities between traditional decision-making research (formal-empiricist and analytical approach), and the naturalistic paradigm:
Table 2.1. Three paradigms in decision-making research (Cohen, 1993).

<table>
<thead>
<tr>
<th>Traditional Decision-making Research</th>
<th>Naturalistic Paradigm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formal-Empiricist Paradigm</strong></td>
<td><strong>Rationalist Paradigm</strong></td>
</tr>
<tr>
<td>Criteria of normative evaluation</td>
<td>Behavioural and formal</td>
</tr>
<tr>
<td>Style of psychological modelling</td>
<td>Formal</td>
</tr>
<tr>
<td>⇒ Systematic variation of model parameters</td>
<td>⇒ Demonstration of formal errors</td>
</tr>
<tr>
<td>⇒ Artificial tasks</td>
<td>⇒ Simplified “real-world” tasks</td>
</tr>
<tr>
<td>⇒ Study of decision processes</td>
<td>⇒ Study of decision processes and outcomes</td>
</tr>
<tr>
<td>⇒ Complex real-world situations</td>
<td></td>
</tr>
</tbody>
</table>

The Naturalistic Decision-making paradigm includes a variety of models presented by Klein as follows: first, recognition-primed decision model (Klein, 1989). Next comes image theory by Beach and Mitchell (Beach, 1990) when decision-making is seen as constrained by three types of images: values, goals, and plans. Rasmussen (1989) presents model of cognitive control, which regards decision-making as a dynamic process intimately connected with action. Lipshitz (1989) views decision as enactment of an action argument. Montgomery (1983) introduces dominance search model, and Pennington and Hastie (1988) see decision-making as constructing a plausible explanatory model. Hammond (1988) is the author of cognitive continuum theory, and Noble (1989) discusses situation assessment model. Decision cycles model is introduced by Connolly (1988). All of these models were developed by different researchers using different methodologies to study quite different questions in a variety of realistic settings. However, it is possible to distinguish a few themes that make a core of NDM approach, as described by Lipshitz (1993):

- **Diversity of form** — real-world decisions are made in different ways. This diversity shows that the models agree on the futility of trying to understand and improve real-world decisions by means of a single concept, such as maximising expected utility. On the other hand, diversity of forms is partly determined by the type of decisions studied.

- **Situation assessment**, or a “sizing up” and construction of a mental picture of a situation, is a critical element in decision-making. Unlike laboratory experiments, where problems are defined and presented by the researcher, the real-world problems have to be identified and defined by the decision-maker. Some researchers connect situation assessment directly to selections of actions, others suggest that it

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3 Called “analytical” in the present study
2. Decision-making research in cognitive psychology

is a preliminary phase that initiates a process of alternatives’ evaluation. In general, all nine models suggest that making decisions in real-life settings is a process of constructing and revising situation representations as much as (not more than) a process of evaluating the merits of potential courses of action.

- Decision-makers often use mental imagery. ADM approach presents decision-making as calculative cognitive processes (i.e., weighing the costs and benefits of alternative courses of action). NDM models emphasise different cognitive processes that are related to creating images of the situation, most notably categorisation (e.g., of the situation), the use of knowledge structures (e.g., schema), and the construction of scenarios (e.g., in the form of storytelling and mental modelling).

- Since NDM is context-specific, understanding the context surrounding the decision process is essential.

- Decision-making is dynamic—it does not consist of discrete isolated events or processes. All NDM models reject the idea of decisions as isolated events. There are basically two ways to recognise the dynamic quality of decisions: according to Hammond, Rasmussen and Connolly, decision makers switch between intuitive and analytical decision-making as a function of changing task requirements. The others (e.g., Klein, Montgomery, Beach) suggest a two-phase sequence in which a preliminary selection based on matching or compatibility rules is followed by more deliberate evaluation that they call updating, mental simulation, dominance search, profitability testing and reassessment.

- Normative models of decision-making must derive from an analysis of how successful decision makers actually function, not how they “ought” to function. According to naturalistic approach, prescriptions cannot be separated from descriptions because (a) some of the methods used actually make a good sense despite their imperfections and (b) people will find it difficult to apply methods which are too different from the ones they would customarily use. The last statement is, however, questionable for two reasons. First, even if decision-making processes are natural, they are not always successful, i.e., prescriptions should be derived from best practice. Second, although NDM is context-specific, theoretical generalising might make the best practice even better (cf. Hammond, 1987, 1988).

As already stated above, naturalistic decision-making is a function of the task. In other words, the NDM is the most successful in specific situations. According to Orasanu and Connolly (1993), there are eight important factors, which characterise decision-making in naturalistic settings, but which are frequently ignored by analytical decision-making research. To encounter all 8 factors in one situation (or all 8 factors at their extreme) is a “worst case” scenario for a decision-maker. Such situations are not very common, but a decision task is quite often complicated by several of these factors listed below along with a brief explanation:

- **Ill-structured problems.** Usually, a decision-maker has to do significant work to define the problem, develop appropriate response options, or even recognise the situation as the one where choice is required. Observable features of the setting
may be related to one another by complex causal links, interactions between causes, feedback loops etc. When a task is ill-structured, there are usually several equally good ways of solving the same problem. There is no accepted procedure to use - it is necessary to select or invent a way to proceed - nor is there a single correct or best answer. Ill-structured problems are usually made more ambiguous by uncertain dynamic information and by multiple interacting goals.

- **Uncertain dynamic information.** The real world where naturalistic decision-making takes place usually provides incomplete and imperfect information, which may be ambiguous, of poor quality, likely to be dynamic, and sometimes even suspect in its validity.

- **Shifting, ill-defined, or competing goals.** The decision-maker may be driven by multiple purposes, not all of them clear; some of them may even be opposed to others. Such conflicts are especially hard to resolve because they are often novel and must be resolved quickly. The situation may also change quickly, bringing new values to the picture.

- **Action/feedback loops.** Unlike analytical decision models which regard decision-making as a single event, naturalistic decision-making implies a series of events, a string of actions over time that are to deal with the problem. It is not just a matter of gathering information until one is ready for decisive actions. The existence of multiple opportunities for decision-maker to do something may be helpful if an early mistake generates information that allows corrective action later. However, action/feedback loops may generate problems. Actions taken or results observed may be loosely coupled to each other (e.g. occur with substantial time lag), which would make it hard to establish causality.

- **Time stress.** Decisions in naturalistic settings are often made under significant time pressure, which has several important implications. First, a decision-maker will often experience high level of stress, with the potential for exhaustion and loss of vigilance. Second, a decision-maker will be inclined to use less complicated reasoning strategies (Payne, Bettman and Johnson, 1988). Decision strategies that demand deliberation – for example, the extensive evaluation of multiple options recommended by the analytical approach - are simply not feasible. Appropriate decision strategies will be the ones that lead to actions. Extensive training using analytical decision models would yield more optimal decisions if subjects worked without time pressure, but would give no advantages if decisions had to be made under moderate or severe time constraints (Zakay and Wooler, 1984).

- **High stakes.** This factor is important as the opposite of decisions made in a laboratory. The subjects of decision experiments usually are not involved in the task as much as decision-makers in the real-world settings.

- **Multiple players.** A decision may be distributed over a set of partly co-operative, partly competing individuals who try to co-ordinate their activities. To ensure that all team members share the same understanding of goals and assessment of the situation, so that the relevant information is brought forward when needed, can be hard.
2. Decision-making research in cognitive psychology

- Organisational goals and norms. NDM often occurs in organisational setting, which is relevant to decision process in two ways. First, the values and goals to be applied are not simple preferences of the decision-maker. Second, organisations may respond to the decision-maker’s difficulties by establishing more general goals, rules, standard operating procedures, “service doctrine” or similar guidelines. These factors are difficult to incorporate into artificial environments (cf. Hackman, 1986).

It should be mentioned that such features, as ill-structured problems, uncertain dynamic information, shifting, ill-defined or competing goals and multiple players would account for uncertainty in the decision-making setting. It is quite possible to say that the level of uncertainty depends on the number of cues as well as their degree of intensity.

2.1.3. Cognitive continuum theory and correspondence-accuracy principle of decision-making

The cognitive nature of the task would also predict the accuracy of naturalistic decision-making, according to the cognitive continuum theory as Hammond (1988) suggests. The theory claims that cognitive processes, which guide the decision-making, can be located within a cognitive continuum ranging from intuition to analysis. A decision process is more intuitive (and less analytical) to the extent that it is executed under low control and conscious awareness, rapid rate of data processing, high confidence in answer and low confidence in the method that produced it. According to inducement principle, certain task characteristics induce the use of more intuitive and less analytical processes and vice versa. Intuitive tasks are those that require processing large amount of information in short time, whereas analytical tasks would present quantitative information in sequential fashion. Task properties inducing either intuition or analysis are presented in Table 2.2:
Table 2.2 Inducement of intuition and analysis by task conditions (Hammond et al., 1987).

<table>
<thead>
<tr>
<th>Task Characteristics</th>
<th>Intuition-Inducing State of Task Characteristics</th>
<th>Analysis-Inducing State of Task Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Number of cues</td>
<td>Large (&gt; 5)</td>
<td>Small</td>
</tr>
<tr>
<td>2. Measurement of cues</td>
<td>Perceptual</td>
<td>Objective reliable</td>
</tr>
<tr>
<td>3. Distribution of cue values</td>
<td>Continuous highly variable distribution</td>
<td>Unknown distribution; cues are dichotomous; values are discrete</td>
</tr>
<tr>
<td>4. Redundancy among cues</td>
<td>High redundancy</td>
<td>Low redundancy</td>
</tr>
<tr>
<td>5. Decomposition of task</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>6. Degree of certainty in task</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>7. Relation between cues and criterion</td>
<td>Linear</td>
<td>Non-linear</td>
</tr>
<tr>
<td>8. Weighing of cues in environmental model</td>
<td>Equal</td>
<td>Unequal</td>
</tr>
<tr>
<td>9. Availability of organising principle</td>
<td>Unavailable</td>
<td>Available</td>
</tr>
<tr>
<td>10. Time period</td>
<td>Brief</td>
<td>Long</td>
</tr>
</tbody>
</table>

So, a cognitive process can be located on a cognitive continuum as more or less intuitive or analytical, and a task can be located on a task continuum as inducing intuition or analysis. Two indices, the cognitive continuum index, and the task continuum index, which Hammond has designed, can be used to locate tasks and decision processes on the continuums, respectively.

The cognitive continuum theory brings us closer to the problem of decision evaluation. Obviously, there are better decisions, and there are worse decisions, but which is which? The answer, although it might seem intuitively obvious, is not at all simple. Moreover, it is treated differently by different perspectives. Analytical decision-making, for example, would answer this question implicitly but precisely: any decision is bad, which is not made in accordance with the strict statistics-based rules. At least, this is the conclusion that can be drawn from the literature on decision biases.

The NDM perspective would provide a somewhat ambiguous answer, which is not surprising if we bear in mind the characteristics of this approach, namely, uncertain, dynamic environment, ill-defined or competing goals and action/feedback loops (the case when the causality between an action and a result is hard to establish). However, Hammond’s correspondence-accuracy principle (CAP) suggests that neither the use of analytical decision-making techniques nor the exploitation of naturalistic decision processes per se can guarantee quality decision (Hammond, 1988). He suggests that judgements are most accurate (and decision-making most effective) when the location of the cog-
native processes on the cognitive continuum matches the that of the decision task on the task continuum. In other words, changes in the characteristics of task lead to predictable changes in the nature of cognitive processes, and changes in the extent to which the two are compatible lead to predictable changes in the decision’s accuracy. Thus, bad decision is the one with the mismatch between cognitive style and task characteristics (e.g. intuitive decisions in a situation inducing analytical performance), and good decision is the one that maintains the compatibility (e.g. intuitive decision made for the task with intuitive requirements). The cognitive continuum theory and its correspondence-accuracy principle are demonstrated graphically in Figure 2.2.
dertaken, a decision maker may use an imaginary action-feedback loop as a substitute for trial-and-error strategy. Mental modelling would serve this purpose quite well.

It should be mentioned, however, that action and judgement represent the two ends of a continuum rather than a clear dichotomy. Although both of them give quite recognisable examples: fire fighting, which requires immediate actions, and evaluating aesthetic appeal of a highway, which is a pure judgement, very many decisions would fall into the grey zone between. Besides, since decisions in naturalistic settings are usually highly context-dependant, singling out a decision event becomes both difficult and meaningless.

Still, the decision continuum has a corresponding continuum of evaluation strategies, with correspondence-accuracy principle (for judgements) and action-feedback loops as the poles. In this case cognitive processes of evaluation would change from observing the real effects of an action to considering the imaginary effects of an action through mental modelling. As far as the evaluation of judgements is concerned, the correspondence-accuracy principle (CAP) does provide a theoretical explanation, but is it what decision-makers actually do? The tentative answer would be "yes", especially if we remember that CAP includes the characteristics of the task. An expert decision maker may be quite unaware of his or her cognitive processes, but being skilled in the situation assessment he or she could recognise the appropriate (intuitive or analytical) mode of reasoning and perform successfully.

Decisions producing both actions and judgements can be successfully evaluated by such cognitive strategy as use of mental schemata, or expert scripts. The term refers to highly developed, sequentially ordered knowledge in a specific field, which is acquired through substantial experience in the domain and which dramatically improves the information processing capability of an individual (Glaser, 1984; Mitchell and Ches-teen, 1995). According to Abelson and Black (1986, p.1), “knowledge is schematised, that is, organised in chunks or packages so that, given a little bit of appropriate situational context the individual has available many likely inferences on what might happen next in a given situation.” As such, mental schemata would recognise successful decision outcomes regardless of whether decisions are supposed to produce action or judgement.

So far, the discussion of naturalistic decision-making may be summarised as follows:

− **Naturalistic decision-making** (NDM) is an intuitive cognitive process characterised by low cognitive control and conscious awareness, rapid rate of data processing (including template matching), high confidence in answer and low confidence in the method that produced it.
− NDM is a joint function of two factors: features of the task and the subject’s knowledge and experience relevant to the task.
− NDM incorporates a host of cognitive processes characterised by: diversity of form, several of which are action-oriented, importance of situation assessment, use of mental imagery, context dependence, and dynamism.
− NDM occurs in situations characterised by the following factors: ill-structured problems, uncertain dynamic environment, shifting, ill-defined or competing problems.
goals, action/feedback loops, time stress, high stakes, multiple players, organisa-
tional goals and norms. Such factors as ill-structured problems, uncertain dynamic
environment, shifting, ill-defined or competing goals and multiple players would
account for environmental uncertainty. The more numerous and extreme the pre-
sent factors are, the more uncertain the environment is.

- Naturalistic decisions cannot be evaluated by standards accepted in analytical per-
spective. Instead, correspondence-accuracy principle, which presumes compatibil-
ity between cognitive processes (intuitive or analytical) and characteristics of the
tasks, provides suitable grounds for evaluation of expert judgements.

- When the situation permits by providing feedback with clear correlation between
action and outcome (either through trial-and-error or by means of mental modelling),
evaluation by outcome is another possible alternative.

- Use of cognitive schema, or expert scripts makes possible to evaluate the whole
range of decision outcomes continuum - from immediate actions to pure judg-
ments.

- In sum, **NDM is an intuitive cognitive process, which is often action-oriented and
occurs under condition of time pressure and high uncertainty in expert subjects possess-
ing superior experience and knowledge of the domain.**

### 2.2. Expertise in decision-making

By definition, naturalistic decision-making demands superior (expert) knowledge and
experience on the part of a decision-maker. Experience, however, is domain-specific
knowledge and skills.

The question of the role experience and expertise play in decision-making is not so
simple. On the one hand, empirical evidence suggests that people in general are fairly
competent decision-makers (cf. Cohen, 1993), because they would acquire certain
competence in the course of life. However, decisions made in everyday life are seldom
domain-specific if they do not concern professional responsibilities. That is why mak-
ing general everyday decision will hardly lead to expert knowledge.

On the other hand, analytical decision-making is, according to research in biases
and heuristics, counterintuitive (Kahneman and Tversky, 1982). In other words, peo-
ple even if they have received substantial training in applying statistical rules to deci-
sion-making would fail to recognise a task as requiring statistical approach if this is not
stated explicitly. This finding is confirmed by numerous studies of decision-makers
being trained to use analytical models (cf. Zakay and Wooley, 1984; Payne, Bettman
& Johnson, 1988), as well as studies on bias reduction training (cf. Bukszar and Con-

Still, people can become experts but no one is born expert. Since NDM is consid-
ered a property of expert decision-makers, it seems quite logical to assume that entre-
preneurs can (and do) become expert decision-makers capable of using NDM. In or-
der to give proper theoretical ground to this assumption, let us first examine develop-
ment of expertise models.
2.2.1. Development of expertise

The development of expertise as a field of study in cognitive psychology has a long tradition of detailed comparisons of experts and novices in specific domains. The tradition began with classical studies of chess masters carried out by deGroot (1965/1978) and Chase and Simon (1973). The researchers compared novices to experts (grand masters) by a number of parameters, namely their memory abilities, the depth of their planning (the number of moves ahead), etc. None of these characteristics accounted for the chess masters’ expertise. What actually distinguished them from novices was their ability to see the complex picture on a chessboard as a set of meaningful chunks, or patterns. On the contrary, if the pieces on the board were arranged randomly, masters, like novices, would poorly reconstruct the configuration after a brief viewing (Simon, 1987).

According to Chase and Simon (1973), the masters’ skills in recognising meaningful chess configuration was a result of long-term experience, which enabled them to perceive a configuration on a chessboard as a set of highly familiar patterns. Moreover, through experience the masters would associate a few moves with each pattern, so that they would come rapidly to mind. As a result, the master does not have to go through a lengthy analytical reasoning or a random trial-and-error process.

This line of research was further extended to rather diverse fields, such as physics (Chi, Feltovich and Glaser, 1981), statistics (Schoenfeld and Herrmann, 1982), computer programming (Adelson, 1981), radiology (Lesgold, Feltovitch, Glaser and Wang, 1981) etc. The common characteristic of these studies has been the importance of the expert’s knowledge. As it appeared, the experts do not just know more facts than novices do (i.e. their declarative knowledge is bigger). Often much of the expert’s knowledge is tacit; as expertise grows people start “knowing” things differently. In other words, an expert when confronted with a problem would see a pattern of cues, which is associated with specific problem-solving strategies (they can be also called expert scripts – Mitchell & Chesteen, 1995, mental schemata - Glaser, 1984, or holistic templates – Dreyfus & Dreyfus, 1989).

As novices develop their skills, their abilities to chunk information, to recognise familiar patterns, and to attend to critical cues increasingly improve, i.e. proceduralisation of declarative knowledge occurs, as cognitive psychologists would put it (Anderson, 1990). So, in the first stage of acquiring expertise, people acquire declarative knowledge of the domain. If confronted with a problem, a novice tries to apply general, abstract strategies such as means-ends analysis, or employ functional-relation seeking strategies. Through repeated attempts of this nature, general strategies become particularised to fit the domain, and become pattern seeking rather than functional-relation seeking (Hammond, 1988).

However, since decision-making is regarded as a competence with different levels of proficiency, it seems necessary to describe the development of expertise in more details. According to Dreyfus & Dreyfus (1989), there are 5 stages of expertise development: novice, advanced beginner, competent, proficient and expert. The brief description of a person’s skills as well as strategies employed at each stage are briefly described below and summarised in Table 2.2.
2. Decision-making research in cognitive psychology

Stage 1: Novice - during the first stage of the skills acquisition, the novice learns to recognise various cues relevant to the skill and acquires rules for determining actions based upon those facts and features. The cues to be treated as relevant are so clearly and objectively defined for the novice that they can be recognised without reference to the overall situation in which they occur. Such elements are called “context-free”, and the rules that are to be applied to these cues regardless of what else is happening are “context-free rules” (Dreyfus & Dreyfus, 1989). The novices strive for making a good job, but being incapable (so far) to perceive the task as a coherent whole, they would judge their performance mainly by how well they follow the learned rules.

Stage 2: Advanced beginner – performance improves to a marginally acceptable level only after the novice has considerable experience in coping with real situations. While that encourages the learners to consider more context-free facts and to use more sophisticated rules, it also teaches them to enlarge their perception of a skill. Through practical experience in concrete situations with meaningful cues, which neither an instructor nor the learner can define in terms of objectively recognisable context-free features, the advanced beginner starts recognising those cues when they are present, due to their similarity with prior examples, i.e. start seeking patterns. These new cues are called situational, unlike the previous context-free ones. Rules for behaviour may now refer to both the situational and the context-free factors. On this stage experience becomes much more important than any form of verbal description.

Stage 3: Competent – with more experience the number of recognisable context-free and situational cues present in real-world tasks eventually becomes overwhelming. To cope with this problem people learn, or are taught, to adopt a hierarchical procedure of decision-making (an inherent property of analytical decision-making). Choosing a plan to organise the situation, and then examining only a small set of cues that are the most important according to the chosen plan, a decision-maker can both simplify and improve the performance.

In general, a competent performer with a goal in mind sees a situation as a set of facts. The importance of the facts may depend on the presence of other facts. A person has learned that when a situation has a particular constellation of those elements, a certain conclusion must be drawn, decision made, or expectation investigated.

Choosing a plan is not simple, even when the decision-maker has risen to competence. There is no objective procedure like the novice’s context-free cue recognition. While the advanced beginner can get along without recognising and using a particular situational cue until a sufficient number of examples renders identification easy and sure, competence level performance demands making an organising plan. Moreover, the choice critically affects behaviour in a way that one particular situational cue rarely does.

This combination of non-objectivity and necessity introduces an important new type of relationship between the decision-maker and the environment. We remember that the novice and the advanced beginner recognise learned cues and then apply learned rules and procedures. As a consequence, they feel little responsibility for the outcome of their act. If no mistakes have been made, a negative outcome is seen as the result of inadequately specified cues or rules. On the other hand, the competent deci-
sion-makers, having struggled with the choice of a plan, feel responsible for, and hence, emotionally involved with the product of their choice. While both their understanding and decision-making are still detached, they become involved in what happens thereafter. The outcome, which is clearly successful, is deeply satisfying and leaves a vivid memory of the plan chosen and of the situation seen from the perspective of the plan. Nor is a disaster easily forgotten.

The two highest levels of skill, proficiency and expertise, are characterised by a rapid, fluid, involved kind of behaviour that shows no apparent similarity to the slow, detached reasoning of analytical problem solving.

Stage 4: Proficient - up to this point the learners of a new skill, to the extent whether they have made decisions rather than just following the rules, have made conscious choices of both goals and decisions choices of both goals and decisions after reflecting upon various alternatives. This is the model of decision-making, the detached and deliberate selection among alternatives, which is generally recognised in analytical decision-making and academic literature on psychology of choice. This type of analytical behaviour occurs frequently to learners of a new skill and occasionally to the experts when it can be very successful in specific domains. Still, for everyday behaviour it is an exception rather than a rule (Dreyfus & Dreyfus, 1989; Means, 1983; Simon, 1976).

Proficient performers become usually deeply involved in the task and will be experiencing it from some specific perspective because of recent events. Guided by this perspective the performers will single out certain features of the situation as salient, whereas others will be ignored. As situation evolves, the salient cues are modified and even their relative salience may be changed (Dreyfus & Dreyfus, 1989). No detached choice or deliberation occurs. It just happens, apparently because the proficient performers have experienced similar situations in the past and memories of them trigger plans similar to those that worked in the past and anticipation of events similar to those that occurred. In other words, proficient performers start using expert scripts.

We remember that advanced beginners recognise situational elements (i.e. start seeking patterns) after experiencing several examples. No evidence suggests that it is done by identifying components of these cues and combining them by a rule (Dreyfus & Dreyfus, 1989). Similarly, no evidence suggests that people recognise the whole situations by applying rules relating to salient cues. This intuitive ability to use patterns without decomposing them into component features is called "holistic similarity recognition" (cf. Hammond, 1988; Klein, 1989 – Recognition-primed Decision-Making).

Proficient performers, while intuitively organising and understanding the task, will still find themselves thinking analytically about what to do. Cues that are perceived as important due to the performer’s experience will be assessed and combined by the rule (i.e. analytically) to produce decision about how to manipulate the environment in the best way.

Stage 5: Expert - experts generally know what to do based on mature and practised understanding. When deeply involved in coping with the environment, they do not see problems in some detached way and work at solving them, nor do they worry
about the future or devise plans (Dreyfus & Dreyfus, 1989). With enough experience in a variety of situations, all seen from the same perspective or with the same goal in mind but requiring different tactical decisions, the mind of the proficient performer seems to group together situations sharing not only the same goal, but also the same decision, action or tactics. At this point not only is a situation, if seen similar to a prior one, understood, but the associated decision, action, or tactics simultaneously come to mind. According to Simon (1987, p.60), "the grandmaster’s memory holds more than a set of patterns. Associated with each pattern in his or her memory is information about the significance of that pattern - what dangers it holds, and what offensive or defensive moves it suggests. Recognising the pattern brings to the grandmaster’s mind at once moves that may be appropriate to the situation."

An immense library of distinguishable situations is built up on the basis of experience. According to the estimations, a chess grandmaster can recognise approximately 50,000 types of positions, and the same can probably be said about car driving (Dreyfus & Dreyfus, 1989; Simon, 1987). The natural language vocabulary of college graduates has been estimated to be in a range of 50,000 to 200,000 words. Moreover, when a word is recognised, people also get access to information in their memories about the meaning of the word and to other information associated with it as well. "Our ability to speak and understand the natural language has the same intuitive and judgmental flavour as the grandmaster’s ability to play chess rapidly" (Simon, 1987, p. 60).

The five stages of skill acquisition can be summarised in Table 2.2. It should be noted that the views of Dreyfus & Dreyfus (1989) do not fully coincide with the conclusions made by other researchers, e.g. Hammond (1988). That is why the Decision/Cognitive Process column in Table 2 presents two sets of conclusions concerning development of expertise. The comments to the Dreyfus & Dreyfus’ views are shown in italics.
Table 2.3 Five stages of skill acquisition. (Dreyfus & Dreyfus, 1989)

<table>
<thead>
<tr>
<th>Skill Level</th>
<th>Cues</th>
<th>Perspective</th>
<th>Decision/ Cognitive Process</th>
<th>Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Novice</td>
<td>Context-free</td>
<td>None</td>
<td>Analytical; functional relation seeking</td>
<td>Detached</td>
</tr>
<tr>
<td>2. Advanced</td>
<td>Context-free;</td>
<td>None</td>
<td>Analytical/ quasi-rational; pattern seeking begins</td>
<td>Detached</td>
</tr>
<tr>
<td>Advanced beginner</td>
<td>situational</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Competent</td>
<td>Context-free;</td>
<td>Chosen</td>
<td>Analytical/ quasi-rational; both pattern seeking and functional relation seeking</td>
<td>Detached understanding and deciding, Involved in outcome</td>
</tr>
<tr>
<td></td>
<td>situational</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Proficient</td>
<td>Context-free;</td>
<td>Experienced</td>
<td>Analytical/ Quasi-rational; both pattern seeking and functional relation seeking</td>
<td>Involved understanding; Detached deciding</td>
</tr>
<tr>
<td></td>
<td>situational</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Expert</td>
<td>Context-free;</td>
<td>Experienced</td>
<td>Naturalistic (intuitive); both pattern seeking and functional relation seeking</td>
<td>Involved</td>
</tr>
<tr>
<td></td>
<td>situational</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

According to Dreyfus & Dreyfus (1989), the ability to make naturalistic decision (including the ability to use intuition where it, according to CAP, belongs) is a property of an expert, and as such naturalistic decision-making is superior to its analytical counterpart. This conclusion agrees with Hammond’s (1987, p.764) finding that “intuitive and quasi-rational cognition are frequently superior to analytical cognition because they are substantively more correct...” Still, numerous pieces of evidence suggest that experts do employ analytical decision-making when they find it appropriate (Simon, 1987; Hammond, 1987). Exactly when analytical decision is appropriate depends on the characteristics of the domain (or the task) to which the decision belongs.

The question that awaits answering is whether the development of decision-making expertise described above is applicable to entrepreneurs. According to the conclusion made in the previous section, entrepreneurial decision-making is naturalistic. In this case it is quite possible to assume that expertise in entrepreneurial decision-making would undergo the same stages and the following proposition can be formulated:

**Proposition 1:** due to the lack of the specific domain experience, novices (or aspiring) entrepreneurs demonstrate analytical decision-making regardless of the nature of the task for which the decision is made;

**Proposition 2:** while developing their decision-making skills, entrepreneurs switch from analytical to quasi-rational decision-making, which is still used regardless of the nature of the task;

**Proposition 3:** expert entrepreneurs master the whole range of decision-making continuum and employ cognitive processes appropriate to the decision task.
2.2.2. Decision-making competence

Expertise development model described above implies that “skills” and “competence” are used synonymously. Yet it may be necessary to introduce a slight distinction between these two concepts. Defined broadly, competence is the combination of acquired knowledge of facts (declarative knowledge), which ought to be used properly (procedural knowledge or skills). The level of skill acquisition is partially presupposed by training and partially by innate abilities. Figure 2.3 presents a model for competence and its components:

\[
\text{COMPETENCE} = \text{KNOWLEDGE} + \text{SKILLS} + \text{ABILITIES}
\]

\[
\downarrow \quad \downarrow
\]

\[
\text{DECLARATIVE} \quad \text{PROCEDURAL}
\]

**Figure 2.3. Competence and its components**

The distinction between competence and skills has important implications. First, it presumes that expert competence requires superior knowledge – both declarative (knowledge of facts) and procedural (capability to use this knowledge, or skills). Skills in naturalistic decision-making in general and entrepreneurial decision-making in particular - if we assume its naturalistic character - are numerous and versatile. As was discussed above, NDM skills include ability to chunk information and match patterns (Simon, 1987), which predisposes the ability to create, store and use cognitive schema, or expert scripts (Mitchell and Chesteen, 1995). Use of expert scripts is one of the most important skills in making decisions in entrepreneurial tasks (Gaglio, 1997; Mitchell and Chesteen, 1995).

Other skills crucial in naturalistic decision-making and supposedly playing an important role in entrepreneurial decision-making include mental modelling (mental imagery) and situation (task) assessment skills. Mental modelling is used to create virtual feedback either when the novelty of the situation makes it impossible to use cognitive schema automatically, or when stakes are too high and actions stored in cognitive schema have to be legitimised by reasoning, however brief. Skills in situation or task assessment are vital for expert decision-makers (including entrepreneurs) because they enable decision-makers to evaluate the cognitive structure of the task as intuition, analysis or quasi-rationality-inducing, and to match it with appropriate cognitive strategy. It should be mentioned, however, that experts make situation assessment intuitively, using their cognitive schema. Thus, it is quite possible to assume that using cognitive schema is a very general skill, which has to be mastered before the others are successfully performed.

The above reasoning finds support in the numerous studies, e.g. Klein, Calderwood and Clinton-Cirocco (1986), which includes Klein’s study of fire fighting, Lip-
shitz’ (1989) research concerning military decision-making, Stanwick’s (1996) – on use of mental imagery in strategic management, etc. Findings from Klein et al’s (1986) study demonstrate that fire ground commanders react to the situation in terms of highly familiar patterns associated with certain actions. If time permits, commanders use an apparently imagery-based consideration of the implications of the planned actions, “watching” it unfold in the present context to consider any complications. Similarly, Lipshitz (1989) concludes that the Israeli army officers he studied make decisions by matching a situation to an associated action, considering whether there are any problems with the anticipated action, and executing if there are none.

The present study does not address directly the question of developing entrepreneurial skills, although the author recognises its importance and considers it one of the study’s main research implications. Still, Stanwick’s (1996) study of how top managers in declining corporations use mental imagery to improve their companies’ performance demonstrates clear similarities between “imagination imagery” process employed by managers, and entrepreneurial process of effectuation (Sarasvathy, 1999, 2001). Imagination imagery is a process of visualising mental images unrelated to actual past actions (Howe, 1989), while efficacy is a process of creating a market, when the market is finally defined through strategic vision for the company (Sarasvathy, 1999). Both processes are employed in a highly uncertain environment, lacking historical information and demanding creativity and flexibility.

Declarative knowledge (knowledge of facts) is an important component of decision-making competence. Exactly what kind of knowledge is important is difficult to say a priori, because expert knowledge is by definition context-bound (a brief outline of knowledge and skills an entrepreneur should possess will be given in Chapter 3). However, if we regard the subtasks within venture creation: initial discovery, market making, opportunity refinement, resource acquisition and (new) co-ordination of (new) resources, it is possible to assume that entrepreneurs employ two types of knowledge – general and specific throughout the whole range of the tasks. It should be remembered still that general knowledge is domain-specific, and specific knowledge is highly individualised (Fiet, 2000).

Considering the relative importance of both types of knowledge for the creation and use of expert scripts, it is possible to assume that general knowledge plays a crucial role in creating the scripts (experts are able to create, store and use more patterns because they know more), whereas specific knowledge is in fact a script retrieved in a discovery situation (cf. Fiet, 2000; Gaglio, 1997).

The last very important aspect of entrepreneurial competence – ability – is not addressed in the present study as it falls rather within the domain of cognitive psychology and requires advanced research skills and knowledge of the domain to be properly investigated. Besides, a number of studies suggest that superior performance (usually regarded as a result of innate abilities) is, in fact, the result of many years of deliberate practice (Ericsson et al, 1993, Howe, 1990).

The next chapter would elaborate in further details on the nature of the entrepreneurial task, as well as the cognitive processes employed.
3. Entrepreneurial decision-making: tasks, cognitions and performers

3.1. Entrepreneurship – an empirical phenomenon and a field of research

Entrepreneurship is still a research field in emergence. It is young: one of the first courses in entrepreneurship and innovation was carried out by Peter Drucker at New York University in 1953; the first entrepreneurship conference was held at Purdue University in 1970 (Cooper, 2003).

Over the years the field has undergone significant development; according to Katz (2002) there exist 44 peer-review journals published in English. Fried (2003) points out that entrepreneurship journals can be found among scholarly publications ranked as Outstanding (Journal of Business Venturing) and Significant (Entrepreneurship Theory and Practice).

And yet there exists frustration among researchers in the field (Low, 2001; Davidsson, 2003; Shane and Venkataraman, 2000). As the field’s critics would assert, entrepreneurship seems to lack a general paradigm and a theory; its methodology ought to be more rigorous (Shane and Venkataraman, 2000; Cooper, 2003). To make the matter even worse neither the research field nor the empirical phenomenon it studies has yet been provided with a generally accepted definition.

To a certain extent the criticism is warranted; however, the present state of entrepreneurship research has its causes. First, the phenomenon under study is utterly complex; there is a notion that entrepreneurship is not one, but a “hodgepodge of empirical phenomena” (Shane and Venkataraman, 2000). Due to this empirical complexity it is not hard to understand that confusion or lack of clarity is quite likely to affect the definition of the field, the theoretical and methodological approach, and the relationships to other research areas.

Definition of entrepreneurship as a field of research may serve one of the most vivid examples of this confusion. Definitions are many. Depending on the complexity of the phenomenon, as well as a researcher’s delineation of the field of study, entrepreneurship may be defined as behaviours or outcomes; as devoted solely to profit-making or belonging to the area of social non-profit activities as well; as occurring only at start-ups or in (small) firms owned by the manager or as existing by right in the large organisations etc. (Davidsson, 2003). To give just one example, conventional wisdom of modern organisation theory and management states that an organisation, in order to survive and stay profitable, should be innovative, entrepreneurial, capable
to learn – the list of buzzwords can be continued, and they all are used more or less as synonyms.

Still, conventional wisdom may not be altogether wrong; it is supported by some of the existing definitions of entrepreneurship, i.e. the one by Gartner (1988): “Entrepreneurship is the creation of new organisations”. Another study by Gartner (1990) points out that the leading scholars in the field of entrepreneurship, business leaders and politicians alike, would define innovation, growth and uniqueness as inherent properties of entrepreneurship.

So, as often is the case, both the scholarly definitions and the conventional wisdom nail down one of the most prominent aspects of entrepreneurship, be it a scholarly field or an empirical phenomenon – novelty.

The field of entrepreneurship does not have a single theory. Such a situation is not good, since it undermines the field’s legitimacy. Indeed, if an area of study has trouble to distinguish itself from the nearby disciplines, it can rightly be asked whether the field has anything to contribute to explain and/or predict empirical phenomena. In other words: can the field of entrepreneurship create unique knowledge, as compared to other discipline, if they engage in studies of the same empirical phenomenon?

The sceptics would probably say “no”; the leading scholars in the field say definitely “yes”. Valiant attempts are being made at both defining the field’s boundaries and creating its theoretical framework. Shane and Venkataraman (2000), as well as Davidsson (2003) and Gartner (1988; cf. Gartner, 1990) ought to be named among the champions, but the list can be long. Gartner’s view has been referred to above; for Venkataraman (1997), and Shane and Venkataraman (2000, p.218) entrepreneurship is “the study of sources of opportunities [to create future goods and services – Venkataraman (1997)]; the processes of discovery, evaluation, and exploitation of the opportunities; and the set of individuals who discover, evaluate and exploit them.” It should be noted that the authors do not draw a strict distinction between entrepreneurship as an empirical phenomenon and a research field.

According to Davidsson, who tries to reconcile Gartner’s and Shane and Venkataraman’s positions, in order to obtain a better understanding of entrepreneurship as a research field on its own right, a clearer distinction is to be made between entrepreneurship as a societal phenomenon, entrepreneurship as a scholarly domain, and entrepreneurship as an educational subject. In this regard Davidsson (2003, p.318) would define entrepreneurship as an empirical phenomenon as “the introduction of new economic activity that leads to change in the marketplace”, and entrepreneurship research field as “the behaviors undertaken in the process of discovery and exploitation of ideas for new business ventures.” (Davidsson, 2003, p.317)

The question, however, begs itself whether such a distinction (between the empirical phenomenon and the field of research) is necessary. Shane and Venkataraman (2000) do not recognise it. Would it not suffice to define the phenomenon in question and to assume by definition that “entrepreneurship research” is the field studying “entrepreneurship”? Unfortunately, the answer is not as self-evident. As already mentioned, entrepreneurship as a field of research needs to a) distinguish itself from the other disciplines should they engage in the study of the same phenomenon; b) prove
its ability to create unique knowledge in order to explain and/or predict the empirical phenomenon in question; c) establish its theoretical framework; d) establish its methodology.

Paradoxically, entrepreneurship as a distinct research field is not viable without other disciplines. This view is firmly supported by Davidsson (2003) and Low (2001). Most clearly this interdependence is revealed in methodology issues. Entrepreneurship, indeed, borrows freely from the “tool-kits” of other social sciences, yet this is one of the field’s strengths, rather than weakness (Chandler and Lyon, 2001). Methods per se are neither good nor bad; rigour in applying a particular research technique, as well as its fit to the theoretical approach and/or the empirical phenomenon under study would differentiate a methodologically sound work from one executed poorly (Martin, 1990). In this case, ability to employ the whole range of social science methodology would indeed contribute to entrepreneurship’s success as a research domain dealing with a complex social phenomenon.

As far as building up a theoretical framework is concerned, entrepreneurship theory, which can be regarded as being under development, benefits from other disciplines as much as the field’s methodology. Economics could demonstrate one of the clearest examples of a fruitful collaboration, on one hand, and the necessity to define the field, on the other. The names of Schumpeter (1934), Kirzner (1973) and Baumol (1993) would spring to mind almost immediately once economists’ contribution to entrepreneurship research is mentioned. Kirzner’s treatment of opportunity as a key concept of entrepreneurship research is, however, rather special, since he would completely ignore the empirical results of his theorizing. In other words, while making a valuable theoretical contribution to the process of opportunity discovery, he leaves the issues of opportunity evaluation and exploitation completely unattended. These two processes are discussed by Cantillon (1999) and Shackle (in Batstone & Pheby (1996)). The concept of innovation as an inherent feature of entrepreneurship was introduced by Knight (1921); his other contribution to entrepreneurship theory was the proposed distinction between risk and uncertainty (Knight, 1921). In general, these economists point out that entrepreneurship, as an empirical phenomenon, would include decision-making under risk and uncertainty.

This intrinsic condition of risk and uncertainty is to be primarily borne in mind as we start discussing the unique contribution of entrepreneurship as a research field distinct from the other disciplines. However, the distinguishing features are numerous. According to Shane and Venkataraman (2000, p.218), the uniqueness of knowledge, generated in the field, is derived from the following three sets of research questions:”(1) why, when and how opportunities for the creation of goods and services come into existence; (2) why, when, and how some people and not others discover and exploit these opportunities; (3) why, when and how different modes of action are used to exploit entrepreneurial opportunities.”

The relationship between entrepreneurship as a field of research and other fields is described in Figure 3.1:
As already discussed, entrepreneurship is an utterly complex empirical phenomenon, which can be studied at different levels of analysis: individual, corporate and societal. The level of analysis is one of the features which entrepreneurship research shares with (or borrows from) other disciplines: psychology and strategy employ individual level of analysis; analysis on the firm level is the property of economics, sociology and management/strategy, whereas societal or regional level is also often used in economics and sociology.

It becomes then quite logical for entrepreneurship to borrow not only levels of analysis but also to benefit from the established theoretical framework (as in case of economics and psychology) and methodological tools which exist in the disciplines. All this taken together would help to increase the theoretical soundness and methodological rigour of entrepreneurship studies.

However, there exist two factors which distinguish the field of entrepreneurship from other disciplines and make it unique, namely: a) the individual-opportunity nexus (Shane and Ekhardt, 2003) as its object of study and b) the property of novelty/uncertainty/risk as inherent to the nexus. No other field investigates the same combination of the same phenomena.

In this regard psychology, with its focus on an individual, holds a prominent place among the disciplines as far as its contribution to entrepreneurship is concerned. The psychological approach to entrepreneurship will be reviewed in the next section.
3. Entrepreneurial decision-making: tasks, cognitions and performers

3.2. The psychological approach in entrepreneurship

Since both entrepreneurship and psychology often employ the same level of analysis, namely individual, borrowing models and methods from psychology in order to study entrepreneurship seems quite beneficial. However, this approach is not without its pitfalls as more than thirty years of development have witnessed.

It is possible to say that the development of the psychological approach in entrepreneurship research has gone through three distinct stages:

- The trait approach;
- Cognitive behavioural models;
- Entrepreneurial cognition.

In the following sub-sections the discussion about these stages will be elaborated.

3.2.1. The trait approach

It was the first attempt to introduce psychological research in entrepreneurship, probably due to the most intuitively appealing reasons. Indeed, even though the field itself is young, entrepreneurial activities (i.e. selling at a higher price than buying or producing and selling new products and services) are as old as human history (Cooper, 2003). At any time there always existed people who excelled in these activities more than the others. Speaking in modern terms, some people were better to discover and exploit the opportunities (Shane and Venkataraman, 2000). The question of why some people were better than others was bound to be asked. It ought to be mentioned that this question does not have only purely scientific, but also practical relevance. Indeed, should we know that people possessing certain personality traits are highly likely to succeed as entrepreneurs, the lives of investors (venture capitalists or bankers) and policy makers could be much easier. It would then suffice to obtain the results of a personality test from a potential entrepreneur in order to make an investment decision (Delmar, 2000).

Starting from McClelland’s (1961) pioneering work, the cause for these differences in the results of entrepreneurial activities has been sought in different personality traits. Speaking briefly, some people are supposed to possess “entrepreneurial personality”, i.e. a combination of stable personality traits which would distinguish them from non-entrepreneurs and demonstrate high correlation with entrepreneurial success. During the past 35 years the trait approach has attempted to describe the entrepreneurial personality as the key component in new venture formation, giving attention to the contributions of people themselves to the entrepreneurial process (Coulton and Udell, 1976; McClelland, 1965).

Unfortunately, the years of research have brought forth rather meagre results. Differences in personality traits could explain but a small part of differences in entrepreneurial behaviour and business performance (Gartner, 1988; Delmar, 1996; Delmar, 2000). The efforts to isolate psychological or demographic characteristics that are common to all entrepreneurs, have generally failed due to weak, disconfirming or non-
significant results. So far, no contributions in the entrepreneurship literature were able to report a unique set of personality traits that characterise the entrepreneur (Brockhaus and Horowitz, 1986; Sexton and Bowman-Upton, 1991; Shaver, 1995). The reason is threefold (Delmar, 2000):

a) There exist too many characteristics and traits that could be attributed to an entrepreneur. Hornaday (1982), for example, points out more than 40 traits which entrepreneurs can exhibit. Consequently, it is very difficult to reach a common understanding operating by such a large number of different traits and their definitions.

b) Human personality is not one-dimensional, as the trait approach presumes, but multi-dimensional. Modern psychological research distinguishes five dimensions (cf. Hogan, 1991); so, in order to establish “entrepreneurial traits” all five dimensions should be measured.

c) Apart from being multi-faceted and complex, human personality is also developing. Even if entrepreneurs demonstrate certain characteristics, there is no guarantee that they have possessed these traits from birth, or even since they have started up a venture. Another aspect of the same issue is that even if some traits endure over time, human behaviour is adaptable. Stable traits provide poor explanation of this adaptable behaviour.

And yet, even though the trait approach has been abandoned as the main psychological approach in entrepreneurship research, it has made an important contribution. First, it provided a negative result of high relevance: we know now that such thing as “entrepreneurial personality” does not exist.

Second, equally important, the trait research was able to identify that successful entrepreneurs indeed possess such common personality traits as internal locus of control, over-optimism, high tolerance for ambiguity and desire for autonomy, but not high risk-taking propensity (Delmar, 2000).

Still, as already mentioned, even though these characteristics are common for successful entrepreneurs, they cannot distinguish entrepreneurs from non-entrepreneurs, nor can they provide an explanation and predictors of successful behaviour. Thus, at present the psychological approach in entrepreneurship research has shifted from investigation of personality traits to investigation of behaviour, motivation and cognition.

3.2.2. Cognitive models of entrepreneurial behaviour

The cognitive models of entrepreneurial behaviour introduce the next stage in the development of the psychological approach in entrepreneurship. Delmar (2000) discusses two main groups: attitude-based models and motivation models.

a) Attitude-based models concern both the start-up and growth of firms. They claim that it is not attitude per se that is the strongest predictor of an entrepreneur’s be-
haviour, but the perceived behavioural control. In other words, it is a person’s confidence in possessing enough skills and knowledge to start up a firm or make it grow that drives the behaviour (Davidsson, 1989; Davidsson, 1995; Krueger, 1993; Wiklund, Davidsson, Delmar and Aronsson, 1997). Other people’s attitude and subjective norms play minor role. Yet these models provide little explanation of why people choose certain behaviour (Delmar, 2000).

b) Unlike attitude-based models, motivational models concern emotions. In other words, if attitude-based models investigate what is considered important and how this affects the behaviour, motivational models investigate issues that cause emotions (pleasure, interest or stress) and their effect on the behaviour (Delmar, 2000). The two main concepts within this approach are perceived self-efficacy and intrinsic motivation. Perceived self-efficacy can be defined as people’s perceived ability to control their lives, and is one of the main concepts in entrepreneurship research (Boyd and Vozikis, 1994). In general it has been found that entrepreneurs high in perceived self-efficacy achieve higher performance of their firms than those with low self-efficacy, when performance is operationalised as profitability, customer satisfaction and ability to survive (Delmar, 2000). Perceived self-efficacy also positively correlates with the intention to start up and exploit new opportunities (Krueger and Dickson, 1993). In general, people with high perceived self-efficacy approach difficult tasks as challenges to be mastered rather than an obstacle to be avoided. An important point, though, is that self-efficacy can be trained; persons with low self-efficacy can change their behaviour and break the negative pattern (Bandura, 1986).

The second motivational model, intrinsic motivation, is closely connected with interest and enjoyment. People with intrinsic motivation become engaged in certain behaviour without any apparent reward rather than the activity itself (Delmar, 2000). Intrinsic motivation, or task interest, is a good predictor of business growth and profitability, since interest leads to higher attention, better decision-making and a feeling of enjoyment (Delmar, 1996).

Summing up, it is possible to conclude that cognitive models of entrepreneurial behaviour possess higher predictive power than their predecessor, the trait approach. However, these models do not consider such an important aspect of cognitive behaviour as decision-making. This issue becomes the focus of investigation for entrepreneurial cognition, an emerging trend within psychological approach to entrepreneurship.

3.2.3. Entrepreneurial cognition

This is a relatively new area within the field of entrepreneurship based on entrepreneurship theory and empirical research as well as cognitive psychology.

In fact, entrepreneurship research has always held a multidisciplinary approach. As has been discussed in Section 3.1 attempts to explain the relationships between the entrepreneur and new venture formation stems from several fields: economics, personality psychology and strategy. Each of these approaches has its contributions, as well as
shortcomings. Suffices to mention (once again) that the trait approach ultimately failed to reveal stable personality traits, which would distinguish successful entrepreneurs from non-entrepreneurs and would predict potential success or failure with sufficient accuracy.

Yet, despite these research challenges, practitioners and venture capitalists have continued to consider the individual who forms the venture to be critical to its success (Hall and Hofer, 1993; Herron, 1990; Sandberg, 1986; Shane and Venkataraman, 2000; Stuart and Abetti, 1990). Thus actual practice within the entrepreneurship community has differed from much of the research reported to date, and therefore new approaches, which explain the contribution of the entrepreneur to new venture creation, are required still.

The entrepreneurial cognition perspective provides such a link between the entrepreneur and the new venture creation through focusing not on the personality traits, but on an individual’s cognitive behaviour. It introduces a theoretically rigorous and empirically testable approach that systematically explains the role of the individual as well as the context in the entrepreneurial process, and provides an effective tool for probing and explaining the previously unexplained phenomena within the entrepreneurship research domain (Mitchell, Busenitz, Lant, McDougall, Morse and Smith, 2002).

An example of such contribution may be the investigation of the role of entrepreneurial environments, characterised by information overload, high uncertainty or novelty, strong emotions, time pressure and fatigue. Through the lens of entrepreneurial cognition approach it is possible to distinguish both positive and negative aspects of entrepreneurial cognitions and behaviour. The negative aspects would include counterfactual thinking, affect illusion, self-serving bias, planning fallacy, and self-justification (Baron, 1998); overconfidence or representativeness errors (Busenitz and Barney, 1997); and overconfidence, illusion of control, and misguided belief in the law of small numbers (Simon, Houghton and Aquino, 2000). Some of the positive aspects include the making of the venture creation decision using cognitive mechanisms such as expert scripts (Mitchell, Smith, Seawright and Morse, 2000).

The entrepreneurial cognition field has relatively short history. The term entrepreneurial cognition was first used by Busenitz and Lau (1996). Some of the first works in entrepreneurial cognition were done in the areas of cognitive biases and heuristics in strategic decision-making (Busenitz, 1992), and in feasibility and desirability perception, planned behaviour and self-efficacy (Krueger, 1993). Almost at the same time entrepreneurial cognition-based concepts were first used to distinguish entrepreneurs from non-entrepreneurs (Mitchell, 1994). Then Palich and Bagby (1995) used cognitive theory to explain entrepreneurial risk-taking, and Mitchell and Chesteen (1995) demonstrated how a cognition-based entrepreneurial instruction pedagogy was superior to the traditional “business plan only” approach to teaching entrepreneurial expertise.

The next wave of entrepreneurial cognition research was led by Baron (1998), who argued that consideration of several cognitive mechanisms such as counterfactual thinking, attributional style, the planning fallacy and self-justification, might have sig-
significant usefulness in explaining why entrepreneurs do the things that they do. Then McGrath (1999), and Simon, Houghton and Aquino (2000) provided analyses of how cognitive errors, such as overconfidence, illusion of control, and misguided belief in the law of small numbers, etc. shape such phenomena as the creation of real options for entrepreneurs. Busenitz and colleagues (e.g. Wright et al., 2000; Alvarez and Busenitz, 2001) have now utilised cognitive models to explain how the heuristic-based logic that appears to be stronger in entrepreneurs, helps to explain how entrepreneurs think and make strategic decisions; and Mitchell et al. (2000) have utilised entrepreneurial cognition constructs to explain the venture creation decision in the cross cultural setting. Most recently, the use of cognitive constructs has been further extended to explain cognitive complexity in aboriginal economic development and in family business (Mitchell and Morse, 2002; Mitchell, Morse, and Sharma, 2003).

As a conclusion, it is possible to say that the entrepreneurial cognition approach offers help to understand how entrepreneurs think and behave; “why” they do some of the things they do. This approach also provides a theoretically rigorous and testable argument for such distinctiveness. As such, when one is interested in entrepreneurship-related phenomena, it now appears essential for researchers to credibly account for the role of the individual entrepreneur. The cognitive approach provides the necessary research “tool-kit” to do so. Thus entrepreneurial research with a cognitive foundation is on the rise today because there is a gap waiting to be filled in, and which the cognitive approach is able to fill (Mitchell et al. 2002).

The brief summary of the discussion above can be found in Figure 3.2:

**Figure 3.2. Psychological approach in entrepreneurship research**

As we have seen, ample evidence suggests that people do not perform entrepreneurial task (discovering and exploiting opportunities; Shane and Venkataraman, 2000) equally well. Numerous attempts have been made to explain why certain individuals become highly successful in this task whereas others do not, and to predict which individuals would prove potentially successful entrepreneurs. The psychological research has contributed theoretical guidelines, level of analysis and methodology.
Starting from investigation of stable personality traits, the psychological approach in entrepreneurship subsequently moved to behavioural explanations: first to cognitive models of attitude and motivation, and then to studying cognitive models of decision-making under risk and uncertainty (entrepreneurial cognition approach), which regards decision-making as a joint function of the individual’s cognitive behaviour and the cognitive properties of the task. This approach serves as the theoretical framework of the present study.

3.3. Entrepreneurial task

As was made clear in the previous chapter, decision-making is a joint function of the nature of the task and the cognitive processes of a decision-maker. Thus, to investigate the nature of their task becomes highly important, if we are indeed interested in understanding how entrepreneurs make optimal decisions.

Taking the ideas of Shane and Venkataraman (2000), Davidsson (2003) and Sarasvathy et al. (2003) as points of departure, one can pose that entrepreneurial task can be defined as bringing (new) goods and services to the marketplace in a novel and more profitable way. This is the task accomplished by entrepreneurs through venture creation.

An attempt to refine and operationalise this crude definition almost at once meets substantial difficulties, conceptual as well as terminological. So far, little consensus exists in the field of entrepreneurship concerning venture creation. However, most of the researchers hold it to be a process, reciprocal in nature yet directional, as it is characterised by reduction of uncertainty toward the final stages of the process (cf. Bhave, 1994; de Koning, 1999; Ardichvili, Cardozo and Ray, 2003; Shane and Ekhardt, 2003).

Disagreement occurs when initial stages of the process are discussed; it is followed by subsequent conceptual and terminological confusion. Traditionally this initial stage of venture creation is labelled “opportunity recognition”. Arguments mostly arise in regard to its nature: whether it should be considered objective, subjective or the combination of the two. Davidsson (2003) makes a well-grounded attempt to reconcile the opposing views by introducing one more concept, venture idea. According to him, opportunity is an objective state, which exists as “an uncountable in the form of technological possibilities, knowledge and unfulfilled human needs backed with purchasing power” (Davidsson, 2003, p.338). Venture ideas, then, are subjective, “the creations of individuals’ minds. They are specific (but changeable and more or less elaborate) entities that are acted upon” (Davidsson, 2003, p. 339). It is impossible to know a priori whether venture ideas are “good”, i.e. reflecting existing opportunity or “bad”, i.e. based on the entrepreneur’s misperception of the external environment.

This view is partially supported by Shane and Ekhardt (2003) who pose that it is not opportunities per se but the interaction between opportunities and enterprising individuals (“individual-opportunity nexus”) which gives rise to formation of new ventures (cf. Shane, 2003). However, for the sake of terminological consistency, the au-
thors continue their use of the term “opportunity” throughout their investigation of the venture creation process.

It ought to be mentioned that while using the term opportunity recognition, some authors implicitly refer not only to the initial stage of the venture creation process, but also to its more advanced stages; at times, even to the process as a whole (cf. Ardichvili and Cardozo, 2000; de Koning, 1999). There also exists certain disagreement concerning the number of stages in the venture creation sequence as well as their order.

Classification of opportunities is one more topic viewed differently by the researchers in the field. Taxonomies are numerous; a good example is the latest one by Shane and Ekhardt (2003) where opportunities are categorised through the process of venture creation (discovery, evaluation and exploitation) as well as according to factors such as type of identification (for discovery), locus of opportunity etc.

This classification, however, does not explicitly take into consideration an inherent feature of entrepreneurial process, namely uncertainty. Indeed, according to Knight (1921; in Sarasvathy et al., 2003), an economic agent might face three types of uncertainty:

1. Future distribution exists and is known, which means that risks can be calculated and decisions ought to be made by analysis, since all possible outcomes are equally likely. In other words, an economic agent faces condition of near certainty (or very low uncertainty).
2. Future distribution exists but is unknown in advance. In other words, probabilities of each outcome scenario exist and could be found out over time, since the environment changes over time (i.e. is dynamic). In order to make a decision, the economic agent has to implement emergent strategies of trial-and-error. Such a situation exhibits moderate level of uncertainty.
3. The future is both unknown and unknowable, since neither outcomes nor probabilities are known to exist (left alone their distribution). This is the ultimate level of uncertainty, labelled true uncertainty by Knight. He does not elaborate on the actions of the economic agent (entrepreneur) under conditions of true uncertainty, although he mentions that decisions are made through intuitive judgements based on experience.

Taking Knightian classification of uncertainty as a point of departure, Sarasvathy et al. (2003) suggest their own opportunity typology implicitly depending on the uncertainty level:

1. “Opportunity Recognition”
   "If both sources of supply and demand exist rather obviously, the opportunity for bringing them together has to be “recognised” and then the match-up between supply and demand has to be implemented either through and existing firm or a new firm. This notion of opportunity has to do with the exploitation of the existing markets. Examples include arbitrage and franchises." (Sarasvathy et al., 2003,
It can be pointed out that opportunity recognition occurs under condition of near certainty, as defined by Knight.

2. "Opportunity Discovery"

"If only one side exists – i.e. demand exists, but supply does not, and vice versa – then, the non-existent side has to be "discovered" before the match-up can be implemented. This notion of opportunity has to do with the exploration of existing and latent markets. Examples include: Cures for diseases (Demand exists; supply has to be discovered); and application for new technologies… (Supply exists; demand has to be discovered)." (Sarasvathy et al., 2003, p.145). In terms of uncertainty, opportunity discovery occurs then the uncertainty level is medium.

3. "Opportunity Creation"

"If neither supply nor demand exists in an obvious manner, one or both have to be “created” and several economic inventions in marketing, financing etc. have to be made, for the opportunity to come into existence. This notion of opportunity has to do with the creation of new markets. Examples include Wedgwood Pottery, Edison’s General Electric, U-Haul, AES Corporation, Netscape, Beanie Babies, and the MIR space resort." (Sarasvathy et al., 2003, p.145) Opportunity creation occurs under condition of “true” (by Knight) or ultimate uncertainty.

We may assume that entrepreneurs in the course of their business life may come to identify any (or all) types of opportunity, from recognition to discovery to creation. Let us now consider what type of decision-making would yield best results depending on the type of opportunity and in accordance with correspondence-accuracy principle (Hammond et al., 1987).

According to Hammond et al. (1987) tasks can be categorised as inducing analysis, intuition, or quasi-rationality (heuristics). Since we know that analytical tasks are performed most successfully in stable environments, and intuition is a property of naturalistic decision-making that occurs in a (highly) uncertain environment, it is quite logical to associate analysis-inducing tasks with a low level of genuine uncertainty, quasi-rational tasks with moderate level, and intuitive tasks with high level of uncertainty.

As has been already discussed, each type of opportunity is associated with a certain level of uncertainty: ultimate uncertainty with opportunity creation; moderate uncertainty with opportunity discovery and low uncertainty with opportunity recognition. We may now compare the level of uncertainty for each opportunity type to be able to categorise them as intuition/analysis-inducing, according to the procedure developed by Hammond et al. (1987). Properties of the tasks as intuition/analysis-inducing are found in Table 2.1 in Chapter 2.

Thus, if we compare the properties of entrepreneurial tasks of opportunity creation/discovery/recognition with the levels of uncertainty by Knight and cognitive properties by Hammond, we can see that a) the high uncertainty task as opportunity creation can be recognised as intuition-inducing; b) opportunity discovery (moderate uncertainty task) can be recognised as quasi-rationality-inducing; and c) opportunity recognition (low uncertainty/near certainty) can be recognised as analysis-inducing.
3. Entrepreneurial decision-making: tasks, cognitions and performers

The interrelations between the types of opportunity, level of uncertainty and induced cognitions are demonstrated in Table 3.1:

**Table 3.1 Types of opportunity and induced cognitions**

<table>
<thead>
<tr>
<th>Opportunity creation (Knight; Sarasvathy et al.)</th>
<th>Opportunity discovery (Moderate; outcomes/ probabilities are known; probabilities become known in time)</th>
<th>Opportunity recognition (Low; outcomes/ probabilities are known)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultimate (“true”); outcomes/ probabilities unknown</td>
<td>Moderate; outcomes are known to exist; probabilities become known in time</td>
<td>Low; outcomes/ probabilities are known</td>
</tr>
<tr>
<td>Induced cognition (Hammond et al.)</td>
<td>Intuition</td>
<td>Quasi-rationality</td>
</tr>
</tbody>
</table>

Summing up, it is possible to describe the connection between opportunity(-ies), venture idea and venture creation as follows:

Opportunities, depending on their nature (level of uncertainty) can be created (under ultimate uncertainty), discovered (under moderate uncertainty) or recognised (under low uncertainty/near certainty) (cf. Sarasvathy et al., 2003). Any of these processes leads to formulation of a venture idea (Davidsson, 2003) in the mind of the entrepreneur. Depending on the nature of the opportunity, its identification, or creation of the venture idea - its mental model - would prompt different modes of decision-making: intuition, quasi-rationality and analysis. Figure 3.3 demonstrates the relationship between type of opportunity, level of uncertainty and cognitive processes involved in opportunity identification:

![Figure 3.3. Opportunity, uncertainty and cognition](image-url)

**Figure 3.3. Opportunity, uncertainty and cognition**
As mentioned earlier, different types of opportunities are likely to induce different types of cognitions. According to correspondence-accuracy principle, opportunity creation, due to its highly uncertain nature, is likely to induce intuitive cognition (i.e. opportunities are created intuitively); opportunity discovery is likely to induce quasi-rational cognition (i.e. opportunities are discovered with the help of heuristics/quasi-rationality); and opportunity recognition is likely to induce analysis (i.e. opportunities are recognised analytically).

Types of opportunity and their levels of uncertainty played crucial role in the operationalisation and positioning of the experimental tasks by performing uncertainty assessment. This means creating possibility to position the experimental tasks in the areas of high, medium and low uncertainty, i.e. cognitive processes of opportunity creation/discovery/recognition have been identified as intuition, quasi-rationality and analysis-inducing respectively. Taking this theoretical categorisation as the point of departure, the author of the present study created descriptions of entrepreneurial situations (experiment scenarios) which presumed opportunities to be created, discovered or recognised. In order to increase the tasks’ external validity, they were subsequently empirically grounded as their plausibility was assessed by a panel of experienced entrepreneurs and managers. More details concerning the validation of the tasks are provided in Chapter 4.

3.4. Cognitive processes of entrepreneurs

3.4.1. Entrepreneurial expertise

In order to perform successfully, entrepreneurs should possess a wide knowledge and a number of skills, some of them related to the general business knowledge, including traditional functional areas (Hood and Young, 1993; Ardichvili, Cardozo and Ray, 2003). Entrepreneurs’ knowledge can also be regarded as particularly entrepreneurial, such as greater knowledge of business creation (Gartner, 1989). Other skills that are common for entrepreneurs and managers include the skill to motivating others, influence skills, information sharing and collecting, delegation, communications skills, control, organising, and planning (Stumpf, Dunbar and Mullen, 1991).

Skills, particularly relevant for entrepreneurs, would include: knowing the business and markets, being an entrepreneurial force, accommodating adversity, as well as oral presentation skills, interpersonal skills, the ability to prepare and present a business plan etc. (Drucker, 1985; McMullan and Long, 1990; Ronstadt, 1985; Vesper and McMullan, 1988)

To be able to perform the whole range of tasks at different levels of uncertainty while creating, discovering or recognising opportunity and creating a venture, entrepreneurs ought to possess a highly specific decision-making skill—ability to match decision-making mode to the nature of the task. Presumably, this is the skill which, being highly developed, would distinguish an expert entrepreneur from a novice. In other words, experts in entrepreneurial decision-making would be able to produce correct
expert judgement if the situation demands opportunity creation (i.e. create an opportunity in order to transform a radical technical discovery into a profitably sold product). They would inerrably recognise a situation requiring analysis (as in case of opportunity recognition). In this case they are either sufficiently trained themselves to perform analysis correctly, or are able to acquire expert assistance (cf. Stevenson and Sahlman, 1990). When the situation is moderately uncertain, as it is for opportunity discovery, expert entrepreneurs would apply heuristics.

Summing up, it is now possible to refine the Propositions 1, 2 and 3 (see Chapter 2) pertaining to entrepreneurial cognitions induced by the type of opportunity:

**Proposition 4:** Expert entrepreneurs would use expert judgement for opportunity creation; they would use quasi-rationality (heuristics) predominantly for opportunity discovery. Opportunity recognition would be carried out through analytical (planning) techniques.

Speaking in terms of cognitive psychology, entrepreneurs as expert decision-makers are characterised by their ability to form and retrieve entrepreneurial scripts, each pertaining to a distinct type of opportunity. A script, as defined in information theory, is “knowledge, [which] is schematised, that is, organised in chunks or packages so that, given a little bit of appropriate situational context the individual has available many likely inferences on what might happen next in a given situation” (Abelson and Black, 1986, p.1). Thus, expert entrepreneurs would keep in their memory all kinds of scripts pertaining to the situations in which different types of opportunities occur. Having encountered specific cues, they would immediately recognise the situation and retrieve the appropriate script.

An interesting question is whether entrepreneurial expertise is developed through success or failure. The answer would depend, to a large extent, upon the researcher’s frame of reference. According to motivational models, entrepreneurial expertise is prompted by success achieved through mastery experience (personal or vicarious), and high intrinsic motivation, which leads to re-enforcement of positive motivation (Bandura, 1995; Delmar, 2000).

However, from the standpoint of entrepreneurial cognition theory and information theory, in order for a script to be formed both success and failure are necessary. Since the present study adopts entrepreneurial cognition theory which as its theoretical framework, the answer to the question above will be unambiguous. In order to become a true expert capable of making adequate decisions across a variety of tasks, the entrepreneur has to possess numerous scripts derived from both successes and failures in situations characterised by different levels of uncertainty.

### 3.4.2. Entrepreneurial decision-making: is it naturalistic?

The discussion in the previous sub-section implies that entrepreneurial decision-making is considered naturalistic. Features of entrepreneurial decision-making, such as action orientation, use of mental imagery and cognitive schema, point at its naturalistic character.
In order to prove it, let us start by analysing the effectuation model of entrepreneurial decision-making created by Sarasvathy (1999; 2001). Bearing in mind the characteristic features of naturalistic decision-making, as mentioned in the previous paragraph and described in detail in Chapter 2, it is not hard to see the clear resemblance between naturalistic decision-making (NDM) models and the effectuation model.

First, the effectuation model is empirically grounded, as required of a naturalistic decision-making theory. Second, the expert entrepreneurs in Sarasvathy’s (1999) study widely use mental imagery. (The whole study is, in fact, an exercise in mental imagery – the subjects are to perform in imaginary situation as they market a non-existent product.) However, according to the subjects, the situation is very similar to those in real life. In other words, the subjects are engaged in a behavioural simulation (Stumpf, Dunbar and Mullen, 1991). The use of mental imagery becomes especially clear when the subjects perform the final stage of creating a market – defining a market (Sarasvathy, 1999). A conclusion may also bring together effectuation and use of mental imagery as two forms of enactment as sense making (Weick, 1969). On the other hand, enactment, according to Johannisson (1999), is a crucial part in entrepreneurial process.

The next point is constructing situation representations in order to evaluate alternative courses of actions. In other words, decision-making in naturalistic setting leads to action and is not preceded by time-consuming analysis. This is, arguably, what entrepreneurs, notorious action-takers, would do. As one of the subjects in Sarasvathy’s (1999, p.14) study puts it, “I always live by the motto of “Ready-fire-aim.” I think if you spend too much time doing ready-aim-aim-aim-aim, you’re never gonna see all the good things that would happen if you actually start doing it and then aim. And find out where your target is.”

According to Sarasvathy (2001), effectuation is a peculiar “entrepreneurial” mode of decision-making, which yields best results in uncertain environment, when future is unpredictable – especially as far as commercialisation of a radical innovation is concerned.

Briefly, effectuation can be defined as “taking a set of means as given and focussing on selecting between possible effects that can be created with that set of means” (Sarasvathy, 2001, p.245). Unlike analytical reasoning, effectuation benefits greatly from arising contingencies, which cannot be easily analysed and predicted, but can, however, be exploited. In other words, effectuation aims at controlling of an unpredictable future, rather than at attempts to predict an uncertain one, as analytical techniques do. These features set effectuation as a decision-making model firmly into the realm of naturalistic decision-making as one of heuristics; empirical findings point out at effectuation as something expert entrepreneurs would commonly use while making decisions (for example, making marketing decisions in the non-existing markets). As such, effectuation can be legitimately assumed to be a specifically entrepreneurial heuristics preferably used under conditions of (high) uncertainty.

The last but not least argument supporting the idea of entrepreneurial decision-making being naturalistic is the use of cognitive schema. According to Mitchell and Chesteen (1995), extensive use of schemata, or expert scripts, is a pronounced charac-
3. Entrepreneurial decision-making: tasks, cognitions and performers

characteristic of expert entrepreneurs. As already stated above, knowledge structures, such as schema, are widely used in naturalistic decision-making.

Comparing characteristics of a situation where naturalistic decision-making typically occurs with “entrepreneurial situation” can provide additional cues for the discussion concerning naturalistic character of entrepreneurial decision-making. In order to establish whether entrepreneurial decision-making is naturalistic, it is necessary to remember that NDM is a joint function of two factors: characteristics of the task and the subjects’ knowledge and experience. It is, therefore, necessary to define which situations (tasks) can be regarded as entrepreneurial.

Entrepreneurs engage in a number of tasks. Entrepreneurship is, either entirely or partially, about doing something new, performing “new combinations” (Schumpeter, 1934). Or, following the definition of entrepreneurship as an empirical phenomenon, it concerns with providing future goods or services (Shane and Venkataraman, 2000). But since anything involving future is by definition unknown (and, according to Shackle (1970) and Sarasvathy (1999) based on Knight (1921) even unknowable), it is quite logical to assume that entrepreneurs usually act under genuine uncertainty of moderate to high degree. This view is also supported by Sarasvathy’s et al. (2003) classification of opportunities. It is then understandable that due to their inherent levels of uncertainty, opportunity creation and opportunity discovery would pose ill-structured problems, and since entrepreneurs usually function in organisational settings, such factors as shifting, ill-defined, competing goals and multiple players are very likely to be present. This description of entrepreneurial situation is very close to naturalistic settings. Two other factors, namely time stress and high stakes, are also common for both entrepreneurial situations and naturalistic settings. So, the following proposition seems justified:

**Proposition 5:** Entrepreneurs make naturalistic decisions during the process of venture creation, providing that the situations demonstrate moderate to high level of uncertainty, varying degree of time stress and high stakes.

Since NDM is a function of subjects’ expert knowledge, it seems necessary to discuss entrepreneurs’ level of proficiency as decision-makers. Apparently, not all of them are experts in this area (Mitchell and Chesteen, 1995). Nevertheless, naturalistic decision-making by definition demands superior (i.e. expert) knowledge and experience. It is possible to assume that expert entrepreneurs might engage in naturalistic decision-making while performing opportunity creation and opportunity discovery (situations characterised by ultimate/high and high/moderate uncertainty level).

We can also assume, as prompted by Correspondence-accuracy principle, that opportunity recognition, which occurs in stable conditions near certainty would induce analytical decision-making in expert entrepreneurs.

As for novices, they are yet to obtain the mastery of contingent decision-making skills; thus, we cannot claim that their behaviour is naturalistic.

Discussing the entrepreneurial situation it is impossible to miss its similarity with a crisis, as described by Wiener and Kahn (1962). They define crisis as a situation that
demands action decisions, presents a sense of threat perceived by the decision maker, an increase in the degree of uncertainty (i.e. it is dynamic), induces urgency and time pressure and a sense that the outcome would shape the future. All these factors, on the other hand, demonstrate a remarkable similarity to a discovery situation (Davidsson, 2000). The only but profound difference is how the situation is perceived by the decision-maker: whereas a crisis induces a sense of threat, a discovery situation is seen as opportunity (Davidsson, personal communication; cf. Simon, Houghton and Aquino, 2000). Hence it is possible to conclude that an entrepreneurial situation has the same features as a crisis but is perceived as an opportunity rather than a threat.

3.4.3. Intuition, analysis and things in-between

As we have seen, the Correspondence-accuracy principle of decision-making specifies that high uncertainty during opportunity creation would induce intuitive decision-making, whereas the low uncertainty environment pertaining to opportunity recognition is likely to induce strictly analytical cognitive approach in order to achieve optimal results. And there is a vast grey zone in between, where opportunity discovery belongs; its uncertainty level varies and consequently quasi-rational decision-making (use of heuristics) is supposed to yield satisfactory results. Another important conclusion to remember is that none of the cognitive approaches per se is superior to any other, despite the fact that some of them are better researched and appear to be more heavily “promoted”.

Analytical decision-making approach may serve a very clear example to that statement. Management literature, with its beginning in the classical works (cf. Fayol, 1949; Taylor, 1911) as well as through the 50s and 60s, can demonstrate a considerable range of normative theories of analytical (rational) decision-making, especially when the field of strategy is concerned (Ansoff, 1965). A simplified model of analytical decision-making has been shown in Figure 2.1; a more sophisticated model of strategic decision-making is discussed below.

This analytical (rational) model assumes a stepwise process of analysis, which begins with information being gathered about the environment and the organisation (external and internal appraisal; Hatch, 1997). Further steps include evaluation of opportunities and threats for the organisation within the environment, as well as assessment of the organisation's own strengths and weaknesses (SWOT analysis). Executed properly, this is quite an elaborated procedure including definition of the environment’s needs and demands, assessment of the organisation’s competencies, and finally, identification of the so called performance gap, or the opportunity arising due to the differences between potential and actual performance (Hatch, 1997). In order to perform all this, a decision-maker ought to obtain the information concerning competitors’ activities, relationships with the customers and suppliers, potential changes in the customer demands, possible changes in the economic conditions, demographics, cultural trends, potential scientific discoveries, etc. Not to be forgotten is the information concerning the organisation’s aspect, such as products and services provided by the organisation, the product distribution network and the organisation’s geographical
locations, Human Resource Management system, research and development; organisational culture – in other words, all the minute aspects of organisational life are to be identified and brought into analysis (Hatch, 1997).

It becomes clear that the analytical strategy model would hardly fit opportunity creation and opportunity discovery. This model requires copious amounts of information to be gathered. Further, the information obtained has to be processed in accordance with the established analysis techniques to eliminate potential flaws and biases and warrant optimal results. This can be a costly process, as Simon (1979) points out. Moreover, a decision-maker must possess substantial skills in order to perform the analysis correctly (cf. Abelson and Levi, 1985). These factors make it easy to understand the fact that managerial decision-making often falls short of the strict analytical approach (Simon, 1955).

On the other hand, the model is not at all as flawed as it may seem. On the contrary, all the constraining factors taking into consideration (e.g. information gathering cost and information availability/reliability), the use of the model may indeed provide good results under appropriate circumstances. It should be as well mentioned that the conditions of (near) certainty, which according to CAP would justify the application of the model, are not as rare as may seem. Indeed, during opportunity recognition (which occurs when an entrepreneur starts up an imitative venture or opens a franchise), the entrepreneur faces conditions of low uncertainty/near certainty. In this case the use of analytical strategy model would lead to adequate decisions.

Does the above reasoning mean that entrepreneurs are especially prone to biases and would widely use heuristics in their decision-making? The answer, supported by certain empirical findings, is affirmative. In managing risks, an intrinsic factor of entrepreneurial environment, entrepreneurs demonstrate behaviour quite different from the analytical pattern, unlike bank managers, also engaged in risk management (Sarasvathy, Simon and Lave, 1998). Also while formulating a start up strategy entrepreneurs would rely much more heavily on emergent rather than planned approaches (Harris, Forbes and Fletcher, 2000). It should be added, though, that certain elements of planning become strongly associated with the company growth.

Baron (1998) confirms as well that, due to peculiar characteristics of their environment (notably, high levels of uncertainty, novelty, emotions and time pressure – in other words, the very conditions for naturalistic decision-making to occur), entrepreneurs are apt to demonstrate decision-making biases. The list includes counterfactual thinking – the effect of imagining what might have been (elsewhere also called mental modelling); affect infusion – the influence of current emotional state on decisions and judgements; attributional style – a tendency to attribute various outcomes to either external or internal causes; the planning fallacy – a strong tendency to underestimate the amount of time necessary to complete a given project, or the amount of work to be performed in a given time, and self-justification – a tendency to justify previous decisions even if they produced undesirable outcomes.

4 “Bias” is an established term in cognitive psychology. It implies that a cognitive process is at variance with the norms of statistic theories of choice. The author of the present study does not ascribe negative connotation to this word.
Most interesting and important findings pertaining to heuristics and biases in entrepreneurial decision-making are presented in the studies by Busenitz and Barney (1997) and Sarasvathy (1999; 2001). Unlike Baron, who had investigated the use of multiple decision biases in his study, Busenitz and Barney concentrate on overconfidence and representativeness. They also compare decision-making techniques of entrepreneurs to those of managers in large organisations. Overconfidence can be defined as a propensity to decision-makers’ overoptimistic initial assessment of the situation, and their difficulty to incorporate additional information about the situation due to this initial optimism (Fischhoff, Slovic, and Lichtenstein, 1977). Representativeness, first described by Tversky and Kahneman, is now considered one of the most common decision biases (Tversky and Kahneman, 1971; Hogarth, 1987, both in Busenitz and Barney, 1997). In brief, representativeness is a propensity to generalise basing on a small, non-random sample (Tversky and Kahneman, 1971 in Busenitz and Barney, 1997), with personal experience being the most common basis for generalisation (Kahneman, Slovic, and Tversky, 1982).

Not surprisingly, the authors discover that entrepreneurs are much more prone to demonstrate decision biases than managers. In other words, entrepreneurs do think differently than managers, and subsequently, their behaviour differs as well (Busenitz and Barney, 1997).

Effectuation, a new type of specifically entrepreneurial heuristics, has been discovered and is now researched by Sarasvathy (1999; 2001), who said that “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” (Sarasvathy, 2001, p.245).

Quite notably, Sarasvathy (1999) has first discovered effectuation while investigating entrepreneurial decision-making in non-existing markets. Indeed, in full accordance with the correspondence-accuracy principle, such a highly uncertain environment would call for heuristics based decision-making. Not surprisingly, the researcher finds out that being required to make marketing decisions in the non-existing markets, entrepreneurs would use effectuation rather than analytical model, recommended by marketing literature (Sarasvathy, forthcoming).

It should be mentioned that Sarasvathy does not claim effectuation to be a superior decision-making mode per se. On the contrary, she keeps pointing out that both effectual and analytical (“causal”, in her terms) thinking is an inherent part of human reasoning. Distinguishing the circumstances when either process (or combination of both) would provide particular advantages or disadvantages is, in her mind, an important task of future research (Sarasvathy, 2001).

However, the opportunity categorisation by Sarasvathy et al. (2003) and CAP can provide a (tentative) answer. Effectuation is a decision-making mode in preference to opportunity discovery. Gradually, as uncertainty decreases, quasi-rational decision-making becomes more and more analytical, to be eventually replaced by planning for opportunity recognition.

Having discussed the appropriate decision-making modes depending on the type of opportunity, we may conclude that opportunity creation is a condition of utmost uncertainty, which, in accordance with CAP, calls for intuitive decision-making tech-
Entrepreneurial decision-making: tasks, cognitions and performers

nique – use of expert judgement – to produce an optimal result. What can be said about intuition in management and entrepreneurship?

According to the best knowledge of the author of the present study, not much, and the reports would be quite ambiguous. Barnard (1938) is, probably, the first one to have drawn attention to intuition as an intrinsic part of successful managerial work. Yet since then, the concept of intuition seems to have been viewed as a taboo in decision-making as well as management research. Suffices to say that intuition, as a research construct is not even defined (Brownlie & Spender, 1995)! Still, lately, following the ascension of the naturalistic paradigm in decision-making research (which was discussed in Chapter 2), intuition has begun to attract due attention.

In this regard Simon’s research is, probably, the first to spring to mind. His work has started with a pioneering concept of bounded rationality (1955) and goes on, following Barnard to a large degree, to conclude that intuition is an intrinsic part of expert behaviour, which most often becomes evident through an expert judgement in the conditions of uncertainty. As he points out in a brief, but very important research note, “the expert manager, too, has in his or her memory a large amount of knowledge, gained from training and organised in terms of recognisable chunks and associated information.” (Simon, 1987, p.61).

Brownlie and Spender (1995), when analysing the decision-making of senior marketing managers, lend support to Simon’s definition. Not surprisingly, they find out that under conditions of high uncertainty the best decisions are indeed made through expert judgement.

It has to be kept in mind that CAP is a general construct. It specifies clear theoretical conditions for successful decision-making under varying degrees of uncertainty, yet it does not claim that any heuristics or decision-making biases (which are natural elements of human decision-making under uncertainty) are always favourable. Both can (and do) produce mistakes, at times severe, even disastrous. However, according to Hammond et al. (1987), intuition and heuristics are apt to produce more mistakes, but with less severe consequences. By contrast, analytical techniques result in fewer mistakes, although those that are occasionally made are very severe.

The cognitive continuum theory and the correspondence-accuracy principle also point out that such varied behaviour is to be found empirically in expert decision-makers. That is why the present study investigates two groups of entrepreneurs: experts and novices across a variety of tasks. Classification of opportunities, presented by Sarasvathy et al. (2003) together with Knight’s (1921) classification of uncertainty level in economic situations provide an analytical tool, a gauge necessary to evaluate the level of uncertainty within the experimental tasks.

3.5. Conclusions and hypotheses

Finally, we have arrived to a point where all the previous reasoning about decision-making in general and entrepreneurial decision-making in particular can be summa-
rised in order to provide a theoretical guideline for future research. In other words, earlier propositions could be reviewed and hypotheses can be made.

Decision-making research has a long and exciting history. Its recurrent theme, however, has always concerned the comparison between unaided (intuitive, natural) human reasoning, on the one hand, and reasoning which follows strict rules of logics, mathematics or mathematic statistics, on the other.

Three paradigms of decision-making research would employ different theoretical frameworks, different research methods and give different answers to the above question. Within traditional approach to decision-making research - Formal-Empiricist and Rationalist paradigms (Cohen, 1993) - formal, more or less normative models would prevail theoretically, and experiments in more or less artificial settings involving more or less naïve subjects are favoured methodologically. Proponents of traditional research firmly pronounce unaided human reasoning to be fault-prone and inconsistent.

In contrast with the traditional approach, the Naturalistic paradigm would stress the fact that decision-making is a process (and not a single, isolated event) carried out in complex, ambiguous, uncertain environments by subjects with greatly varying levels of expertise. Accordingly, unaided decision-making is not recognised as being faulty per se and under any circumstances; nor is it considered being altogether faultless; rather, it is possible to distinguish between appropriate and inappropriate decisions. The Cognitive continuum theory (CCT), one of the trends in the Naturalistic paradigm, would suggest an analytical tool to make such a distinction: the Correspondence-accuracy principle (CAP) (Hammond, 1988). According to CAP, a decision would yield optimal results (and thus be appropriate) if cognitive processes used by decision-makers correspond to the nature of the task, for which the decision is made. Although in real life settings both cognitive properties and tasks would represent parts of a continuum rather than strictly calibrated points on a scale, it is nevertheless possible to identify, at least, the poles and the middle point of the continuums. Thus, CCT would break down all tasks into analysis-, quasi-rationality and intuition-inducing, and cognitive processes, consequently, into analytical (rational), quasi-rational and intuitive, with analysis and intuition representing the poles of both continuums, and quasi-rationality (heuristics) representing the middle points.

It appears quite logical that the Naturalistic paradigm treats heuristics and biases quite differently from the traditional approach. Instead of regarding them as faults of unaided reasoning, proponents of the naturalistic approach consider them cognitive processes on their own right, normally employed by people while making decisions in natural settings and yielding both appropriate and inappropriate results.

Considering decision-making as it is treated by the Naturalistic paradigm, it is possible to draw the following conclusions:

− Decision-making is a joint function of the task, for which the decision is made, and the decision-maker’s level of expertise.
− Neither unaided “natural” reasoning, nor elaborated rules based on mathematical and statistical principles per se would guarantee optimal decisions across
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According to the correspondence-accuracy principle (CAP) of the cognitive continuum theory, an optimal decision can only be made if cognitive processes employed match the nature of the tasks.

Expertise of a decision-maker is thus defined by his/her ability to recognise the task as requiring either analytical, or quasi-rational, or intuitive cognitive processes, and perform these processes in accordance to the task. According to Ericsson et al. (1993), such a superior performance is acquired after many years of prolonged training (i.e. performing tasks in a specific domain).

As far as entrepreneurs are concerned, it is quite possible to assume that CAP would apply to their decision-making as well. In other words, in order to understand entrepreneurial decision-making one should investigate the task(s) performed by entrepreneur, as well as cognitive processes employed while performing those tasks.

New venture creation (entrepreneurial task) is a non-linear, albeit directional process; it varies depending on the type of opportunity which commences it. Importantly, each opportunity type is characterised by specific level of uncertainty (from very high to very low) and thus is supposed to induce different cognitive processes.

When analysed in terms of the Cognitive continuum theory, all types of opportunity fall neatly within a cognitive continuum, with opportunity creation exhibiting the highest uncertainty, and opportunity recognition providing conditions near certainty. Opportunity discovery falls in the grey zone of gradually receding uncertainty.

According to the Correspondence-accuracy principle, an optimal decision for opportunity creation is made through an expert judgement. In other words, an expert entrepreneur gives his/her judgement regarding the feasibility of a new venture.

For opportunity discovery, expert entrepreneurs might successfully employ specifically entrepreneurial heuristic – effectuation - as well as other heuristics. Due to its intrinsic property to control unknown future (rather than to attempt at controlling an uncertain one), effectuation may serve as a powerful uncertainty inhibitor.

The situation of opportunity recognition, providing conditions of a near-certainty, calls for decisions made analytically, e.g. by means of relevant planning techniques.

Since opportunity creation/discovery/recognition occur at different points of the continuum, the cognitive processes employed by expert entrepreneurs would vary depending on the level of uncertainty.

According to the Naturalistic paradigm in decision-making research, cognitive processes, as described above, are demonstrated by expert decision-makers as opposed to novices. Speaking in terms of cognitive psychology, entrepreneurs, as expert decision-makers are characterised by their ability to match cognitive
requirements of the task with the appropriate decision-making mode through
the use of expert scripts.

- By contrast, novices either do not possess those scripts or fail to recognise the
cues, which would help to retrieve the appropriate script. Their decision-
making modes would not match the task requirements.

And, as a result, the following hypotheses have been formulated:

I. Hypotheses pertaining to cognitive processes in novices:

   \( H^{1a} \): Novice entrepreneurs use analytical decision-making regardless of the na-
ture of the task.

   \( H^{1b} \) (rival): Novice entrepreneurs use quasi-rational decision-making (heuristics)
regardless of the nature of the task.

   \( H^{1c} \): Cognitive processes of novice entrepreneurs do not vary significantly depend-
ing on the nature of the task.

II. Hypotheses pertaining to cognitive processes in experts:

   \( H^{2} \): Expert entrepreneurs’ dominant cognitive processes vary significantly depend-
ing on the nature of the entrepreneurial task:

   \( H^{2a} \): intuition is dominant in highly uncertain (intuition-inducing) tasks;

   \( H^{2b} \): quasi-rationality is dominant in moderate to highly uncertain (quasi-
rationality-inducing) tasks;

   \( H^{2c} \): analysis is dominant in low uncertainty (analysis-inducing) tasks.

III. Hypotheses pertaining to comparison of cognitive processes between experts
and novices:

   \( H^{3a} \): In intuition-inducing tasks experts will use intuition to a greater extent
than novices;

   \( H^{3b} \): In intuition-inducing tasks novices will use analysis to a greater extent than
experts.

   \( H^{4} \): In quasi-rationality-inducing tasks experts will use quasi-rationality to a
greater extent than novices.

   \( H^{5} \): In analysis-inducing tasks there is no statistically significant difference in the
use of analysis between experts and novices.

The hypotheses will be tested, and the analysis and its results will be discussed in
Chapter 5. More exploratory analysis, which concerns the entrepreneurs’ attitude to-
wards a venture idea and their field of education, will be carried out in Chapter 6.
4. Methodology

4.1. Research methods in cognitive psychology and entrepreneurship

As discussed previously, entrepreneurial decision-making is a joint function of the task (opportunity identification) and entrepreneurial expertise (ability to match decision-making style with the task requirements while retrieving appropriate cognitive schema). In this regard a researcher is confronted with the following methodological challenges:

− Re-creating task environment. According to the cognitive continuum theory (Hammond et al., 1987), accurately re-creating the nature of the task becomes a crucial factor if one aims at studying the interplay between cognitive processes and task requirements.
− Decision-making involved in opportunity identification is a process; hence, methods of recording and analysing data should be attuned to the nature of the phenomenon.

4.1.1. Research techniques in the field of entrepreneurship

In 1988 MacMillan called on the entrepreneurship research community to move away from exploratory studies (in entrepreneurship context meaning mostly case studies) and start concentrating on establishing causality. This admonition was avidly supported by Chandler and Lyon (2001).

According to these authors (Chandler and Lyon, 2001), in the last few years entrepreneurship researchers indeed started demonstrating a shift in the research methodology from exploratory, non-theory driven studies, towards ones investigating causal relationships, including experimental research.

Not surprisingly, experimental studies (though still rather rare) are mostly conducted in entrepreneurial cognition research (Mitchell et al., 2002). One of the best-known studies in the area, although it cannot be called strictly experimental, is one by Baron and Brush (1999), devoted to investigation of social skills in entrepreneurial success. The authors had videotaped a number of entrepreneurs giving presentations of their venture concepts; the videotapes were subsequently evaluated by expert judges. Another interesting and very recent study was conducted by Gatewood et al. (2002) on entrepreneurial expectancy, task effort and performance. Most notably, this experiment utilized an internet-based computer simulation as well.

In general, as far as experiments are concerned, conjoint analysis can be regarded as a useful and promising research methodology. The term “conjoint analysis” refers to
any technique involving subjects, who are required to make series of judgements based on specially designed tasks provided by a researcher (Shepherd and Zackarakis, 1997). This technique is also one of the established methods in psychology, known in that field as "stated preference techniques".

If a study aims at capturing and investigating a process, longitudinal studies may be very beneficial. According to Chandler and Lyon (2001) and Davidsson (2003) longitudinal research has indeed begun to attract increased attention of the entrepreneurship research community. However, despite its substantial general advantages, the present study rejects this technique for the following reasons:

First, it is very difficult to capture opportunity identification (or initial discovery of a venture idea) in real settings. As an intuitive cognitive process, it takes place in the entrepreneur’s mind and can be only observed indirectly, through actions or judgements (e.g. utterances like "that’s a great idea!"). In practice that would mean that it becomes necessary to follow the subjects of the study 24 hours a day in order to capture the discovery moment. When subjects are provided a scenario (from which they may or may not derive the actual venture idea), and their thinking aloud is recorded and transcribed, collecting data about the discovery becomes much easier.

Second, it is difficult to find and/or calibrate uncertainty levels necessary for the study in a natural environment. Again, scenarios provided by the researcher are constructed in a way as to represent the real level of uncertainty in a natural setting, yet the researcher enjoys the convenience of presenting the setting and collecting the data.

The third obstacle refers to time limits. By definition, longitudinal research is carried out in real time and continues for as long as the process under investigation takes. As pointed out earlier, the amount of time may become prohibitive.

What is even more important, the present study does not aim at investigating venture creation as a process in its entirety, from the beginning to the end. Rather, the purpose is to find out whether the cognitive processes of entrepreneurs would match cognitive requirements of the tasks within the venture creation continuum; in other words, the analysis concentrated on a cross-section of cognitive processes at the most cognitively clear points of the task continuum – intuition-inducing (highly uncertain); quasi-rationality-inducing (moderately uncertain) and analysis-inducing (very low uncertainty). Thus, the experiment participants were presented with three types of simulated tasks: opportunity creation by evaluating venture idea potential of a radical innovation (intuition-inducing task); opportunity discovery by evaluating venture potential of a new computer game (quasi-rationality-inducing task) and opportunity recognition by evaluating resources at a company takeover (analysis-inducing task).

Since neither longitudinal research nor field experiment were included, the choice remained between conjoint analysis and simulation experiment. As the study aims at investigating cognitive processes, the choice fell on simulations, because conjoint technique provides little possibility to recreate complex environments, which could be perceived as authentic by the experiment participants.
4. Methodology

4.1.2. Re-creating task environment

As previously described in Chapter 2, Traditional and Naturalistic paradigms in decision-making research differ immensely in their views on research methodology as far as settings and data collection methods are concerned. “Traditional” researchers used either artificial or simplified “real-world” tasks performed by subjects in laboratory environment regardless their level of proficiency (Cohen, 1993; Orasanu & Connolly, 1993). Besides, such experiments would imply that subjects’ performance is compared with pre-defined optimum models of decision-making. According to Hammond et al. (1987), this indirect comparison leads to three major pitfalls:

First, one optimum model, or standard, of decision-making does not exist; the researcher has to choose among many available. However, there is still no agreement on which decision-making model is to be considered correct.

Second, analytical models, which are considered standard, set a ceiling over the subjects’ performance, and as such cannot be used in comparison with naturalistic, or intuitive, models, in cases when NDM provides superior performance.

Third, using analytical models in a laboratory is always accompanied by exact (never deficient or redundant) and correct (never misleading or ill-structured) information. Even the performance of the models is faultless. Such circumstances are very unlikely in the real world.

So, it is possible to say that studying decision-making by means of “traditional” laboratory experiments will result in three major causes of distortion:

- **Method of comparison.** Indirect method of comparison, when one of the models is a priori taken as a standard puts a ceiling on a subject’s performance. In order to compare different models of decision-making directly, the subjects should employ all the test models across the variety of tasks.

- **The subjects’ level of proficiency.** “Traditional” experiments were performed by naïve subjects, most often college students, without any consideration of their level of expertise concerning the task. As was described earlier, decision-makers possessing different level of proficiency use different models (both appropriately and inappropriately to the task). Thus, decision-makers should be thoroughly categorised according to their level of proficiency.

- **The environment and the tasks.** “Traditional” research was conducted using artificial or greatly simplified tasks in a low uncertainty environment (laboratory). As was explained earlier, decision-making performance of the same subject using the same model (e.g. analysis or intuition) may vary dramatically depending on the environment’s level of uncertainty. It means that in order to obtain reliable results, the uncertainty level of the task (environment) must be evaluated and specified.

So, experiments with naïve subjects performing artificial tasks and being evaluated according to the standards established a priori seem quite inappropriate to study decision-making in subjects on different levels of expertise for the tasks of varying degrees
of uncertainty. In this case there are two potential strategies to be considered: field research and simulation.

As far as relevance is concerned, field research has no rivals. However, this type of research is often incapable of handling the findings: the environment may be so complex and uncertain that any causal interpretation of the data becomes virtually impossible (Brehmer & Dörner, 1993). Besides, since field research is necessarily conducted in real time, it may become prohibitively time-consuming.

On the other hand, simulation offsets major drawbacks of field research. Although simulation is most often used in development of skills, including the most complex ones, such as entrepreneurial skills (cf. Mitchell & Chesteen, 1995; Stumpf, Dunbar & Mullen, 1991; Dentico, 1999), it is increasingly used as a research methodology (Brehmer & Dörner, 1993; Brehmer, 1992; Low & Venkataraman, 1994; Keys & Wolfe, 19XX; West & Wilson, 1995). There are two major advantages of simulation as compared to field research. First, a simulation experiment can “compress time” by providing feedback shortly after actions have been undertaken. In such a case observations over causal relationships can be made immediately. Second, a simulation combines possibility to immerse subjects in a rich and dynamic environment that a researcher can nevertheless calibrate by the uncertainty level. Thus, a simulation provides an opportunity to match the level of uncertainty and the model of decision-making quite accurately.

However, these opportunities bear potential pitfalls within themselves. This argument becomes evident if we consider use of simulation while studying NDM. As stated above, the most successful performance in Naturalistic Decision-Making is given by experts under utterly uncertain circumstances. Unclear (impossible to establish causality) and/or delayed feedback plays an important role in creating such uncertain environment. Simulation, by providing clear feedback, can reduce level of uncertainty and thus distort results.

One more, equally serious potential problem with simulations is their irrelevance to the subjects’ previous knowledge. As already discussed, expert knowledge and experience are very domain-specific. It means that in order to investigate expert decision-making a simulation must reconstruct the peculiarities of the domain (and situation) with great precision.

It should be mentioned as well that there exists certain confusion concerning the term “simulation”. If understood as an interactive setting where participants make decisions in consequence with particular roles assigned to them, simulations are often confused with similar activities, namely role-play and microworlds. Although close to each other, these three types of setting differ in several important aspects, as in the following examples. Microworlds, according to Brehmer (Brehmer & Dörner, 1993), are a simulated environment of a small town (Lohhausen), an African tribe (Moro), or a forest fire fighting ground (DESSY). In other words, a microworld is a network of variables, which could be numerical and quantitative, Boolean, nominal, as well as vectors and matrices, and which subjects are to control.

According to Gredler (1992), a microworld can be constructed by combining a computerised database and an adventure-game model. The game model would pro-
provide necessary stimulation and involvement through travel and incidents, and the database would serve as a source of information for the simulated environment. In Gredler’s view microworlds are more close to role-play than to simulations due to their ability to make the subjects’ pre-experiential knowledge and skills an essential part of the setting.

Examples of the simulations proper are quite numerous, e.g. Gredler (1992) recognises five subtypes of simulation activities. One of the best known is crisis-management simulation, which addresses the complexities of managing a relief operation after a natural disaster.

Behavioural simulations, as introduced by Stumpf, Dunbar and Mullen (1991), are a special type of experimental setting, different in many aspects from computer simulations described above. According to the authors, behavioural simulations focus on the participants’ inputs themselves, including behaviours and other decision-making processes when participants’ prior knowledge and experience become an essential part of the simulations. The background information is provided by a researcher and may vary at need — from most brief and sketchy to most detailed thus providing an opportunity to re-create a desirable level of uncertainty. Unlike computer simulations, which induce a pre-determined set of efforts in order to comply with the requirements of pre-programmed models, behavioural simulations teach about sense making and opportunity-seeking.

The main types of simulated settings are discussed in Table 4.1. They are based on the description provided by Gredler (1992), Brehmer & Dörner (1993) and Stumpf, Dunbar and Mullen (1991).

The table makes clear that both role-plays and behavioural simulations are acceptable for experiments with highly uncertain environments. The possibility to vary the background information from brief and sketchy to most complex and detailed provides a researcher with the opportunity to create varied levels of uncertainty and also enables the subjects to bring in their own knowledge and expertise as an integral part of the simulated environment. This way it becomes possible to simulate such highly uncertain environments as discovery of a venture idea in connection with a radical technical innovation and making a market for it. Sarasvathy (1999) in her study employed the strategy of re-creating market making through behavioural simulation.

It should be mentioned as well that role-play might not be a suitable setting for the novices. Experts, relying on their superior knowledge and experience, become able to create mental models of a test situation (which is what a role play is about), whereas novices may simply lack this ability. However, this is not true for behavioural simulations, where the nature and amount of background information is an integral part of the setting. A researcher reconstructs the environment in accordance with the required level of uncertainty.

Hence, the entrepreneurial environments possessing moderate or low levels of uncertainty such as opportunity discovery and opportunity recognition can be equally conveniently studied by behavioural simulations.
Table 4.1. Types of simulated settings

<table>
<thead>
<tr>
<th>Features of the Setting</th>
<th>Simulations</th>
<th>Role Play</th>
<th>Microworlds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Computer</td>
<td>Behavioural</td>
<td>By Gredler</td>
</tr>
<tr>
<td><strong>Background information</strong></td>
<td>Complex, detailed, dynamic, opaque⁵</td>
<td>Varied from brief and sketchy to detailed and complex</td>
<td>Brief, sketchy</td>
</tr>
<tr>
<td><strong>Reality of function⁶</strong></td>
<td>High</td>
<td>High</td>
<td>Varied</td>
</tr>
<tr>
<td><strong>Subjects’ embeddedness</strong></td>
<td>Embedded; subjects interact with the system from inside</td>
<td>Embedded; due to sense-making qualities subjects co-create the setting</td>
<td>Embedded</td>
</tr>
<tr>
<td><strong>Subjects’ previous knowledge</strong></td>
<td>Evaluated and matched to a pre-determined optimum model</td>
<td>Essential part of the setting</td>
<td>Essential part of the setting</td>
</tr>
<tr>
<td><strong>Subjects’ creativity and improvisation</strong></td>
<td>Counter-productive</td>
<td>Essential</td>
<td>Essential</td>
</tr>
<tr>
<td><strong>Recreated levels of uncertainty</strong></td>
<td>Moderate</td>
<td>Varied</td>
<td>High</td>
</tr>
</tbody>
</table>

---

⁵ The term “opaque” is introduced by Brehmer (Brehmer & Dörner, 1993). It means that not all parts of a simulated system are visible and the subjects have to make hypotheses concerning the potential course of actions. Situations described by Gredler (1992) possess the same characteristics.

⁶ The term is introduced by Gredler (1992). Reality of function means that the subjects perceive a simulated setting nearly as strongly as reality.
4. Methodology

4.2. Experiment: setting and participants

A number of reasons are to be considered when discussing the study’s design and methodology. First, naturalistic decision-making and entrepreneurial cognition are research areas where solid theoretical grounds are still being built; as such, theory, although contributing to the necessary pre-understanding, can hardly serve as a sole source of guidance for this particular project. Certain theoretical contribution is very likely to be empirically grounded.

Second, as discussed above, the cognitive task of venture creation is a process carried out under varying degree of uncertainty. Hence, the design of the study must permit reconstruction of different uncertainty levels. At the same time it should not depart far from natural settings as far as its possibility to induce certain cognitive processes is concerned. In this regard behavioural simulations, when the researcher provides the subjects with accurately constructed scenarios, seem the most suitable option. Besides, the cognitive processes of decision-making will vary in expert subjects depending on the characteristics of the tasks, and these changes must be captured during data collection.

4.2.1. Constructing task scenarios

Cognitive psychology research claim decision-making to be highly contingent on the demands of the task (Payne, 1982; Hammond et al., 1987; Hammond, 1988). Accordingly, Hammond et al in their 1987 study have suggested a sophisticated and systematic approach to the construction and analysis of task conditions. They maintain that the tasks, first of all, ought to be constructed and presented in packages, which would include many task properties, as would be natural for a task to occur in reality. Thus they strongly argue against the research practice of deliberate reduction and disaggregating of the normally covariant task properties for the sake of statistical convenience.

The second important feature while constructing a task package is to ensure that “the inclusion of properties in the task package presented to the subjects should be justified in terms of their presence within naturally occurring tasks.” (Hammond et al., 1987, p. 755). Equally important is the number of task properties included in the package. It should be high to allow for intersubstitutability, or, in Hammond et al.’s words, “a feature of naturally occurring tasks, [which] permits a low value of one task property to be compensated for by a high value of another and also enhances generalization over environmental systems.” (Hammond et al., 1987, p. 755; cf. Brunswik, 1956; Hammond, 1966).

While constructing the task package, the researcher should also compile a reasonably comprehensive list of factors, which might affect cognitive activity, judging from theoretical or empirical grounds. Otherwise there might be a risk of inclusion of new task properties all the time, should the researcher wish to increase the generalisability of the findings. In other words, once the task package is ready to be introduced to the subjects, it should not be altered (Hammond et al., 1987).

Hammond et al. present a list of task properties that are likely to induce analytical, quasi-rational (heuristic) or intuitive cognition in subjects. For example, a task is sup-
posed to induce intuitive cognition if it a) presents many redundant cues; b) cues’ values are continuous; c) cues are displayed simultaneously; d) cues are measured perceptually, and e) there is no scientific theory, explicit principle or methods of cues’ organising available for the subject.

It ought to be pointed out, once again, that the task properties only induce certain cognitions; the relation between task and cognitive properties is by no means deterministic. Subjects can very well apply analysis to intuition-inducing tasks (e.g. if they have time to do it or are conditioned to analytical decision-making by education). Equally, intuition can be applied to analysis-inducing tasks (e.g. under severe time constraints or if the subject is not taught proper analysis techniques). Moreover, quasi-rational task would by definition include properties of both intuition and analysis and thus can prompt the subjects to engage in any type of cognition, or both (Hammond et al., 1987).

The task packages for the present study require reproduction of the peculiarities of business domain. First of all, a question of how entrepreneurs would receive their information concerning an opportunity (from which a venture idea is to be derived) has to be answered. According to Fiet et al. (2000), information search can be conducted in many ways. However, one the most common ways of obtaining information in business world is through reading material. This way of task presentation is also easiest for the researcher to achieve. Hence information packages are to be constructed as a set of three scenarios, or vignettes: one possessing intuition-inducing properties (opportunity creation), one inducing quasi-rationality (opportunity discovery) and one prompting mostly analytical cognitions (opportunity recognition).

The list of task properties inducing corresponding cognitions is presented in Table 4.2. Using the features summarised in Table 4.2 as theoretical grounds, the four scenarios have been constructed.
4. Methodology

Table 4.2 Task properties and cognitive properties. Adapted from Hammond et al. (1987)

<table>
<thead>
<tr>
<th>Task properties</th>
<th>Intuition-inducing task</th>
<th>Quasi-rationality-inducing task</th>
<th>Analysis-inducing task</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of cues</strong></td>
<td>Small/large with high redundancy</td>
<td>Small</td>
<td>Small/large with low redundancy</td>
</tr>
<tr>
<td><strong>Relevance of cues</strong></td>
<td>Unknown/low relevance</td>
<td>High relevance/high redundancy</td>
<td>High relevance</td>
</tr>
<tr>
<td><strong>Measurement of cues</strong></td>
<td>Perceptual measurement</td>
<td>Objective reliable measurement</td>
<td>Objective reliable measurement</td>
</tr>
<tr>
<td><strong>Decomposition of task</strong></td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td><strong>Availability of organising principle</strong></td>
<td>Unavailable</td>
<td>Available</td>
<td>Available</td>
</tr>
<tr>
<td><strong>Cognitive control</strong></td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td><strong>Mode of cue display</strong></td>
<td>Simultaneous by written or oral descriptive messages; observation over real-life objects and phenomena</td>
<td>Sequential by written messages containing descriptions, graphs and figures</td>
<td>Sequential by written messages containing figures and graphs</td>
</tr>
<tr>
<td><strong>Time period</strong></td>
<td>Relatively brief</td>
<td></td>
<td>Relatively long</td>
</tr>
<tr>
<td><strong>Experimental task</strong></td>
<td>Opportunity creation</td>
<td>Opportunity discovery</td>
<td>Opportunity recognition</td>
</tr>
</tbody>
</table>

Scenario 1. Invention (intuition-inducing task)

This scenario introduces a brief description of a radical technical invention, which has not yet been turned into a commercial product. The only thing known about this device is that it exists; its technical properties are not described in sufficient details (although this information can be, in principle, obtained from the inventor). The cost of production is, of course, not known, and since the device is a radical invention, the market for it is non-existing. Thus, for an entrepreneur this is a theoretically clear case of opportunity creation fraught with high uncertainty. As such, the task is, according to the cognitive continuum theory, intuition-inducing:

Dear participant!
Please, read the description of a situation below. Your task is to decide whether the situation described looks like a business opportunity that you could use. If so, please, tell how you would proceed.
At first it looks simply as a shining line. When the special spectacles are put on, the monitor grows up making an impression of a full-size TV or com-
puter monitor. This monitor of the future is called after a cartoon character, Linus on the line. A guy, who grows up from a line.

“The idea about the monitor just popped up”, says Hans Biverot at Celsiustech Electronics, who has recently invented the monitor. “There was not any particular problem I was trying to resolve.”

Still, there are two problems that the monitor does resolve. Unlike a normal TV, Linus takes no place at all. And though it requires special spectacles, it is possible to see both the monitor and the surroundings.

The existing spectacles, often called VR-spectacles (from virtual reality), have limitations because they do not allow seeing anything apart from the picture in the spectacles. They function as a TV-set placed precisely in front of each eye. Wherever you may turn your head, you would see the picture. When Linus is used, the picture is visible only if you look at the device, which creates this thin line.

Special spectacles.

Linus spectacles have two mirrors, one fixed, and one moving. The moving one is synchronised with the monitor. When every new line comes up on the monitor, the mirror moves a little. This way the lines spread over the retina and create a complete picture when all the parts are drawn. Since the mirrors cover only a part of the sight field, the user is able to see the surrounding and the monitor at the same time.

Hans Biverot has worked with the invention since the beginning of the 90s. Today there exist two demonstration devices: one a colour TV, the other is a monitor built on green light diodes. These demo versions can show both non-moving and moving pictures.

**Scenario 2. Computer game (quasi-rationality-inducing task)**

This scenario is constructed using a real case from Swedish IT industry: Daydream was a real software company, which went public by the end of the 90s and whose shares were first hugely overpriced. When its stock collapsed many minor shareholders lost all their savings. The version of Mastermind mentioned in the text has never been completed.

The scenario describes the earliest stage of Daydream forming and fund-raising. A subject’s task is to decide whether to invest. According to the cognitive continuum theory, the task is quasi-rationality-inducing; in terms of entrepreneurship, this is a case of opportunity discovery. Since quasi-rationality-inducing tasks would combine quasi-rational and analytical properties, it was necessary to combine text and charts (quasi-rationality-inducing features) with numbers (analysis-inducing). To add analysis-inducing property to the scenario (in order to maintain its quasi-rationality-inducing nature), the relevant information from a survey of the Swedish IT market was included. The task’s level of uncertainty is moderate. This scenario was used in data collection during 2001.
Dear participant!

Please, read the description of a situation below. Your task is to decide whether the situation described looks like a business opportunity that you could use. If so, please, tell how you would proceed.

According to a Swedish research report, computer games have become an industry with a turnover of several billion Swedish crowns (SEK). The industry’s total market worth in 1998 was SEK 1,3 billion solely in Sweden and was stated to expand. During a normal day every third user plays a computer game. Another report confirms that computer game is becoming a new media form.

The estimated market worth of the new industry grew 25-30 per cent during 1999. Computer games are played mostly by people aged 15-24, but according to the report, game playing is winning older age groups as well. Men play computer games two to three times more often than women, but there are nearly as many women as men who have played computer games at least once. One third of those who use a computer during a normal day play games with it, roughly equal to the number of users who surf and use computers in their home offices.

According to the report, more and more computer games would be Internet-compatible. Using broadband connection will enable on-line playing function better and attract broader audience.

![Profit breakdown in computer games industry](image)

A few young Swedes from the city of Umeå, founders of a software company called Daydream made up their minds to create a variant of Mastermind, an intellectual computer game requiring finding out where different combinations are hidden. The game background represents a house with deposit boxes in every room.

So, they had an idea, but they lacked financing to make the game ready. They tried to find an investor, because Umeå banks denied a loan.
Scenario 3. LBO (analysis-inducing task)

This scenario is almost purely analytical. The text is taken, basically without alteration, from a business case on financial analysis. A subject is given both textual information and numbers; the information is too brief to carry out a full-fledged financial analysis but sufficient to induce analytical decision-making. In terms of entrepreneurship this is a case of opportunity recognition at a very low uncertainty level.

Dear participant!
Please, read the description of a situation below. Your task is to decide whether the situation described looks like a business opportunity that Ken could use. If so, please, tell how you would proceed, were you in his shoes.

To Buy or Not to Buy
Ken: I would like to buy Goswell.
Bill: That is completely out of the question.

Bill was the chairman, chief executive officer and majority owner of a financial services company, Vestry, which had been founded four years previously. Whilst the firm had suffered a number of growing pains, it had been very successful and was viewed by the financial press as “up and coming”. Goswell was the consulting subsidiary, formed two years previously. Ken had been hired to set up Goswell, and owned a minority shareholding in both the subsidiary and the parent company.

Eleven month prior to this conversation, Vestry had raised £1 million through a public offering on the Second Market. Goswell was highlighted in the issue document as one of the major strategic thrusts for the future. In the document, the directors had forecast sales of £3 million for Vestry for the year and profit before tax of £800,000. It was now four weeks prior to the end of the first financial year as a public company.

Company details as presented in the prospectus are:

<table>
<thead>
<tr>
<th>Vestry</th>
<th>Goswell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales forecast</td>
<td>£3,000,000</td>
</tr>
<tr>
<td>Pre-tax profit forecast</td>
<td>£800,000</td>
</tr>
<tr>
<td>Net assets</td>
<td>£1,000,000</td>
</tr>
<tr>
<td>Employees</td>
<td>60</td>
</tr>
</tbody>
</table>

Scenario 4. Taking over a filling station (analysis-inducing)

This scenario, like the previous one, is analysis-inducing; it is also a case of opportunity recognition with the low level of uncertainty presumed. It was created for the third round of data collection in spring 2003. This time the experiment was concentrated on the task continuum poles, i.e. analysis-inducing and intuition-inducing.
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tasks. Scenario 1 was used as the intuition-inducing task, and the present scenario 4 was written to serve as the analysis-inducing task. The reason to abandon the previously used Task 3 was that the participants regarded it as too specific and not entrepreneurial enough. Although the cognitive nature of the Task 3 and the Task 4 is the same, speaking theoretically, taking over a franchise appears to the participants as more entrepreneurial situation.

All information concerning the filling station, including the excerpts from the annual report, graciously provided by a franchisee of one of the major petrol companies in Sweden, is authentic.

Although this scenario is longer than the previous one, it is constructed upon the same theoretical principles, both cognitive (analysis-inducing) and entrepreneurial (opportunity recognition at a low level of uncertainty). In Scenarios 3 and 4 decisions are induced by analysing numbers and supplementary verbal information.

Dear participant!

Please, read the description of a situation below. Your task is to decide whether the situation described looks like a business opportunity that you could use. If so, please, tell how you would proceed.

At a filling station in a village somewhere in Middle-Sweden, you stop for some petrol and a snack. There are quite a lot of people at the little station and a few cars bear Danish and German registration plates. Waiting in the queue at the cashier you start reading the fliers spread around on the newspaper stall and on the counter. You find out that the concern, to which the station belongs, has an opening. You get curious and while your sausage is being grilled, you start talking with the woman at the counter. She is the station manager, and her job has come up. She is a local, has worked at the station for quite a while and enjoyed her work. However, she now has the chance to continue her studies; that is why she is leaving her job.

She tells you that the concern provides a lot of support, including education, and of course, marketing and promotion. Education is varied and ranges from an introduction course to new employees to ongoing education for managers. The station offers a well-assorted, though not large, selection of groceries, tobacco and newspapers. Fast food and video rent are included.

Naturally, automotive needs are considered as well. The station offers everything a car driver might need: fuel, oil, and other necessary stuff. There is a hall for manual car wash, a small workshop and a car-rent service.

Ten people (manager including) work at the station. They work in teams in shift. The station is opened from 7 am till 9.15 pm.

You give in to curiosity and you ask the manager (who appears to be a very nice person) to give you some numbers. She gives you an excerpt from last year’s results (SEK):
Proceeds:
Petrol sales  9 641 913
Other sales  5 616 371
Total proceeds  15 258 284

Direct costs:
Petrol     - 9 222 308
Other      - 4 014 073
Total direct costs - 13 236 381

Revenue  2 021 903

Personnel costs:
Wages       - 985 240
Other costs  - 360 382
Total personnel costs - 1 345 622

Other costs  - 20 131
Financial revenues  501
Financial costs     - 67 610

Results before financial revenues and costs 189 041

Results pre-tax  189 041

Tax          - 11 196

Results net  177 845

You have somewhat mixed feelings when you finish reading. Could it be something for you?

4.2.2. Empirical validation of scenarios

The study by Hammond et al. (1987), referred to above, provides theoretical grounds for scenario construction. However, in order to increase validity, the scenarios are to be also validated empirically. This task is carried out in two steps using Q-techniques resembling method.

The term Q-technique is often used as a synonym to a related term, Q-methodology; yet such usage is not entirely correct. Q-methodology is a generic name introduced by Stephenson (1953) to denote a set of philosophical, statistical and psychological ideas for research on individuals. Q-technique is a set of procedures used to implement Q-methodology. As described by Kerlinger (1984), it focuses mostly on
subjects sorting decks of cards called Q-sort, so that responses from different individuals to the Q-sorts could be further correlated. Generally speaking, Q-technique is merely a sophisticated way to rank-order objects. A subject is given a set of cards with verbal statements, single words, phrases, pictures, etc. The task is to sort the set into several piles according to some criterion. Sorting instructions and the objects sorted would depend on the research purpose.

Q-technique is a rather common research methodology. It is most widely used in the research of feelings, preferences and opinions (Brouwer, 1999). Not surprisingly this technique is often exploited by more “applied” areas of social science, such as consumer marketing, economic psychology, clinical psychology, etc. (Saad, 1999; Sachs, 2000). Apart from studies of attitudes proper, Q-sorts could be successfully used for the selection and/or validation of vignettes (Watson and Blanchard-Fields, 1998).

In the present study Q-sorts were used to validate the scenarios. The first pilot sorting was performed by doctoral students at Jönköping International Business School (JIBS). According to the results of this session, the author of the present study prepared a relevant set of structured Q-sorts based on the principles of Cognitive Continuum Theory (Hammond, 1987). The deck included the whole set of cognition-inducing task properties:

**Intuition inducing tasks**
- The cues are too few, not enough to make a decision
- The cues are many, but most of them are irrelevant
- Cues cannot be measured objectively
- The task is perceived as a single whole, it is impossible to analyse it by analysing its constituent parts
- It is impossible to understand how task cues are organised
- I am certain in my answer, but I do not know how I have made it

**Quasi-rationality-inducing tasks**
- The cues are too few, it is difficult to make a decision
- The cues are many, they are both relevant and irrelevant
- Some of the cues can be measured objectively
- The task is perceived as a single whole, but it is possible to distinguish its constituent parts
- It is possible to understand how the task cues are organised
- I am quite certain in my answer and can explain how I have made it

**Analysis-inducing tasks**
- The cues are few and all of them are relevant
- The cues are many; yet it is easy to make a decision because all of them are relevant
- The cues can be measured objectively
− The task constituent elements are easy to see
− It is easy to understand how the task cues are organised
− There is only one correct answer and I can explain how I have made it

Each statement was written on a separate card. All together, three sets of cards were prepared that to provide the evaluation panel with the opportunity to apply each statement to every scenario under consideration. The panellists’ task was to read the scenarios and pick up the cards from the Q-sorts which, in their opinion, would best characterise each one of them. The underlying logic was that the subjects would mostly pick up the sentences relevant for intuition-inducing task for Scenario 1, analysis-inducing task for Scenario 3 and quasi-rationality-inducing task for Scenario 2, in addition to descriptions from both “intuition” and “analysis” piles for Scenario 2. The panellists were experienced entrepreneurs and managers from a local branch of the Rotary Club in Jönköping as well as researchers at JIBS with long experience as business consultants. Every panellist’s response was then presented in table form (see example in Appendix A). Table contained all the statements above; after the panellists had read the scenarios and picked up the cards (statements) they deemed most appropriate for each vignette, the researcher marked the statements in the table in accordance with the choices. In the example the panellist picked up two intuition-inducing statements and one quasi-rationality-inducing statement for Scenario 1. Theoretically, this scenario is intuition-inducing, a matter the panellist has confirmed.

The same panellist also picked up two quasi-rationality-inducing statements and one analysis-inducing for Scenario 2, which is quasi-rationality-inducing in terms of theory. Thus, the theoretically derived nature of this scenario was also confirmed.

Similar forms were filled in for all panellists and their responses aggregated. In general, the responses were distributed in a way that confirmed the theoretical category of each scenario.

It should be mentioned that Scenario 4 was not reviewed by the panel but rather underwent empirical validation "on the spot". While the protocols were collected, many participants (especially expert entrepreneurs) made impromptu comments about this particular scenario, pointing out how plausible the described situation was. They also said that it was very easy for them to visualise the whole visit to the station including the discussion with the manager.

4.2.3. Sampling experiment participants

As mentioned earlier, cognitive psychology predicts that subjects would substantially differ in their decision-making depending on their level of proficiency (Anderson, 1983; Dreyfus and Dreyfus, 1985; Hammond et al., 1987). While the current study does explore the development of expertise, it is necessary to compare decision-making in both novices and expert subjects, in order to provide theoretical grounds with empirical evidence.
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In accordance with the Hypotheses formulated in Chapter 3, the subjects are expected to demonstrate the correlation between the task properties and cognitive properties (see Fig. 4.1).

The *novice* column presents two sets of rival hypotheses. According to Dreyfus & Dreyfus (1989), subjects on every level of proficiency use only analytical reasoning while making decisions, whereas experts use intuition (naturalistic decision-making). However, both traditional and naturalistic research in decision-making confirms that people do make quasi-rational, or common sense, or biased decisions in a variety of decision situations (cf. Hammond, 1988; Kahneman & Tversky, 1982; Simon, 1987; Klein et al., 1993), and avoid using analytical models as counter-intuitive (Kahneman & Tversky, 1982). As a result, the following hypotheses may be formulated: Hypothesis 1a predicts that novices engage mostly in analysis, regardless task requirements, and Hypothesis 1b, which expects novices to demonstrate predominantly quasi-rational decision-making regardless of task properties.

![Figure 4.1 Task requirements and cognitions in experts and novices](image)

**Level of proficiency**

The present study defines novices as *aspiring entrepreneurs* or *starters*. Some of them are students at Jönköping International Business School (JIBS) or students at the School of Engineering (both within Jönköping University), who either have started up a business or aspire to do so. Although the students have been already taught the analytical methods of decision-making, their level of proficiency, as far as analytical decision-making is concerned, is still low. Thus, it is possible to test both Hypotheses 1a and 1b.

Experts are defined as habitual portfolio entrepreneurs, with no less than seven to ten years of experience since their first start up. According to Ericsson et al. (1993), this is the shortest period of time required to reach the expert level. Their expert level of proficiency in entrepreneurial decision-making is confirmed by their belonging to
the group, since starting up several companies and running them profitably imply, by definition, high proficiency in both identification and exploitation of opportunities. Note that such entrepreneurs would habitually perform not only tasks of moderate and high uncertainty level, but also those of low uncertainty level. The proficiency makes it possible to test these subjects across the whole range of both tasks and decision-making models.

In general, sampling criteria for both novices and experts are summarised and presented in Table 4.3.

It should be pointed out that matching, although methodologically desirable, often presents considerable empirical difficulties, especially as age and level of education are concerned. Theoretically speaking, the participants should be matched by age as closely as possible (since people may acquire certain decision-making skills in the course of their lives, substantial age differences may be potentially confounding). Since it takes at least seven years to reach the expert level of performance (Ericsson et al., 1993), one could hardly expect to meet expert entrepreneurs less than 30 years old. In reality, they may be even much older. The majority of expert subjects were about 50 years old.

On the other hand, although it is possible to find 30-years-old novices (some of them were actually this age), it is difficult to find people who would start their first business at the age of 50. Should such persons appear significant doubts may occur concerning their motivation as entrepreneurs.
### Table 4.3. Experiment sampling criteria

<table>
<thead>
<tr>
<th>Variables</th>
<th>Novices</th>
<th>Experts</th>
<th>Matching</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individuals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>As they are</td>
<td>As they are</td>
<td>Method would benefit from matching but it’s hardly possible in practice: an age gap to be expected</td>
</tr>
<tr>
<td>Gender</td>
<td>As they are</td>
<td>As they are</td>
<td></td>
</tr>
<tr>
<td><strong>Entrepreneurial experience – number of years since the thrust business’ start-up</strong></td>
<td>Lack of entrepreneurial experience; would go “by the book”; 0 – less than 1 years</td>
<td>Have acquired expert skills due to long experience (not less than 7-10 years)</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>College or University degree with major or minor in economics/business administration</td>
<td>College or University degree with major or minor in economics/business administration</td>
<td>Matching as far as possible; check for potential bias from engineering and law</td>
</tr>
<tr>
<td><strong>Entrepreneurial motivation</strong></td>
<td>Active search for “entrepreneurial” courses/workshops; have started up a business</td>
<td>By definition</td>
<td></td>
</tr>
<tr>
<td><strong>Businesses</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of businesses</strong></td>
<td>No more than 1</td>
<td>No less than 2 whereas no less than 1 breaks even or generates profits</td>
<td></td>
</tr>
<tr>
<td><strong>Degree of innovativeness</strong></td>
<td>Mixed groups of companies from “innovative” and “non-innovative” industries.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Industry</strong></td>
<td>Can be important for learning (expertise acquisition); is not tested in the present study.</td>
<td>Mixed groups</td>
<td></td>
</tr>
<tr>
<td><strong>Size/turnover</strong></td>
<td>Can be important for learning (expertise acquisition); is not tested in the present study.</td>
<td>Mixed groups</td>
<td></td>
</tr>
<tr>
<td><strong>Organisational form and decision-making</strong></td>
<td>Decisions are made by the entrepreneur individually or as a member of a management team.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.2.4. Collecting data

Data collection was carried out in three steps. The first stage took place in spring-summer 2001, when think-aloud protocols of 10 novices and 16 experts were collected.

Recruiting novice subjects did not present substantial difficulty. The researcher obtained a list of participants of two workshops devoted to small business start-ups held at JIBS in 2000 and 2001. These participants were asked to take part in the experiment; 10 of them agreed (response rate about 20 per cent). Within this group 7 students were from the University of Jönköping (either JIBS or School of Engineering), one was a JIBS’ graduate, one was a student of the University’s School of Education and Communication, who had taken a few courses in Business Administration curriculum. The last participant held a college degree in social sciences and communication.

These subjects would either call on the researcher’s office where protocols were collected, or the author would go to them. During data collection a participant was given all three scenarios to read. Afterwards the participant would start thinking aloud and the utterance was tape-recorded. The tapes were subsequently transcribed and the protocols coded and analysed.

The experts were chosen from a large database collected at JIBS and screened according to the sampling criteria presented in Table 6 and in the sampling questionnaire (see Appendix B). Those that met the sampling requirements were approached by mail and/or e-mail; unfortunately, the response rate was rather low (about 10 per cent). Yet a significant advantage of this sample was its geographic diversity – the subjects were recruited from such varied regions of Sweden as Stockholm and Malmö, as well as the island of Gotland. Subjects in this sample were also highly educated, all of them holding university degrees in business administration or engineering.

Protocols from these expert subjects were collected by telephone. Prior to the time appointed for the experiment session, the scenarios had been sent by e-mail. At the appointed time the author telephoned the participants and collected their think-aloud protocols. The tapes were transcribed and analysed the in the same way as for novices.

Another group of experts were successful local entrepreneurs from Jönköping region. Initially the list of names was obtained from the Jönköping branch of a professional organisation called Board Members Academy. This nation-wide organisation includes experienced and successful entrepreneurs, business managers and professionals who are willing to share their business experience by serving as members of the board of directors at small and medium-sized local enterprises. The list was screened in the same way as the database referred to above, and acceptable candidates were approached. Unfortunately, the response rate in this case was even lower, about 4 per cent. It should be also noted that the majority of these local participants had lower education than the other group of experts. Most of the local entrepreneurs held a college degree (this being representative of their age group in Jönköping region). This made matching by level of education rather difficult. To counteract this confounding factor, attempts were made during the following rounds of data collection to recruit
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experts with higher education across the country and to recruit novices with pre-university education.

The researcher visited the experts, who agreed to participate in the study, and collected their think-aloud protocols. In total 16 expert protocols were collected from both the national and the regional expert groups.

During autumn 2001 these 26 protocols were transcribed, coded and analysed. Coding and analysing principles are discussed in the next section of this chapter.

To make the number of novices approximately equal to the number of experts, and to increase statistical power of the study, 11 more novice and expert protocols were collected during spring-summer 2002, the subjects being mostly JIBS students in Business Administration. Apart from participating in general Business Administration curriculum, these students also took part in the Future Enterprise Programme (a special section of general Business Administration curriculum with more practical focus). The response rate of this group was high - 75 per cent. These protocols were coded and analysed during autumn 2002 and the results were integrated with those of the previous group.

Finally, the third, supplementary round of data collection was conducted in spring 2003 after data had been analysed and the preliminary results had been reported internally at JIBS. This time the experiment was concentrated on the tasks representing the poles of the task continuum: an intuition-inducing and an analysis-inducing task. Thus, the most theoretically clear-cut scenarios also generated the largest amount of data.

As has been already mentioned, the intuition-inducing task (Task 1) remained the same whereas the analysis-inducing task was changed (from Task 3 to Task 4). The reason for this replacement had been the participants' perception of the Task 3. Since it described a financial consultancy firm many participants regarded it as to a certain extent alien and rather irrelevant to their current experience. It was then decided to replace the vignette by another, more common situation, which described taking over a petrol station.

The participants were mostly expert entrepreneurs possessing high level of education as well as novices with college education (non-business). The experts were recruited locally, as well as in the province of Halland and in the city of Gothenburg. The novices were recruited locally.

All together 55 subjects participated in the three rounds of data collection (or the two rounds of experiment) and provided 147 verbal protocols across three types of task: intuition, quasi-rationality and analysis-inducing. After coding the protocols yielded exactly 3500 chunks (undividable meaningful units used subsequently in the statistical analyses). During content analysis the protocols were also supplemented by 147 coding charts (one for each protocol).
4.3 Analysing verbal protocols

According to Woods (1993), a broad array of research techniques can be used to study complex behavioural situations. One of such technique groups is protocol analysis, or, in Wood’s terms, process-tracing methodologies. “The goal of these methods is to map out how the incident unfolded including available cues, those cues actually noted by participants, and participants’ interpretation in both the immediate and in the larger institutional and professional context. This is called a process-tracing or protocol analysis method because it focuses on how a given outcome came about” (Woods, 1993, p. 232). These techniques normally use protocols from either verbal reports or from records of problem-solving behaviour in order to trace the information flow and knowledge activation. Think-aloud protocol\(^7\) is one of verbalisation techniques used in the study. The method makes subjects think aloud while making decisions, also called concurrent verbalisation (Svenson, 1989; Russo et al., 1989; Ford et al., 1989; Sarasvathy, 1999). According to Ericsson & Simon (1993), think-aloud protocols, as research methodology, have substantial advantages over process-tracing methods involving retrospective recall (interviews) and purely stimulus-response methods (questionnaire). For example, validity of retrospective recall may be doubtful since this method provides the subjects with a possibility to make stories about how they believe they resolved the problem. Questionnaires, in their turn, force the researcher to deduce the subjects’ decision processes, whereas concurrent verbalisation allows the researcher to follow up the cognitive processes of decision-making (Sarasvathy, 1999).

Basic data for the analysis is the transcription of the subjects’ tape-recorded verbalisation. The analysis itself involves singling out and coding of the semantic chunks relevant to the research questions or hypotheses.

Verbal protocols have been already used successfully in a number of empirical studies, including the studies of entrepreneurship (cf. Sarasvathy, 1999; Sarasvathy, Simon & Lave, 1998; Ericsson & Simon, 1993; Choi and Shepherd, 2001).

It should be mentioned that verbal protocol analysis is a time-consuming technique, especially if protocols are numerous. As mentioned above, in the present study 147 protocols have been collected and analysed as compared to 27 investigated by Sarasvathy (1999) and 11 by Choi and Shepherd (2001).

The first stage of coding was singling out semantic chunks, i.e. the smallest, undividable meaningful units (Ericsson & Simon, 1993; Svenson, 1989). Since oral speech is not completely grammatical, semantic chunks could vary in length – from single words to phrases to sentences and in some cases even to a group of sentences. Every chunk was subsequently categorised (coded) as representing intuitive, or quasi-rational, or analytical cognitive process.

While discussing coding, the issue of its validation must be addressed. As other methods of content analysis, coding may be prone to subjective interpretation. In case

\(^7\) The terms “think-aloud protocol” and “verbal protocol” are used synonymously. Another established term “concurrent verbalisation” is not used.
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the coded chunks make ground for further (quantitative) analysis, this propensity may represent a threat to a study’s reliability.

However, little consensus exist so far concerning the possible validation of coding. Indeed, according to Ford et al. (1989, p.107), “We attempted to code the reliability of this categorization process but few researchers reported attempts to assess coder agreement. Additionally, many studies did not report rules used for categorizing individual decision maker responses into decision categories.” Ford et al. discussed 45 studies in decision-making, whereof 19 employed verbal protocol technique. An example from entrepreneurship research supports this conclusion, when only one subject was recruited, and no validation attempts were made, i.e. the protocol was not re-coded (Sandberg, Schweiger and Hofer, 1988).

At present, though, most of researchers using protocol technique agree that the protocols must be re-coded in order to increase the reliability of coding. Still, they disagree about the exact requirements for the re-coding procedures. For example, Svenson, one of the leading Swedish experts in protocol analysis, does not address validation of coding at all, providing validation of chunking (division) instead, which is accomplished by two external judges who independently divide the protocols into chunks (Svenson, 1989).

Some researchers hold that the protocols must be re-coded by a cognitive psychologist, albeit one unfamiliar with the study (Ericson and Simon, 1984; Sarasvathy, 1999). Another view, supported by the majority of cognitive psychologist and entrepreneurship researchers, is that it suffices to employ any external re-coder, e.g. a student (cf. Busenitz and Barney, 1997). In case the researcher and the re-coder differ in their opinions the disagreements are discussed until consensus is reached.

There also exists a third opinion stating that even an external re-coder is unnecessary and the researcher can successfully re-code the protocols or part of them.

Bearing in mind that re-coding boosts reliability, in the present study 25 per cent of the protocols were re-coded by an external re-coder with the inter-coder reliability of 82 per cent. The results were discussed with the author and incorporated in the analysis.

The re-coding procedure demonstrated certain deviations between coding done by the author and by the external re-coder. This is unfortunate, yet probably inevitable. Preparing verbal protocols for statistic analysis includes, in fact, two complex tasks – chunking and coding, i.e. dividing the text into least meaningful units and assigning proper theoretical categories to each of them. While performing any of these tasks a researcher may be prone to subjective interpretation, and ideally both chunking and coding should be judged. Yet among the researchers employing this technique it is predominantly coding that attracts attention and is subject to external evaluation. It is understandable since coding mistakes “in favour” of the theory in use would present a more serious threat to reliability of the study. The problem, however, is that if a coder (whether the researcher or the judge) does not perform chunking him- or herself, the content of the protocol might become to a certain extent context-free, which in turn would deprive the coder of some important information and affect the coding. For example, in the present study the difference between analytical and quasi-rational
chunks might depend on context; an example of such a situation is provided further in this chapter.

However, both re-chunking and re-coding is quite a labour-intensive and time-consuming task, especially if empirical data is abundant, as in the present study. Also in order to be able to perform the coding, the judge must be trained, which in itself is time-consuming. Therefore the coding in the present study was guided by a compromise resulted from discussing the coding and the re-coding.

The protocols were coded by the author and by the external re-coder according to the following rules, and characteristic features of intuition and analysis summarised in Table 4.4:

<table>
<thead>
<tr>
<th>Cognitive control</th>
<th>Intuition</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of data processing</td>
<td>Rapid</td>
<td>Slow</td>
</tr>
<tr>
<td>Conscious awareness</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Confidence</td>
<td>High confidence in answer, low confidence in method</td>
<td>Low confidence in answer, high confidence in method</td>
</tr>
</tbody>
</table>

### Presence of Intuition

According to Kahneman and Tversky, (1982, p.124) “A judgement is called intuitive if it is reached by an informal and unstructured mode of reasoning without the use of analytical methods or deliberate calculation.”

According to Simon (1987, p.57), “In judgemental decision-making, the response to the need for a decision is usually rapid, too rapid to allow for an orderly sequential analysis of the situation, and the decision-maker cannot usually give a veridical account on either the process by which the decision was reached or the grounds for judging it correct. Nevertheless, decision-makers may have great confidence in the correctness of their intuitive decisions and are likely to attribute their ability to make them rapidly to their experience.”

Decision-makers are highly confident in their answers. For example, a very definite judgement is made preceding the other statements. “What a great idea!” statement would appear in the very beginning of a protocol. Another example is a judgemental sentence, which completely contradicts previous reasoning, as in the following excerpt:

Subject reasons, “I believe that... they shall certainly... they have found people who would invest in that, because... because IT then... because IT is involved... even if there are many who... got hurt a little from all that happened to Ericson and mobile phones and... It cannot go this fast... Broadband doesn’t go that fast, but it goes slowly ahead. But...should I get this enquiry I wouldn’t invest in them, even if it is only... well, it’s not only... 2 million.”
4. Methodology

Presence of Quasi-rationality

Quasi-rationality is detected through the presence of subjective opinions, mostly referring to one's personal experience, and the use of simple rules of thumb. The subjects do not try to analyse the situation, do not perform stepwise reasoning, but express their opinion based on own experience or well-known facts:

“3-D spectacles is good stuff, I used to sell them myself”, or “This is what the customer wants – stuff that conveys status.”

Coding a chunk as quasi-rational may depend on context. For example, if a subject says that he wants to make a marketing analysis, but adds up that in order to do that he would ask his friends’ opinion, this is an example of quasi-rationality.

Presence of Analysis

Chunks are identified as analytical if the subjects try to retrieve any established technique of financial, marketing or strategic analysis, however truncated the reasoning might be. In other words, the reasoning is to be stepwise, for example:

“These people are experienced consultants... it means that the company assets go home every night.”

Request for more information is also identified as presence of analytical cognition. A very clear cue for analysis is reasoning regarding numbers and charts given in the tasks.

Appendix C provides an example of a verbal protocol, chunked and coded. When the protocols are coded through, the number of chunks in each group is counted. Since the protocols vary in length, the number of chunks is complemented by the relative frequency (percentage) of each cognition. These frequencies are subsequently analysed statistically in the course of hypotheses testing and more explorative analysis. The results are described in Chapters 5 and 6.
5. Analysis and Results

5.1. Dominant cognitive processes

According to the correspondence-accuracy principle (Hammond et al., 1987), as discussed above, a decision can be considered optimal if the dominant cognition in a decision-making task corresponds to its cognitive nature. Let us investigate whether this conclusion holds and the cognitive processes of expert and novice entrepreneurs vary with the tasks, as is stated by the hypotheses below:

I. Hypotheses pertaining to cognitive processes in novices:

\[ H_{1a} \]: Novice entrepreneurs use analytical decision-making regardless of the nature of the task.

\[ H_{1b} \] (rival): Novice entrepreneurs use quasi-rational decision-making (heuristics) regardless of the nature of the task.

\[ H_{1c} \]: Cognitive processes of novice entrepreneurs do not vary significantly depending on the nature of the task.

II. Hypotheses pertaining to cognitive processes in experts:

\[ H_{2} \]: Expert entrepreneurs' dominant cognitive processes vary significantly depending on the nature of the entrepreneurial task:

\[ H_{2a} \]: Intuition is dominant in highly uncertain (intuition-inducing) task.

\[ H_{2b} \]: Quasi-rationality is dominant in moderately to highly uncertain (quasi-rationality-inducing) tasks.

\[ H_{2c} \]: Analysis is dominant in low uncertainty (analysis-inducing) tasks.

III. Hypotheses pertaining to comparison of cognitive processes between experts and novices:

\[ H_{3a} \]: In intuition-inducing tasks experts shall use intuition to a greater extent than novices.

\[ H_{3b} \]: In intuition-inducing tasks novices shall use analysis to a greater extent than experts.

\[ H_{4} \]: In quasi-rationality-inducing tasks experts shall use quasi-rationality to a greater extent than novices.

\[ H_{5} \]: In analysis-inducing tasks there is no statistically significant difference in the use of analysis between experts and novices.

In order to confirm or disconfirm the hypotheses, let us consider the cognitive behaviour of both expert and novice entrepreneurs across the variety of tasks. All together 55 subjects participated in 4 tasks during the three rounds of data collection. During the first two rounds 37 subjects (17 experts and 20 novices) participated in an intuition-
inducing task (Task 1), a quasi-rationality-inducing task (Task 2) and an analysis-inducing task (Task 3). During the third, complementary round of data collection, 18 more subjects participated in 2 tasks: an intuition-inducing (Task 1, the same as in the first and second round) and an analysis-inducing (Task 4, theoretically similar to Task 3 in the first round, but worded differently). As a result, all 55 subjects participated in the intuition-inducing task (Task 1), and in an analysis-inducing task (either Task 3 or Task 4). Of those, 30 subjects were expert entrepreneurs and 25 were novice or aspiring entrepreneurs. Thirty seven subjects participated in the quasi-rationality-inducing task, 17 being experts and 20 being novices. Since the analysis-inducing Tasks 3 and 4 were constructed according to the same theoretical premises (although worded differently), the values for similar cognitions in each task were combined. The mean value for the analysis-inducing task in the tables in the present Chapter refers to this combined value. Expert-novice distribution by task is shown in Table 5.1:

**Table 5.1. Experimental design: participants and tasks**

<table>
<thead>
<tr>
<th>TASK</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novices</td>
<td>20 (5)</td>
<td>20</td>
<td>20</td>
<td>(5)</td>
<td>25</td>
</tr>
<tr>
<td>Experts</td>
<td>17 (13)</td>
<td>17</td>
<td>17</td>
<td>(13)</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>37</td>
<td>37</td>
<td>18</td>
<td>55</td>
</tr>
</tbody>
</table>

The analysis was made by “compare means” SPSS procedure, when the mean percentage of the intuitive, quasi-rational and analytical chunks was found for experts and novices separately in each task. In order to confirm their statistical significance, the results were tested by parametric analysis of variance tests (t-test; ANOVA) and non-parametric tests.

Statistical significance was also used as the chief measure of the test power. According to Cohen (1988), statistical significance is the main indicator of the Type I error; its level of .05, despite being a convention, is the most common measure widely accepted in the field of behavioural research.

Certain consideration was also given to such measures as effect size (ES) and statistic power \( \beta \). As Cohen (1988) puts it, ES is an arbitrary measure referring to the whole population rather than a specific sample; its appropriate level ought to be decided upon prior to the experiment. In other words, the expected ES in the population determines the size of the sample necessary to detect the effect under investigation. Generally speaking, ES of any non-zero value could suffice to reject the null hypothesis (Cohen, 1988). However, Cohen suggests qualitative definitions of “small”, “medium” and “large”. Any size, however, is set by the researcher a priori taking into consideration the theory involved, previous research and the nature of the field. As Cohen (1988) points out, effect in psychological research tends to be rather small.

The present study demonstrates several peculiarities concerning sampling. First, the samples are drawn from two populations: that of experts and that of novices. Theo-
Theoretical premises used to define each population are given in Table 4.3. Since sampling was guided by theory, it is also non-random.

The two samples differ in their relation to the null hypothesis, which is assumed to be true for novices (i.e. no difference is supposed to exist in their cognitive behaviour regarding the nature of the task). On the other hand, the null hypothesis is assumed to be false for experts, i.e. experts’ cognitive behaviour is supposed to vary with the cognitive task. Theoretical pre-understanding has prompted the author to assume the whole population of experts to be capable of the hypothesised behaviour to a high extent. Similarly, the population of novices has been assumed to be incapable of such behaviour. In other words, ES is estimated high, being over 0.8 (Cohen, 1988).

$\beta$ value is given less consideration compared to $\alpha$ (statistical significance) due to the fact that the Type II error is usually regarded as less grave than the Type I. In other words, missing the existing phenomenon brings forth consequences less severe than falsely accepting a phenomenon that does not exist (Cohen, 1988). Still, given the substantial number of the participants (25 novices and 30 experts) and the high ES value, it is also possible to estimate $\beta$. According to Cohen (1988, p.54), given $\alpha = .05$ and ES = 0.8 (a conservative estimation), statistical power for the present study could be found between 0.85 and 0.90 for novices (sample of 25), and between 0.90 and 0.95 for experts (sample of 30). This is sufficient, since it even exceeds $\beta = 0.8$ recommended by Cohen as a guideline for behavioural research (Cohen, 1988, p.56).

5.2. Cognitive patterns of novices

5.2.1. Analysis or heuristics?

$H_{1a}$: Novice entrepreneurs use analytical decision-making regardless of the nature of the task.

$H_{1b}$ (rival): Novice entrepreneurs use quasi-rational decision-making (heuristics) regardless of the nature of the task.

Figure 5.1 summarises cognitive processes of novice entrepreneurs across the tasks. The entries represent relative frequencies within tasks:

---

8 Power table for t-test as used in the present study.
5. Analysis and Results

As the figure makes clear, the presence of analysis is very strong in every category of task. In the intuition-inducing task (Task 1), analytical cognition, although not dominant per se, is nevertheless highest among cognitions (42 per cent of all chunks are analytical). In the quasi-rationality-inducing Task 2, as well as in the analysis-inducing Tasks 3&4, analysis is the dominant cognition being present in 62 and 70 per cent respectively.

In order to establish whether the dominance of analysis is statistically significant, a paired samples t-test is performed. Its results are summarised in Table 5.2:

Table 5.2: Analysis as dominant cognition in novices across tasks

<table>
<thead>
<tr>
<th>Pair</th>
<th>Mean paired diff.</th>
<th>Std. deviation</th>
<th>Sig. t-test (2-tailed)*</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>percent I chunks T1</td>
<td>0.20</td>
<td>0.571</td>
<td>0.095</td>
</tr>
<tr>
<td></td>
<td>percent A chunks T1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>percent I chunks T2</td>
<td>0.54</td>
<td>0.496</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>percent A chunks T2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>percent I chunks T3&amp;4</td>
<td>0.62</td>
<td>0.447</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>percent A chunks T3&amp;4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>percent QR chunks T1</td>
<td>0.08</td>
<td>0.662</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td>percent A chunks T1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>percent QR chunks T2</td>
<td>0.33</td>
<td>0.677</td>
<td>0.042</td>
</tr>
<tr>
<td></td>
<td>percent A chunks T2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>percent QR chunks T3&amp;4</td>
<td>0.46</td>
<td>0.647</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>percent A chunks T3&amp;4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Note that since the hypothesis is directional, significance value is single-tailed and should be divided by half.
As we see, the results demonstrate rather strong support for H 1a. The analytical cognition shows highest percentage of all cognitions across all tasks, even though it does not exceed 50% in Task 1 (and thus cannot be called strictly dominant). It is significantly higher than intuition in Task 2 and the combined task (T3&4). Also in Task 1 it is significantly higher than intuition although significance is marginal. Analysis is also significantly higher than quasi-rationality in Task 2 and combined task, and higher than quasi-rationality in Task 1, although this difference is non-significant. These results are confirmed by Wilcoxon signed ranks test. The difference between analysis and intuition in Task 1 is marginally significant (at 10% risk level) if the test is regarded as one-way (since the hypothesis is directional).

Thus the Hypothesis 1a is supported and its rival Hypothesis 1b is not supported. Novice entrepreneurs are more prone to analytical than any other type of cognition regardless of the nature of the task.

5.2.2. Cognitive patterns of novices: fixed or adapting?

According to the Hypothesis 1c, cognition of novices is fixed, i.e. the amount of intuitive, quasi-rational and analytical chunks should not vary significantly across the tasks. A paired-sample t-test and a Wilcoxon signed ranks test have been conducted in order to prove or disprove the hypothesis. The t-test’s results are presented in Table 5.3:

Table 5.3. Cognition shifts in novices across tasks

<table>
<thead>
<tr>
<th>Pairs</th>
<th>Mean paired diff.</th>
<th>Std. deviation</th>
<th>t-test sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Percent I chunks T1</td>
<td>0,15</td>
<td>0,238</td>
<td>0,004</td>
<td>25</td>
</tr>
<tr>
<td>percent I chunks T3&amp;4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Percent QR chunks T1</td>
<td>0,12</td>
<td>0,281</td>
<td>0,047</td>
<td>25</td>
</tr>
<tr>
<td>percent QR chunks T3&amp;4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Percent A chunks T1</td>
<td>0,27</td>
<td>0,274</td>
<td>0,001</td>
<td>25</td>
</tr>
<tr>
<td>percent A chunks T3&amp;4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As the table shows, the difference between cognitions across the tasks is highly significant. This means that novices do to some extent adapt their cognitions to the nature of the task, and thus Hypothesis 1c is not supported. This conclusion is also supported by the results of Wilcoxon test (sig. 0,002, 0,068 and 0,001) respectively.

5.2.3. Cognitive patterns of experts

H 2: Expert entrepreneurs’ dominant cognitive processes vary significantly depending on the nature of the entrepreneurial task:

To test the Hypothesis 2, let us now consider what processes dominate the expert entrepreneurs’ cognition across tasks.
The cognitive patterns of the experts are shown in Figure 5.2:

![Figure 5.2. Dominant cognition in experts across tasks](image)

**Figure 5.2. Dominant cognition in experts across tasks**

In order to test Hypothesis 2, it is necessary to examine the statistical significance of cognitive differences demonstrated in Figure 5.2. Again, a t-test has been conducted and its results are given in Table 5.4:

<table>
<thead>
<tr>
<th>Pairs</th>
<th>Mean paired diff.</th>
<th>Std. deviation</th>
<th>t-test sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Percent I chunks T1</td>
<td>0.16</td>
<td>0.242</td>
<td>0.001</td>
<td>30</td>
</tr>
<tr>
<td>percent I chunks T3&amp;4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Percent QR chunks T1</td>
<td>0.22</td>
<td>0.276</td>
<td>0.001</td>
<td>30</td>
</tr>
<tr>
<td>percent QR chunks T3&amp;4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Percent A chunks T1</td>
<td>0.38</td>
<td>0.312</td>
<td>0.001</td>
<td>30</td>
</tr>
<tr>
<td>percent A chunks T3&amp;4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Since the result is significant, Hypothesis 2 is supported. Cognitive processes of experts vary depending on the nature of the task.

**H 2a: Intuition is dominant in highly uncertain (intuition-inducing) tasks.**

Concerning Hypotheses 2a, Figure 5.2 makes clear that intuition, albeit accounting for 30 per cent of all chunks, is not a dominant cognition. The experts’ cognitive processes in Task 1 are dominated by quasi-rationality (51 per cent). Thus, we cannot claim support for Hypothesis 2a.

It must be noted, though, that Hypothesis 2a is a special case. Although intuition is not dominant among the cognitions, it may be nevertheless worthwhile to investigate whether it is used to a higher extent in Task 1 compared with the other tasks.
This way we can either obtain the indirect support for the theory underlying the hypothesis, or regard it as ultimately null. The results of the t-test are given in Table 5.5:

<table>
<thead>
<tr>
<th>Pairs</th>
<th>Mean paired diff.</th>
<th>Std. deviation</th>
<th>t-test sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Percent I chunks T1 percent I chunks T2</td>
<td>0.16</td>
<td>0.334</td>
<td>0.063</td>
<td>17</td>
</tr>
<tr>
<td>2. Percent I chunks T1 percent I chunks T3&amp;4</td>
<td>0.16</td>
<td>0.242</td>
<td>0.001</td>
<td>30</td>
</tr>
</tbody>
</table>

The results show that the experts indeed use intuition to a significantly higher extent in Task 1 than in the other tasks. Hence, the correspondence-accuracy principle, which stands behind the Hypothesis 2a, is supported. Even though intuition is not the dominant cognition, expert entrepreneurs still use it more frequently in intuition-inducing tasks than in any others.

**H 2b:** Quasi-rationality is dominant in moderately to highly uncertain (quasi-rationality-inducing) tasks.

**H 2c:** Analysis is dominant in low uncertainty (analysis-inducing) tasks.

The experts demonstrate ample use of quasi-rationality in the quasi-rationality-inducing Task 2, which occurs in 50 per cent of all chunks. As Hypothesis 2b postulates, experts would use quasi-rational cognition in a quasi-rationality-inducing task. It is possible to make the tentative conclusion that Hypotheses 2b can find support.

Hypothesis 2c speculates about experts’ use of analytical cognition in analysis-inducing tasks. According to Figure 5.2, analysis is the dominant cognition in the Task 3&4 (57 per cent). So, we may tentatively claim that also Hypothesis 2c finds support.

In order to find out whether the tentative conclusions concerning Hypotheses 2b and 2c holds, let us consider the results of the t-test presented in Table 5.6:

---

10 Since the hypothesis is directional, significance value should be divided by half.

11 The result is also confirmed by Wilcoxon test.
5. Analysis and Results

Table 5.6. Experts’ use of quasi-rationality and analysis across tasks

<table>
<thead>
<tr>
<th>Pairs</th>
<th>Mean paired diff.</th>
<th>Std. deviation</th>
<th>t-test sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Percent I chunks T2</td>
<td>0.37</td>
<td>0.520</td>
<td>0.009</td>
<td>17</td>
</tr>
<tr>
<td>percent QR chunks T2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Percent QR chunks T2</td>
<td>0.14</td>
<td>0.635</td>
<td>0.388</td>
<td>17</td>
</tr>
<tr>
<td>percent A chunks T2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Percent I chunks T3&amp;4</td>
<td>0.43</td>
<td>0.503</td>
<td>0.001</td>
<td>30</td>
</tr>
<tr>
<td>percent A chunks T3&amp;4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Percent QR chunks T3&amp;4</td>
<td>0.28</td>
<td>0.540</td>
<td>0.008</td>
<td>30</td>
</tr>
<tr>
<td>percent A chunks T3&amp;4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As the table makes clear, the difference in cognition in Task 2 is significant only when intuition and quasi-rationality are compared, but becomes non-significant when comparing quasi-rationality and analysis. The conclusion is that Hypothesis 2b is marginally supported - the results are fully in line with the Hypothesis, but they reach significance only in one of the comparisons.

As for Hypothesis 2c, the table reveals highly significant results as far as the difference between all cognitions within Task 3&4 is concerned. Thus the Hypothesis is confirmed.

5.3. Cognitive differences between experts and novices

In order to evaluate the differences of cognitive patterns between experts and novices, let us consider their cognitions across tasks. The mean values are provided in Figure 5.3:

Figure 5.3. Cognitive patterns of experts and novices across tasks
5.3.1. Intuition in intuition-inducing tasks

**H 3a:** In intuition-inducing tasks experts shall use intuition to a greater extent than novices.

**H 3b:** In intuition-inducing tasks novices shall use analysis to a greater extent than experts.

The results in Figure 5.3 permit to tentatively conclude that Hypotheses 3a and b are true. Indeed, the experts seem to use intuition in Task 1 to a higher extent than novices (30 and 23 per cent respectively), and they use analysis in Task 1 to a lower extent than novices (19 and 42 per cent respectively). A t-test and a Wilcoxon test were conducted in order to see whether conclusions were statistically significant. The results are given in Tables 5.7 and 5.8.

### Table 5.7. Experts’ and novices’ use of intuition in intuition-inducing task

<table>
<thead>
<tr>
<th>Percent int. chunks T1</th>
<th>Mean value</th>
<th>Std. deviation</th>
<th>Sig. (t-test) (2-tailed)</th>
<th>Asymp. sig. (Wilcoxon, 2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experts</td>
<td>0.30</td>
<td>0.205</td>
<td>0.265</td>
<td>0.119</td>
<td>30</td>
</tr>
<tr>
<td>Novices</td>
<td>0.23</td>
<td>0.245</td>
<td></td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

As Table 5.7 shows, the Hypothesis 3a is not supported. However, the estimated effect points in the predicted direction, and the result of Wilcoxon test signifies certain support for the Hypothesis (since the Hypothesis is directional, the result of the test can be significant at 6% risk level).

### Table 5.8 Experts’ and novices’ use of analysis in intuition-inducing task

<table>
<thead>
<tr>
<th>Percent an. chunks T1</th>
<th>Mean value</th>
<th>Std. deviation</th>
<th>Sig. (t-test) (2-tailed)</th>
<th>Asymp. sig. (Wilcoxon, 2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experts</td>
<td>0.19</td>
<td>0.226</td>
<td>0.007</td>
<td>0.031</td>
<td>30</td>
</tr>
<tr>
<td>Novices</td>
<td>0.42</td>
<td>0.378</td>
<td></td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

Table 5.8 above provides strong support for Hypothesis 3b. The difference in the use of analysis, when the novices use analysis to a higher extent than the experts, is statistically significant according to the t-test and to the Wilcoxon non-parametric test. In other words, despite only weak support for Hypothesis 3a, we are permitted to confirm the theory behind Hypotheses 3a and 3b. The experts seem to adapt their decision-making to the nature of the task better than novices do.
5. Analysis and Results

5.3.2. Heuristics in quasi-rationality-inducing tasks

**H4**: In quasi-rationality-inducing tasks experts shall use quasi-rationality to a greater extent than novices.

The Hypothesis has been tested in a way similar to Hypotheses 3a and 3b. The results of the tests are found in Table 5.9:

**Table 5.9 Experts’ and novices’ use of heuristics in the quasi-rationality-inducing task**

<table>
<thead>
<tr>
<th></th>
<th>Mean value</th>
<th>Std. deviation</th>
<th>Sig. (t-test) (2-tailed)</th>
<th>Asymp. sig. (Wilcoxon, 2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experts</td>
<td>0.50</td>
<td>0.354</td>
<td>0.064</td>
<td>0.062</td>
<td>17</td>
</tr>
<tr>
<td>Novices</td>
<td>0.29</td>
<td>0.312</td>
<td></td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

Since the Hypothesis 4 is directional, the significance value can be divided by half. Thus, the difference between the experts’ and novices’ use of heuristics in quasi-rationality-inducing task becomes significant below 5% risk level, and the Hypothesis 4 is supported.

5.3.3. Analysis in analysis-inducing tasks

**H5**: In analysis-inducing tasks there is no statistically significant difference in the use of analysis between experts and novices.

Also Hypothesis 5 was tested in a similar way to the three previous ones. The results of the tests are presented in Table 5.10:

**Table 5.10 Experts’ and novices’ use of analysis in analysis-inducing tasks**

<table>
<thead>
<tr>
<th></th>
<th>Mean value</th>
<th>Std. deviation</th>
<th>Sig. (t-test) (2-tailed)</th>
<th>Asymp. sig. (Wilcoxon, 2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experts</td>
<td>0.57</td>
<td>0.323</td>
<td>0.185</td>
<td>0.084</td>
<td>30</td>
</tr>
<tr>
<td>Novices</td>
<td>0.70</td>
<td>0.350</td>
<td></td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

As the table demonstrates, the result of the t-test is non-significant with either 5 per cent or 10 per cent risk level; the result of the Wilcoxon test is significant below 10% risk level. While there is a tendency in the data towards more ample use of analysis among novices, Hypothesis 5 can be regarded as supported.
5.4. Conclusion

It is possible to say that Hypotheses 1b and 1c are not supported, whereas Hypotheses 1a, 2, 2a, 2b, 2c, 3a, 3b, 4 and 5 enjoy full or partial support. The results are summarised in Table 5.11:

Table 5.11. Hypotheses testing

<table>
<thead>
<tr>
<th>H1a</th>
<th>H1b</th>
<th>H1c</th>
<th>H2</th>
<th>H2a</th>
<th>H2b</th>
<th>H2c</th>
<th>H3a</th>
<th>H3b</th>
<th>H4</th>
<th>H5</th>
<th>(11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y/N</td>
<td>Y</td>
<td>Y/N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>(9)</td>
</tr>
</tbody>
</table>

In other words, the results generally support the theory and the instances of weak or no support do not represent a major blow to the theory due to the following reasons:

a) Nine hypotheses out of eleven are supported, of these seven are supported at high level of significance and two marginally.

b) The results, even though they are non-significant, are nevertheless in line with the hypothesis (e.g. Hypothesis 2b) thus providing marginal support to the theory.

c) Admittedly the novices tend to also adapt their decision-making style. However, in full accordance with the theory, they show far less ability to adapt to the nature of the task than the experts do. This seeming deviation from theory is easy to explain: in theory experts and novices are ideal types. No empirical cases, i.e. real individuals, should be expected to be complete, or naïve novices. Thus it should not be surprising that empirical novices show some, albeit very limited, signs of adaptive, expert-like behaviour.

Hence, we may legitimately conclude that:

a) Novice entrepreneurs are much more prone to use the analytical cognition regardless of the nature of the task (Hypothesis 1a).

b) Correspondence-accuracy principle is valid for expert entrepreneurs (Hypotheses 2, 2a, 2b and 2c).

c) Expert and novice entrepreneurs do differ in their use of cognitions across tasks (Hypotheses 3a, 3b, 4 and 5). More elaborate conclusions and implications of the findings for future research, practitioners and education are found in Chapters 6 and 7.
6. Cognitive Patterns in Experts and Novices

The results presented in the previous chapter show that experts’ and novices’ cognitive behaviour significantly supports the theory, even though this behaviour cannot be regarded as absolutely clear-cut theoretically. As hypothesised, it is possible to conclude that the null hypothesis is indeed false in relation to experts. Contrary to the theoretically based assumptions, the null hypothesis also proves false in relation to novices. Although this conclusion does not undermine the theory, an attempt to investigate the reasons for these deviations seems worthwhile. The present chapter provides such an attempt carried out through an exploratory, more interpretative analysis of the data. The statistical analysis relies on “compare means” SPSS procedure, when the mean percentage of the intuitive, quasi-rational and analytical chunks is found for experts and novices across tasks. Two more variables are included in the analysis, type of education and business idea discovery. The former is used in order to investigate whether business/management education is more conditioning towards analysis than other type of education. The latter is added in order to investigate whether cognitive patterns differ in the situations of discovery and rejection of venture ideas respectively. Acceptance/rejection situation has been analysed across tasks in three ways: combined for all participants, separately for experts, and separately for novices. The statistical significance of the results has been established through one-way ANOVA as well as with non-parametric tests: Mann-Witney test for 2 independent samples, and Kruskall-Wallis test for K independent samples. The mean values in all tables in this chapter represent relative frequency.

6.1. Novices: type of education and cognitive patterns

Since Hypothesis 1a has been proven true (see Chapter 5), we can say that the novices in general are significantly more prone to analytical behaviour than the experts, regardless of the nature of the task. However, the novices are a heterogeneous group consisting of a) JIBS students receiving business education (University of Jönköping); b) students of the school of Engineering (also University of Jönköping) and c) novices possessing other type of college/university training. There is a theoretical rationale behind the inclusion of this variable (type of education) in the analysis. As cognitive psychology states, novices are prone to analytical cognition (Dreyfus & Dreyfus, 1989). This assumption also finds strong support in the present study (H1a). However, contrary to the theoretical assumptions, novices demonstrate adaptable, expert-like behaviour (H1c not supported). It seems logical to see the reason for this deviation of the theoretically predicted behaviour in one of the background variables. The most influential
factor, as far as development of expertise is concerned, is the type of education. This is also the only variable where the novices in the study are not matched.

Let us now investigate whether cognitive patterns of business students would significantly differ from a) non-business novices as a group, i.e. engineering students and students receiving other type of education taken together and b) from students of engineering and others separately. The analysis has been carried out across tasks.

Cognitive patterns of novices in intuition-inducing Task 1 are presented in Figure 6.1 where values represent relative frequencies:

![Figure 6.1. Cognitive patterns of novices in intuition-inducing task by areas of education](image)

**Figure 6.1. Cognitive patterns of novices in intuition-inducing task by areas of education**

In order to establish whether the observed differences in the presence of intuition, quasi-rationality and analysis across education groups are statistically significant, two types of non-parametric test are carried out. First, business students are compared with non-business novices by Kruskall-Wallis test; second, business students are compared with engineering students and with other novices, respectively, by ANOVA and Mann-Whitney test. Significance values for these analyses are presented in Table 6.1 and 6.1a:
6. Cognitive Patterns in Experts and Novices

Table 6.1 Statistical significance of differences in cognitive patterns across types of education

<table>
<thead>
<tr>
<th>Comparison</th>
<th>t chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business/non-business</td>
<td>0.115</td>
<td>0.339</td>
<td>0.020</td>
</tr>
<tr>
<td>Business/engineering</td>
<td>0.096</td>
<td>0.178</td>
<td>0.079</td>
</tr>
<tr>
<td>Business/other</td>
<td>0.125</td>
<td>0.367</td>
<td>0.015</td>
</tr>
</tbody>
</table>

Business students N=17; engineering students N=4; others N=4

Table 6.1a. Difference in cognitive patterns established by ANOVA

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>t chunks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>business</td>
<td>17</td>
<td>0.15</td>
<td>0.16</td>
<td>0.034</td>
</tr>
<tr>
<td>engineering</td>
<td>4</td>
<td>0.29</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td>4</td>
<td>0.49</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>QR chunks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>business</td>
<td>17</td>
<td>0.28</td>
<td>0.28</td>
<td>0.264</td>
</tr>
<tr>
<td>engineering</td>
<td>4</td>
<td>0.51</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td>4</td>
<td>0.45</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>A chunks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>business</td>
<td>17</td>
<td>0.56</td>
<td>0.26</td>
<td>0.017</td>
</tr>
<tr>
<td>engineering</td>
<td>4</td>
<td>0.20</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td>4</td>
<td>0.06</td>
<td>0.12</td>
<td></td>
</tr>
</tbody>
</table>

As the tables demonstrate, business students are significantly more prone to analytical cognition compared to non-business novices. Comparison to the students of engineering yields statistical significance within 90 per cent confidence interval for non-parametric test (ANOVA provides between groups significance at 5% riks); business students are more prone to analytical, whereas students of engineering are more prone to intuitive cognition. Comparison to other novices points out, again, that business students are significantly more prone to analytical cognition.

Thus, it is possible to conclude that in intuition-inducing task business student tend to employ analytical cognition to significantly higher extent than non-business novices.

Let us now investigate cognitive patterns of all three education groups in the quasi-rationality-inducing Task 2. The mean value for each cognition is presented in Figure 6.2:

---

12 Kruskall-Wallis test
13 Mann-Whitney test
14 Mann-Whitney test
Again, the statistical significance of differences in cognitive patterns is established by ANOVA, Kruskall-Wallis and Mann-Whitney tests. Significance values for these comparisons are presented in Table 6.2 and 6.2a.

Table 6.2 Statistical significance of differences in cognitive patterns across types of education

<table>
<thead>
<tr>
<th>Comparison</th>
<th>I chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business/non-business Asymp. Sig\textsuperscript{15}</td>
<td>0.857</td>
<td>0.020</td>
<td>0.047</td>
</tr>
<tr>
<td>Business/engineering Asymp. Sig. 2-tailed\textsuperscript{16}</td>
<td>0.676</td>
<td>0.082</td>
<td>0.193</td>
</tr>
<tr>
<td>Business/other Asymp. Sig. 2-tailed\textsuperscript{17}</td>
<td>0.676</td>
<td>0.021</td>
<td>0.030</td>
</tr>
</tbody>
</table>

Business students N=16; engineering students N=2; others N=2

Table 6.2a. Differences established by ANOVA

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I chunks business</td>
<td>16</td>
<td>0.09</td>
<td>0.18</td>
<td>0.963</td>
</tr>
<tr>
<td>engineering</td>
<td>2</td>
<td>0.06</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td>2</td>
<td>0.06</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>QR chunks business</td>
<td>16</td>
<td>0.18</td>
<td>0.21</td>
<td>0.001</td>
</tr>
<tr>
<td>engineering</td>
<td>2</td>
<td>0.53</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td>2</td>
<td>0.94</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>A chunks business</td>
<td>16</td>
<td>0.73</td>
<td>0.34</td>
<td>0.018</td>
</tr>
<tr>
<td>engineering</td>
<td>2</td>
<td>0.41</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td>2</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{15} Kruskall-Wallis test
\textsuperscript{16} Mann-Whitney test
\textsuperscript{17} Mann-Whitney test
As the tests make clear, business students are again much more prone to analytical cognition compared to non-business novices, who, in their turn, tend to exhibit significantly higher use of quasi-rationality. Engineers, as compared to business students, are also more prone to use heuristics (significance with 10% risk in non-parametric test and with 5% risk by ANOVA). Comparison between business students and other novices points out that business students are significantly more prone to analytical cognition, whereas other novices make significantly higher use of heuristics.

Again, the general conclusion is that business students are significantly more prone to analytical cognition than non-business novices.

Finally, let us investigate the cognitive patterns of novices in analysis-inducing task. The mean values are presented in Figure 6.3.

Figure 6.3. Cognitive patterns of novices in analysis-inducing task by areas of education

The statistical significance of differences in cognitive patterns is once again established by ANOVA, Kruskall-Wallis and Mann-Whitney tests. Significance values for these comparisons are presented in Tables 6.3 and 6.3a.
Table 6.3 Statistical significance of differences in cognitive patterns across types of education

<table>
<thead>
<tr>
<th>Comparison</th>
<th>I chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business/non-business</td>
<td>0.185</td>
<td>0.001</td>
<td>0.009</td>
</tr>
<tr>
<td>Business/engineering</td>
<td>0.092</td>
<td>0.002</td>
<td>0.016</td>
</tr>
<tr>
<td>Business/other</td>
<td>0.338</td>
<td>0.002</td>
<td>0.016</td>
</tr>
</tbody>
</table>

Business students N=17; engineering students N=4; others N=4

Table 6.3a Differences established by ANOVA

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I chunks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>business</td>
<td>17</td>
<td>0.08</td>
<td>0.20</td>
<td>0.924</td>
</tr>
<tr>
<td>engineering</td>
<td>4</td>
<td>0.09</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td>4</td>
<td>0.05</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>QR chunks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>business</td>
<td>17</td>
<td>0.07</td>
<td>0.18</td>
<td>0.001</td>
</tr>
<tr>
<td>engineering</td>
<td>4</td>
<td>0.57</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td>4</td>
<td>0.57</td>
<td>0.31</td>
<td></td>
</tr>
<tr>
<td>A chunks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>business</td>
<td>17</td>
<td>0.85</td>
<td>0.27</td>
<td>0.002</td>
</tr>
<tr>
<td>engineering</td>
<td>4</td>
<td>0.34</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td>4</td>
<td>0.38</td>
<td>0.29</td>
<td></td>
</tr>
</tbody>
</table>

Once again the results make clear that business students are significantly more prone to analytical cognition than non-business novices, who, on the other hand, use quasi-rationality to a significantly higher extent. Comparisons with the students of engineering and other novices, respectively, demonstrate similar trends: business students are much more prone to use analysis than any of the non-business groups, whereas the students of engineering and novices possessing other types of training are more prone to use heuristics.

Judging by the results of the tests described above, we can legitimately conclude that business students are significantly more prone to analytical decision-making regardless of the nature of the task. Hence, business education can be considered significantly more conditioning towards analysis than any other type of education.

On the other hand, there is also some indication that non-business novices are more prone to use quasi-rational cognition; at least, such a trend is demonstrated in two tasks out of three – quasi-rationality and analysis-inducing tasks.

The conclusions above can be illustrated by cognitive charts, where every chunk represents a dot and is coded as 0 (for intuition), 1 (for quasi-rationality) and 2 (for analysis). The examples of such charts for novices are found in Appendices C and D. Appendix D demonstrates charts created for a business student. As we can see, this

---

18 Kruskall-Wallis test
19 Mann-Whitney test
20 Mann-Whitney test
participant employs only analytical cognition in every task, be it intuition, quasi-rationality or analysis-inducing.

The charts in Appendix E are created for a non-business novice. It is easy to observe that this participant makes an ample use of quasi-rationality in both intuition-inducing and analysis-inducing tasks.

Yet the conclusions above should nevertheless be regarded as rather tentative, due to two reasons. First, the number of students of engineering and other novices was very low: four participants in each group. Second, these results were not based on hypotheses derived a priori from entrepreneurship theory. Thus, even though the first exploratory results point out at an unexpected and intriguing trend, the issue of business education's conditioning nature is by no means resolved and requires further research.

6.2. Cognitive patterns and venture idea discovery

The participants, either experts or novices, were not prompted to a positive answer while reflecting over their tasks. In other words, a decision was good for the purpose of the study regardless of whether the participant discovered a venture idea or failed to do so, i.e. rejected the situation as potentially unpromising.

Still, it would be worth investigating whether the participants' cognitive patterns differ depending on their acceptance or rejection of the situation. One may also wonder if these cognitive patterns would be different for experts and novices.

In order to provide answers to these questions, cognitive patterns of all subjects, both experts and novices, were investigated across tasks with respect to whether a venture idea was found or rejected. The mean value for each cognition was identified in each task. Statistical significance of the results was obtained through ANOVA and Mann-Whitney test.

6.2.1. General cognitive patterns and venture idea discovery

The cognitive patterns observed in the intuition-inducing tasks are presented in Table 6.4:

<table>
<thead>
<tr>
<th>Venture idea Task</th>
<th>N</th>
<th>1 chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected</td>
<td>26</td>
<td>0.35</td>
<td>0.47</td>
<td>0.18</td>
</tr>
<tr>
<td>Discovered</td>
<td>29</td>
<td>0.19</td>
<td>0.41</td>
<td>0.40</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>0.018</td>
<td>0.399</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Sig. ANOVA</td>
<td></td>
<td>0.006</td>
<td>0.425</td>
<td>0.010</td>
</tr>
</tbody>
</table>
As can be observed from Table, the cognitive patterns do differ in acceptance and rejection situations. Intuition is used to a significantly higher extent in rejection, whereas analysis plays the leading role in acceptance.

Let us now consider the cognitive patterns in quasi-rationality-inducing task. The results are presented in Table 6.5:

Table 6.5. Cognitive patterns and venture idea discovery in quasi-rationality-inducing task

<table>
<thead>
<tr>
<th>Venture idea Task 2</th>
<th>N</th>
<th>I chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected</td>
<td>22</td>
<td>0.14</td>
<td>0.32</td>
<td>0.54</td>
</tr>
<tr>
<td>Discovered</td>
<td>15</td>
<td>0.06</td>
<td>0.49</td>
<td>0.45</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>0.590</td>
<td>0.111</td>
<td>0.708</td>
<td></td>
</tr>
<tr>
<td>Sig. ANOVA</td>
<td>0.279</td>
<td>0.161</td>
<td>0.504</td>
<td></td>
</tr>
</tbody>
</table>

The quasi-rationality-inducing task appears to be the most confounding for the participants. There is a slight difference in acceptance and rejection situations; however, none of these differences is statistically significant. Let us now investigate cognitive patterns in the analysis-inducing task. The results are found in Table 6.6:

Table 6.6. Cognitive patterns and venture idea discovery in analysis-inducing task

<table>
<thead>
<tr>
<th>Venture idea Task 3&amp;4</th>
<th>N</th>
<th>I chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected</td>
<td>18</td>
<td>0.23</td>
<td>0.21</td>
<td>0.56</td>
</tr>
<tr>
<td>Discovered</td>
<td>37</td>
<td>0.05</td>
<td>0.29</td>
<td>0.66</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>0.015</td>
<td>0.144</td>
<td>0.426</td>
<td></td>
</tr>
<tr>
<td>Sig. ANOVA</td>
<td>0.002</td>
<td>0.332</td>
<td>0.321</td>
<td></td>
</tr>
</tbody>
</table>

Similar to the intuition-inducing task, the presence of intuition is significantly stronger in rejection. However, we cannot claim the analysis to be significantly stronger in the analysis-inducing task.

So far, it is possible to observe that in two tasks out of three intuition is significantly stronger in rejection decisions. Notably, this pattern emerges in the tasks inducing clear-cut cognition: either intuition or analysis. There is also a tendency for analysis to be significantly more prominent in the acceptance situation in the intuition-inducing task. One may wonder, however, if this rather weak pattern can become more pronounced should cognitive patterns of experts and novices be analysed separately.
6.2.2. Cognitive patterns of experts and venture idea discovery

To obtain an answer to the question above, let us first consider cognitive patterns of experts in acceptance or rejection situations across tasks. Cognitive patterns of experts in intuition-inducing task are presented in Table 6.7:

<table>
<thead>
<tr>
<th>Venture idea Task 1</th>
<th>N</th>
<th>I chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected</td>
<td>14</td>
<td>0.39</td>
<td>0.52</td>
<td>0.09</td>
</tr>
<tr>
<td>Discovered</td>
<td>16</td>
<td>0.20</td>
<td>0.49</td>
<td>0.31</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>0.013</td>
<td>0.771</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Sig. ANOVA</td>
<td></td>
<td>0.009</td>
<td>0.740</td>
<td>0.007</td>
</tr>
</tbody>
</table>

As the table makes clear, the experts demonstrate statistically significant differences in cognitive patterns pertaining to acceptance and rejection situation. Expert entrepreneurs are much more prone to use intuition for rejection, whereas a discovery of a venture idea demonstrates the strong presence of analysis. In general it is also possible to note that the experts' tendency to use more intuition for rejection and more analysis for acceptance in intuition-inducing task does not differ from the general trend in the same task.

The experts' cognitive patterns in quasi-rationality-inducing task are found in Table 6.8:

<table>
<thead>
<tr>
<th>Venture idea Task 2</th>
<th>N</th>
<th>I chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected</td>
<td>9</td>
<td>0.19</td>
<td>0.44</td>
<td>0.37</td>
</tr>
<tr>
<td>Discovered</td>
<td>8</td>
<td>0.06</td>
<td>0.58</td>
<td>0.36</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>0.297</td>
<td>0.440</td>
<td>0.596</td>
<td></td>
</tr>
<tr>
<td>Sig. ANOVA</td>
<td></td>
<td>0.321</td>
<td>0.457</td>
<td>0.952</td>
</tr>
</tbody>
</table>

It is possible to observe, once again, that there exists no clear pattern of cognitive differences in acceptance or rejection situation in the quasi-rationality induced task among the experts. Apparently, the confounding nature of the task does not permit such a pattern to emerge.

Now let us again consider the cognitive patterns of experts in the analysis-inducing task. The results are found in Table 6.9:
In the analysis-inducing task the experts demonstrate a clear tendency to use intuition to a significantly higher extent in the situation of rejection, whereas in the situation of acceptance there is a significantly stronger presence of analysis. This tendency differs from the general situation, where only intuition is significantly higher in rejection, and the use of analysis in acceptance or rejection demonstrates no significant differences.

6.2.3. Novices: Cognitive patterns and venture idea discovery

Let us now compare the cognitive patterns of novices in acceptance or rejection situations across tasks. The results of such analysis in the intuition-inducing task are presented in Table 6.10:

<table>
<thead>
<tr>
<th>Venture idea Task 1</th>
<th>N</th>
<th>I chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected</td>
<td>10</td>
<td>0.30</td>
<td>0.37</td>
<td>0.33</td>
</tr>
<tr>
<td>Discovered</td>
<td>15</td>
<td>0.18</td>
<td>0.33</td>
<td>0.49</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>0.377</td>
<td>0.867</td>
<td>0.227</td>
<td></td>
</tr>
<tr>
<td>Sig. ANOVA</td>
<td>0.240</td>
<td>0.696</td>
<td>0.289</td>
<td></td>
</tr>
</tbody>
</table>

It is easy to notice that in the intuition-inducing task, novices demonstrate no significant difference of their cognitive behaviour in either acceptance or rejection situation.

Let us now investigate the cognitive patterns of novices in the quasi-rationality-inducing task. The results are found in Table 6.11:

<table>
<thead>
<tr>
<th>Venture idea Task 1</th>
<th>N</th>
<th>I chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected</td>
<td>8</td>
<td>0.35</td>
<td>0.25</td>
<td>0.40</td>
</tr>
<tr>
<td>Discovered</td>
<td>22</td>
<td>0.06</td>
<td>0.30</td>
<td>0.64</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>0.003</td>
<td>0.604</td>
<td>0.067</td>
<td></td>
</tr>
<tr>
<td>Sig. ANOVA</td>
<td>0.002</td>
<td>0.665</td>
<td>0.075</td>
<td></td>
</tr>
</tbody>
</table>

---

21 Within 90 per cent confidence interval for both tests
6. Cognitive Patterns in Experts and Novices

Table 6.11. Novices: Cognitive patterns and venture idea discovery in quasi-rationality-inducing task

<table>
<thead>
<tr>
<th>Venture idea Task 2</th>
<th>N</th>
<th>I chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected</td>
<td>13</td>
<td>0.10</td>
<td>0.24</td>
<td>0.66</td>
</tr>
<tr>
<td>Discovered</td>
<td>7</td>
<td>0.06</td>
<td>0.38</td>
<td>0.56</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td></td>
<td>0.889</td>
<td>0.169</td>
<td>0.491</td>
</tr>
<tr>
<td>Sig. ANOVA</td>
<td></td>
<td>0.588</td>
<td>0.340</td>
<td>0.604</td>
</tr>
</tbody>
</table>

As expected, the novices demonstrate no significant difference in their use of intuition and analysis in the rejection and acceptance situation. To complete the analysis, let us consider the cognitive patterns of novices in the analysis-inducing task. The results are found in Table 6.12:

Table 6.12. Novices: Cognitive patterns and venture idea discovery in analysis-inducing task

<table>
<thead>
<tr>
<th>Venture idea Task 3&amp;4</th>
<th>N</th>
<th>I chunks</th>
<th>QR chunks</th>
<th>A chunks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected</td>
<td>10</td>
<td>0.14</td>
<td>0.17</td>
<td>0.69</td>
</tr>
<tr>
<td>Discovered</td>
<td>15</td>
<td>0.04</td>
<td>0.27</td>
<td>0.69</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td></td>
<td>0.422</td>
<td>0.232</td>
<td>0.750</td>
</tr>
<tr>
<td>Sig. ANOVA</td>
<td></td>
<td>0.145</td>
<td>0.462</td>
<td>0.990</td>
</tr>
</tbody>
</table>

Yet again the novices demonstrate no significant difference in their cognitive behaviour in the acceptance and rejection situation. Thus, it becomes possible to conclude that experts and novices exhibit different cognitive behaviour in the intuition-inducing and analysis-inducing tasks as far as acceptance or rejection of a venture idea is concerned. The experts exhibit clear trend: they are much more prone to use intuition in rejection, whereas discovery of a venture idea demonstrate a strong use of analysis. The novices, on the other hand, do not demonstrate any clear pattern in their decision behaviour. Neither does any trend emerge in any group of subjects in the quasi-rationality-inducing task.

6.3. Experts’ cognitive patterns: why do they differ?

So, the question begs itself: what are the possible reasons for such distinct decision-making patterns to emerge? It is possible to suggest two explanations.

An observation that first springs to mind is that the experts demonstrate significant difference of cognitive patterns only in the intuition-inducing and the analysis-inducing tasks. In these situations of either very high or very low uncertainty (the two poles of the task continuum), the experts are prone to use intuition if they reject the situation’s potential, and they use analysis to make the discovery.
It must be noted that such behaviour seems at variance with the Correspondence-accuracy principle (CAP): if the task is intuition-inducing, any behaviour is expected to be aided by intuition, not analysis. In the analysis-inducing task the situation is the reverse: here, according to the CAP, an optimal decision is to be made by means of analysis, be it acceptance or rejection.

One possible explanation is to suggest that the experts use intuition and analysis not only as the means of thought structuring but also as inhibitors of perceived uncertainty (perceived, because in the analysis-inducing task genuine uncertainty is already very low). This conclusion seems justified due to the cognitive properties of both intuition and analysis: intuition provides high confidence in answer, whereas analysis provides high confidence in method (Hammond et al., 1987; Hammond, 1988). Thus, it seems quite natural to use both cognitions to bring down the level of perceived uncertainty.

This conclusion, although seemingly possible, provide little explanation from the point of view of entrepreneurship research, pertaining rather to the field of cognitive psychology. Yet there exists another, “entrepreneurial”, explanation of these puzzling differences.

In general, entrepreneurship research suggests two rival explanations for the cognitive nature of a venture idea discovery: first, as a result of a systematic search (cf. Fiet, 2002) and second, as a result of a serendipitous flash of insight, “entrepreneurial alertness” (cf. Gaglio and Katz, 2001).

In terms of cognitive behaviour systematic search is predominantly analytical. Thus, we may assume that expert entrepreneurs are quite prone to analytical behaviour when they discover a venture idea. This can be an argument in favour of the systematic search theory. However, this conclusion is only tentative and should be corroborated by further research.
7. Conclusions and Implications

7.1. General conclusions

Let us now summarise the present study and discuss its conclusions, its research contribution as well as its implications for future entrepreneurship research, entrepreneurship education and its potential usefulness for the practitioners.

The study's aim has been to investigate cognitive processes of entrepreneurs in connection with opportunity identification. Two factors were assumed to play the major role: decision-makers' (entrepreneurs') level of expertise and the level of uncertainty pertaining to the type of opportunity. To perform the investigation it was necessary to identify and explore a) the nature of entrepreneurial task and b) the nature of entrepreneurial cognition.

The study has employed individual level of analysis, and the analytical tool has been provided by cognitive psychology, namely, the cognitive continuum theory and its corollary, the correspondence-accuracy principle.

The cognitive continuum theory (CCT) is a general theory of decision-making. It states that the universe of tasks for which a decision is made can be viewed as a continuum. Or, in the words of Herbert Simon (1977, p. 46), it represents “…a whole continuum, with highly programmed decisions at one end of that continuum and highly unprogrammed decisions at the other end. We can find decisions of all shades of grey along the continuum, and I use the terms programmed and unprogrammed simply as labels for the black and the white of the range.”

In other words, one end of the continuum represents tasks of high uncertainty, novel and unstructured, whereas the other end represents tasks that are repetitive in nature, highly structured and of low (or even non-existent) uncertainty. More detailed discussion of the entrepreneurial task's cognitive nature in relation to the task continuum is found in Chapter 3.

The correspondence-accuracy principle (CAP), a the corollary of the CCT, asserts that the task continuum is corresponded by the continuum of decision-making modes or techniques, ranging from intuitively made decisions (judgements or actions) to decisions resulting from a step-by-step analysis preceded by an exhaustive data collection. However, no decision mode per se is superior to others within the continuum; rather, in order for a decision to yield optimal results, its mode on the decision continuum should correspond to the requirements of the task on the task continuum. In other words, for an unprogrammed (highly uncertain, ill-structured) task such as opportunity creation one should use intuitive (unprogrammed) decisions, whereas for a programmed (well-structured, of low uncertainty) task such as opportunity recognition an analytical, structured decision is most fitting.
Both the CCT and CAP were developed by Hammond (see Hammond et al. 1987; Hammond, 1988) and empirically grounded in his research over expert highway engineers. The theory is also very close to the ideas of Simon (1977) concerning managerial decision-making.

Since the present study’s aim has been to investigate whether the theory is also applicable to entrepreneurial decision-making, it has been necessary to a) formulate the nature of an entrepreneurial task and b) find its place on the task continuum regarding its level of uncertainty.

The study was able to reveal that the cognitive nature of the entrepreneurial task is complex. Indeed, as explained in Chapter 3, this process is directional, although by no means linear (cf. Shane and Eckhardt, 2003). Again, using the words of Simon (1972, p.43), it can be described as “wheels within wheels within wheels”, or reciprocal shift towards the low uncertainty pole.

However, the present study does not focus on the process nature of the entrepreneurial task (venture creation sequence). Rather, the investigation aims at discovering the cognitive nature of the initial stage of the process: opportunity creation, opportunity discovery and opportunity recognition. Combining Knight’s (1921) ideas of different uncertainty levels in the economic process, and Sarasvathy et al.’s (2003) definitions of opportunity creation, discovery and recognition as entrepreneurial tasks, the author of the present study could define the uncertainty level for each task and place them onto the task continuum.

In order to investigate entrepreneurial decision-making it has been also necessary to create experimental tasks, which could be placed at the high uncertainty pole, the low uncertainty pole and in the middle of the continuum, to induce intuitive, analytical or quasi-rational decision-making mode respectively. To accomplish the intuition-inducing tasks the participants have been presented with a brief description of a radical technical innovation (opportunity creation) in order to make a judgement concerning the existence of a venture idea. The quasi-rationality-inducing task presumed evaluation of the market potential of a new computer game (opportunity discovery), and the analysis-inducing tasks concerned evaluation of the takeover potential for the two businesses: a consultancy firm and a filling station for each task (opportunity recognition).

Even though the present study disregards the process nature of the tasks due to the highly complex nature of the empirical phenomenon and the subsequent disagreement in the field concerning its nature, it still remains an important question. The potential to explore the process empirically is discussed further in the present chapter as far as the implications for future research are concerned.

The study claims both the CCT and CAP as pertaining mostly to expert decision-making. Therefore, the author deems it necessary to investigate whether decisions made by novices would be in any respect different from those made by experts.

Using cognitive psychology (CCT and CAP) and entrepreneurship theory (the nature of entrepreneurial task) as a joint frame of reference, the author has been able to formulate Hypotheses pertaining to the cognitive behaviour of novices, cognitive behaviour of experts and the differences between the two groups.
Table 7.1 presents the Hypotheses and indicates if they were supported or not.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>H 1a: Novice entrepreneurs use analytical decision-making regardless of the nature of the task.</td>
<td>Yes</td>
</tr>
<tr>
<td>H 1b (rival): Novice entrepreneurs use quasi-rational decision-making (heuristics) regardless of the nature of the task.</td>
<td>No</td>
</tr>
<tr>
<td>H 1c: Cognitive processes of novice entrepreneurs do not vary significantly depending on the nature of the task.</td>
<td>No</td>
</tr>
<tr>
<td>H 2: Expert entrepreneurs’ dominant cognitive processes vary significantly depending on the nature of the entrepreneurial task:</td>
<td>Yes</td>
</tr>
<tr>
<td>H 2a: intuition is dominant in highly uncertain (intuition-inducing) tasks;</td>
<td>Yes</td>
</tr>
<tr>
<td>H 2b: quasi-rationality is dominant in moderately to highly uncertain (quasi-rationality-inducing) tasks;</td>
<td>Yes (marginally)</td>
</tr>
<tr>
<td>H 2c: analysis is dominant in low uncertainty (analysis-inducing) tasks.</td>
<td>Yes</td>
</tr>
<tr>
<td>H 3a: In intuition-inducing tasks experts will use intuition to a greater extent than novices;</td>
<td>Yes (marginally)</td>
</tr>
<tr>
<td>H 3b: In intuition-inducing tasks novices will use analysis to a greater extent than experts.</td>
<td>Yes</td>
</tr>
<tr>
<td>H 4: In quasi-rationality-inducing tasks experts will use quasi-rationality to a greater extent than novices.</td>
<td>Yes</td>
</tr>
<tr>
<td>H 5: In analysis-inducing tasks there is no statistically significant difference in the use of analysis between experts and novices.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

As the table makes clear, out of eleven hypotheses nine are supported, whereas two are supported marginally and seven are supported in full. These results indicate strong support to the underlying theory. Also the absence of support for Hypothesis 1c, as well as marginal support for Hypotheses 2b and 3a have prompted a post-hoc investigation. The results of hypotheses testing and the post-hoc investigation enable the following conclusions:

- Expert entrepreneurs do recognise the nature of the decision task and are able, to a high extent, to match their decision-making techniques with the nature of the task. This conclusion is proved by full or marginal support of Hypotheses 2, 2a, 2b and 2c. This means that the skill of entrepreneurial decision-making is expressed through the adaptable behaviour of experts.

- Being a skill, the decision-making behaviour in entrepreneurial tasks is different for expert and novice entrepreneurs. As has been mentioned above, the experts' behaviour is adaptable; novices, however, are to a high extent prone to analyti-
cal decision-making regardless of the nature of the decision task. This claim is confirmed by the full support of Hypothesis 1a.

- Again, since entrepreneurial decision-making is a skill, the expert entrepreneurs' behaviour is found to be generally in compliance with the correspondence-accuracy principle, whereas novices' behaviour is not. This conclusion is proven true by full or partial support of Hypotheses 3a and 3b, 4 and 5.

- Absence of support to Hypothesis 1c, as well as marginal support to Hypothesis 3a indicates that even novices' behaviour is adaptable to a certain degree. Since novices in the present study form a heterogeneous group consisting of students of business administration, students of engineering and students/holders of a college degree in other fields, it was assumed that different areas of education might induce different cognitive behaviour. Analysis presented in Chapter 6 confirms this assumption; indeed, students of business administration appears to be most prone to analysis in decision-making, whereas students of engineering and other fields are more prone to use heuristics.

- The experiment participants have not been prompted to any definite answer concerning either presence or absence of a venture idea in the experimental tasks. Any decision was accepted. However, the author of the present study has decided to investigate whether cognitive behaviour of experts and novices might differ depending on acceptance or rejection of a venture idea. Indeed, the experts exhibit a clear trend: they are much more prone to use analysis in rejection, whereas discovery of a venture idea demonstrate a strong use of analysis. The novices, on the other hand, do not demonstrate any clear pattern in their decision behaviour. Neither does any trend emerge in any group of subjects in the quasi-rationality-inducing task.

Generally speaking, the contribution of the present study can be defined as follows:

1. The study has confirmed that cognitive psychology can successfully provide analytical tools to investigate entrepreneurship phenomena. The use of the cognitive continuum theory and the correspondence-accuracy principle may enlarge the theoretical basis of entrepreneurship research, which so far has had to rely mostly on concepts provided by economics.

2. The study sets a precedent methodologically – so far experiments have been uncommon in the field of entrepreneurship research. In order to counteract potential threats to validity and reliability the study makes use of triangulation: it employs multiple data sources and utilises a combination of quantitative and qualitative research methods. Qualitative methods have been employed for data collection and quantitative methods have been used for data analysis. The study also employs a legitimate and well-proven in cognitive psychology method of process research, verbal protocol collection. Also the use of verbal protocol is quite novel in the field of entrepreneurship.

3. The study makes a contribution to our knowledge of the nature of entrepreneurial skills. The study confirms that opportunity identification may occur at different
levels of uncertainty: ultimate/high (opportunity creation), high/moderate (opportunity discovery) and moderate/low (opportunity recognition). In terms of the cognitive continuum theory it means that opportunity identification may be found along the task continuum characterised by gradually diminishing uncertainty. In terms of business life it means that entrepreneurs may find a venture idea as they come across a radical technical innovation (opportunity creation - ultimate uncertainty); if they try to bring to the market a new product to meet existing demand (opportunity discovery – moderate uncertainty). Finally, an idea to start up a franchise business also belongs to opportunity identification, namely, its least uncertain variety of opportunity recognition.

It is important to remember that these types of opportunity identification possess different cognitive nature and require different decision-making modes in order to yield optimal results.

Expert entrepreneurs, while performing the task of opportunity identification, are able to recognise the cognitive nature of the opportunity they confront and adapt their cognitive behaviour to the cognitive nature of the task. It means that entrepreneurial decision-making is not an inborn aptitude but a skill, which is acquired by an entrepreneur in the course of the person’s business life. This, in turn, means that an appropriate decision-making behaviour in entrepreneurial situations can be taught and learned.

7.2. Implications of the study

7.2.1. Implications for future research

The present study can provide immediate ground for several research attempts:

− The use of intuition and analysis by expert entrepreneurs apparently merits further investigation. As mentioned in Chapter 6, it can be closely connected to the hotly debated issue of entrepreneurial alertness vs. systematic search as the source of opportunity identification. According to Kirzner (1985, p.56) entrepreneurial alertness is a “motivated propensity of man to formulate an image of the future.” In other words, as Gaglio and Katz (2001) point out, this ability to discover an opportunity without extensive search is a skill. “Logically, the alert individual or entrepreneur must perceive the market environment correctly....; identify the true driving forces and critical factors; and infer the real relational dynamics among these elements...“ (Gaglio and Katz, 2001, p.97). As described, the skill of assessing the market situation correctly and the ability to translate the flash of insight into profitable product seems quite alike the description of entrepreneurial decision-making skills in the present study. To find out the relationships between these two constructs seems rather promising, since entrepreneurial alertness is one of the most highly debatable concepts in entrepreneurship research.
On the other hand, there exists a rival explanation of the cognitive nature of venture idea discovery; according to Fiet (2002), this is a result of a systematic search. The present study provides certain indications in support of this theory; however, further research is necessary before definite conclusions could be made.

Venture creation is another concept in entrepreneurship research that attracts much attention. As already mentioned, there is still little consensus among the entrepreneurship researchers concerning this concept. In the present study the process nature of venture creation has been disregarded. Rather, the investigation concentrates on the initial phase of the process (opportunity identification through creation, discovery or recognition), depending on the cognitive nature of the situation. Arguably, opportunity creation/discovery/recognition constitute only a part of venture creation process. Opportunities need to be converted into goods or services, brought to the market and sold profitably. Venture creation, entrepreneurial task, would embrace all these processes. An important question, though, is whether the venture creation process commenced by opportunity creation (i.e. under condition of ultimate uncertainty) would differ from venture creation commenced by opportunity discovery (medium uncertainty) and opportunity recognition (low uncertainty). Conceptual investigation of the existing theoretical treatment of venture creation and discovery of venture idea ("opportunity identification") will be the first step in creation and subsequent empirical (experimental) test of a venture creation model. This, in turn, can be expected to provide interesting and important results.

The present study involves two opposite (though not extreme) groups of entrepreneurs: experts and novices, who differ by their level of entrepreneurial expertise. The issue of expertise development, however, has not been addressed. It can be important to investigate judgement, learning and expertise – what entrepreneurial knowledge is and how it is applied. Similar, equally important issue is how entrepreneurs can acquire knowledge and how this knowledge acquisition and skill development can be improved (Shepherd, personal communication). If, as literature indicates, entrepreneurial expertise presumes creation of expert script(s) (cf. Mitchell and Chesteen, 1995), then proceduralisation of declarative knowledge and transfer of tacit knowledge would come into focus and ought to be investigated.

The post-hoc analysis described in Chapter 6 leads to several unanticipated but intriguing conclusions a) that business education appears to be strongly conditioning towards analysis; b) that expert entrepreneurs use intuition mostly in rejection, and analysis – in acceptance of a venture idea. However, as mentioned before, the analysis carried out involves a small sample and hence possesses little statistic power. Replication of the experiment with larger sample (and more pointed research questions) would increase power and substantially improve generisability. Presumably conditioning nature of business education should be addressed and either confirmed or disconfirmed, since it will have important implications for entrepreneurship education.
7. Conclusions and Implications

As already discussed, the present study is theory-driven; its major theory source is derived from cognitive psychology. This proved a fruitful approach; however, the theoretical and methodological basis of the future research can be substantially extended should a newly emerged framework, entrepreneurial cognition, become adopted. Entrepreneurial cognition is a relatively new area within the field of entrepreneurship based on entrepreneurship theory and empirical research as well as cognitive psychology.

Adopting entrepreneurial cognition as theoretical framework, and taking the results of the present study as points of departure, it is possible to suggest the following aims of investigation (Shepherd, personal communication):

− To gain a deeper understanding of judgement/decision-making of individuals involved in the entrepreneurial process including assessment policies, decision policies and behaviour, and judgement and learning. Contrast people who differ in entrepreneurial inclination, as well as contexts that are more and less entrepreneurship inducing.
− Assessment policies – the investigation of the criteria entrepreneurs use to make an assessment. The criteria used in the assessment, the nature of that relationship, and the relative importance of the assessment criteria. Also those of important stakeholders in the entrepreneurship process.
− Decision policies and behaviour – the investigation of how and why an entrepreneur decides or intends to act. Investigation of the criteria used, their relative importance, and the nature of the relationships. Also those of important stakeholders in the entrepreneurial process.

Proposed methods are expected to be mostly experimental, although methodological flexibility and variety is given much consideration. A common denominator is to supplement other research approaches, which focus solely on entrepreneurship as it occurs in “real life”. In the controlled laboratory environment, more “purified” situations can be created, which facilitates theory testing.

− Conjoint analysis and policy capturing represent experimental, real time data collection techniques that are well suited to entrepreneurship research. Conjoint analysis (also called “stated preference technique” in psychology research) refers to any technique that requires respondents to make a series of holistic judgements based on specially developed profiles provided by the researcher. From this series of judgements the respondents’ decisions can be “broken down” (decomposed) providing the researcher an opportunity to investigate the underlying structure of the decisions, i.e. what factors influence decisions and in what way. It collects data on the decision as the decision is being made. Another well established real time data collection technique, to give an example, is verbal (think aloud) protocol.
− Traditional experiment – randomisation of treatments across a sample.
Developing simulations and scenarios – a series of related scenarios are presented to capture changing and even emergent thought. In case when the nature of a decision situation is of especial importance and a field experiment is impossible, the situation can be simulated in the laboratory. This includes all kinds of simulations – from the simplest paper-and-pencil simulations to creating sophisticated computer-based microworlds.

The proposed research is reciprocal by nature, since it aims at theory creation, theory testing and method development. Contribution from theory and methodological rigour (both can be derived also from other disciplines) will lead to rigorously designed multifaceted experiments, involving complex simulations, if necessary. Their results, in turn, will lead to improved understanding of empirical phenomena that can translate into broadening of the theory, improvement in education and development of normative advice for the practitioners. Let us now discuss a few examples of research attempts, which have more direct implication to education and practice than the previously described projects.

Development of normative advice for practitioners is an important and at times overlooked contribution. Entrepreneurship research is sometimes regarded as descriptive only; however, it is not about trying to find out about current practice. This is a very narrow and delimiting view, which sentences entrepreneurship research to always lag behind entrepreneurship practice (Davidsson, 2002).

It is possible to argue that entrepreneurship research should take on a greater challenge than that; stop being entirely descriptive and start being (at least, to some extent) normative (Davidsson, 2002). Entrepreneurship research projects can ultimately provide important cues enabling researchers to predict what will happen on the market as a consequence of demographic, cultural, socio-economic, and technological changes. Making prediction of this kind is the same as pointing at entrepreneurial opportunities. To study what successful entrepreneurs have done is important, but an even more important and interesting question is what could be done right now, before somebody else pre-empts an opportunity that is open at this very moment. Entrepreneurship scholars should be able to answer this question, and be able to translate the answer into normative recommendations for practitioners, and this is another implication of the present study. And, finally, but not the least important, entrepreneurship educators could emphasise developing such skills among their students. In the long run one more implication of the present study is providing a doer training, which makes students not only smart critics, but competent actors (Davidsson, 2002).

An example of such a project possessing high practical value can be a replication of Hammond et al.’s (1987) study. To conduct the study the researchers created and used very precise indices of task uncertainty. Creating similar indices for entrepreneurial tasks could become an important aid for the practitioners enabling the increased level of awareness about the uncertainty level. In other words, while assessing a venture idea entrepreneurs could use an analytical tool instead of relying solely on their own experience.
And yet, such a highly analytical approach holds potential pitfalls, since eventual faults in the analysis tend to cause much more severe consequences compared to faults of judgement (misdirected intuition) (Hammond et al., 1987). Bearing this in mind, an opposite approach can be suggested. If assessment of a market situation is a skill (as has been proved in the present study), it can be also improved not analytically but heuristically. In other words, expert entrepreneurs could hone their skills and novice entrepreneurs can become experts in a somewhat similar way as chess players, pilots or intelligence agents. Through participation in carefully constructed simulations entrepreneurs become exposed to an extensive variety of market situation, which should enable development of relevant cognitive schema and increase of entrepreneurial decision-making skills.

7.2.2. Implications for education and practice

Finally, can any practical recommendations be derived from the results of the present study? The answer, albeit tentative, is nevertheless affirmative. As the results pointed out, expert entrepreneurs are doing quite well, and their decision-making is quite close to optimal. Novices, on the other hand, are rather prone to excessively analytical behaviour, which may potentially lead to sub-optimal decisions. In other words, this is the situation assessment skills, which differentiate experts from novices, and potential practical recommendations should facilitate its development.

Developing expert skills requires time; according to Ericsson and Smith (1991) as much as seven to ten years regardless of the area of skill acquisition. Yet, as far as entrepreneurship is concerned, acquiring superior decision-making skills in the domain would imply exposure to a variety of business settings, in which potential discoveries of a venture idea may occur. In other word, in order to become an expert, a novice entrepreneur should encounter situations from the whole range of the task continuum (from highly uncertain to quite certain), and acquire tacit knowledge (or develop cognitive schemata) concerning the optimal behaviour in each situation.

Logically, a successful teaching strategy should then aim at increasing novices’ exposure to the maximum variety (uncertainty-wise) of entrepreneurial situations. If students are trained for one type of situations only (be they analysis-inducing or intuition-inducing), the education would be of little use. In such a case the students can hardly develop the skill of situation assessment, and their decisions in unfamiliar situations are likely to be inadequate.

Success in training across a variety of situations can be achieved through simulations. As discussed in Chapter 4, different simulation settings, from behavioural simulations to microworlds, are able to provide entrepreneurial situations within the whole range of the task continuum. Moreover, such situations can be rigorously constructed and calibrated, the latter being highly important for the education purposes. And, the last but not least, upon completion of a simulation task the novices will be provided with the most detailed (if necessary) feedback. Since knowledge is acquired and skills are developed only on the basis of feedback, this feature of simulated tasks makes them indispensable in entrepreneurship education.
Apart from simulations, there are other ways to achieve this goal, e.g. pairing novices and experts, as has been demonstrated by Mitchell and Chesteen (1995). When management undergraduates were provided an access to expert entrepreneurs’ cognitive schemata (by observing the experts decision-making and discussing it) their decision-making behaviour became much more optimal compared with the decision-making behaviour acquired from traditional business education. So, providing novice entrepreneurs (entrepreneurship undergraduates or non-university novices) with an expert mentor seems to be potentially fruitful and relatively easy way of facilitating development of entrepreneurial decision-making skills.

One of the most important questions in entrepreneurial education concerns the possibility to teach students to identify an opportunity. Indeed, opportunity identification is the initial stage of venture creation, which often occurs in the setting of high uncertainty. Whether opportunity identification can be taught was investigated by Saks and Gaglio (2002).

The researchers conducted one-hour telephone interviews with fourteen professors in entrepreneurship teaching a master level course which should cover the concept of entrepreneurial opportunity and discuss the process of its identification. Most of the respondents possess substantial teaching experience; yet their personal experience in opportunity identification varies from none to extensive. All respondents have been asked whether, in their opinion, opportunity identification can be taught, and how (Saks and Gaglio, 2002).

Many respondents see their task as teachers in either creating environments which would induce entrepreneurial behaviour or facilitating entrepreneurial schema development in students. Thus these observations provide an indirect support to the conclusions of the viability of “entrepreneurial mentorship” and teaching with the help of simulations.

Yet there is still a question about the role of declarative knowledge in the entrepreneurship education. In the author’s opinion providing the knowledge of facts and developing analytical skills (e.g. business planning) can be by no means ignored. Indeed, as demonstrated in the discussion of the expertise development (see Chapter 2), the expert intuition is based on extensive knowledge, both declarative and procedural (knowledge of facts coupled with skills). Moreover, a number of entrepreneurial situations are either quasi-rationality or analysis-inducing and thus require analytical skills or ability to use professional heuristics or combination of both.

Some entrepreneurship researchers also hold an opinion that opportunity identification should not be regarded as a more or less serendipitous flash of insight, but as a systematic search. This view is clearly expressed Fiet (2002), who has experimentally confirmed that providing students with the extensive knowledge as well as teaching them how to conduct systematic search would substantially increase their chances to discover a venture idea.

However, the author of the present study does not regard these two approaches as controversial, but rather perceives them as complementary. A summary of different teaching methods and education forms in entrepreneurship with their theoretical
7. Conclusions and Implications

background as well as contribution to development of entrepreneurial skills is found in Table 7.2:

Table 7.2. Different forms of entrepreneurship education

<table>
<thead>
<tr>
<th>Teaching method</th>
<th>Theoretical background</th>
<th>Contribution to skill development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical reading (classical method)</td>
<td>Acquiring declarative knowledge</td>
<td>Enables acquisition of analytical skills; predisposes development of sound judgement (use of intuition skills). Usually disregards cognitive nature of the task and therefore requires subsequent training through participation in simulated tasks.</td>
</tr>
<tr>
<td>Reading business cases (classical method in management/entrepreneurship education)</td>
<td>Acquiring professional heuristics (declarative knowledge)</td>
<td>Predisposes development of situation assessment skill; does not explicitly consider cognitive nature of the task and therefore requires subsequent training through participation in simulated tasks.</td>
</tr>
<tr>
<td>Systematic search for opportunity (Fiet)</td>
<td>Increases sensitivity to possible misbalances/opportunity sources</td>
<td>Trains analytical skills.</td>
</tr>
<tr>
<td>Participation in simulated tasks of varied complexity and uncertainty (present study)</td>
<td>Increases exposure to entrepreneurial tasks of varied uncertainty; facilitates development of cognitive schema</td>
<td>Enables development of all entrepreneurial skills: situation assessment, use of intuition, analysis and professional heuristics in relevant task conditions. Must include extensive feedback.</td>
</tr>
<tr>
<td>Entrepreneurial mentorship (Mitchell and Chesteen)</td>
<td>Facilitates development of cognitive schema</td>
<td>As above; success depends on the degree of maturity of mentor’s schema. Should include feedback/debriefing.</td>
</tr>
</tbody>
</table>

Summing up, it is possible to conclude that what novice entrepreneurs require is knowledge of facts, as well as acquisition of various skills: of analysis, on the one hand, and of situation assessment, on the other. Also they need to acquire professional heuristics and develop the ability to use them. And there are very many ways through which this knowledge and be acquired and skills can be developed, be it entrepreneurial mentorship, systematic search, or creation of a simulated venture. Success of future entrepreneurs is fostered by providing stable and reliable theoretical grounds, as well as by introducing rigorously tested methods of education and research.
7.3. Limitations of the study

Although the study demonstrates strong support to the theory, the instances when the subjects’ behaviour deviates from theoretically predicted are clearly observable. Exploring these deviations in Chapter 6 we have been able to make some interesting tentative conclusions. Let us consider these deviations again in order to try and find the reasons as well as possible sources for their occurrence.

In general, deviations of the observed phenomena from theoretically predicted results can appear due to three reasons: faulty theory, drawbacks in methodology and faults in data collection.

7.3.1. Limitations of method

Unfortunately, there is no warranty for a study to be completely free from method faults. No empirical study is perfect; however, questionable reliability (consistency or stability of a score from a measurement scale) and validity (evidence that the measurement actually measures what it was supposed to) would substantially undermine the trustworthiness of the report results. In general, potential threats to these constructs are counteracted through triangulation, i.e. the use of multiple research methods in data analysis; use of multiple respondents or multiple data sources (Chandler and Lyon, 2001).

There are several factors in the present study, which may cause potential threats to reliability and validity. First, being an experiment, the study was carried out not in the field but in the laboratory through a paper-and-pencil simulation using specially constructed choice scenarios. Second, verbal protocol analysis, as any method of content analysis, is subject to subjective interpretation from the researcher during the process of analysis (coding).

In order to counteract these threats the following measures were taken:

− Theoretical and empirical grounding of scenarios. Experimental scenarios for all tasks were constructed according to strict theoretical premises and than evaluated by a panel of highly experienced entrepreneurs and managers, in order to establish their external validity. More detailed discussion about scenarios construction and evaluation is provided in Chapter 4.

− Moreover, it should be mentioned that the use of paper-and-pencil simulations in general and choice scenarios in particular is an established method of decision-making research providing high reliability and validity (cf. Gaglio and Katz, 2001; Elliot and Archibald, 1986; Highhouse and Yuce, 1996; Kahneman and Tversky, 1979).

− Validation of coding of verbal protocols. It must be pointed out that although analysis of verbal protocols is also an established and legitimate method of researching cognitive processes, and is now used in both cognitive psychology and entrepreneurship, there is still little consensus among the researchers concerning
7. Conclusions and Implications

the validation of coding, as has been discussed in detail in Chapter 4. As has been mentioned already in the present study 25 per cent of the protocols were re-coded by an external re-coder; the results of this procedure were discussed with the author and incorporated in the analysis.

− Triangulation. Two major means of triangulation were used in the present study: collecting data from multiple participants and using several methods of data analysis. All together 55 expert and novice entrepreneurs participated in the study and provided 147 verbal protocols for all decision-making tasks. To the author’s best knowledge this is the largest amount of verbal protocols actually used for coding and analysis in entrepreneurship research, as it yielded totally 3500 cognitive chunks (smallest meaningful units being coded). This richness of empirical data enabled successful use of statistical methods of analysis, both parametric and non-parametric. As we could see in Chapter 5, statistical analyses demonstrated clear trends and significant results in support of the theory.

It should be also pointed out that the results of the post-hoc exploratory analysis possess rather low statistic power due to the low number of participants. Further research with larger sample should be carried out in order to find out a) whether university education in business administration is indeed strongly conditioning towards analysis and b) if expert entrepreneurs’ cognitive behaviour is more prone to analysis while accepting a venture idea and more prone to intuition while rejecting it.

7.3.2. Data collection drawbacks

Another source of potential discrepancies between observed and predicted results is data collection drawbacks. For the present study this means, first and foremost, sampling faults.

The theory-driven nature of the study presupposes a special way of sampling: theoretical sampling rather than statistically representative (Denzin, 1989). All potential participants have been first categorised into population of expert and novice respectively; then each group (especially experts) is described in accordance with the theory; whenever possible, the expert and novice participants are matched. More detailed discussion of sampling is provided in Chapter 4. It should be also mentioned that the mixed groups design employed in the study is quite powerful in detecting within group variances (Neale and Liebert, 1986). In the present study this indeed happened with the group of novices; however, the heterogeneity (within group variance) was detected and lead to further exploratory analysis and interesting conclusions described in Chapter 6.

The problem also was that the strict theoretical sampling criteria were very hard to translate into actual procedure. Even though the region of Jönköping is by right considered one of the most entrepreneurial in Sweden, a lot of long-term entrepreneurs (experts were recruited from this group) in the region would not meet sampling requirements due to a) traditionally low level of education and b) non-innovative nature
of their businesses. In order to comply with the theory-based sampling criteria the au-
author undertook careful screening and only those entrepreneurs who matched the theo-
retically established profile were approached. Another measure was to recruit partici-
pants not only locally but also nation-wide. In this case the protocols were collected
via telephone.

Another sampling problem was a low response rate; at times as low as 10 per cent
(which is rather unusual for Sweden) with the average of 12 per cent for the experts.

Finding novices was somewhat easier, since their theoretical profile was not as
strict. The majority of novices in the study were recruited from JIBS students of Busi-
ness Administration and start-ups at Jönköping Science Park. However, since recruit-
ing only students with business training would inevitably bias sampling, efforts were
made to find and recruit novices without previous business training.

As a result, the experiment participants were neither absolute experts, nor absolute,
or naïve, novices. This situation, however, is typical for any research in social science.
Experts and novices are mere theoretical constructs and a researcher cannot expect to
find these ideal types among real individuals. Yet the fact that no extreme groups (ab-
solute novices or absolute experts) were recruited as the study’s participants could in-
crease its genericability. In behavioural context extreme groups may provide high effect
size but low representativeness (Neale and Liebert, 1986). In the present study neither
experts, nor novices were recruited from the extreme populations.

It is then possible to conclude that substantial efforts were made to increase the re-
liability of the study and to validate its results and conclusions.

7.3.3. Theory drawbacks or “they have it all wrong out there”

A somewhat sarcastic insider joke about “faulty” empirical phenomena departing from
“correct” theoretical predictions does contain a grain of truth, especially if social sci-
ence is concerned. Indeed, social phenomena, due to their extremely complex nature
always deviate, to some extent, from theoretically predicted results and models. Ex-
pecting one hundred per cent theory compliance can be considered at best a naïve and
at worst an extremely rigid approach.

In the present study the deviations become clearly observed when we consider the
results of two hypotheses testing: the Hypotheses 1c and 2b being disconfirmed and
marginally confirmed, respectively.

As we remember, the Hypothesis 1c claims novices’ decision-making being fixed,
non-adaptable. This conclusion seems justified, since the preceding Hypothesis 1a,
which states that novices employ predominantly analytical decision-making, finds
support. Nevertheless, somewhat paradoxically, even novices do adapt their behaviour
to the nature of the task.

Similarly, neither do experts demonstrate decision-making which can be absolutely
clearly categorised. According to the theory, in quasi-rationality-inducing tasks the use
of heuristics should be significantly higher, as is stated by the Hypothesis 2b. How-
ever, the hypothesis becomes only marginally supported since it is used to a signifi-
cantly different extent only as compared to intuition, and not as compared to analysis.
7. Conclusions and Implications

As for analysis is concerned, the experts indeed demonstrate it as dominant cognition in the analysis-inducing tasks; and this result is statistically significant. However, the analysis is present in 56 per cent of all cognitions; theoretically speaking, this amount can be expected to be higher.

Another deviation not reflected in any hypothesis but demonstrated in the course of the study is the presence of intuition not only in the intuition-inducing task, but also in the quasi-rationality and analysis-inducing tasks, as was not foreseen by the theory.

So, the question begs itself: do the subjects behave “wrong” or should the theory be adjusted? The answer, unfortunately, is anything but self-evident; in fact, this is one of the most hotly debated issues in social science, and it depends, to a high extent, on the researcher’s epistemological standing and, consequently, on the descriptive or normative nature of the theory.

As has been already discussed in Chapter 2, the Naturalistic decision-making paradigm, which provides theoretical framework for the present study, is rather permissive in its assessment of “natural”, unaided decision-making. Unlike its predecessors in cognitive psychology/decision-making theory, NDM does not claim naturally occurring decision behaviour being inherently inferior to the learned (implied analytical) one. Yet being so permissive, the paradigm nevertheless does not deny usefulness of normative theories and models, which it can easily incorporate within itself.

Such is the case of the cognitive continuum theory and its corollary, correspondence-accuracy principle. Both are, in fact, normative, and have been tested as such. As we remember, the correspondence-accuracy principle was tested by its founder Kenneth Hammond (Hammond et al., 1987) with the group of expert highway engineers. Unlike the present study, Hammond’s subjects were not free to choose a decision-making mode for the task. All subjects in Hammond’s study were to perform all tasks using all three decision-making modes in each task. Analytical decisions involved calculating a formula; quasi-rational decisions meant using a combination of well-known professional heuristics and some calculations; intuitive decisions were to be expressed through a judgement. As for the tasks, the analysis-inducing one was to calculate the traffic capacity of a certain part of a highway; in the quasi-rationality-inducing task the subjects were to evaluate how dangerous a part of a highway was, and in the intuition-inducing tasks the subjects were to give their judgement about the aesthetic appeal of the highway. So, the subjects were supposed to calculate a formula (analytical decision-making), to use professional heuristics (quasi-rational decision-making) and to give a judgement (intuitive decision-making) in each and every task: while evaluating traffic capacity (analysis-inducing task), assessing danger (quasi-rationality-inducing task) and judging the aesthetic appeal of the road (intuition-inducing task). All the nine results were subsequently measured and evaluated; only then could the researcher draw the conclusion about correspondence-accuracy principle being true. Indeed, the optimal results were achieved when the subjects were able to use the decision behaviour corresponding to the nature of the task. Hence, both cognitive continuum theory and correspondence-accuracy principle can be legitimately defined as normative constructs.
We do not know, however, how the subjects in Hammond et al.’s (1987) study would behave were they free to choose any decision-making mode in each task. This was the question raised in the present study: whether expert entrepreneurs by virtue of their decision-making skills would recognise the cognitive nature of the task and employ the correspondent decision-making mode. In other words, the study aimed not only at testing the normative theory, but also at describing the naturally occurring cognitive behaviour of the expert (and novice) subjects; all in strict accordance with the naturalistic decision-making paradigm.

That much being told, it becomes easier to understand why the subjects’ observed behaviour deviated from the theoretically predicted. When a normative theory is applied to a descriptive study in the social context, such a (slight) deviation is bound to occur.

An alternative explanation, especially concerning the experts’ behaviour in analysis-inducing tasks is also possible. There exists evidence that entrepreneurs are prone to escalation bias, also called escalation of commitment in re-investment decisions (McCarthy, Schoorman and Cooper, 1993; Juliusson, 2003). In other words, facing low returns or even direct losses from their businesses, entrepreneurs would continue investments instead of discontinuing it as financial analysis would demand. In terms of CCT we can define the situation as quasi-rational behaviour (escalation bias) being applied to an analysis-inducing task (investment decision).

Still, the question remains: is it the theory or the subjects’ behaviour to be adjusted? Or, in other words, is the best practice always the best?

Here, as the research enters the realm of its practical implication a word of caution seems quite in place. Conclusions of a research report make difference; according to Davidsson (2002) a misdirected normative advice from an entrepreneurship researcher to a practitioner or a policy maker can indeed cause much harm.

Paradoxically, as Davidsson (2002) makes clear, one of the reasons for this damage to occur is an uncritical translation of the entrepreneurs’ empirical behaviour into normative recommendations. The “best practice” understood as “average expert behaviour” is quite often good enough and quite seldom optimal. This conclusion finds support in numerous findings of decision-making theory discussed in Chapter 2.

Thus, even if researchers ought to, in a way, speak with a guarded tongue, they should not, as the author of the present study firmly believes, refrain from providing normative advice or supporting a normative theory. Moreover, following Davidsson (2002, p.22) the author is quite convinced that one of the researcher’s most important tasks is to convey the generalised research-generated abstract knowledge to practitioners through “normative advice based on theory-based implications of technological, cultural, socio-economic, demographic and institutional changes”.

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7.4. Summary: a tale of entrepreneurship

Eighty years ago driving a motor car has been an endeavour for the chosen few. Nowadays flying a private airplane might be considered just as extravagant, adventurous, not to say foolhardy.

Starting up and running an own company – being an entrepreneur – is, in the popular mind, probably still closer to flying an own jet than to driving a steady, reliable family car. Mostly, because the consequences of business accidents are dire; a missed opportunity or a wrong venture idea may easily lead to a failure, which often means loss of jobs for the company employees and a personal bankruptcy for the owner. In some countries a once sustained bankruptcy would bring the social stigma of a loser for the rest of an entrepreneur’s life, which is often accompanied by substantial difficulties in starting another business.

Can failures be avoided? Should they? Are bankrupts indeed good-for-nothing losers never again to be trusted or heroes, who have learned their lessons the hard way?

Dealing with uncertainty, whether great or small, lies in the very core of entrepreneurship. By definition, there are no recipes; people have to learn how to run a business by running it and making mistakes. But do they indeed have to make so many mistakes? And so severe?

Let us develop the driving analogy. Compared with the situation eighty years ago the cars have become much more numerous, fast and potentially dangerous. Yet the driving has become much more common and safe – all due to education. Nowadays potential drivers is obliged to learn, before they are allowed to handle the car on their own, that driving along a quiet country road on a fine summer day is quite different from driving on a heavily trafficked, frosty highway. Before receiving a driving licence a person becomes exposed to a broad variety of imaginable traffic conditions – in order to learn the correct behaviour in different situations.

Arguably, very similar things happen to entrepreneurs. As the present study has shown, running a business might involve very different situations, from highly uncertain to almost certain, which would induce different decision behaviour. Moreover, as the study has demonstrated, experienced and successful entrepreneurs are quite capable of such behaviour. They would recognise the nature of an entrepreneurial situation and make adequate decisions.

This is, then, not far fetched to say that, like driving, entrepreneurial decision-making is a skill. People are taught to recognise the nature of a traffic situation; modern education saves novice drivers from dying in an accident during their virgin ride. Then, given time and practice, almost any novice can become a skilful driver. Similarly, people can be taught to recognise the nature of a business situation; ideally, business education should enable young entrepreneurs to successfully run their first company. Then, given time and practice, an entrepreneur can become an expert; the previously received education would protect him or her from failure as much as a novice driver is protected from a fatal road accident.

This study makes just one of the first steps on the long and exciting road. However small, this step is nevertheless of importance: we know now that, despite their almost
indefinite variety, business situations can be divided into categories inducing distinct decision-making patterns. We also know that experienced entrepreneurs, unlike novices, are able to discern these categories and make appropriate decisions. And, finally, we know that this ability is not an inborn aptitude but a skill to be taught and learned.

Entrepreneurship matters. The author firmly believes that it matters immensely. True, not everybody aspires to run an own business, but the more companies exist, the higher is the possibility to find another job if one is unhappy with the current. And for those who wish to be their own bosses, possibilities might be endless: from merely providing for their families to making their innermost dreams come true. Ultimately, entrepreneurship is about making one’s own life. Independence makes people free.
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References


# Appendix A

Q-sort for evaluation of scenarios; panellist AL.

<table>
<thead>
<tr>
<th></th>
<th>“Invention”</th>
<th>“Computer game”</th>
<th>“LBO”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cues are too few; impossible to make a decision (I)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cues are numerous but most of them irrelevant (I)</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Cues cannot be measured objectively (I)</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Situation is perceived as a coherent whole; it’s impossible to analyse its components. (I)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It’s impossible to find the organising principle for the cues (I)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am confident in my answer although I don’t know how I got it (I)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not enough cues; difficult to make a decision (QR)</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Cues are numerous, both relevant and irrelevant (QR)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some cues can be measured objectively, other cannot (QR)</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Situation is perceived as a coherent whole, but it is possible to see its components. (QR)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It’s possible to see the organising principle for its components (QR)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I’m quite confident in my answer and can explain how I got it (QR)</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Cues are few and all are relevant (A)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cues are numerous but decision is easy to make since all are relevant. (A)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cues can be measured objectively (A)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Components are easy to recognise (A)</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Organising principle is self-evident (A)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is just one correct answer and I can explain how I got it (A)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes to A.L.: more data on LBO, soft market data — what kind of company is Goswell, how good they are as consultants, their “rate of success”. Asks for Goswell’s estimated price. (Tries to make situation more “intuitive”? Looks for familiar cues—> Tries to use own cognitive schema?) Doesn’t like the word “ledtrådar”, because it makes the situation to a quiz. Suggests “upplysningar”. Has no formal university education.
Appendix B

SAMPLING QUESTIONNAIRE

Entrepreneur

1. When are you born?
2. When have you started your first business?
3. What is your education?
   a) Primary school 6 yrs
   b) “Technical school” (realskola)
   c) Secondary school 9 yrs
   d) High School ≤ 2 yrs. Subjects studied?
   e) High School 3 yrs. Subjects studied?
   f) College/University bachelor (3yrs or less)
   g) College/University master (3+ yrs)
   h) Postgraduate (PhD)
4. Have you studied business administration/entrepreneurship/economics?
5. Have you participated in “business start-up” courses?

Business:

6. How many businesses have you started (alone or as a partner)?
7. How many businesses do you profitably run at present?
8. In what industries/branches?
9. How often do you introduce the following innovations (please mark the most suitable):
   a) New products?
   b) New technology?
   c) New markets?
   d) New sources of raw material?
   e) Changes in organisation structure? Why?
10. a) How many employees have all your businesses together ever had?
    b) How many employees do all your businesses have at present?
11. a) What was the largest turnover of all your businesses together?
    b) What is the turnover of all your businesses at present?
Appendix C

Example of coded verbal protocol; E9

Legend: R = researcher; HL = the entrepreneur’s initials

Intuitive chunks are in italics;

Quasi-rationality is bold;

Analysis is underlined;

Chunks are separated by //

TASK 1

R: We talk about this invention – the screen; yes, it exists.

HL: I don’t have to evaluate… I don’t have to… Is it in the market yet?

R: I’m not sure. To be honest, I did not check it.

HL: No, no. So you want to know if I believe it’s a good idea… and how it could be used.

R: If you would invest in it and if “yes” then… how… if “now” – why.

HL: If it works… as it says in here… then… I would say – wonderful idea! // Because… it’s the way with the development – it must continue, and the new… new things must come… which just come and come… // In this case, then… just because it doesn’t take place, I think, it’s important. And it could resolve a lot… // It’s possible to see – e.g. on board a plane. // Now there are many tiny screens in the seats, but in this case nothing of the kind will be needed. // It would be possible to solve… Besides, I believe… the space, since people live so crumpled, there’s not much space… in the homes… // So, it’s not that relevant in Sweden, but it’s coming to this, as in other countries. Then space will be important. // Then there’re always
some... a group who think the latest... latest technology must develop. Those...
I think you can cater to them. // I can also imagine how this could be used for
teaching; at the hospitals and so on... // You can have people... everybody can
watch TV without disturbing others. // Had I been in the industry, I would have
had the means, too... I would have invested in the project. // But not on my own
– it's too large an investment... // You would need some kind of joint venture, I
believe. // And then you could think how to market it.

R: And how would you like to market it?

HL: There're several segments in this. // First, it's kind of – consumer... con-
sumer games... use for pleasure... // Then, more seriously – within... you can
use it for teaching, probably. // And also... it's important... that it's quiet. // Oh,
well, quiet – I don't know, but... // What do they say about the sound?

R: Nothing.

HL: I believe it's possible... // At any rate, the picture is not supposed to disturb
others... // There are different segments and... // You could see and test the custom-
ers... who would give most money. // There's high-tech with is used for that purpose
which is later used... less seriously, as consumer... if it's more profitable. // You have
to investigate.

R: OK. Thank you very much. It's not that scary, you know. You should just reflect
on it... and be spontaneous, kind of.
TASK 2

HL: You want to know if this… If this is a good idea?

R: Yes, this one about computer game. If you would invest.

HL: Well… Though, I don’t know… what I’d like to know here… it’s so… if
there’s something of the kind in the market yet…//

R: It’s another question.

HL: That’s why… as it happens today, it’s…// you can download much faster, and
you can use stuff directly from the Net.// If there’s something of the kind in the
market yet… not Swedish, but the international market…// In this case it
wouldn’t be…// I would think so… and I would invest, depending on how much
money they need…// And then you could… set together this game… that is,
make it XXXXX…// You could launch it as… as it is here – the intellectual
game… by promoting it, maybe, with… I don’t remember what you call it…
those who have IQ over… //

R: That’s Mensa.

HL: Yes, exactly. //Connect to them in some way… and then make a jippo of it…
//You should, kind of, promote the higher age groups… a little…// So that eve-
eybody… who wants to appear intelligent, so to speak… They should think,
that’s the thing. // And then you should get a little… quite a lot… media and
stuff on that…// yes, media, and you should … add the new bits yourself…// It
should not be kind of game that you just buy and install… it should be a new
club, some organizing force, in a way. So that they develop this intellectual
game all the time, probably... kind of groups who play against each other. But
you should not... you should not make it... to children's play, or to teenagers' but
you should bring it up to other age groups. Because there is a little more money
there, and not just once, but... Then it will be a service, then it's an idea, and a new
product. I think so.

So I would probably invest, depending on how much money they needed, and how
much... they were willing to develop this part.

R: It was nice to hear.

TASK 3

HL: I have to evaluate... If Persson should sell to Svensson?

R: Both and. And if Svensson should buy. If it's a reasonable thing for him to do.

HL: The question is then... Vestra can get by without Goswell. That's the ques-
tion, then. Should Svensson buy Goswell, he would run it most successfully, I
think. Make profit. But... it wouldn't be... the company would not be on the
stock exchange.

R: Indeed?

HL: I think it will be too small to be present... So to speak. If he doesn't
want... that it's considered among smaller companies... It depends on what
Svensson wants to do with Goswell... he would probably... Since it's a consul-
tancy firm...// I believe Svensson should... run Goswell successfully. As an own company. // You don’t have to go public if you run it as a consultancy firm... with... with the stuff he has. // On the other hand I don’t know if Vestra would... get by without Goswell.// So you should, actually, find out what they are... // Because Goswell makes quite a lot... of Vestra...// Without own capital – this was Vestra’s, actually.// I don’t know... I can’t give an answer.

R: OK. But... You’ve mentioned – Svensson would get by, but for Vestra it’s different.

HL: Yes, it’s too big. // Besides, I’m not that experienced, when you come so high.//

R: But why do you think Svensson would be successful with Goswell?

HL: Because I think he is... // He is, you know... as I understand, he was hired to start up Goswell, so he’s the entrepreneur who has run the show. And it’s kind of own company for him.// So I believe he’s an entrepreneur and it’s the size that makes it manageable. //

R: OK. Thank you very much.
Appendices

Appendix D

Cognitive charts of a novice receiving business education:
E24 - novice
Legend: 0 = intuition; 1 = quasi-rationality; 2 = analysis

Task 1, intuition-inducing: venture idea found

Task 2, quasi-rationality-inducing: venture idea rejected

Task 3, analysis-inducing: venture idea found
Appendix E

Cognitive charts of a novice receiving non-business education

E51 – novice

Legend: 0 = intuition; 1 = quasi-rationality; 2 = analysis

Task 1, intuition-inducing: venture idea rejected

Task 4, analysis-inducing: venture idea found
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