THE UNIVERSITY OF WARWICK

Library Declaration and Deposit Agreement

1. STUDENT DETAILS

Please complete the following:

Full name: LEONIE BALDACCHINO

University ID number: 1064285

2. THESIS DEPOSIT

2.1 I understand that under my registration at the University, I am required to deposit my thesis with the University in BOTH hard copy and in digital format. The digital version should normally be saved as a single pdf file.

2.2 The hard copy will be housed in the University Library. The digital version will be deposited in the University's Institutional Repository (WRAP). Unless otherwise indicated (see 2.3 below) this will be made openly accessible on the Internet and will be supplied to the British Library to be made available online via its Electronic Theses Online Service (EThOS) service.
[At present, theses submitted for a Master's degree by Research (MA, MSc, LLM, MS or MMedSci) are not being deposited in WRAP and not being made available via EthOS. This may change in future.]

2.3 In exceptional circumstances, the Chair of the Board of Graduate Studies may grant permission for an embargo to be placed on public access to the hard copy thesis for a limited period. It is also possible to apply separately for an embargo on the digital version. (Further information is available in the *Guide to Examinations for Higher Degrees by Research*.)

2.4 *If you are depositing a thesis for a Master's degree by Research, please complete section (a) below. For all other research degrees, please complete both sections (a) and (b) below:*

(a) Hard Copy

I hereby deposit a hard copy of my thesis in the University Library to be made publicly available to readers ~~(please delete as appropriate) EITHER~~ immediately ~~OR after an embargo period of .... months/years as agreed by the Chair of the Board of Graduate Studies~~.

I agree that my thesis may be photocopied. YES / ~~NO (Please delete as appropriate)~~

(b) Digital Copy

I hereby deposit a digital copy of my thesis to be held in WRAP and made available via EThOS.

Please choose one of the following options:

~~EITHER~~ My thesis can be made publicly available online. YES / ~~NO (Please delete as appropriate)~~

~~OR My thesis can be made publicly available only after.....[date] (Please give date)~~
~~YES / NO (Please delete as appropriate)~~

~~OR My full thesis cannot be made publicly available online but I am submitting a separately identified additional, abridged version that can be made available online~~.
~~YES / NO (Please delete as appropriate)~~

~~OR My thesis cannot be made publicly available online. YES / NO (Please delete as appropriate)~~

3. GRANTING OF NON-EXCLUSIVE RIGHTS

Whether I deposit my Work personally or through an assistant or other agent, I agree to the following:

Rights granted to the University of Warwick and the British Library and the user of the thesis through this agreement are non-exclusive. I retain all rights in the thesis in its present version or future versions. I agree that the institutional repository administrators and the British Library or their agents may, without changing content, digitise and migrate the thesis to any medium or format for the purpose of future preservation and accessibility.

4. DECLARATIONS

(a) I DECLARE THAT:

- I am the author and owner of the copyright in the thesis and/or I have the authority of the authors and owners of the copyright in the thesis to make this agreement. Reproduction of any part of this thesis for teaching or in academic or other forms of publication is subject to the normal limitations on the use of copyrighted materials and to the proper and full acknowledgement of its source.
- The digital version of the thesis I am supplying is the same version as the final, hard-bound copy submitted in completion of my degree, once any minor corrections have been completed.
- I have exercised reasonable care to ensure that the thesis is original, and does not to the best of my knowledge break any UK law or other Intellectual Property Right, or contain any confidential material.
- I understand that, through the medium of the Internet, files will be available to automated agents, and may be searched and copied by, for example, text mining and plagiarism detection software.

(b) IF I HAVE AGREED (in Section 2 above) TO MAKE MY THESIS PUBLICLY AVAILABLE DIGITALLY, I ALSO DECLARE THAT:

- I grant the University of Warwick and the British Library a licence to make available on the Internet the thesis in digitised format through the Institutional Repository and through the British Library via the EThOS service.
- If my thesis does include any substantial subsidiary material owned by third-party copyright holders, I have sought and obtained permission to include it in any version of my thesis available in digital format and that this permission encompasses the rights that I have granted to the University of Warwick and to the British Library.

5. LEGAL INFRINGEMENTS

I understand that neither the University of Warwick nor the British Library have any obligation to take legal action on behalf of myself, or other rights holders, in the event of infringement of intellectual property rights, breach of contract or of any other right, in the thesis.

Please sign this agreement and return it to the Graduate School Office when you submit your thesis.

Student's signature: ....[redacted]...................... Date: ...30 MARCH 2013...

JHG 05/2011

ENTREPRENEURIAL EXPERIENCE

AND OPPORTUNITY IDENTIFICATION:

THE ROLE OF INTUITION AND COGNITIVE VERSATILITY

by

Leonie Baldacchino

A thesis submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

Warwick Business School
UNIVERSITY OF WARWICK

March 2013

INVESTING IN YOUR FUTURE
EUROPEAN SOCIAL FUND
MALTA 2007-2013

The research work disclosed in this publication was partially funded
by the Strategic Educational Pathways Scholarship (Malta).
The scholarship is part-financed by the European Union – European Social Fund (ESF)
under Operational Programme II – Cohesion Policy 2007-2013,
'Empowering People for More Jobs and a Better Quality of Life'.

Operational Programme II – Cohesion Policy 2007-2013
Empowering People for More Jobs and a Better Quality of Life
Scholarship part-financed by the European Union
European Social Fund (ESF)
Co-financing rate: 85% EU Funds; 15% National Funds

Investing in your future

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

for my loved ones

because without you, this would not be

ACKNOWLEDGEMENTS

This PhD has been a journey of enlightenment and self-fulfilment, however, it was not without its challenges. For their role in enabling me to see this project to fruition, there are many people I would like to thank.

Sincere gratitude is due to my exceptional supervisor, Professor Deniz Ucbasaran, and to my co-supervisors Professor Andy Lockett and Dr. Laure Cabantous, for their guidance, support and dedication throughout the course of this research.
Deniz, thank you for sharing your expert scholarship with me, for our endless conversations, for your direction and mentorship. Thank you for being not only someone I could turn to, but also someone I could look up to.
Andy and Laure, thank you for your invaluable suggestions, for your engaging discussions, for your formative feedback.
It has been a privilege to work with all three of you.

Heartfelt thanks are due to my precious family and dear friends, for their cherished support, patience and encouragement. A special mention goes to:
My beloved Mum and Dad – thank you for believing in me, for investing in me, for supporting me. Thank you for nurturing my love of books and thirst for knowledge, and for teaching me the value of hard work and perseverance.
My dear sisters Marisa, Arlette and Joanne, and my dear brother Ricky – thank you for always being there for me, in many more ways than I could ever mention.
Audrey, Clarence and Jean; and Liz, Glenn and Jack – thank you for so kindly giving me a home away from home, it has meant more to me than you know.
Thanks also go to Elaine, Romina, Nadege, Yasmin, Diane, Kailey, Amanda, Lisa, Janice and Katie, for the role each of them played in the production of this thesis, which included transcribing many hours of audio-recorded speech, inputting data into spreadsheets, and validating my analyses. In particular, I would like to thank my Dad and my sister Arlette for the long hours they devoted to meticulously editing and proofreading my chapters. Thank you!

Special thanks go to Professor Sandra M. Dingli, Director of The Edward de Bono Institute, University of Malta. Thank you Sandra for the instrumental role you have played in shaping the path which has led to where I am at present, and which leads to where I hope to be headed in the future. Thank you for being so supportive and understanding, for affording me the time and space to work on my research, and for your infinite words of wisdom.
I could not but also thank my esteemed colleagues at University of Malta – thank you Vince for your valuable advice, and thank you Josianne, Shirley, Margaret and Brenda for your support and caring concern.

This study would not have been possible had it not been for the entrepreneurs who so kindly found time in their busy schedules to participate in this research – thank you for trusting me with your thoughts and ideas, and for allowing me to study the fascinating processes that take place inside your entrepreneurial minds.

Last but most certainly not least, my heartfelt gratitude goes to dearest Mario, to whom I owe so much that I don't know where to begin. Thank you Mario for your understanding even though it wasn't easy, for being there for us even when I wasn't around, and for hanging on until the end of this bumpy ride, because you gave me the strength to make it across the finish line.

Any errors and omissions in this thesis are my responsibility.

DECLARATION

Name & Surname: LEONIE BALDACCHINO

Warwick ID: 1064285

Degree: DOCTOR OF PHILOSOPHY

Title of Thesis: ENTREPRENEURIAL EXPERIENCE AND OPPORTUNITY IDENTIFICATION: THE ROLE OF INTUITION AND COGNITIVE VERSATILITY

Department: WARWICK BUSINESS SCHOOL

I hereby declare that I am the legitimate author of this Thesis and that it is entirely my own original work.

No portion of this work has been submitted in support of an application for another Degree or qualification of this or any other university or institution of learning.

Signature of Student

LEONIE BALDACCHINO
Name of Student (in Caps)

30 MARCH 2013
Date

ABSTRACT

The issue of "why, when and how" some people, but not others, discover opportunities is central to our understanding of entrepreneurship. Although there is a growing body of research in this area, opportunity identification remains an ongoing phenomenon of interest as many questions remain unanswered. One important question concerns the effects of experience on opportunity identification. Research suggests that entrepreneurs become more adept at identifying opportunities as they gain experience, but the cognitive processes underlying this relationship remain unclear. This study explores this gap in the literature by addressing the following research question: *To what extent can the relationship between entrepreneurial experience and opportunity identification be explained by cognitive strategy?* Guided by sound theoretical principles (Cognitive-Experiential Self-Theory) and by a critical review of the scholarly literature, this study argued first, that intuition is a key process that links experience to an enhanced ability for opportunity identification, and second that intuition is most effective when used together with analysis in a versatile cognitive strategy – an approach characterised by high levels of both intuition and analysis, and an ability to switch between them as needed. Building on these arguments, this study develops and tests a model in which intuition and cognitive versatility are hypothesised to mediate the relationship between experience and opportunity identification. Seventy-four technology-entrepreneurs completed a think-aloud protocol analysis exercise in which they generated potential business ideas for three innovative technologies. In addition, they completed an online survey that was designed to control for factors which may influence intuition, cognitive versatility and/or opportunity identification, namely cognitive style, risk perception, risk propensity, and entrepreneurial experience. The model was tested by integrating the survey data with the coded and quantified protocol data in a series of regression and mediation analyses. Consistent with prior research, this study found that experienced entrepreneurs are more proficient than novices at identifying opportunities. Extending previous research, this study shows that intuition and cognitive versatility mediate the relationship between experience and opportunity identification. Not only do experienced entrepreneurs use their intuition to help them identify potentially lucrative opportunities, they also employ a process of analysis to complement their intuition and to ensure that this intuition is not leading them astray. Overall, these results suggest that scholars need to consider cognitive versatility, rather than simply looking at intuition or analysis in isolation, and to think about how this can be shaped to benefit opportunity identification.

Keywords: Entrepreneurship
Intuition
Cognitive Versatility
Cognitive Strategy
Experience

CHAPTER 1

INTRODUCTION

1.1 Background

Entrepreneurship is widely regarded to be the engine of economic growth as it is a major source of job creation, innovation and wealth. In spite of the challenging economic conditions of recent times, small and medium sized enterprises (SMEs, i.e., those with up to 250 employees) are still described as the backbone of the European economy, accounting for 98% of all enterprises, 67% of total employment – or 87 million jobs – and 58% of gross value added (GVA) in 2012 (Wymenga, Spanikova, Barker, Konings & Canton, 2012). In view of these figures, it is argued that learning about what contributes to prosperous entrepreneurship is instrumental for the cultivation of a thriving economy.

Recent years have witnessed a steep surge in the study of entrepreneurship and entrepreneurs. Fuelled by the notion that entrepreneurship is "one of the roads to future prosperity" (Iversen, Jørgensen & Malchow-Møller, 2008, p. 1) and hence that "as a field of scholarly inquiry, entrepreneurship is vitally important" (Dutta & Crossan, 2005, p. 245), scholars devote countless hours every day to developing theory and conducting research on this phenomenon. This has led to growth and progress in the field on both a conceptual and an empirical level (Davidsson, 2005).

A great deal of entrepreneurship literature is concerned with understanding the identification of entrepreneurial opportunities (see Short, Ketchen, Shook & Ireland, 2010, for a review). Opportunities, which may be defined as “situations in which new goods, services, raw materials, markets and organizing methods can be introduced through the formation of new means, ends, or means-ends relationships” (Eckhardt & Shane, 2003, p. 336), are the lifeblood of entrepreneurship (e.g., Shane & Venkataraman, 2000). The issue of “why, when, and how some people and not others, discover ... opportunities” (Shane & Venkataraman, 2000, p. 218) is therefore central to our understanding of entrepreneurship (Kreuger, 2005).

Recent research indicates that entrepreneurs who are able to identify and explore multiple opportunities prior to launching new ventures are more likely to pursue opportunities which lead to superior venture outcomes, such as higher early-stage sales revenues (Gruber, MacMillan & Thompson, 2008) and market diversification (Gruber, MacMillan & Thompson, 2012b). It therefore follows that understanding what leads to the identification of more and better quality opportunities has both academic and economic significance.

1.2 Research Gap

In spite of the growth in this area of research, opportunity identification remains “an enduring phenomenon of interest” (Dutta & Crossan, 2005, p. 427) as many questions remain unanswered. One such question concerns the effects of entrepreneurial experience on opportunity identification. Recent research indicates that experienced entrepreneurs identify more and better quality opportunities than their inexperienced counterparts (e.g., Gruber et al., 2008, 2012a, 2012b; Ucbasaran, Westhead, Wright & Binks, 2003a; Ucbasaran, Westhead & Wright, 2009). However, it is not clear how experience enables entrepreneurs to become more proficient at opportunity identification.

Scholars have sought answers to this question in theories of entrepreneurial cognition, which aim to explain "how entrepreneurs use simplifying mental models to piece together previously unconnected information that helps them identify and invent new products and services, and to assemble the necessary resources to start and grow businesses" (Mitchell, Busenitz, Lant, McDougall, Morse & Smith, 2002, p. 97). From this viewpoint, experience leads to the accumulation of knowledge (Shepherd & DeTienne, 2005) and to the formation of complex cognitive structures (Baron & Ensley, 2006; Gaglio & Katz, 2001), and these allow entrepreneurs to detect previously unconnected gaps, trends and patterns in their environment, leading to the identification of opportunities (Baron, 2006). There is however still a great deal to be learned about *how* entrepreneurs are able to use their knowledge and cognitive structures to "connect the dots" between seemingly unrelated stimuli (Baron, 2006, p. 106), and how this, in turn, triggers ideas for new business opportunities.

Guided by Cognitive-Experiential Self-Theory (CEST: Epstein, 2003, 2010; Epstein, Pacini, Denes-Raj & Heider, 1996; Pacini & Epstein, 1999) and by conceptual work on opportunity identification (Dimov, 2007a, 2007b, Dutta & Crossan, 2005), this study suggests that intuition may be one of the cognitive processes responsible for enabling experienced entrepreneurs to leverage their vast knowledge and complex mental frameworks to enhance their opportunity identification ability. Intuitive processing – which involves the matching of "environmental stimuli ... with some deeply held (nonconscious) category, pattern or feature" (Dane & Pratt, 2007, p. 37) – is conceptualised in CEST as being experientially-derived and holistically-oriented (Epstein, 2003, 2010), and is argued to be crucial for opportunity identification. According to Dutta and Crossan (2005):

> Efforts at utilizing this knowledge and transforming it into specific business opportunities begin with deep intuition on the part of the individual. Before the contours of the opportunity are identified and a business opportunity is developed, it is important that entrepreneurs engage in an intuiting process to clarify in their own minds what the idiosyncratic knowledge entails in terms of an unmet need (p. 436).

Numerous scholars have argued that intuition should be given more importance in scholarly research. However, due at least in part to the methodological challenges involved in studying a nonconscious process such as intuition, which by definition occurs out of conscious awareness and therefore does not lend itself to self-reflection (Sadler Smith, Hodgkinson & Sinclair, 2008), not many researchers have "taken up the challenge" (Blume & Covin, 2011, p. 138) of empirically investigating intuition in entrepreneurial settings. There is therefore a gap in the academic literature concerning the role of intuition in entrepreneurship which has prompted appeals for scholarly attention (Blume & Covin, 2011).

A review of the literature – presented in Chapter 2 – indicates however, that intuition should not be studied in isolation, but should be viewed within a broader cognitive framework which also includes analytical processing, which refers to "the process of trying to understand a problem by breaking it down into its components and then performing logical and/or mathematical operations on these components" (Klein, 2004, p. 74). The dual-process perspective, which encompasses a collection of theories of human cognition including the abovementioned CEST (see Evans, 2008, for a review), affirms that human beings process information by means of two independent but interactive cognitive systems, one of which gives rise to intuition and the other to analysis. Scholars maintain that these two modes of processing should be studied together, because "if there are two different information-processing systems, it can only be a source of confusion to conduct research as if there were only one" (Epstein, 2003, p. 180).

Conceptual work on cognitive strategy – which refers to the information processing approach employed by individuals "in response to circumstantial demands" (Hodgkinson & Clarke, 2007, p. 245) – indicates that the most effective decision makers are not governed by a predominantly intuitive or a predominantly analytical cognitive style – which refers to "an enduring overarching preference in approach to the processing of information" (Hodgkinson & Clarke, 2007, p. 245). Instead, they have the ability to engage in high levels of both intuition and analysis, and to "switch cognitive gears" between the two modes of processing as required (Louis & Sutton, 1991), in what is known as a versatile cognitive strategy, or cognitive versatility (Hodgkinson & Clarke, 2007). It is not clear, however, whether this type of cognitive strategy is effective for the purpose of identifying opportunities. While scholars suggest that intuition benefits opportunity identification, they offer little indication of how it interacts with analysis during this process. The gap in the literature mentioned above concerning the role of intuition in opportunity identification therefore extends to include cognitive versatility.

1.3 Research Question and Overview of the Study

In view of the above, the research question underlying this study is as follows:

To what extent can the relationship between entrepreneurial experience and opportunity identification be explained by cognitive strategy?

In addressing this research question, this study shall investigate the effects of intuition and cognitive versatility on opportunity identification, and shall explore the role they may play in enabling entrepreneurs to become more proficient at identifying opportunities as they gain experience in the field.

Based on an extensive review of the literature and guided by sound theoretical principles (CEST: Epstein, 2003, 2010), this study argues first, that intuition is a key process that links experience to an enhanced ability for opportunity identification, and second that intuition is most effective when used together with analysis in a versatile cognitive strategy – an approach characterised by high levels of both intuition and analysis, and an ability to switch between them as needed (Hodgkinson & Clarke, 2007).

Building on these arguments, this study develops and tests a model in which intuition and cognitive versatility are hypothesised to mediate the relationship between experience and opportunity identification. Specifically, experience is argued to allow entrepreneurs to become both more intuitive and more cognitively versatile, and this in turn enables experienced entrepreneurs to identify more and better quality opportunities than their inexperienced counterparts. Implicit in this model is that: (1) experienced entrepreneurs are able to be *both* highly intuitive *and* highly analytical; (2) they are able to switch between the two modes of processing to meet the varying demands of particular situations; and (3) *both* intuition *and* analysis play a role in opportunity identification.

This conceptual model is tested with a sample of 74 entrepreneurs, defined in this study as owner-managers of one or more businesses, in line with previous research on opportunity identification (e.g., Gruber et al., 2008, 2012a, 2012b; Ucbasaran et al., 2003a, 2009). A rigorous multi-method approach was adopted consisting of a think-aloud protocol analysis exercise (Ericsson & Simon, 1993) designed to measure cognitive strategy (use of intuition and analysis) during a series of opportunity identification tasks, together with an online survey to control for factors which the literature suggests may influence cognitive strategy and/or opportunity identification, namely cognitive style, risk perception, risk propensity, and experience.

1.4 Intended Contributions

In tackling this area of research, this study seeks to contribute to two strands of literature: entrepreneurship and intuition.

1.4.1 Contribution to the Entrepreneurship Literature

While the relationship between entrepreneurial experience and opportunity identification has received a fair amount of attention over the last decade (Gruber et al., 2008, 2012a, 2012b; Ucbasaran et al., 2009; Baron & Ensley, 2006), the cognitive processes underlying this relationship have been under-explored. In being among the first to explore the role of intuition and cognitive versatility as mediators in the relationship between experience and opportunity identification, this study aims to break new ground in explaining “why, when, and how” (Shane & Venkataraman, 2000, p. 218) some people – namely, experienced entrepreneurs – are able to identify more and better quality opportunities than others.

A limited amount of conceptual work has linked intuition to opportunity identification (Dimov, 2007a, 2007b; Dutta & Crossan, 2005) but this has not been addressed on an empirical level. Furthermore, scholars have failed to acknowledge the potential role that analysis may play in the process, thus painting an incomplete picture of a phenomenon that is so crucial for entrepreneurship (Shane & Venkataraman, 2000). In developing and rigorously testing a model which explores the role of intuition in the identification of opportunities, this study provides much needed empirical evidence to support (or negate) the conceptual work which has been published on the topic. Furthermore, in investigating the proposition that intuition needs to be combined with analysis in a versatile cognitive strategy, it aims to shed new light on the cognitive processes – and strategies – that enhance opportunity identification.

1.4.2 Contribution to the Intuition Literature

The literature review presented in Chapter 2 will reveal several weaknesses in the extant research on intuition in business settings. These include an overreliance on potentially inaccurate self-report instruments (as argued by Blume & Covin, 2011), many of which measure dispositional cognitive style rather than actual intuitive processing (e.g., Kickul, Gundry, Barbosa & Whitcanack, 2009), and/or which are based on outdated theoretical foundations (e.g., Elbanna & Child, 2007). Methodological shortcomings of this kind are likely to hinder theory development due to the acceptance or rejection of hypotheses on the basis of inaccurate, incomplete, or unreliable empirical evidence. Scholars have therefore recently called for more robust research to be carried out using sophisticated methods designed to capture intuitive processing as it occurs (Blume & Covin, 2011; Hodgkinson & Sadler-Smith, 2011). This study's multi-method approach was designed in response to these calls, with the aim of providing robust empirical evidence on the actual use of intuition, whilst accounting for dispositional preferences for cognitive style.

Furthermore, intuition scholars have appealed for the adoption of research techniques that are consistent with – and which contribute to – dual-process theory (Dane & Pratt, 2007, 2009; Hodgkinson, Sadler-Smith, Sinclair & Ashkanasy, 2009b). While the extant literature suggests that it is not only possible, but also highly desirable, for individuals to be cognitively versatile (Hodgkinson & Clarke, 2007), empirical research on the interaction between intuition and analysis is limited. In being among the first to explore the use of intuition together with analysis within the framework of cognitive strategy, this study aims to contribute to dual-process theory by empirically illustrating the extent to which intuition and analysis can be used concurrently, and by providing evidence to support (or negate) the claim that intuition and analysis are most effective when used together in a versatile cognitive strategy. Finally, in exploring the effect of experience while controlling for cognitive style, this study aims to elucidate the antecedents of cognitive versatility.

1.5 Overview of the Following Chapters

This thesis is structured as follows. Chapter 2 lays the groundwork of this study by means of a literature review. The point of departure was to explore what is known about entrepreneurial intuition in order to support the argument that it could be one of the cognitive processes underlying opportunity identification. To this end, a review was carried out on the literature on intuition in business settings. This review revealed the notion that intuition should be studied within the context of a versatile cognitive strategy. Therefore, Chapter 2 focuses primarily on intuition, with the literature on cognitive versatility nested within it where appropriate.

Chapter 3 outlines the development of the conceptual model underlying this study. Three sets of hypotheses were derived from cognitive theories and from various strands of literature (entrepreneurship, intuition, creativity, and expertise) to address this study's research question. The first set of hypotheses concern the relationship between experience and opportunity identification, the second set deal with the effects of intuition on opportunity identification, of experience on intuition, and of intuition as a mediator between experience and opportunity identification, and the third set are concerned with the effects of cognitive versatility on opportunity identification, of experience on cognitive versatility, and of cognitive versatility as a mediator between experience and opportunity identification.

Chapter 4 provides full details about the methods employed in this study, including the selection of research participants, and the procedures of data collection and analysis. It highlights the shortcomings of past research, justifies this study's mixed methods research design, and describes in detail each step from planning and preparing for the study, through data collection and processing, to data analysis and model testing. Chapter 4 also discusses issues related to validity and reliability, together with the ethical considerations of this study.

The findings of this research are presented in Chapters 5, 6, 7 and 8. Chapter 5 presents socio-demographic data, descriptive statistics and results of a series of inferential and correlation analyses to familiarise readers with the nature of the sample and data. Chapters 6, 7 and 8 present the results of the regression and mediation analyses which were carried out to test the first, second and third sets of hypotheses respectively.

Chapter 9 discusses the key findings of this study in the light of the relevant literature, highlights the key contributions made by this study, and outlines their implications for practice. It then describes this study's strengths and limitations, some of which open up avenues for future research. These and other avenues are outlined, after which a final reflection concludes this thesis.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

> We experience feelings about what is or is not the right decision, but the reasons that underlie these feelings escape us. We know but we cannot explain why. It seems as though we have an intuition or sixth sense that is beyond our own comprehension (Hogarth, 2001, p. 4).

The topic of intuition has generated a great deal of interest among humans ever since the beginning of civilisation. Its origins can be traced back to the ancient societies of thousands of years ago, to a time where "the most valuable kind of knowledge" came in the form of mystical "intuitive insights or experiences ... regarded as messages from the gods or evidence of the exceptional powers of the seer or oracle" (Noddings & Shore, 1998, p. 4). Over the centuries that followed, generation after generation of philosophers, theologians, psychologists, psychiatrists and economists have used the term 'intuition' to account for a wide range of phenomena and experiences.

For example, according to Noddings and Shore (1993), the ancient Greek philosopher Aristotle (384-322 B.C.) referred to intuitive reason, or to knowledge that exists without proof; Christian theologians St. Augustine (354-430 A.D.) and St. Thomas Aquinas (1225-1274 A.D.) spoke about intuition as a god-given faculty, gifted to a select few through revelations; and German philosopher Immanuel Kant (1724-1804) argued that intuition is the recognition and awareness of entities that occurs in a non-rational manner. Psychologist Carl Gustav Jung (1875-1961) proposed intuition as a psychological function which operates at an unconscious level; psychiatrist Eric Berne (1910-1970) regarded intuition as an unconscious source of knowledge that is most effective in clinical settings when combined with objective observation; while economist Herbert Simon (1916-2001) viewed intuition as "analyses frozen into habit and into the capacity for rapid response through recognition" (Simon, 1987, p. 63).

In spite of – or perhaps as a result of – its long history, throughout which connotations of spirituality and mysticism prevailed, intuition was for many years shrouded in a blanket of mystery and awe. Scientific study of intuition was, until relatively recently, largely unheard of, as scholars were reluctant to associate themselves with a phenomenon that was viewed by many as being scientifically weak, and which was therefore relegated to the periphery of the field of psychology (Hodgkinson et al., 2008). The ruling paradigm in cognitive theory until the 1970s was that of *Homo economicus* – the 'rational economic man', which suggests that people are driven by pure rationality and are thus able to pursue the optimal outcome in every given situation with almost mathematical precision (Gibcus, Vermeulen & Radulova, 2008). This classical theory of rational choice regarded intuition as a negative influence on human cognition as it was believed to lead to "irrational choice behaviour" (Peters, Västfjäll, Gärling & Slovic, 2006, p. 79).

It has, however, become increasingly evident that purely rational models of decision making are inadequate to account for the complexity of human cognition. A shift in focus gradually occurred from these models of pure rationality, to a theory of bounded rationality – which holds that individuals can never be fully rational or analytical as they are always constrained by cognitive limitations, availability of information, and by time restrictions (see Simon, 2000) – to a dual-process view of human information processing, which fully integrates the role of affectively charged intuition (Dane & Pratt, 2007) in human cognition alongside rational analysis (see Evans, 2008, for a review).

As a result of its increased acceptance in academic circles, there has been a marked growth over the past few years in the number of scholars who have taken an interest in the study of intuition in various fields including management and entrepreneurship. This has led to a "considerable body of theory and research … that clearly demonstrates that the concept of intuition has emerged as a legitimate subject of scientific inquiry" (Hodgkinson et al., 2008, p. 19), rather than "a magical sixth sense or a paranormal process" (Matzler, Bailom & Moordian, 2007, p. 13) as was previously believed.

Nevertheless, there is still a great deal to be learned about intuition, and scholars have issued several pleas for further research on this phenomenon in domains such as management and entrepreneurship (e.g., Blume & Covin, 2011; Hodgkinson et al., 2008). This study, which aims to investigate the effects of intuition and cognitive versatility (see Hodgkinson & Clarke, 2007) on opportunity identification, and to explore their role in mediating the relationship between entrepreneurial experience and opportunity identification, is in response to these pleas.

In order to address these objectives, the first step in this study was to take stock of the conceptual and empirical work that has been carried out in this area of research by means of a literature review. This was necessary in order to prevent "conceptual slippage" (Akinci & Sadler-Smith, 2012, p. 15) that may arise from the "bewildering array of meanings and connotations" (Noddings & Shore, 1998, p. 2) that have been associated with intuition in the past, to avoid "needless duplication of effort" (Akinci & Sadler-Smith, 2012, p. 15) which may occur when researchers embark upon a project with insufficient awareness of what others before them have achieved, and to design a theoretically-derived conceptual framework and sound methodology that would advance the state of knowledge in the field.

A preliminary literature search which focused exclusively on intuition in entrepreneurship yielded a only a few journal articles (e.g., Allinson, Chell & Hayes, 2000; Mitchell, Friga & Mitchell, 2005) and a book chapter (Sadler-Smith, Hodgkinson & Sinclair, 2008) that dealt specifically with this topic, indicating that such a narrow focus would be overly restrictive and would not provide the broad and solid foundations upon which a study should be built. This search did, however, provide indications that considerably more work had been carried out on managerial intuition. To the extent that management research and entrepreneurship research both form part of the general business scholarship landscape, it was argued that important insights may be gained by exploring this neighbouring body of knowledge.

The preliminary review was therefore followed by a more extensive literature review on intuition in the fields of both management and entrepreneurship. Full details of, and justification for, the selection of the literature reviewed in this chapter are presented in Appendix A and outlined below for ease of reference. It should be noted that a more inclusive approach was adopted for the other chapters in the thesis as a broader base, covering a variety of additional topics and sources, was required to construct the hypotheses, research design and methodology for this study. The criteria for inclusion of the literature reviewed in this chapter thus do not apply to the rest of the thesis.

In an attempt to cut down the potentially infinite number of journals that might otherwise have been consulted, the search boundaries of this review were initially limited to peer-reviewed articles published in journals ranked as Grade 3, Grade 4 or Grade 4* in six of the subject areas listed in the Association of Business Schools (ABS) Academic Journal Quality Guide, Version 4 (Harvey, Kelly, Morris & Rowlinson, 2010). The six subject areas include 63 journals which together cover all the publication outlets for research on cognition, entrepreneurship and management as listed in the ABS Guide. Searches were conducted within each of these journals first for the Boolean search term intuit* in the Abstracts field, and then for intuit* AND entrepreneur* in the Full Text fields, using appropriate electronic databases. The abstracts of the extracted articles were read in order to determine whether or not they should be retained for further analysis. The inclusion criterion was that articles should make a significant conceptual or empirical contribution to knowledge about intuition in entrepreneurship or management.

In all, 62 articles met this criterion and were retained for full review. To these, six studies from other sources – which came to the researcher's attention during the course of the literature review as being highly relevant for this research – were added to make up a final sample of 68 publications. It must be acknowledged that limiting the review to this body of literature inevitably led to the exclusion of a number of noteworthy publications from the literature review presented in Chapter 2. These include the paper by Kahneman and Klein debating the anti-intuition heuristics and biases programme and the pro-intuition naturalistic decision making tradition, published in a non-ABS listed journal (American Psychologist, 2009), a joint interview piece with these two researchers on the same topic, also published in a non-ABS listed journal (McKinsey Quarterly, 2010), and several books which have recently been published on intuition (e.g., Gigerenzer, 2008; Hogarth, 2001;

Kahneman, 2011; Klein, 2004; Sadler-Smith, 2008, 2010) and intuition research methods (Glöckner & Witteman, 2010; Sinclair, 2011). However, the blind peer review process that precedes publication in the ABS-listed academic journals provides a "stamp of quality" which renders them "one of the most important means of publishing and disseminating the results of academic research and scholarship" (Harvey et al., 2010, pp. 1-2).

This chapter provides a critical analysis of these 68 publications, organised in the following manner: Section 2.2 examines how intuition has been defined in the literature and formulates a working definition of intuition for the purpose of this study. Section 2.3 delineates intuition from a number of similar but distinct constructs, such as insight and instinct, for which it is sometimes mistaken. Section 2.4 outlines the debate that took place in the psychology literature concerning the nature of human cognition, and situates this study within the dual-process theory of human information processing. Section 2.5.1 then presents the key themes which emerged from the literature concerning managerial intuition, while Section 2.5.2 focuses on the themes related to intuition in the entrepreneurship domain. The chapter concludes by highlighting the key insights that emerge from the literature review and by formulating this study's research question.

2.2 What is Intuition?

One of the concerns of the growing body of literature on intuition has been to provide a clear, comprehensive and consensual definition of intuition in an attempt to ground it firmly within the realm of science and to steer it away from "connotations of mystery and the paranormal" (Sadler-Smith & Shefy, 2004, p. 81).

According to Hodgkinson et al. (2008) "the etymological roots of the term 'intuition' stem from the Latin word *in-tuir*, which can be translated as 'looking, regarding or knowing from within'" (p. 2). Similarly, Sadler-Smith and Shefy (2004) explain that "the root of the term 'intuition' may be traced to the Latin *intueor* or *intueri* meaning 'to contemplate' or 'look within'" (p. 81).

The internally-derived 'sense of knowing' implied by these Latin terms is a theme that runs through several conceptualisations of intuition. For example Hodgkinson, Sadler-Smith, Burke, Claxton and Sparrow (2009a) define intuition as "'knowing' but without knowing why", or as "a judgment ... that comes to mind with an aura or conviction of rightness or plausibility, but without clearly articulated reasons or justifications" (p. 279). Similarly, Blackman and Sadler-Smith (2009) refer to intuition as a form of knowing – or "intuitive knowing" – which they describe as "affectively charged, holistic and involuntary" and which "cannot be literally spoken" (p. 579). For Sadler-Smith and Shefy (2004), intuition is "a form of knowing that manifests itself as an awareness of thoughts, feelings, or bodily sense connected to a deeper perception, understanding, and way of making sense of the world that may not be achieved easily or at all by other means" (p. 81).

Sinclair and Ashkanasy (2005) compare intuitive processing to a "non-conscious scanning of internal … and external … resources in a non-logical, non-temporal manner in order to identify relevant pieces of information that are fitted into the 'solution picture' in a seemingly haphazard way, similar to assembling a jigsaw puzzle" (p. 357). Consistent with Hodgkinson et al.'s (2009a) definition above, Sinclair and Ashkanasy highlight the "feeling(s) of certitude and relief" that accompany the sudden intuitive emergence of the "big picture" (p. 357).

According to Miller and Ireland (2005), "intuition can be conceptualized in two distinct ways: as holistic hunch and as automated expertise" (p. 21). The "holistic hunch", popularly known as 'gut feeling', arises from a subconscious process in which information stored in memory is rearranged to form new connections (akin to Sinclair and Ashkanasy's jigsaw puzzle metaphor mentioned above), which are then manifested as judgments or choices which "feel right" (p. 21). This bears much similarity to Sadler-Smith and Shefy's (2004) notion of "intuition-as-feeling", which "connects the mind and body" by means of subconscious affective reactions to external stimuli (p. 81).

Miller and Ireland's (2005) second conceptualisation of intuition as "automated expertise" refers to the "recognition of a familiar situation and the straightforward but partially subconscious application of previous learning related to that situation" (p. 21). Miller and Ireland explain that this second form of intuition is domain-specific and develops gradually as a result of gaining salient experience in one's own area of expertise. This automated process replaces the explicit analysis conducted by individuals prior to gaining sufficient experience in their domain. This is also in line with Sadler-Smith and Shefy's (2004) view of intuition, who contend that over time, experience and analysis become "frozen ... into familiar routines and habitual responses" which then form the basis of "intuition-as-expertise" (p. 82).

This expertise-based view of intuition may be traced back to the work of Simon (1987) who argued that intuition is "simply analyses frozen into habit and into the capacity for rapid response through recognition" (p. 63). Simon studied the thinking processes of chess grandmasters and concluded that their ability to identify a good move within seconds, even when playing against multiple opponents at the same time, is due to their intuition or professional judgment:

> In simultaneous play, the professional takes much less than a minute, often only a few seconds for each move. There is no time for careful analysis … It is done by "intuition", by applying one's professional "judgment" to the situation. A few seconds' glance at the position suggests a good move, although the player has no awareness of how the judgment was evoked (Simon, 1987, p. 59).

This intuition, Simon argued, arises from the extensive knowledge of patterns and of their significance, both of which are held in the chess grandmaster's memory:

> For the expert, such a chess board is not an arrangement of 25 pieces but an arrangement of a half dozen familiar patterns, recognizable old friends … 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. Recognizing the pattern brings to the grandmaster's mind at once moves that may be appropriate to the situation. It is this recognition that enables the professional to play very strong chess at a rapid rate. Previous learning that has stored the patterns and the information associated with them in memory makes this performance possible (Simon, 1987, p. 60).

Many authors agree that this instant, knowledge-based pattern-recognition process is the secret not only of chess grandmasters' intuition, but also of intuition of experts in other domains including management and entrepreneurship. Hodgkinson et al. (2008) maintain that the intuitive ability of experts is "derived in large part from the large numbers of patterns held in long-term memory" and in part from "their capacity to recognize salient environmental cues and rapidly match those cues to commonly occurring patterns, responding in ways that lead to effective problem solving and decision making" (p. 7).

The above indicates that expertise is considered by many scholars to be a defining feature of intuition. It is worth noting, however, that some authors have proposed other forms of intuition which are not based on experience and pattern recognition. For example, Crossan, Lane and White (1999) argue that “entrepreneurial intuition ... relies less on the knowledge base of the individual, but rather, on their creative capacity to recognize gaps and to identify possibilities” (p. 436). Similarly, Dane and Pratt (2009) view “creative intuition” as a “creative act of synthesis in which disparate elements are fused together in novel combinations” (p. 9). The merits of these distinctions and their implications for this study on entrepreneurial experience, intuition and opportunity identification, shall be discussed in further detail in Section 2.5.2.2.

In an attempt to synthesise the various conceptualisations of intuition, Blume and Covin (2011) observe three elements that are common to the majority of definitions, including the ones discussed above. The first is that intuition originates beyond conscious thought, and therefore leads to the sense of “‘knowing’ without knowing why” described by Hodgkinson et al. (2009a, p. 279). While individuals are aware of the outcomes of their intuition (e.g., intuitive decisions), the process of how they arrived at such decisions is not accessible to conscious scrutiny (Dane & Pratt, 2007) and cannot be articulated (Blackman & Sadler-Smith, 2009).

The second element which Blume and Covin (2011) found to be common to all definitions of intuition is that it involves holistic associations. This encompasses both the expertise-based view of intuition (Hodgkinson et al., 2008, 2009a; Miller & Ireland, 2005; Sadler-Smith & Shefy, 2004; Simon, 1987) as well as the non expertise-based entrepreneurial (Crossan et al., 1999) or creative views (Dane & Pratt, 2009), as all forms of intuition involve the formation of new connections between disparate pieces of information or stimuli.

The third element upon which there is consensus in the literature according to Blume and Covin (2011) is that intuition results in affectively charged judgments. Sadler-Smith (2008) states that "intuition is at the crossroads of thinking and feeling – the nexus of cognition and affect" (p. 30), while Sinclair and Ashkanasy (2005) maintain that intuition "comprises both cognitive and affective elements" (p. 357). Dane and Pratt (2007) claim that a judgment can be identified as intuitive if it is accompanied by affect, such as the "feeling(s) of certitude and relief" described by Sinclair and Ashkanasy (2005, p. 357).

In view of the above, this study adopts the definition proposed by Dane and Pratt (2007) who view intuition as "affectively-charged judgments that arise through rapid, nonconscious, and holistic associations" (p. 40). It is worth noting that this definition was also embraced by scholars such as Blume and Covin (2011) and Hodgkinson et al. (2008), since it effectively consolidates all three abovementioned consensual elements of intuition.

2.3 What Intuition is Not

Although scholars have reached broad consensual agreement about the nature (and definition) of intuition, there are still a number of constructs, namely instinct, incubation, insight and guessing, which bear some similarity to intuition and which some readers may find difficult to tell apart. Another key concern of intuition researchers has therefore been to highlight the similarities and differences between intuition and each of these other constructs to facilitate their delineation from one another. Sadler-Smith and Shefy (2004) caution readers to not "mix up your I's" (p. 81), with reference to intuition, instinct, incubation and insight. Many authors use these terms interchangeably, but although they are related, there are important differences between them.

Instinct refers to "hardwired, autonomous reflex actions" such as the knee-jerk, or to the "behaviour patterns of certain animals (such as the homing instinct in birds)" (Hodgkinson et al., 2009a, p. 279). According to Dane and Pratt (2007), instincts differ from intuition in that instincts are innate whereas intuition is derived from experience, and in that they do not originate from the experiential processing system, which is the cognitive system that gives rise to intuition (see Section 2.4 and Chapter 3 for further details about this system).

Incubation refers to a period of non-conscious processing which normally takes place following an impasse in conscious analytical thought. During incubation, the issue is deliberately 'put aside' while the individual focuses conscious attention elsewhere. In some cases, this period of incubation may result in an insight, which "literally means seeing the solution to the problem" (Sadler-Smith & Shefy, 2004, p. 81). This is known to some as illumination, or as the 'aha' or 'Eureka' moment, which often occurs when least expected.

Insight is therefore similar to intuition in that they both involve non-conscious processing, and in that they both result in a form of 'knowing' (a solution, a judgment, an idea, etc.). They differ, however, in that insight occurs as a result of a lengthy process of incubation, whereas intuition occurs instantly, without incubation. Insight may be preceded by intuition, where an individual would experience the Freudian 'tip of the tongue' phenomenon right before the 'aha' moment (Hodgkinson et al., 2008; Hodgkinson et al., 2009a), but while insight brings to conscious awareness not only the solution of a problem but also the logical processing underlying it, the reasoning beneath intuition cannot be explained by the individual (Dane & Pratt, 2007).

A final construct which some may equate with intuition is guessing. Cynics sometimes criticise intuitive judgments as being nothing but 'best guess' decisions. However Isenberg (1984) maintains that "intuition is not … a random process of guessing" (p. 86), while Dane and Pratt (2007) explain that:

> Intuition is similar to guessing only in terms of its speed. Guessing neither involves affectively charged judgments nor requires making associations through nonconscious information processing. It also lacks ... certitude (p. 40).

It is therefore clear that although intuition bears some similarity to a number of other constructs, it has its own distinctive features which must be borne in mind as one conducts research, in order to ensure validity of findings and interpretation and avoid conceptual slippage. Also to be borne in mind when studying intuition is that, as briefly explained in Chapter 1, intuitive processing does not occur in a vacuum but is part of a cognitive framework which also encompasses analytical processing. This dual nature of human cognition is explained in the next section.

2.4 Debating the Nature of Human Cognition

Besides providing a consensually agreed definition of intuition and differentiating it from similar but distinct constructs, another key concern of intuition scholars has been to develop a theoretical understanding of how intuition is positioned within the overarching framework of human cognition.

It has long been recognised that human beings process information in two distinct modes, or at two different levels (Dane & Pratt, 2009), with the first being characterised by non-conscious, automatic, inductive, holistic thought, and thus giving rise to intuitive processing, and the second being characterised by conscious, rational, logical, sequential, deductive and detailed reasoning, and hence leading to analytical processing (Allinson et al., 2000; Dutta & Thornhill, 2008). There has, however, been some debate as to whether these two modes of processing constitute two opposite ends of the same bipolar construct, as proposed by those who hold a unitary view of human cognition (e.g., Allinson & Hayes, 1996; Hayes, Allinson, Hudson & Keasey, 2003), or whether they are two separate constructs altogether, as argued by proponents of dual-process theory (e.g., Hodgkinson & Sadler-Smith, 2003a, 2003b).

According to the unitary view, such as Hammond's Cognitive Continuum Theory (CCT: see Hammond, 2000), human cognition lies "on a continuum along which all degrees of style are possible" (Allinson & Hayes, 1996, p. 123). In this view, judgements are never purely intuitive or purely rational (analytical) but are *quasi-rational* (Hammond, 2000) as they vary in their intensity of each. The implication of conceptualising intuition and analysis as two ends of a single continuum is that any increase in one mode of processing must take place at the expense of the other, such that a more intuitive judgement is necessarily less rational and vice versa (Hodgkinson & Sadler-Smith, 2003a).

Conversely, the dual-process perspective, which encompasses a collection of theories of human cognition including the Cognitive-Experiential Self-Theory (CEST) developed by Epstein and colleagues (see Epstein et al., 1996; Pacini & Epstein, 1999), claims that intuition and analysis constitute two interrelated but distinct systems which are largely independent of one another (Hodgkinson & Sadler-Smith, 2003a). The independence of these systems implies that an increase in one mode of processing need not affect the level of activation of the other. In other words, the intuitive system and the analytical system may be activated (or deactivated) to varying degrees at the same time. Therefore according to dual-process theory, a judgement that is more intuitive is not necessarily less analytical and vice versa – it could be at once both intuitive and analytical, or indeed, neither intuitive nor analytical.

This debate has important theoretical and empirical implications, for it determines how the relationship between intuition and analysis is operationalised and measured. It is therefore worth examining if, and how, it has been resolved. This literature review identified eight journal articles which made a significant contribution to this debate, and to the establishment of a dominant theoretical position. Table 2.1 lists these eight articles, outlines their key concepts and contributions, indicates which were empirical and which were conceptual, and demonstrates that they were largely published in journals forming part of the *Psychology* subject group in the ABS quality guide (Harvey et al., 2010).

It should be noted that as explained above, the focus of this literature review was primarily on intuition in entrepreneurship and management. Journal articles and books which dealt with intuition in other domains were excluded, and it should be noted that there is other work that discusses the merits of these two opposing theoretical perspectives in other fields (see e.g., Evans, 1989, 2008, 2010; Stanovich, 1999, 2004; Strack & Deutsch, 2004). However, this selection of eight articles provides a comprehensive account of the main tenets of both unitary theory and dual-process theory, and it is deemed to contain work that is most relevant for this study, as the articles are largely authored by scholars of industrial and organisational psychology and behaviour (e.g., Allinson & Hayes, 1996; Hodgkinson & Sadler-Smith, 2003a, 2003b).

Table 2.1 Debating the Nature of Human Cognition: Insights from the Psychology Literature

Study	Source*	Type#	Key concepts / Variables	Relevance / Contribution
Allinson & Hayes (1996)	JMS	E	Development and validation of the Cognitive Style Index (CSI)	CSI is a widely used tool to measure cognitive style; It is based on the unitary view of human cognition
Epstein, Pacini, Denes-Raj & Heier (1996)	JPSP	E	Development and validation of the Rational-Experiential Inventory (REI)	The revised version of the REI, which appears in the follow-up to this study (see below), is the key tool recommended for measuring cognitive style in line with dual-process theory
Pacini & Epstein (1999)	PPID	E	Revision of the Rational-Experiential Inventory (REI)	This revised version of the REI is the key tool recommended for measuring cognitive style in line with dual-process theory
Hodgkinson & Sadler-Smith (2003a)	JOOP	E	CSI, dual-process theory	Critique of CSI, with empirical evidence in support of dual-process theory; Recommends use of REI as a superior measure of cognitive style
Hayes, Allinson, Hudson & Keasey (2003)	JOOP	C	CSI, unitary theory	Response to above critique: defence of CSI and its underlying unitary theory
Hodgkinson & Sadler-Smith (2003b)	JOOP	C	CSI, dual-process theory	Response to above defence: further support for dual-process theory
Hodgkinson, Langan-Fox & Sadler-Smith (2008)	BJP	C	Intuition, dual-process theory	Defines intuition, delineates it from other constructs, positions intuition within dual-process theory, suggests ways in which intuition can be operationalised and measured
Hodgkinson, Sadler-Smith, Sinclair & Ashkanasy (2009b)	PAID	E	CSI, REI, unitary theory, dual-process theory	Critique of both CSI and REI; provides empirical evidence in support of dual-process theory; Recommends use of REI as a superior measure of cognitive style

*** For full name of the journals please refer to Table A3 in Appendix A**
 # E = Empirical, C = Conceptual;

An analysis of these articles reveals that the main arguments in favour and against unitary theory and dual-process theory were largely based on the development, validation and discussion of the Cognitive Style Index (CSI) and the Rational-Experiential Inventory (REI). These are both self-report measures of cognitive style – which, as explained in Chapter 1, represents “an enduring overarching preference in approach to the processing of information” (Hodgkinson & Clarke, 2007, p. 245) – but they are built on different theoretical foundations.

The CSI was developed and validated by Allinson and Hayes (1996) to measure cognitive style in business and management settings. Allinson and Hayes hold a unitary view of cognitive style which is similar to Hammond’s (2000) quasi-rationality approach. The CSI therefore operationalises cognitive style along a single dimension with analysis at one end and intuition at the other. Conversely, the REI, which was constructed by Epstein, Pacini and Norris on the basis on Epstein’s CEST (as cited in Pacini & Epstien, 1999), and later revised by Pacini and Epstein (1999), treats intuition and analysis – which in the terminology of CEST are labelled *experientiality* and *rationality* respectively – as two independent systems, thus representing the dual-process view of cognitive style.

Although these scales are predicated upon conflicting theoretical premises, a factor analysis of these scales conducted by their respective authors appeared to offer considerable support for both these instruments, prompting each to insist that the theory underlying their respective instrument is the one that best explains the nature of human cognition. For example Allinson and Hayes (1996) found a single factor solution for the CSI in all the samples in their study. They contend that “the unifactorial structure of the instrument apparent in most of the factor analysis ... suggests that it may genuinely tap the hypothetical unitary dimension of cognitive style (p. 131). In contrast with this claim, Pacini and Epstein (1999) extracted two components for the REI, with the rationality (analysis) items loaded onto the first component, and the experientiality (intuition) items loaded onto the second factor. According to Pacini and Epstein, this confirms the assumption of CEST that there are two independent information processing modes. This is further supported by the fact that the Rationality and Experientiality scales were found to be uncorrelated.

In what appears to have been a successful bid to settle this debate, Hodgkinson et al. (2009b) conducted a comparative analysis of these two instruments in order to assess the CSI and REI "in terms of their theoretical underpinnings, to investigate their factor structures, and to evaluate their compatibility in terms of their declared theoretical foundations" (p. 342). On the basis of their results, they conclude that intuition and analysis are two independent constructs which are best measured using the REI, and consequently, that the dual-process perspective is the one that best explains the analytical-intuitive nature of human information processing.

In view of these findings and conclusions, the present study adopts the dual-process approach to conceptualise the nature of human cognition, and thus views intuition and analysis as two separate information processing systems which could be activated at the same time, one at a time, or not at all. This is in line with the views of prominent scholars whose work in support of dual-process theory has recently been published in influential management journals (e.g., Hodgkinson & Clarke, 2007; Hodgkinson et al., 2009a), thus helping to extend this theory into the business domain.

2.5 Intuition in the Management and Entrepreneurship Literature

Now that intuition has been defined, explained and positioned alongside analysis within a sound theoretical framework, it is time to make an appraisal of the current state of knowledge about entrepreneurial intuition. As suggested in Section 2.1, entrepreneurship scholars may gain important insights by exploring the literature in the neighbouring field of management. This is due to the fact that entrepreneurs and managers face various similar challenges which must be resolved using similar cognitive processes. For example, senior managers are responsible for strategic decision making which is described as "crucial because it involves those fundamental decisions which shape the course of a firm" (Eisenhardt & Zbaracki, 1992, p. 17) and "which are essential to the livelihood and survival of the organization" (Elbanna, 2006, p. 1). Similarly, entrepreneurs are responsible for identifying opportunities and for making strategic decisions about issues such as which opportunities to pursue and how to allocate scarce resources (Gibcus et al., 2008). These are also fundamental activities which could make or break a business. Due to these similarities, the body of literature on managerial intuition may be used to inform research on entrepreneurial intuition.

There are however key differences between management settings and entrepreneurial settings, and between the tasks carried out by managers and those carried out by entrepreneurs, which may render the indiscriminate generalisation of findings from one field to the other somewhat problematic. Wickham (2006) explains that entrepreneurship is essentially a style of management, yet he admits that there are several important differences between corporate management and entrepreneurship. For example, corporate managers tend to focus on "sustaining the established organisation, protecting it and maintaining its market position", and on "protecting 'scarce' resources" rather than "using them to pursue opportunities" (Wickham, 2006, p. 16). Conversely, entrepreneurs are "willing to venture: to create change and to pursue opportunity rather than just to maintain the status quo and conserve resources" (Wickham, 2006, p. 17). Furthermore, entrepreneurs are argued to operate in environments characterised by higher levels of risk, increased time pressure, intense personal commitment and deeper emotional involvement (Baron, 2008). Many entrepreneurs typically run small, often new, enterprises and may therefore be disadvantaged by the liabilities of smallness and newness (Witt, 2004), and by added vulnerability to external shocks (Cummings, 2005).

Therefore although the similarities are adequate to justify the transfer of knowledge from the management domain to the entrepreneurship domain an vice versa, the differences appear sufficiently significant to warrant a separate analysis of the two bodies of literature. The remainder of this literature review is therefore split into two parts: Section 2.5.1 deals with the literature on intuition in management, while Section 2.5.2 covers the literature on intuition in entrepreneurship.

One may recall that eight of the 68 publications included in this review are concerned primarily with the debate on the nature of human cognition, and have been reviewed in Section 2.4. Of the remaining 60 publications, 36 contribute primarily to knowledge on managerial intuition and 24 contribute to that on entrepreneurial intuition. These articles, together with their key concepts and contributions, the initials of the journals in which they were published, and an indication of whether they are empirical or conceptual in nature, are presented in chronological order (oldest first) in Tables 2.2 and 2.3 respectively.

The last column of these two tables indicates whether or not each article is considered a ‘core paper’ for the present study. Core papers are those which contributed significantly to the formulation of this study’s working definition of intuition, and to its conceptual framework, research hypotheses and methodology. These include papers which define intuition and delineate it from related constructs (e.g., Dane & Pratt, 2007; Hodgkinson et al., 2009a; Sadler-Smith & Shefy, 2007), those which discuss the relationship between experience and intuition (e.g., Gustafsson, 2006; Sadler-Smith & Shefy, 2004; Simon, 1987), those which argue for the importance of intuition in opportunity identification (e.g., Dimov, 2007b; Dutta & Crossan, 2005), and those which discuss the concept of cognitive versatility (Hodgkinson & Clarke, 2007; Hodgkinson & Healey, 2011). Conversely, non-core papers include those which are largely descriptive or anecdotal in nature (e.g., Agor, 1986; Hayashi, 2001; Isenberg, 1984) and those which include only a marginal discussion about intuition as their focus was on other matters (e.g., Athayde, 2009; Haynie & Shepherd, 2009; Tang, Kacmar & Busenitz, 2012).

2.5.1 Intuition in the Management Literature

Of the 36 managerial intuition publications, 19 were published in journals falling within the *General Management* subject area of the ABS list, four are from *Strategic Management* journals, four are from the *Organization Studies* group, four are from *Management Development and Education*, two are from *Entrepreneurship and Small Business Management*, one was published in a *Marketing* journal, one is an Academy of Management Conference working paper, and one is a book.

Table 2.2 Intuition in the Management Literature

Study	Source*	Type#	Key concepts / Variables	Relevance / Contribution	Core Paper+
Isaack (1978)	AMR	C	Importance of intuition for management	Promotes use and acceptance of intuition in management	N
Isaack (1981)	JSBM	C	Importance of intuition for management, particularly of small businesses	Promotes use and acceptance of intuition, particularly among managers of small business	N
Isenberg (1984)	HBR	E	Importance of intuition for management; Nature of managerial intuition	Promotes use and acceptance of intuition in management; Demonstrates how senior managers use intuition	N
Agor (1986)	OD	E	Nature of managerial intuition	Identifies conditions under which intuitive ability functions best; Describes ways in which managers use intuition	N
Simon (1987)	AME	C	Managerial intuition, pattern recognition and expertise	Highlights role of experience and training for intuition	Y
Schoemaker & Russo (1993)	CMR	C	Pyramid of decision making approaches	Warns of shortcomings of intuition	N
Parikh, Neubauer & Lank (1994)	Book	E	Importance of intuition for management	Provides a conceptual framework of intuition, promotes use of intuition in management	N
Wally & Baum (1994)	AMJ	E	Determinants of pace of SDM	Intuition is one of the determinants of speedy decision-making	N
Burke & Miller (1999)	AME	E	Nature of managerial intuition	Describes when intuition is used, benefits of intuition; quality of intuitive decisions	N
Khatri & Ng (2000)	HR	E	Intuition, strategic decision-making (SDM), stable/unstable environment	Intuition is conducive to SDM in an unstable environment but detrimental in a stable environment	N
Covin, Slevin & Heeley (2001)	JBR	E	Intuitive vs Technocratic (analytical) decision making style measured using simple 4-item Likert scale, organizational structure, high/low-tech environment	Intuition is more prevalent, and more effective, in high-technology industries	N
Clarke & Mackaness (2001)	JMS	E	Structure and content of managerial intuition, measured using cognitive mapping	Senior and junior executives differ in the content but not the structure of their cognitive maps; Intuition is a way of "cutting through" the details of a decision situation to make sense of it	N
Hayashi (2001)	HBR	C	Importance of intuition for management	Promotes acceptance and use of intuition in management	N

[*] For full name of the journals please refer to Table A3 in Appendix A
[#] E = Empirical, C = Conceptual; + Y = Yes (Core Paper); N = No (Not Core Paper)

Table 2.2 (Cont.) Intuition in the Management Literature

Study	Source*	Type#	Key concepts / Variables	Relevance / Contribution	Core Paper+
Bonabeau (2003)	HBR	C	Technologically-based decision support tools	Warns of shortcomings of intuition	N
Simon, Houghton & Savelli (2003)	JBV	E	Satisfaction, new product, risk; Intuition entered as a control variable	Intuition is a significant predictor of launching new products into unfamiliar markets	N
Sadler-Smith & Shefy (2004)	AME	C	Intuition-as-expertise, intuition-as-feeling, rationality, decision-making	Discusses balancing intuition with rationality in managerial decision making; demonstrates when and how managers use intuition	Y
Miller & Ireland (2005)	AME	C	Intuition as holistic hunch or automated expertise	Defines intuition, discuss value of intuition	Y
Hough & ogilvie (2005)	JMS	E	Cognitive style, strategic decision outcomes	Cognitive style is related to strategic decision outcomes	N
Sinclair & Ashkanasy (2005)	ML	C	Intuition, antecedents of intuitive decision making	Defines intuition, offers a testable conceptual framework of antecedents of intuitive decision making, provides overview of methods available for measuring intuition	Y
Dreyfus & Dreyfus (2005)	OSt	C	5-Stage model of acquisition of expertise	Intuition is a key feature of expertise, but experts use a combination of intuition and analysis	Y
Elbanna (2006)	IJMR	C	SDM process	Intuition is part of the SDM process	N
Hodgkinson & Clarke (2007)	HR	C	Dual-process theory, Cognitive strategy including Cognitive Versatility	Provides a framework which can be used to map out cognitive strategy, in line with dual-process theory	Y
Dane & Pratt (2007)	AMR	C	Intuition in managerial decision making	Reviews, reconceptualises and defines intuition, delineates it from related constructs, develops a model and propositions concerning antecedents of intuition effectiveness	Y
Sadler-Smith & Shefy (2007)	AMLE	E	Development of an intuitive awareness programme for management education	Defines intuition, delineates it from related constructs, develops programme to improve managerial intuition; Suggests that intuition should be included in business and management curricula	Y
Elbanna & Child (2007)	SMJ	E	Strategic decision effectiveness	Intuition was one of the antecedents of strategic decision effectiveness in the conceptual model, but no significant relationship was found	N

*** For full name of the journals please refer to Table A3 in Appendix A**
 # E = Empirical, C = Conceptual; + Y = Yes (Core Paper); N = No (Not Core Paper)

Table 2.2 (Cont.) Intuition in the Management Literature

Study	Source*	Type#	Key concepts / Variables	Relevance / Contribution	Core Paper+
Matzler, Bailom & Moordian (2007)	MIT-SMR	C	Importance of intuition for management	Promotes use and acceptance of intuition in management, suggests ways how to hone intuition	N
Hodgkinson, Sadler-Smith, Burke, Claxton & Sparrow (2009a)	LRP	C	Intuition, dual-process theory	Defines intuition, delineates it from other constructs, situates intuition within dual-process theory, suggests ways in which intuition can be operationalised and measured	Y
Woiceshyn (2009)	LRP	E	Intuition, guiding principles, SDM	Strategic decisions are made using rational processes based upon information retrieved intuitively	Y
Blackman & Sadler-Smith (2009)	ML	C	Organizational learning, various forms of knowing including intuitive knowing	Intuition is a form of knowing which cannot easily be articulated	N
Salas, Rosen & Diaz Granados, (2010)	JoM	C	Expertise-based intuition	Defines expertise-based intuition, highlights need for deliberate and guided practice for development of expert intuition	Y
Elbanna, Child & Braga Rodriguez (2010)	AoM	E	Intuition, antecedents of intuitive SDM	Decision uncertainty, environmental hostility, non-financial performance and company size are significant predictors of intuition in SDM; Decision importance, motive, environmental uncertainty and financial performance are not significant predictors of intuition in SDM	N
Dane (2011)	JoM	C	Mindfulness	Mindfulness may enable individuals to be more aware of their intuition	N
Hodgkinson & Healey (2011)	SMJ	C	Dynamic capabilities: Sensing (and shaping) opportunities and threats, seizing opportunities, transforming assets	Intuitive processes are as important as rational processes for the development and maintenance of dynamic capabilities	Y
Akinci & Sadler-Smith (2012)	IJMR	C	Intuition in management research	Provides a review of the history of intuition in management research	N
Armstrong, Cools & Sadler-Smith (2012)	IJMR	C	Cognitive Style	Provides a systematic review of cognitive style in management research	N
Dörfler & Ackermann (2012)	ML	C	Intuition	Suggests two forms of intuition: intuitive judgment and intuitive insight; views intuition as a form of expert knowledge	N

[*] For full name of the journals please refer to Table A3 in Appendix A
[#] E = Empirical, C = Conceptual; + Y = Yes (Core Paper); N = No (Not Core Paper)

Besides issues pertaining to the definition and demystification of intuition and its delineation from similar but distinct constructs as outlined in Sections 2.2 and 2.3, the literature on managerial intuition may be classified into five key themes. In the early days, when the dominant paradigm was that of the *Homo economicus* as explained in Section 2.1, intuition was frowned upon in organisations and only the most daring of managers would admit to making important decisions based on their intuition. However when scholars started to understand the value of intuition in management, they began conveying the message that intuition is and should be used in management (e.g, Agor, 1986). The first theme is therefore concerned with 'exposing' managerial intuition – or with demonstrating that managers often use intuition, and with describing how they use it. The second theme explores the antecedents of intuition, or the factors which are likely to lead to intuition. The third is concerned with the outcomes or effects of intuition, while the fourth outlines the conditions under which intuition is more likely to be effective. The fifth theme highlights the importance of combining the intuitive and analytical modes of processing – or of adopting a versatile cognitive strategy. Each of these themes is reviewed in further detail in Sections 2.5.1.1 to 2.5.1.5 below.

In addition to these five themes, two of the most recent journal articles are reviews of the literature on intuition and cognitive style in the management domain (Akinci & Sadler-Smith, 2012; Armstrong, Cools & Sadler-Smith, 2012). Section 2.5.1.6 briefly outlines these papers' contributions, and highlights how they differ from the present review.

2.5.1.1 Exposing Managerial Intuition

Much of the earlier – as well as some of the more recent – work on managerial intuition was concerned with showing that intuition is widely and successfully used by many managers and executives in their decision making (e.g., Agor, 1986; Isaack, 1978, 1981; Isenberg, 1984; Hayashi, 2001; Matzler et al., 2007; Parikh, Neubauer & Lank, 1994). This stream of literature was motivated by the fact that managers and executives "tended to keep their use of intuition a secret" because "revealing this fact would tend to undermine (their) effectiveness" and because "their colleagues did not or would not understand that intuition can be a reliable basis on which to make important decisions" (Agor, 1986, p. 15).

Isaack (1981) hoped to "mitigate the feelings of inferiority that managers of small businesses might have because they rely considerably on 'feel', 'hunch', 'guesstimates', or 'intuition' in managing their businesses" (p. 74), while Isenberg (1984) sought to "help relieve some managers of the inconsistency between their view of how they are 'supposed to' think and the thinking processes that, through experience, they have learned are actually quite effective" (p. 82). The most vivid portrayal of managerial intuition is offered by Hayashi (2001) who peppers his article with quotations from interviews with several top executives of leading multinational companies, including the (then) CEOs of Chrysler, Johnson and Johnson, and AOL, all of whom attribute their success to their intuitive decision making skills.

According to Isenberg (1984), intuition is used in at least five distinct ways by managers. These include intuitively sensing the existence of problems, relying on intuition to rapidly perform internalised patterns of behaviour, and synthesising seemingly unrelated pieces of information into a coherent picture. Managers also use intuition to check the results of rational analysis in what Isenberg describes as a “belt-and-suspenders approach” (p. 86), or conversely, to circumvent rational analysis when a quick solution is required.

Agor (1986), who explored “how top executives make important decisions” (p. 5), reports two major ways in which the executives he interviewed use their intuition. One group reportedly uses intuition “like an explorer” when making strategic decisions, trying to “foresee the correct path to follow” (p. 12). He explained that in such situations, executives opened their mind to creativity and unusual possibilities, rather than trying to stay within the boundaries stipulated by past experience:

> Under these circumstances, this group of executives was particularly careful to give intuition ‘free rein’, since they were trying to generate unusual possibilities and new options that might not normally emerge from an analysis of past data or traditional ways of doing things. The most effective method for achieving this goal, they found, was *not to adopt* a rigid system or step-by-step method of decision making. What worked was allowing the mind "to flow" where it wanted to go — whether it was sifting past experience or simply playing with concepts and ideas... (p. 12).

Other executives were more conservative in their use of intuition, using it as “the back end, not the front end, of the process —not so much as an explorer, but rather as a synthesizer and integrator” (p. 13). In these cases, they would begin their decision making process in a structured manner, with data collection and rational analysis, then allowing themselves time for reflection and incubation, “or the process of digesting and sifting through the information they have consumed before they would make a final decision” (p. 13).

Agor’s findings are supported by Sadler-Smith and Shefy (2004) who explain that:

> When deliberative rational thought is not achievable or desirable (for example, where unambiguous or sufficient ‘hard’ data is not immediately at hand, might never be available at all, or where creative solutions to problems are needed), one way of managing and coping with uncertainty and complexity and of ‘thinking outside of the box’ is by relying upon intuition. As an outcome of an unconscious process in which there is little or no apparent intrusion of deliberative rational thought, intuitions can be considered ‘soft data’ that may be treated as testable hypotheses (“Do the facts and figures back up my intuition?”) or used to check out a rationally derived choice (“How do I feel about the decision I’ve made?”) (p. 78).

In an international survey carried out in nine countries by Parikh, Neubauer and Lank (1994), managers reported making extensive use of intuition, which they viewed as being highly relevant for decisions in a variety of managerial settings. For example, the majority of managers in this survey believed intuition to play a significant role in corporate strategy and planning, human resource development, marketing, research and development, public relations, investment and business diversification decisions, and in acquisitions, mergers and alliances.

As mentioned above, a key purpose of the above stream of literature showcasing managerial intuitive decision making was to increase awareness of the widespread use of “closet intuition” (Sadler-Smith & Shefy, 2004, p. 80), in the hope that this would remove the stigma that was commonly associated with intuition, and hence increase its acceptance. This was in turn hoped to encourage many more managers to hone their intuitive skills and feel more confident in putting them to good use.

One may conclude that the majority of scholars who write about intuition in the management literature, argue in its favour. However, generalisations from the above literature should be made with caution. These studies are exploratory and descriptive and largely based on managers' attributions of their use of intuition which, as noted by Blume and Covin (2011) are not necessarily always accurate. Furthermore, there are certain conditions in which intuition would be more effective than in others, and it should not be used by itself, but should be combined with analysis. These issues are discussed further in Sections 2.5.1.4 and 2.5.1.5 respectively.

2.5.1.2 Antecedents of Managerial Intuition

Another major concern of management researchers was to determine which factors are likely to lead to intuitive processing and decision making, or in other words, to identify the antecedents of managerial intuition. A great deal of this literature takes the form of exploratory or descriptive empirical studies, with data generated through simple self-report interview-style methods.

For example, Agor's (1986) interviewees were asked to identify various conditions under which their intuitive ability is most likely to come into play. These conditions include when there is a high level of uncertainty, when there is no precedent, when variables are scientifically unpredictable, when facts or hard data are limited or when these do not provide a clear direction, when analytical data do not provide the necessary information, when there is more than one plausible alternative solution to choose from – each with good supporting arguments – and when there are time limits and high pressure for rapid decision making.

In an interview-based qualitative study by Burke and Miller (1999), the examples of intuition as reported by managers bear a great deal of resemblance to those mentioned in

Agor's (1986) study. These include when situations have no predetermined guidelines or rules to follow, if the objective data seem incorrect or inaccurate, when decisions need to be made quickly or unexpectedly because delays would generate additional costs, in novel situations which are high in uncertainty, and when explicit cues or guidelines are lacking. It is interesting to note that although the respondents in both the above studies were managers in large organisations, these descriptions are highly characteristic of the type of scenarios frequently faced by entrepreneurs, including when identifying opportunities, which suggests that intuition would also be useful in opportunity identification.

Although the above examples indicate that intuition comes into play when there is not enough data for rational analysis, an interview Hayashi (2001) conducted with the (then) CEO of Johnson and Johnson indicates that intuition is also important when data is available:

> It's at that point-when I have a tremendous amount of quantitative information that's already been analyzed by very smart people that I earn what I get paid. Because I will look at that information and I will know, intuitively, whether it's a good or bad deal (p. 61).

Sinclair and Ashkanasy (2005) and Elbanna, Child and Braga Rodriguez (2010) constructed broad categories of factors that interact with one another to determine the dominance of intuition or rationality in decision making. Sinclair and Ashkanasy (2005) argue that managerial intuition is determined both by personal disposition and decision making context. More specifically, they suggest that intuitive decision making is affected by four broad categories of factors, namely, the characteristics of the problem, the characteristics of the decision, the decision maker's personal disposition and the context in which the decision making takes place. They further argue that the relationship is moderated by affect and gender.

Using a somewhat similar approach, Elbanna et al. (2010) derive a number of contextual variables from the SDM literature to construct and test a conceptual framework which consists of the nature of the decision problem – namely, decision importance, decision uncertainty, and decision motive, environmental factors – namely, environmental uncertainty and environmental hostility / munificence, and characteristics of the firm – namely, company performance and company size. The measure of intuition used in ths study is a slightly adapted version of a scale constructed by Khatri and Ng (2000) which operationalises intuitive synthesis by means of three indicators, namely, reliance on judgment, reliance on past experience, and use of gut feeling. Elbanna et al. (2010) find that the characteristics specific to the environment and to the firm appear to have more significance for intuition than the nature of the decision problem. Decision uncertainty and environmental hostility were found to be positively related to intuition, while non-financial performance and company size were found to be negatively related to intuition in SDM. On the other hand, no significant relationship was found between intuition and decision importance, decision motive, environmental uncertainty, and financial performance.

One final antecedent, or more specifically, an enabler of intuition which was identified in the management literature, is mindfulness. According to Dane (2011), some intuitions go unnoticed because individuals are not properly attuned to their non-conscious processes. He argues that mindfulness, which he defines as "a state of consciousness in which attention is focused on present-moment phenomena occurring both externally and internally" (p. 1000), may help individuals become more aware of their intuition. This is consistent with Sadler-Smith and Shefy (2007), who included mindfulness as one of the principles upon which their intuition awareness training programme for managers was built. It may be argued that if individuals are more in tune with their intuition, they would be more likely to use it.

2.5.1.3 Outcomes of Managerial Intuition

Besides shedding light on the antecedents of intuition, the literature on managerial intuition also provides an indication of the outcomes of intuition. These include speedy decision making and decision effectiveness.

Wally and Baum (1994) conducted a questionnaire-based study among 151 executives to determine whether intuition, as measured using a six-item self-report index, is an antecedent of decision speed. They found that among the factors found to be positively related to decision speed, centralisation and the use of intuition are the most important. They conclude that "executives who use intuition readily ... appear to be able to perform the intelligence, design, and choice activities that make up strategic decision making faster than other executives" (p. 947). Although Wally and Baum's findings are in line with the now popularly-held view that intuition leads to some improvement in decision making, the rigour with which they were obtained may also be called into question due to a reliance on a simple self-report measure of intuition, which may provide an incomplete picture of intuition.

Clarke and Mackaness (2001) study the structure and content of the cognitive maps of three senior managers to explore how they use intuition in strategic decision making. Their findings indicate that executives use intuition to "cut through" the details of a decision, in order to establish connections between inputs and cognitions, without in-depth analysis. The outcome of intuition according to this study is therefore the ability to rapidly and effortlessly make sense of a situation, which is in turn likely to lead to faster decision making:

> Intuition seems, therefore, to come more into play as a means of 'going beyond' the rational data and information, by using experiences to 'cut through' the essence of a situation, helping to make sense of it, and as a test of its validity (p. 166).

Although this study utilises one of the more sophisticated methods of capturing intuition as compared to the other empirical studies covered in this review, it may be criticised on the grounds that it applies the causal mapping technique post-hoc on a sample of only three participants. For a better designed study that uses cognitive mapping with experimental manipulation and controls, in a more considered effort to trigger intuitive processing, prior to mapping, readers are referred to the work of Maule, Hodgkinson and Bown (2003).

Elbanna and Child (2007) contend that strategic decision effectiveness is directly influenced by the strategic decision-making process, a dimension of which is intuition. It is interesting to note that Elbanna and Child implicitly assume the unitary view in this study, as they hypothesise that rationality and intuition have opposite effects on strategic decision effectiveness, with intuition being negatively associated with decision effectiveness. Findings support the hypothesis that rationality is a predictor of decision effectiveness. Interestingly, however, intuition was not found to be related to decision effectiveness. The data used in this study is the same as that used in Elbanna et al. (2010), and could therefore be criticised on the same grounds – concerning debatable construct validity, overly simplistic measures, and questionable reliability of self-report data – as outlined above.

In two other studies, the outcomes of intuition are indirectly inferred from intuitive cognitive style. The first of these, conducted by Simon, Houghton and Savelli (2003), investigated whether preference for intuitive decision making is linked to the amount of resources invested, and to their choice of an unfamiliar market for the introduction of a new product. This was done by entering intuitive preference as a control variable, along with the main predictor (initial managerial satisfaction) in the regression model. The measure of intuitive decision-making used by Simon et al. (2003) was a self-report, four-item, five-point Likert scale. Regression analyses found that intuition is not related to the amount of business resources invested to introduce a new product, but it is a significant predictor of the choice of an unfamiliar market to launch the new product.

The second study which investigated outcomes of an intuitive cognitive style was that by Hough and ogilvie (2005), which examined its effects on strategic performance outcomes. They examined the decisions of 749 senior (experienced) managers and executives in response to a behavioural simulation task and found that cognitive style is associated with decisiveness and perceived effectiveness of decisions. However one should note that this study did not adopt a dual-process view of intuition but made use of the Myers-Briggs Type Indicator (MBTI) to measure cognitive style. This instrument has been criticised for its debatable construct validity and for its incompatibility with the Jungian theory upon which it claims to be based (Hodgkinson & Clarke, 2007). Furthermore, an intuitive cognitive style does not necessarily denote use of intuition in an actual task (Hodgkinson & Sadler-Smith, 2011), therefore, the findings of this study cannot be taken to mean that intuition itself leads to better quality decisions.

2.5.1.4 Conditions for Effective Managerial Intuition

As outlined above, many managers report widespread use of intuition in their decision making. There are, however, certain conditions in which intuition is more likely to be effective.

Miller and Ireland (2005) argue that the effectiveness of intuition varies not simply as a function of the type of situation being faced, but also as a result of its appropriate matching with the type of intuition to be applied. One may recall from the definitions of intuition discussed in Section 2.2, that Miller and Ireland (2005) identify two types of intuition: holistic hunch and automated expertise. They discuss the use of these types of intuition in situations where an organisation is focused on exploring the environment for new technologies and strategies, and then in situations where an organisation is focused on exploiting existing ways of doing things. Their analysis suggests that holistic hunch, if handled properly, can be valuable for exploration, while automated expertise can be valuable as a starting point for exploitation, but it must be made explicit for decision-making success.

Consistent with the above, Covin, Slevin and Heeley (2001) also argue that intuition needs to be matched with environmental conditions in order to lead to effective decision making. They focus their attention on the relationship between decision making style, organisational structure, and high/low-technology environments, and argue that what may be a proper alignment between decision making style and organisational structure for firms in high-technology environments may be sub-optimal for firms in low-technology environments. Covin et al. (2001) gathered questionnaire data from 96 manufacturing firms, operating in 68 different industries, all having 50 or more employees. There were primary respondents (senior-most executives, i.e., presidents, CEOs) as well as secondary respondents (another senior executive nominated by primary respondent), for corroboration purposes.

The measure of decision making style used in Covin et al.'s (2001) study is Khandwalla's (1977) technocracy dimension. A management style that is high in technocracy is defined as being reliant on quantitative, analytical decision making, while that low in technocracy is higher in intuitive-experience based decision making. Khandwalla's technocracy measure is a made up of 4-items, scored on a 7-pt Likert scale. These items ask whether the organisation's major operating and strategic decisions "nearly always" result from extensive quantitative analysis of data, whether its operating and strategic decisions are "nearly always" detailed in formal written reports, whether they rely principally on experienced-based intuition (rather than quantitative analysis) when making major operating and strategic decisions, and whether their major operating and strategic decisions are much more affected by industry experience and lessons learned, than by the results of formal research and systematic evaluation of alternatives.

Covin et al.'s (2001) findings indicate that in high-technology environments, high sales growth rates are associated with an intuitive decision style and organic structure, while in low-technology environments, high sales growth rates are associated with technocratic style and a mechanistic structure. In other words, intuition appears to be more prevalent – and more effective – in high-technology industries.

In another empirical study of environmental differences and intuition in strategic decision making, Khatri and Ng (2000) argue that intuitive synthesis is more appropriate for strategic (non-routine) decisions than for day-to-day operational (routine) decisions, and that it is more effective in an unstable environment than in a stable environment. They collected questionnaire-based data from 281 senior managers / CEOs from 221 organisations in three industries (computing – considered to be highly unstable, banking – moderately unstable, and utilities – stable). They operationalise intuitive synthesis by means of three indicators, namely reliance on judgment, reliance on past experience, and use of gut feeling.

Khatri and Ng's (2000) findings suggest that senior managers often use intuitive synthesis in their decision making, but that this is contingent upon environmental conditions. They found intuitive synthesis to vary greatly across industries, with the highest level of intuition found in the computer companies, followed by the banks, and then the utilities companies. Khatri and Ng's findings also indicate that intuition is positively related to some types of performance in unstable environments but unrelated or negatively related to performance in unstable environmental conditions. Khatri and Ng's (2000) findings are therefore in line with those of Covin et al. (2001) reported above, concerning the prevalence and effectiveness of intuition in high-technology industries.

2.5.1.5 Combining Intuition and Analysis in a Versatile Cognitive Strategy

Having said all of the above, it is interesting to note that the literature strongly indicates that intuition and analysis should be used together to complement one another. For example the executives in Agor's (1986) study emphasised that intuition should be used together with, and not instead of, rational analysis for effective decision making. This was echoed by the managers in Burke and Miller's (1999) study, 91.5% of whom said that they combine intuition with data analysis in their decision making, "employing intuition in concert with deductive processes" (p. 94). Dreyfus and Dreyfus (2005) note that although "intuitive judgement is the hallmark of expertise" (p. 779), "the best of experts, when time permits, think before they act" (p. 789).

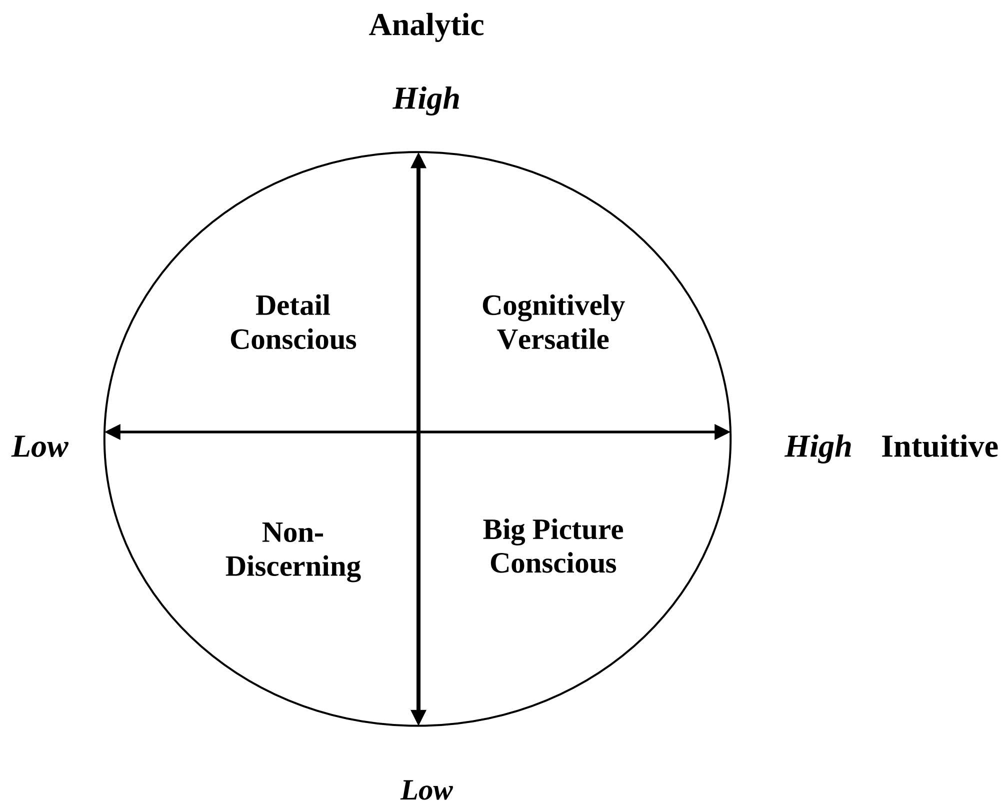
This sentiment is shared by all scholars in the field, even those who argue strongly in favour of intuition. Isaack (1981) argued that "intuition and logical thought work in tandem" (p. 74) and that "it is when this balance is achieved that management is working at its maximum effectiveness" (p. 76). Similarly, Isenberg (1984) noted that "the higher you go in a company, the more important it is to combine intuition and rationality, act while thinking, and see problems as interrelated" (p. 81). Sadler-Smith and Shefy (2004) explain that:

> We are not proposing that intuition is *better* than rationality, or indeed vice versa. We are suggesting that a single-minded emphasis on rationality (or intuition) presents a partial view. Executives might achieve a more balanced perspective by considering both rationality and intuition as complementary and mutually reinforcing components of a decision strategy (p. 87).

The combined use of intuition and analysis is fully consistent with the principles of dual-process theory which, as explained in Section 2.3, views these two modes of processing as arising from two interrelated but independent systems which allows their concurrent activation (e.g., Epstein et al., 1996; Pacini & Epstein, 1999). However individuals vary in their preference for – and use of – intuition and analysis, with some being inclined predominantly towards one mode or the other, while others may be more balanced. Hodgkinson and Clarke (2007) propose a framework to describe how the cognitive style of organisational strategists influences their cognitive strategy – which, as explained in Chapter 1, refers to the information processing approach employed by individuals in response to particular circumstances (Hodgkinson & Clarke, 2007).

In this framework, which is reproduced in Figure 2.1, a 'high-low' intuitive (*x*) axis orthogonally intersects with a 'high-low' analytic (*y*) axis to create four quadrants representing individuals who are (1) "detail conscious": characterised by an analytical cognitive style and who tend to approach tasks in a narrow-focused, step-by-step and logical manner; (2) "big picture conscious": characterised by an intuitive cognitive style and who therefore prefer to tackle problems and decisions holistically and without paying much attention to detail; (3) "non-discerning": lacking a marked inclination for either analytic or intuitive processing, preferring instead to "deploy minimal cognitive resources" while "rely(ing) on the opinion and received wisdom of others, thus relieving themselves of the burdens of analytic and intuitive processing altogether"; and (4) "cognitively versatile": characterised by a cognitive style that is both highly analytic and highly intuitive, i.e., by a tendency to "attend to analytic detail *and* cut through that detail, as and when required", and thus by an ability to "switch more readily between analytic and intuitive processing strategies" (Hodgkinson & Clarke, 2007, pp. 246-247). This fourth category is consistent with the notion that effective cognitive functioning may be due to the ability to detect which mode of processing is appropriate given particular situational demands and to "switch cognitive gears" (shift from one mode to the other) accordingly (Louis & Sutton, 1991).

Figure 2.1 Basic Typology of Contrasting Strategies and Style (Reproduced from Hodgkinson & Clarke, 2007, p. 246)



According to Hodgkinson et al. (2009a), a cognitive strategy which is high in versatility is the most effective for strategic decision making as it enables individuals to "blend and flex to the varying information processing demands, as and when required to do so" (p. 288). This is supported to some extent by Woiceshyn (2009) who studied the strategic decisions of 19 oil company executives using a think-aloud scenario-based method – which, it should be noted, has been recommended as an appropriate tool for measuring intuition (Hodgkinson & Sadler-Smith, 2011; Mitchell et al., 2005; Pretz, 2008) – and found that the effective executives make strategic decisions using rational processes based upon information retrieved intuitively:

> Effective CEOs intuitively retrieved essentials from their subconsciously-stored memory files ... This enabled them to analyse the ... option rationally, dismiss it quickly and to concentrate on others that would create value more effectively (Woiceshyn, 2009, p. 304).

Given that there are some similarities between strategic decision making and opportunity identification in terms of their critical nature to organisational survival as explained in Section 2.5, it may be argued that a versatile cognitive strategy may also be the most appropriate for the identification of opportunities. This has been given no attention in the literature from an entrepreneurship perspective, however Hodgkinson and Healey (2011) discuss the importance of combining intuitive and analytical processes to develop the dynamic capabilities (Teece, 2007) of "sensing (and shaping) opportunities and threats" (p. 1503) and "evaluating and selecting new opportunities" (p. 1507) in the context of strategic management. Hodgkinson and Healey (2011) explain that although these activities have largely been viewed as being based upon purely analytical processes, they would be better served by a "blend of effortful forms of analysis with the skilled utilization of less deliberative, intuitive processes" (p. 1500).

In view of the above, it would be wrong to argue that either intuition or analysis is superior to the other. On the contrary, they are both extremely valuable and should be used in tandem in varying degrees, depending on the specifics of the situation.

2.5.1.6 Recent Reviews of Intuition in Business Research

As mentioned earlier in this chapter, two of the most recent articles that emerged from the search for scholarly work on intuition in management are literature review papers, one authored by Akinci and Sadler Smith (2012) and the other by Armstrong et al. (2012).

Akinci and Sadler Smith (2012) provide a historical review of intuition research in the management domain as well as in base disciplines and related fields, stretching back over eight decades. They highlight the key trends which dominated these fields at different points in time and reflect on how they influenced research on intuition in management. On the basis of this review, they provide various directions and recommendations for future research.

Armstrong et al. (2012) focus their review on the role of cognitive style in the broader field of business research, which includes but is not limited to the management domain, covering a span of 40 years. They identify eight areas of business research which have enjoyed the attention of cognitive style researchers, and synthesise the literature pertaining to each of these areas. They also review several measures of cognitive style, including the abovementioned Cognitive Style Index (CSI) and Rational-Experiential Inventory (REI). Consistent with what was stated in Section 2.3 above, Armstrong et al. (2012) note that while the CSI has been more widely used than the REI in past research, recent trends indicate a shift from the unitary view of cognitive style as measured by the CSI and advocated by its authors (Allinson & Hayes, 1996), towards a dual-process view as measured by the REI (Epstein et al., 1996; Pacini & Epstein, 1999), and supported by proponents of dual-process theory (e.g., Hodgkinson & Sadler-Smith, 2003a, 2003b, Hodgkinson et al., 2009b). Guided by the literature reviewed, Armstrong et al. (2012) conclude their article by highlighting several gaps that warrant the attention of future researchers.

Both of these reviews are highly informative and of great value to anyone interested in intuition in management. Akinci and Sadler-Smith (2012) and Armstrong et al. (2012) not only effectively synthesise a great deal of relevant literature, but by identifying several gaps and by making suggestions for further research, they help set the agenda for future scholarly endeavours. Given their contribution to the literature on intuition in management, do these articles limit the scope of the present review, or are there sufficient differences to argue that they are complementary to one another?

While there is some overlap between the article authored by Akinci and Sadler-Smith (2012) and the work presented in this chapter in that they both concern literature on intuition in management, there is a difference in the research approach adopted by the two reviews which leads to some variation in the areas of coverage. Akinci and Sadler-Smith's (2012) review covers a longer time-span, includes more work from non-management fields, and is not limited to the top-tier peer-reviewed journals which were selected for this chapter. However, they do not report a systematic approach to their research, and admit that they present a "selective review" of empirical, conceptual and theoretical work (pp. 10-11). Consequently, they omit a number of important studies on intuition in management, including those by Clarke and Mackaness (2001), Covin et al. (2001), and Wally and Baum (1994). Furthermore, this chapter adopts a different framework for presenting the analysis of the literature. While Akinci and Sadler-Smith present their findings in chronological order, highlighting the key trends of each era – which is very appropriate given the historical nature of their review – this chapter takes a thematic approach to the analysis, providing different insights about, for example, the antecedents and outcomes of managerial intuition, thus creating a somewhat different overall 'flavour' for the review.

Second, there is a large portion of this chapter which is not covered by either of the two published articles under discussion. Akinci and Sadler-Smith's (2012) article is concerned with intuition in management and base disciplines, but they do not extend their review into the domain of entrepreneurship – which is the focus of the remainder of this chapter. On the other hand, Armstrong et al. (2012) include a section on *creativity, entrepreneurship and innovation* in their paper, but this is one of eight business research areas covered – so it constitutes only a small part of the article. Furthermore, Armstrong et al.'s (2012) review is limited to cognitive style – so it omits several key papers on intuition in entrepreneurship (e.g., Dutta & Crossan, 2005; Mitchell et al., 2005), which are reviewed later in this chapter.

In view of the above, it may be concluded that there are sufficient differences between this chapter and the review articles in discussion to indicate that this is not simply a replication of effort, but that it makes an additional contribution which complements these published works, particularly by means of its inclusion of an extensive review of the literature on intuition in entrepreneurship. This review on entrepreneurial intuition is presented next.

2.5.2 Intuition in the Entrepreneurship Literature

As mentioned in Section 2.5, 24 of the 68 publications in this review contribute primarily to knowledge on entrepreneurial intuition. Of these, 16 appeared in journals from the *Entrepreneurship and Small Business Management* category, two are from the *General Management* subject group, two are from *Organization Studies*, two are from the *Psychology* group (one of which is an edited annual book series), and one is from *Operations Research and Management Science*. The last is a published Doctoral thesis (Gustafsson, 2006).

Table 2.3 presents the key concepts and contributions of these publications, indicates where they were published, which are empirical and which are conceptual, and which are 'core' papers for this study. This literature has been classified into five key themes. The first investigates similarities and differences in cognitive style between entrepreneurs and managers of different levels of seniority, the second explores the role of experience and expertise as antecedents of entrepreneurial intuition, the third identifies several outcomes of an intuitive cognitive style, the fourth discusses the link between intuition and opportunity identification, while the fifth and final theme presents intuition as a component of other psychological constructs. Each of these themes is reviewed in further detail in the sections below.

Table 2.3   Intuition in the Entrepreneurship Literature

Study	Source*	Type*	Key concepts / Variables	Relevance / Contribution	Core Paper#
Mosakowski (1998)	OSc	C	Entrepreneurial resources, competitive outcomes	Intuition is considered to be an entrepreneurial resource	N
Crossan, Lane & White (1999)	AMR	C	4I Organizational Learning Framework, one 'I' of which is Intuition	Outlines the features of entrepreneurial intuition in contrast with those of expert intuition	Y
Allinson, Chell & Hayes (2000)	EJWOP	E	Cognitive Style (measured using CSI)	Cognitive style of entrepreneurs is more intuitive than that of general population of managers but similar to top managers	Y
Sadler-Smith (2004)	OSt	E	Cognitive Style (measured using MSG, two scales of GDMS), firm performance	Intuitive cognitive style is positively related to firm performance; Owner-managers of high-growth firms are more intuitive than their lower-growth counterparts	N
Dutta & Crossan (2005)	ET&P	C	Applies the 4I Organizational Learning Framework to opportunity identification	Intuition is critical in learning about opportunities as every opportunity begins with an intuition	Y
Mitchell, Friga & Mitchell (2005)	ET&P	C	Intuition in entrepreneurship	First paper to define construct of intuition and to outline its antecedents and consequences	Y
Ravasi & Turati (2005)	JBV	E	Entrepreneurial learning	Intuition is the first step in the entrepreneurial process as initially opportunities appear as intuitions	N
Gustafsson (2006)	Doctoral Thesis	E	Intuition and analysis in opportunity identification, entrepreneurial experience and expertise	Prevalence of intuition changes with uncertainly of decision. Experts are capable of adapting their mode of processing in response to changing levels of uncertainty. Novices are more analytical and less adaptable	Y
Baron & Ensley (2006)	MS	E	Opportunity identification prototypes of novice and experienced entrepreneurs	Intuition / gut feeling forms part of the opportunity profiles of novices but not of experienced entrepreneurs	Y
Brigham, De Castro & Shepherd (2007)	ET&P	E	Cognitive Style (measured using CSI), characteristics of firm, job satisfaction	Cognitive style is related to job satisfaction and firm characteristics (structure)	N
Dimov (2007a)	ET&P	E	4I Organizational Learning Framework, Opportunity insight, opportunity intention	Intuition triggers initial business ideas; these are then developed in a learning process driven by intentionality, which is shaped by prior knowledge and by a match between learning style and situation	N
Dimov (2007b)	ET&P	C	4I Organizational Learning Framework, Intuiting, Interpreting, opportunity development	Intuition triggers initial business ideas; this is shaped by contextual influences	Y

[*] For full name of the journals please refer to Table A3 in Appendix A
[#] E = Empirical, C = Conceptual; + Y = Yes (Core Paper); N = No (Not Core Paper)

Table 2.3 (cont)   Intuition in the Entrepreneurship Literature

Study	Source*	Type#	Key concepts / Variables	Relevance / Contribution	Core Paper+
Dutta & Thornhill (2008)	JBV	E	Cognitive Style (measured qualitatively), growth intentions	Cognitive style moderates the relationship between entrepreneurs' changing perceptions of the external environment and growth intentions	N
Dane & Pratt (2009)	IRIOP	C	Intuition	Creative (entrepreneurial) intuition may be related to expertise	Y
Kickul, Gundry, Barbosa & Whitcanack (2009)	ET&P	E	Cognitive Style (measured using CSI), self-efficacy, entrepreneurial intentions	Entrepreneurial self-efficacy in the different stages of the new venture process is related to Cognitive Style	N
Athayde (2009)	ET&P	E	Enterprise potential	Intuition is believed to be a dimension of latent enterprise potential	N
Haynie & Shepherd (2009)	ET&P	E	Adaptive cognition	Intuition forms part of adaptive cognition (under metacognitive experience)	N
Dew, Read, Sarasvathy & Wiltbank (2009)	JBV	E	Effectual logic, predictive logic, expert entrepreneurs	Experts and novices do not differ on intuitive decision-making; low incidence of intuition in the decision-making processes of both groups	N
Baron & Henry (2010)	SEJ	C	Experience, expertise, deliberate practice, new firm performance	Deliberate practice is beneficial for various cognitive processes, one of which is intuition; Experience is not analogous to expertise	N
Vaghley & Julien (2010)	JBV	E	Opportunity identification, intuition	Intuition is a key element of human information processing; plays a role in opportunity identification	N
Blume & Covin (2011)	JBV	C	Intuition, false attribution	First to note that cognitive style / preference for intuition is not analogous to actual use of intuition; Argues that self-report methods are inadequate for measuring intuition	Y
Groves, Vance & Choi (2011)	JSBM	E	Linear and Nonlinear Thinking (cognitive) Styles (measured using LNTSP)	Entrepreneurs differ in thinking style from frontline managers but are similar to top executives; Thinking style of entrepreneurs balanced or versatile, not predominantly non-linear (intuitive)	Y
Tang, Kacmar & Busenitz (2012)	JBV	E	Entrepreneurial Alertness	Alertness is positively correlated with intuition	N
Chaston & Sadler-Smith (2012)	BJoM	E	Entrepreneurial Cognition / Cognitive Style (measured using REI), entrepreneurial orientations, firm capability	There is an interaction effect between intuitive cognitive style and market conditions on firm capability	N

*** For full name of the journals please refer to Table A3 in Appendix A**

 # E = Empirical, C = Conceptual; + Y = Yes (Core Paper); N = No (Not Core Paper)

2.5.2.1 Exploring Differences in Entrepreneurial and Managerial Cognitive Style

One of the first key papers to appear on entrepreneurial intuition was that by Allinson et al. (2000). The central tenet of this research was that because entrepreneurs operate in a new context with limited information, intuitive approaches are more likely to accommodate critical aspects of entrepreneurship than linear rational models. Using Allinson and Hayes' (1996) Cognitive Style Index (CSI), Allinson et al. (2000) measured the preference for intuitive or analytical decision making of a group of 156 entrepreneurs, and compared their results with those of a previous study conducted among managers of large organisations. The key findings of this study are that entrepreneurs of high growth firms have a cognitive style that is more intuitive than that of junior managers, middle managers, and of the general population of managers, but is similar to that of senior managers.

These results have two important implications. The finding that senior managers and entrepreneurs have similar thinking styles supports the notion that there are sufficient similarities between entrepreneurs and top managers to justify the transfer of knowledge about intuition from the management domain to the entrepreneurship domain. However, the finding that entrepreneurs are more intuitive than junior managers, middle managers, and than the general population of managers, confirms that this transfer of knowledge needs to be accompanied by careful critical analysis to explore the extent to which results are generalisable to entrepreneurship. Not all managers are similar to entrepreneurs, so not all findings of management research are applicable to entrepreneurship. Ideally, knowledge about entrepreneurial intuition should be gleaned from studying entrepreneurs, not simply inferred from research with managers, who may or may not share the same cognitive properties with entrepreneurs. In this view, it may be argued that the findings of Allinson et al. (2000) were the first to legitimise the study of intuition in entrepreneurial settings as a field of inquiry in its own right.

A pattern of results that bear some resemblance to those of Allinson et al. (2000) were found over a decade later by Groves, Vance and Choi (2011), who compared Linear (analytical, rational, logical) and Nonlinear (intuitive, creative, emotional) thinking styles of a sample of entrepreneurs with those of actors, accountants, frontline managers and senior executives. The measure used in this study was a 26-item, four-dimensional, forced choice self-report tool known as the Linear and Nonlinear Thinking Style Profile (LNTSP), developed by Vance, Groves and Kindler (2007). Groves et al. (2011) found that entrepreneurs and senior managers share similar thinking styles, but they differ from the other groups of professionals including the frontline managers. The LNTSP may be criticised on various grounds, including the unclear blend of unitary and dual-process theoretical foundations, its conflation of intuition with several related but distinct constructs, and its problematic ipsative scoring procedure (see Hodgkinson & Sadler-Smith, forthcoming). Nevertheless, Groves et al.'s findings are in line with the arguments stated above concerning the cautious generalisation of research from the management domain to the entrepreneurship domain, and about the justification of studying entrepreneurial intuition in its own right.

Although not entirely related to this discussion, it is interesting to note that in Groves et al.'s (2011) study, the thinking style of entrepreneurs and senior managers was found to be balanced in terms of linear and non-linear thinking, rather than predominantly non-linear (intuitive) as indicated in Allinson et al.'s (2000) study. This is consistent with dual-process theory and with the notion of cognitive versatility (see Hodgkinson & Clarke, 2007).

2.5.2.2 Antecedents of Entrepreneurial Intuition

One of the concerns of the literature on intuition in entrepreneurship was to explore the antecedents of entrepreneurial intuition, or in other words, to determine which factors are likely to lead to intuitive processing in entrepreneurship. While management researchers have also asked this question and identified multiple factors including high levels of uncertainty and absence of information (Agor, 1986; Burke & Miller, 1999; Elbanna et al., 2010), the discussion on the antecedents of intuition in the entrepreneurship literature has centred primarily on the role of experience and expertise.

As explained in Section 2.2, most conceptualisations of intuition have associated it with domain-specific experience and expertise (e.g., Hodgkinson et al., 2009a; Miller & Ireland, 2005; Sadler-Smith & Shefy, 2004; Simon, 1987) which would suggest that this is a necessary condition for – or antecedent of – entrepreneurial intuition. However it has been suggested that intuition is possible even in the absence of domain-specific experience (Crossan et al., 1999; Dane & Pratt, 2009). Given that the aim of this study is to investigate the relationship between intuition, experience and opportunity identification, it is worth exploring if there is any way of reconciling these views.

The first to explicitly highlight the possibility that inexperienced entrepreneurs could be as intuitive as their more experienced counterparts were Crossan and colleagues (Crossan et al., 1999; Dutta & Crossan, 2005). These authors explain that intuition can be of two types: The first is *expert intuition*, which Dutta and Crossan (2005) describe as being "based on pattern recognition" and which "emphasizes the complex knowledge base of the individual as being the primary means by which patterns are recognized" (p. 436). The second type of intuition is *entrepreneurial intuition* which, in contrast, "relies less on the knowledge base of the individual, but rather, on their creative capacity to recognize gaps and to identify possibilities" (Dutta & Crossan, 2005, p. 436). In this view, experience is an antecedent of expert intuition but not of entrepreneurial intuition, which leads to "novel, intuitive insights" (Crossan et al., 1999, p. 526) and to the identification of new opportunities (Dutta & Crossan, 2005).

It is worth noting that Crossan et al.'s (1999) notion of intuitive insight may appear to conflate the similar but distinct constructs of intuition and insight (as outlined in Section 2.3), in which case it would go against Sadler-Smith and Shefy's (2004) recommendation to not "mix up your I's" (p. 81). However, Dörfler and Ackermann (2012) explain that insight can be of two forms, namely non-intuitive or intuitive. Non-intuitive insight occurs where problems are well-defined, whereas intuitive insight takes place where problems are poorly structured and where new knowledge and ideas must be produced (Dörfler & Ackermann, 2012). Relating this to the present discussion on entrepreneurial intuition, intuitive insights are business ideas which emerge from the intuitive preconscious reflections of existing or would-be entrepreneurs in response to current or emerging customer needs (Dutta & Crossan, 2005).

The notion of entrepreneurial intuition was later elaborated upon by Dane and Pratt (2009) in the context of their suggested three 'types' or functions of intuition. In the first type, they view intuition as "a vehicle for problem-solving" (p. 4), based on the matching of patterns made possible through practice and experience, such that experience is an antecedent to – or cause of – intuitive judgment. In the second type, intuition is seen to be an input to making moral decisions. This type of intuition is unrelated to the topic under study so no further comment is necessary. Conversely, the third type of intuition proposed by Dane and Pratt (2009) – labelled *creative intuition* – is highly relevant to this discussion.

According to Dane and Pratt (2009), *creative intuition* is "a creative act of synthesis in which disparate elements are fused together in novel combinations" – such as in the generation of entrepreneurial ideas – and is therefore "a key input in the creative process" (p. 9). Dane and Pratt (2009) explain that creative intuition is of particular value in situations where there are few or no precedents upon which to model one's decisions – which are the sort of situations faced in entrepreneurship, where change and uncertainty are the order of the day. They view creative intuition as "akin to" (p. 10) entrepreneurial intuition (Crossan et al., 1999; Dutta & Crossan, 2005), which as has just been explained above is regarded to be unrelated to domain-specific experience and knowledge. At the same time, however, Dane and Pratt (2009) acknowledge that "each of the types of intuition we discuss, particularly creative intuition, *may* be related to expertise" (p. 5, emphasis added) and describe creative intuition as "based on integration of knowledge across different domains" (p. 5). The implications in this case may be interpreted that experience, particularly that which is domain-specific, is an antecedent of the problem-solving type of intuition, but not necessarily of creative intuition.

One way of exploring the merits of the above arguments is to refer to the extant empirical literature on the subject which, unfortunately, is very scarce. The only study which has been published on this specific issue to date is a Doctoral thesis by Gustafsson (2006) who uses a think-aloud verbal protocol method to explore whether novices and experts differ in their use of intuition and analysis when performing opportunity identification tasks of varying levels of uncertainty. Consistent with the expertise-view of intuition, which considers domain-specific experience to be a necessary antecedent of intuition, Gustafsson found the following difference between expert and novice entrepreneurs: The dominant mode of processing of experts shifted from being predominantly analytical in the low uncertainty task to predominantly intuitive in the high uncertainty task, indicating that experts are able to engage in intuitive processing when the need arises. Conversely, the dominant mode of processing of novices tended to be analytical, regardless of the level of uncertainty in the task, indicating an inability to engage in intuitive processing. These findings would negate the notion of 'inexperienced' forms of intuition, such as the entrepreneurial intuition suggested by Crossan et al. (1999) and Dutta and Crossan (2005).

However, there are two problems with this study which may call its findings into question. The first issue is that the author adopts the single-process Cognitive Continuum Theory (see Hammond, 2000) as her guiding theoretical framework. As explained in Section 2.3, this theory places intuition and analysis on two opposite ends of the same bipolar construct, thus eliminating the possibility that the intuitive and analytical modes could be highly activated at the same time. An inspection of the distribution of the cognitive processing of the experts and the novices as reported by Gustafsson reveals that a considerable amount was coded as *quasi-rationality*, which has no place in dual-process theory. One may wonder what results would emerge if the analysis were to be repeated using a dual-process approach and re-coding these quasi-rational 'grey areas' as either intuition or analysis. Would the novices remain predominantly analytical, or would this re-coding reveal an ability to engage in entrepreneurial or creative intuitive processing?

The second problematic issue in this study concerns the weak justification for categorising respondents into the novice and expert categories. Gustafsson's criteria for inclusion in the expert category were that respondents should have between 7 and 10 years of experience together with a relevant college or university degree. However the widely accepted norm is that a minimum of 10 years experience are required for the acquisition of expertise in a given domain (e.g., Weisberg, 1999). Furthermore, even this so-called 'Ten-Year Rule' is now being called into question as a sufficient condition for the formation of expertise, because the quality of experience matters as well as the amount of experience. For example according to Baron and Henry (2010), expertise is not analogous to experience, as the former requires extensive deliberate practice – which refers to prolonged and highly focused effort – rather than mere participation or engagement for ten, or any other number of years. It is therefore possible that Gustafsson's 'experts' were not really experts at all, and that therefore, their ability to engage in intuitive processing was determined by factors other than experience or expertise.

In another study on opportunity identification, Baron and Ensley (2006) asked 88 experienced and 106 novice entrepreneurs to describe the idea on which their new venture was based and to state why they felt it was an idea worth pursuing. They used the software programme Ethnograph 5.0 to carry out a content analysis of the qualitative data gathered, and then conducted panel discussions to identify particular attributes and patterns in participants' responses. This led to a list of attributes of business opportunities and to a set of frequency counts which indicated the number of times each entrepreneur mentioned each of the opportunity attributes during their interview. One of the top five factors that emerged from the entrepreneurs' responses on why they felt that their start-up idea was worth pursuing was "intuition or gut feeling". However, when Baron and Ensley conducted a discriminant analysis to investigate the extent to which entrepreneurs can be classified as novices or experienced on the basis of the factors that emerged from their interview responses, they found that "intuition and gut feeling" was part of the discriminant profile of the novices but not of the experienced entrepreneurs:

> The business opportunity prototypes of experienced entrepreneurs seemed to focus – to a greater extent than the business opportunity prototypes of novice entrepreneurs – on factors and conditions directly related to actually starting and running a new venture (e.g., the ability to generate positive cash flow and meeting customer needs). In contrast, the business opportunity prototypes of novice entrepreneurs tended to emphasize the "newness" or "uniqueness" of their product or service and their "gut-level" belief in its potential (p. 1339).

Baron and Ensley's (2006) finding that intuition or gut feeling is typical of the opportunity identification profiles of novice entrepreneurs, but not of their experienced counterparts, is in contrast with the results of Gustafsson's (2006) study. At face value, Baron and Ensley's results appear to imply that novices – but not experienced entrepreneurs – use intuition in the identification and pursuit of new opportunities, thereby offering support to the notion of 'inexperienced' entrepreneurial intuition (Crossan et al., 1999; Dutta & Crossan, 2005), while negating the widely-held view that intuition is associated with experience and expertise (e.g., Hodgkinson et al., 2008; Miller & Ireland, 2005). However, the manner in which intuitive processing was recorded in this study – simply by counting the number of times respondents referred to their intuition or gut feeling in response to the somewhat leading question of "why did you *feel* this was a good idea?" (Baron & Ensley, 2006, p. 1334, emphasis added) – may be argued to be inadequate for measuring the complexity of intuitive processing. Conclusions on the relationship between experience and intuition based on Baron and Ensley's (2006) findings should therefore be made with caution.

Another study which explored the cognitive processes of experts and novices, and may therefore shed some light on whether experience is a necessary antecedent of intuition in entrepreneurship, was conducted by Dew, Read, Sarasvathy and Wiltbank (2009). They presented a hypothetical business decision scenario to 37 MBA students and 27 expert entrepreneurs – who were defined as founders of multiple companies with over 15 years of experience and proven superior performance – and asked them to think aloud while they made a number of decisions concerning this scenario. The focus of the study was not on intuition but on how expert entrepreneurs think about typical venture start-up decisions, however the authors acknowledged that decision makers sometimes resort to intuition in the absence of adequate information. They therefore counted the number of times that respondents referred to their intuition or gut feel during decision making.

The results of this study reveal a stark contrast in the way novices and experts frame decision problems but, as opposed to Gustafsson (2006) and Baron and Ensley (2006), no significant differences were found with respect to intuition or gut feel. More specifically, neither the experts nor the novices mentioned intuition to any great extent while thinking aloud about the decision problem. These results raise a number of questions about the relationship between experience and intuition: Could these findings be due to a methodological artefact, emerging from the nature of the task portrayed in the decision scenario? The literature suggests that intuition is more appropriate and more prevalent in unstructured tasks with limited information (Agor, 1986; Brigham, De Castro & Shepherd, 2007; Burke & Miller, 1999; Elbanna et al., 2010), but the task presented in this study was highly structured with ample information, thus being more conducive of analytical processing. Could it be due to the rudimentary manner in which intuition was measured, relying only on expressed use of intuition or gut feel, rather than a focused analysis of the underlying processing using theoretically-derived indicators? Whatever the reason, it certainly offers fodder for reflection.

To conclude this discussion, the above critical analysis of the limited research on entrepreneurial experience and intuition has done little to resolve the question of whether experience is a necessary antecedent of intuition in entrepreneurship, indicating that, as noted by Blume and Covin (2011), it is a priority area of research.

2.5.2.3 Outcomes of Entrepreneurial Intuition: Studies of Cognitive Style

Another key question that has generated interest among entrepreneurship scholars concerns the effects of intuition. What, if any, are the benefits of intuition in entrepreneurship? This literature review has revealed that researchers have investigated this question primarily by exploring the outcomes of cognitive style.

The first of these studies was conducted by Sadler-Smith (2004) who investigated the effects of cognitive style of 141 owner-managers on the financial and non-financial performance of their small businesses on two occasions, two years apart. Intuitive and analytical cognitive style was measured using the ‘Intuitive’ and ‘Rational’ subscales of Scott and Bruce’s General Decision-Making Style (GDMS) Likert-scale type questionnaire. Financial performance was defined as the percentage of sales growth during the past year, while non-financial performance was defined as efficiency of operations, public image and good-will, and quality of products and services, in line with Khatri and Ng (2000). During the first round of testing, regression analyses revealed a significant positive relationship between intuitive style, and both financial performance and non-financial performance. During the second round of testing, intuitive style was not associated with non-financial performance, but its association with financial performance was once again found to be positive and significant. While these results are inconclusive with respect to non-financial performance, they offer strong indications that one of the positive outcomes of a preference for intuitive processing is superior financial performance.

Brigham et al. (2007) investigated the relationship between cognitive style – using the CSI as a measure – firm characteristics, and job satisfaction of 159 owner-managers of high-technology small firms. Their findings indicate that owner-managers with an intuitive style tend to be more satisfied when they work in unstructured environments, while those with an analytical style prefer to work in structured environments. This is hardly surprising, considering that the literature suggests an intuitive approach is associated with non-linear, holistic processes while the analytical approach is associated with logical, detailed rationality (e.g., Allinson et al, 2000; Dutta & Thornhill, 2008). Nevertheless, these findings indicate that another positive outcome of an intuitive cognitive style is job satisfaction – but only when working in a suitable (unstructured) environment.

Dutta and Thornhill (2008) conducted a qualitative longitudinal study to investigate the relationship between cognitive style and growth intentions. This approach was highly unconventional in a tradition dominated by quantitative standardised measures such as the CSI. Nevertheless, it shed fresh light on the outcomes of a preference for the intuitive mode of processing by demonstrating that the relationship between entrepreneurs' changing perceptions of their environment and the shifts in their growth intentions is moderated by cognitive style. More specifically, holistic entrepreneurs tend to revise their growth intentions upwards when competitive conditions are anticipated to be positive and downwards when anticipated to be negative. Conversely, analytical entrepreneurs remain closer to initial growth intentions which do not vary much over time. The latter are more objective and adopt a more conservative approach with regards to the revisions of their growth intentions.

Another study that focused on the outcomes of cognitive style was that by Kickul et al. (2009) who investigated its interaction with entrepreneurial self-efficacy and entrepreneurial intentions at different stages of the start-up process. The participants in this study were 138 MBA students with no start-up experience, since the focus was on the pre-founding stage of the new venture process, and the measure used was the CSI. Findings indicate that entrepreneurs with an intuitive cognitive style are more likely to have high self-efficacy in the early stages of a venture (opportunity identification), while those with an analytical cognitive style are more likely to have a higher self-efficacy in the later planning, resource acquisition and launching stages of a venture (opportunity evaluation and exploitation). In other words, enhanced self-efficacy is another positive outcome of an intuitive cognitive style, but only during the opportunity identification stage. A possible implication of these findings is that, to the extent that self-efficacy is positively related with performance (Hmielski & Baron, 2008), an intuitive cognitive style may be more conducive for opportunity identification. For the later stages, an analytical cognitive style is preferable as it leads to higher self-efficacy. It would then follow that in order to be able to deal with the varying demands of the start-up process, entrepreneurs should either work to strengthen their weaker cognitive style – and thus become more cognitively versatile – or they would need to join forces with other individuals to create an entrepreneurial team with diverse cognitive styles. Furthermore, these findings suggest that the opportunity identification stage of the entrepreneurial process may offer more fertile ground for studies of intuition than the opportunity exploitation stage.

The last study in this review to investigate outcomes of an intuitive cognitive style was that by Chaston and Sadler-Smith (2012). Respondents in this study were 137 owner-managers of small businesses in the creative industries sector, whose cognitive style was measured using a short form of the REI – which, as one may recall, is consistent with the dual-process theory view of human cognition. The hypothesised outcome variables in this study were entrepreneurial orientation and firm capability. Regression analyses revealed no significant associations between cognitive style and either of these hypothesised outcomes, but an interaction effect was found between intuitive cognitive style and market conditions on firm capability. In other words, a positive outcome of an intuitive cognitive style is firm capability – which refers to the "bundles of skills and knowledge" necessary to enable entrepreneurs to make the best use of the assets of their business (Chaston & Sadler-Smith, 2012, p. 420) – but this effect is significant only in intensely competitive markets.

The analysis of the articles reviewed in this section demonstrates that the measure of cognitive style most commonly used is Allinson and Hayes' (1996) Cognitive Style Index (CSI), which is based on the outdated unitary view of cognition. Scholars (e.g., Hodgkinson & Sadler Smith, 2003a, 2003b; Hodgkinson et al., 2009b) now recommend that research on cognitive style should make use of instruments that have been developed in line with the dual-process view, such as Pacini and Epstein's (1999) Rational-

Experiential Inventory (REI), as used by the most recent study reviewed above (Chaston & Sadler-Smith, 2012).

Another observation is that while an intuitive cognitive style has been found to be associated with various positive outcomes, including financial performance (Sadler-Smith, 2004), job satisfaction (Brigham et al., 2007), self-efficacy (Kickul et al., 2009) and firm capability (Chaston & Sadler-Smith), research on cognitive style has recently been criticised for providing an incomplete picture of entrepreneurial intuition. Blume and Covin (2011) and Hodgkinson and Sadler-Smith (2011) argue that cognitive style is not necessarily analogous to actual use of intuition. While cognitive style may, for example, predispose individuals towards an intuitive mode of processing, it does not imply that entrepreneurs with a self-reported intuitive cognitive style will necessarily employ an intuitive cognitive strategy in all situations. Furthermore, Blume and Covin (2011) maintain that entrepreneurs often make false attributions to intuition and are therefore unreliable sources of information regarding their use of intuition. The key implication of this line of reasoning is that researchers should not gather data on intuition solely by means of self-report measures, but should make use of alternative methods to tap into the actual use of this process, as recommended by Hodgkinson and Sadler-Smith (2011).

2.5.2.4 Outcomes of Entrepreneurial Intuition: Enabling Opportunity Identification

One of the key philosophical debates in the entrepreneurship literature is concerned with whether opportunities are "recognized or constructed" (Vaghley & Julien, 2010, p. 73). The positivist position argues that there is an objective reality 'out there' where opportunities lie in waiting, ready to be recognised or discovered by entrepreneurs. In this view, opportunities exist regardless of whether or not they are discovered, and are therefore independent from human actors. This discovery of opportunities is enhanced by entrepreneurial alertness, which refers to the ability of entrepreneurs to "notice without search opportunities that have hitherto been overlooked" (Kirzner, 1979, p. 48). In contrast, the constructionist position argues that reality is constantly shaped through its interaction with actions of individuals. From this perspective, opportunities are enacted or created by entrepreneurs rather than being 'out there' waiting to be discovered (Dutta & Crossan, 2005; Vaghley & Julien, 2010).

A fourth key theme which has emerged from the analysis of the articles on entrepreneurial intuition indicates that it plays a vital role in the early stages of the entrepreneurial process, regardless of whether opportunities are viewed through a positivist lens or a constructionist lens. The present study is not concerned with this debate in its own right, as it adopts the "reasonable middle ground position ... that some opportunities are discovered whereas others are created" (p. 54), and uses the term opportunity identification to encompass both possibilities. This philosophical stance is similar to Bhaskar's (1975/2008) critical realist view of the world as being made up of 'intransitive' objects that exist independently of human awareness and action, but which can only be known through 'transitive' scientific inquiry and social construction. Critical realism "focuses upon the space between objectivism and social constructivism" (Hodgkinson & Starkey, 2012, p. 608) and acknowledges the objective reality of phenomena – such as opportunities –, as well as the creative enactment of individuals – such as entrepreneurs. Since the present study suggests that intuition is one of the determinants of opportunity identification (see Aims in Chapter 1), it is important to acknowledge that intuition is regarded as a fundamental element of this process from both the positivist and the social constructionist sides of the debate, as this increases the strength of the argument.

Dutta and Crossan (2005) wrote a conceptual paper based upon the 4I Organizational Learning Framework proposed by Crossan et al. (1999). This framework suggests that learning occurs through four stages, termed *intuiting* – which involves "the preconscious recognition of the pattern and/or possibilities inherent in a personal stream of experience", *interpreting* – which involves "the explaining ... of an insight or idea to one's self and others"; *integrating* – which involves "developing shared understanding among individuals and ... taking coordinated action through mutual adjustment"; and *institutionalizing* – which is "the process of ensuring that routinized actions occur" (Crossan et al., 1999, p. 525).

Dutta and Crossan (2005) argue that this framework offers the means to reconcile the positivist view with the social constructionist view by integrating conflicting elements of these approaches. Of concern to the present discussion is that they view intuition as being "a critical part of learning about opportunities" (p. 436), regardless of whether opportunities are believed to exist independently of human actors, or whether they are believed to be created by entrepreneurs. That is, every business opportunity originates from an intuition about an unmet need, coupled with a vague idea of how it could be met:

> The seed of any entrepreneurial action lies in an initial preconscious reflection by an individual (an existing or would-be entrepreneur) about a potential business idea that the individual feels holds some potential in meeting a current or emerging requirement of customers/potential customers (Dutta & Crossan, 2005, p. 436).

Similarly, Vaghley and Julien (2010) highlight the critical role that intuition plays in the early stages of the entrepreneurial process, both if this is viewed from a positivist lens as opportunity recognition, and from a social constructionist perspective as opportunity creation. They propose a model of human information processing which, they argue, could provide a frame for understanding the way entrepreneurs use information to identify opportunities. This model suggests that entrepreneurs engage in opportunity identification through a process of pattern recognition while enacting or creating opportunities by means of trial-and-error heuristic processing. According to Vaghley and Julien (2010), intuition is one of the key elements of human information processing, being present in both opportunity recognition and enactment. In opportunity recognition, intuition is involved in pattern recognition on the basis of past experience, while in opportunity creation, intuition enables the enactment of opportunities through sensemaking and social interaction and interpretation.

Without addressing the merits of this philosophical debate, other authors have suggested that intuition plays a key role in opportunity identification. Ravasi and Turati (2005) explain that many business opportunities initially appear as rough intuitions, and it is only with considerable development that they can be turned into profitable products or services. Ravasi and Turati (2005), whose focus is on entrepreneurial learning, maintain that intuition is a crucial initial step in the entrepreneurial process, and state that learning occurs as initial intuitions are refined into coherent business opportunities. Dimov's (2007a, 2007b) views are entirely consistent with the above. He extends Dutta and Crossan's application of the 4I Framework to entrepreneurial opportunities and argues that intuition is the trigger of initial business ideas, and that these are then developed in a learning process driven by intentionality, shaped by prior knowledge (Dimov, 2007a) and by contextual influences (Dimov, 2007b).

2.5.2.5 Intuition as a Component of other Constructs

A final trend that emerged from the articles in this review is that various authors regard intuition as forming part of other cognitive processes, to the extent that they include it in scales designed to measure other concepts, namely adaptive cognition (Haynie & Shepherd, 2009), enterprise potential in young people (Athayde, 2009), and entrepreneurial alertness (Tang et al., 2012).

Haynie and Shepherd (2009) view intuition as forming part of metacognitive experience, which in turn is one of five factors constituting metacognitive awareness. They developed a measure of adaptive cognition for use in entrepreneurship research and included items such as "my 'gut' tells me when a given strategy I use will be most effective" and "I depend on my intuition to help me formulate strategies" (p. 710) to measure intuition as a variable within the metacognitive experience subscale.

Athayde (2009) too viewed intuition as forming part of a larger concept. The purpose of her study was to create a measure of the 'enterprise potential' of young people and to shed light upon the impact of entrepreneurship programmes on their participants. She considers intuition to be a dimension of latent enterprise potential, together with achievement, personal control, creativity and leadership. Athayde's (2009) operationalisation of the intuitive element in her measure is, however, highly debatable due to its dubious construct validity. The test consisted of items such as "making mistakes is a good way to learn" and

“I’ll have a guess at a solution to a problem rather than give up” (p. 486). Neither of these have, however, been established in the literature as being facets of intuition. On the contrary, various authors, such as Dane and Pratt, who have written two extensive reviews on intuition in management settings (2007, 2009), have explicitly stated that intuition is not the same as guessing.

The final paper to include intuition as a subset of a larger concept is that by Tang et al. (2012), whose aim was to develop and validate a scale to measure entrepreneurial alertness. They argue that “an important component of alertness is the aspect of judgment which focuses on evaluating the new changes, shifts, and information and deciding if they would reflect a business opportunity with profit potentials” (p. 1). This, they argue, is closely related to intuition, such that they hypothesise that the evaluation and judgment dimension of the alertness scale they develop will be highly correlated with intuition (measured using an adaptation of the scale developed by Khatri & Ng, 2000). This hypothesis was supported in their study, but if one inspects the judgment dimension on the alertness scale, which includes items such as “I have a gut feeling for potential opportunities” and “I have a knack for telling high-value opportunities apart from low-value opportunities” (p. 8), one would note the similarity this bears to several standardised intuition measures, and would therefore not be at all surprised that this positive correlation was found as they appear to be measuring the same construct. In other words, there appears to be excessive overlap between the judgment dimension on Tang et al.’s (2012) alterness scale and their conceptualisation of intuition.

2.6 Conclusion and Research Question

This chapter has presented the key themes that emerged from the review of the literature on intuition in management and entrepreneurship. To summarise, the intuition literature has generally been concerned with providing a comprehensive definition of intuition which distances it from the mystical overtones which were associated with it in the past, with delineating it from other related but distinct constructs, and with developing a theoretical framework to explain the nature of human cognition. The literature on managerial intuition was geared towards various aims, including to highlight the widespread use of intuition in managerial decision making, back in the day when it was regarded as an inferior mode of processing, to investigate the antecedents and consequences of managerial intuition, to identify the conditions under which intuition would be more likely to function effectively, and to remind readers that it should be used in combination with analysis within a versatile cognitive strategy. The literature on entrepreneurial intuition, which is younger than that on managerial intuition, has investigated similarities and differences in cognitive style between entrepreneurs and managers of different levels of seniority, explored the role of experience and expertise as antecedents of entrepreneurial intuition, identified several outcomes of an intuitive cognitive style, argued that intuition is an indispensable element of opportunity identification, and presented intuition as a component of other psychological constructs.

What has been learned about entrepreneurial intuition from this review? What are the gaps which require scholarly attention? How should these gaps be addressed? Some general observations are the following:

First, it may safely be concluded that definitions of intuition have now been established to the consensual satisfaction of the scholarly community (Blume & Covin, 2011; Dane & Pratt, 2007). Therefore future researchers need no longer be concerned with this matter.

Second, dual-process theory has been established as more appropriate than unitary theory for explaining the nature of human cognition. However, a great deal of past research was based on unitary theory (e.g., Elbanna & Child, 2007; Gustafsson, 2006). Future researchers are advised to design research on the basis of – and which would contribute to – dual-process theory (e.g., Hodgkinson & Sadler-Smith, 2003a; Hodgkinson et al., 2009b), and to study intuition alongside analysis within a broader framework of cognitive strategy (Epstein, 2003).

A third observation is that most empirical research on intuition in business settings has tended to make use of instruments that are overly simplistic, that rely on participants' potentially inaccurate self-report accounts of intuition (as argued by Blume & Covin, 2011), and that measure cognitive style or intuitive preference rather than cognitive strategy or actual use of intuition (e.g., Allinson et al., 2000; Kickul et al., 2009; Groves et al., 2011). Findings have been largely exploratory and descriptive, based on anecdotal evidence, and offering very little in terms of explanation of how intuitive cognitive processing occurs in practice. Appeals have recently been made for the investigation of actual use of intuition (Blume & Covin, 2011) using sophisticated methods that complement measures of cognitive style (e.g., Hodgkinson & Sadler-Smith, 2011).

Fourth, this review has shown that most research on intuition in business settings has been conducted in the management field with managers – or management students – as research participants. While there are sufficient similarities between entrepreneurs and top managers (see e.g., Allinson et al., 2000; Groves et al., 2011) to glean knowledge about entrepreneurial intuition from the literature on managerial intuition, there are also differences between entrepreneurs and the general population of managers – such as differences in cognitive style (Allinson et al., 2000; Groves et al., 2011) and in the context in which they operate (Baron, 2008) – which necessitate caution when generalising findings from one domain to the other. Scholars have recently become increasingly aware of the need for further research on intuition in entrepreneurship, as seen from the growing interest in entrepreneurial intuition. Figure A1 in Appendix A – which describes in detail the method of this literature review – illustrates that there has been an accelerated interest in entrepreneurial intuition in recent years, indicating fertile research territory and an increasingly receptive scholarly community.

In addition to these four general observations, three other important insights emerged from this literature review that are more directly aligned with the aim of this study which, as stated in Chapter 1, is to investigate the role of intuition and cognitive versatility in enabling entrepreneurs to become more proficient at identifying opportunities as they gain experience.

First, there are indications that intuition plays a key role in opportunity identification (e.g., Dutta & Crossan, 2005), but this has not yet been explored empirically. This conceptual work is compelling but it would benefit greatly if there were empirical data to support it.

Second, the literature suggests that cognitive versatility is the most effective approach for strategic decision making (Hodgkinson et al., 2009a) and for the dynamic capabilities of sensing and shaping opportunities in the context of strategic management (Hodgkinson &

Healey, 2011). However, empirical evidence for this claim is limited and focuses on strategic decision making in management (Woiceshyn, 2009). It is therefore not clear if cognitive versatility is the most effective strategy for opportunity identification.

Third, this review has shown that intuition is generally viewed as being inherently associated with domain-specific experience and expertise (e.g., Hodgkinson et al., 2008, 2009a; Sadler-Smith & Shefy, 2004), but some authors have proposed forms of intuition that are not experientially-derived (Crossan et al., 1999; Dane & Pratt, 2009). The only empirical study which investigated this issue (Gustafsson, 2006) was guided by the now-outdated unitary theory and lacked adequate justification for the inclusion of respondents in the 'expert' category, hence leading to questionable results.

These three insights indicate that while there are grounds to argue that intuition and cognitive versatility may be at least partly responsible for the enhanced opportunity identification ability of experienced entrepreneurs, there are gaps and unresolved debates related to this matter which warrant further research to test the validity of this claim.

In view of the above, and as intimated in Chapter 1, this study seeks to address the following research question:

To what extent can the relationship between entrepreneurial experience and opportunity identification be explained by cognitive strategy?

The theoretical framework and research hypotheses that address this research question are the focus of the next chapter.

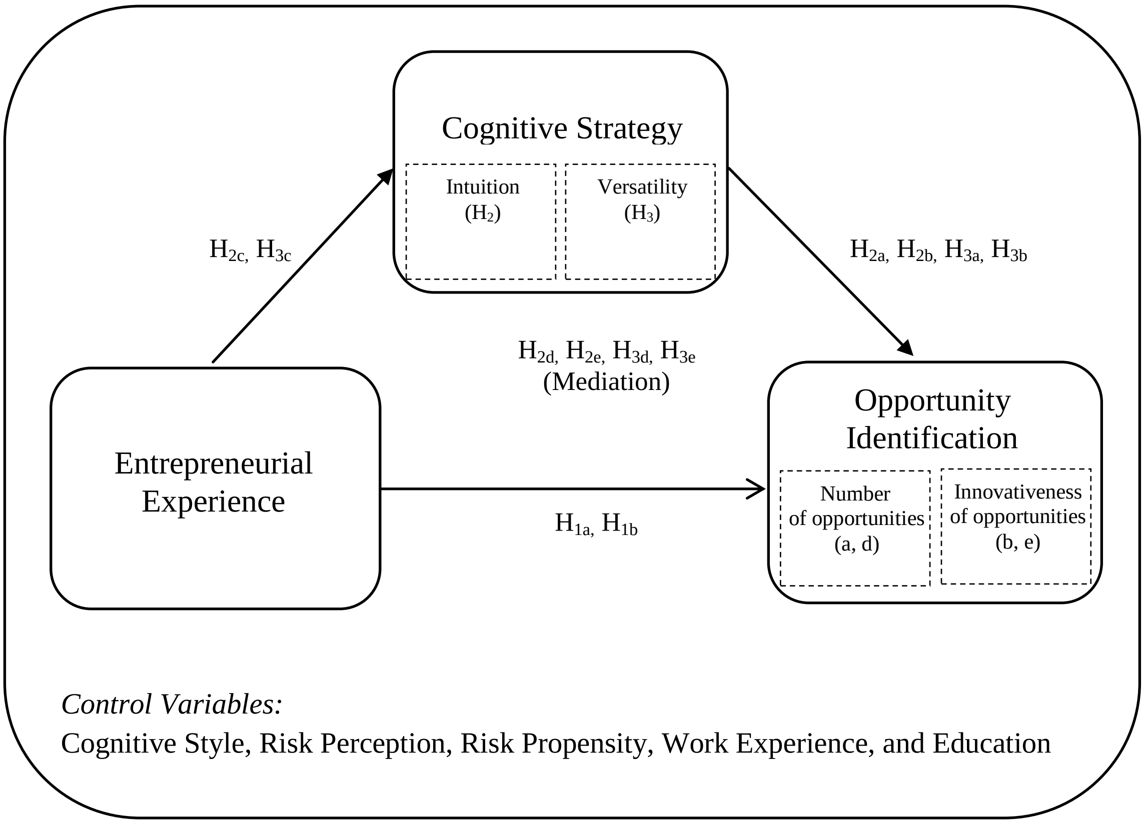
CHAPTER 3

THEORY, CONCEPTUAL MODEL AND RESEARCH HYPOTHESES

3.1 Introduction

This chapter outlines the development of the conceptual model underlying this study which, as has just been stated at the end of Chapter 2, aims to investigate the relationship between entrepreneurial experience, cognitive strategy and opportunity identification. Three sets of hypotheses, which together make up this study's conceptual model as illustrated in Figure 3.1, were derived from cognitive theories and from various strands of literature (entrepreneurship, intuition, creativity, and expertise) to address this study's main research question. Section 3.2 outlines the first set of hypotheses (H_{1a} and H_{1b}) which concern the relationship between experience and opportunity identification. Section 3.3 traces the derivation of the second set of hypotheses (H_{2a} to H_{2e}) which deal with the effects of intuition on opportunity identification, of experience on intuition, and of intuition as a mediator between experience and opportunity identification. In view of what was argued in Chapters 1 and 2 that intuition should be studied within the broader context of cognitive strategy, the third set of hypotheses (H_{3a} to H_{3e}), presented in Section 3.4, are concerned with the effects of cognitive versatility on opportunity identification, of experience on cognitive versatility, and of cognitive versatility as a mediator between experience and opportunity identification.

Figure 3.1 Conceptual Model



3.2 Hypotheses 1a and 1b: Experience and Opportunity Identification

As explained in Chapter 1, the issue of "why, when, and how do some people and not others discover ... opportunities" (Shane & Venkataraman, 2000, p. 218) has received a great deal of attention from entrepreneurship scholars in recent years. Opportunities lie at the very heart of entrepreneurship, therefore understanding entrepreneurship requires an appreciation of the processes involved in opportunity identification (Kreuger, 2005). The growing body of research in this area has led to huge leaps in our knowledge about this important process, yet opportunity identification remains "an enduring phenomenon of interest" (Dutta & Crossan, 2005, p. 427) due to the many questions that remain unanswered.

Among these questions are those concerning the effects of entrepreneurial experience on opportunity identification. Recent research has provided empirical evidence which indicates that habitual entrepreneurs are more adept than novices at opportunity identification (e.g., Gruber et al., 2008, 2012a, 2012b; Ucbasaran et al. 2003a, 2009). Habitual entrepreneurs are business owners who have, or have had, ownership of two or more businesses, either concurrently – known as portfolio entrepreneurs, or sequentially – known as serial entrepreneurs. In contrast, novices are entrepreneurs with no prior business ownership experience (Ucbasaran, Baldacchino & Lockett, forthcoming).

Three recent studies by Gruber and colleagues (Gruber et al., 2008, 2012a, 2012b) indicate that habitual entrepreneurs are able to "construct a larger choice set" (2008, p. 1653) – or identify a greater number – of opportunities prior to launching their ventures. While novice entrepreneurs tend to identify, and subsequently pursue, a single opportunity, habitual entrepreneurs are more likely to "look before they leap" (2008, p. 1663) – i.e., to identify and explore multiple opportunities – and are thus able to select the most promising option. This will in turn lead to superior venture outcomes, such as higher early-stage sales revenues (2008) and market diversification (2012b). Further empirical evidence concerning the positive effects of entrepreneurial experience on opportunity identification is provided by Ucbasaran and colleagues (Ucbasaran et al. 2003a, 2009) who found that habitual entrepreneurs identify a greater number of opportunities than novices.

Scholars have proposed various theories to explain these differences in opportunity identification ability. Many have centred on the notion that individuals differ in terms of: "(1) the possession of prior information necessary to identify an opportunity, and (2) the cognitive properties necessary to value it" (Shane & Venkataraman, 2000, p. 222).

Extending this notion to explain the effects of experience on opportunity identification, scholars argue that experience leads to the accumulation of knowledge (Shepherd & DeTienne, 2005) and to the formation of complex cognitive structures (Baron & Ensley, 2006; Gaglio & Katz, 2001) which enable entrepreneurs to detect gaps, trends and patterns in the environment, leading to the identification of opportunities.

As a result of prolonged or repeated exposure to multiple sources of information, experience facilitates the acquisition of relevant knowledge and increases awareness of salient issues. Knowledge, in turn, allows individuals to make the best use of new information as it becomes available by focusing on its most important dimensions and processing it in a more efficient manner (Shepherd & DeTienne, 2005). Gruber et al. (2008) explain that "individuals who create new firms are equipped with a stock of knowledge that they can apply in the process" of market opportunity search (2008, p. 1654). According to Gaglio and Katz (2001), the application of knowledge in the opportunity identification process is guided by mental schema or models which increase in their level of complexity as a function of experience:

> Experts have more complex schema characterized by extensive cross-links to other schema. These linkages enable experts to see patterns developing, to detect anomalies more quickly, and so forth (p. 97).

In a similar vein, Baron (2006) suggests that entrepreneurs identify opportunities by utilising experientially-acquired prototypes or cognitive frameworks to make sense of changes in technology, markets, government policies, and so on. These frameworks allow individuals to recognise patterns – or "connect the dots" – with respect to seemingly unrelated trends or events, leading in turn to the identification of opportunities. Baron and Ensley's (2006) study of the opportunity prototypes of 88 experienced and 106 novice entrepreneurs from a wide variety of industries identifies significant differences in the business opportunity prototypes of novice and experienced entrepreneurs with respect to the degree of clarity, richness of content, and degree of focus on key attributes of the content domain. The opportunity prototypes of experienced entrepreneurs were clearer, richer and more focused than novice entrepreneurs. These prototypes may in turn trigger ideas in the minds of entrepreneurs that could lead to new business opportunities.

In view of the above, experienced entrepreneurs are expected to identify a larger number of opportunities than their inexperienced counterparts in this study, as posited by the following hypothesis:

H_{1a}: *Higher levels of experience are associated with the identification of a larger number of opportunities*

In addition to investigating differences between novice and habitual entrepreneurs in terms of the number of opportunities they identify, recent studies have explored differences in the innovativeness of these opportunities (Ucbasaran et al., 2003a, 2009). Given the importance of innovation for start-up success (Baldacchino, Cassar & Caruana, 2008), the innovativeness of opportunities is considered to be an important indicator of their quality or wealth-creating potential, to the extent that entrepreneurial opportunities are sometimes defined as the introduction of "*innovative* (rather than imitative) goods, services, or processes to an industry or economic marketplace" (Gaglio, 2004, p. 534). This is further elucidated by DeTienne and Chandler (2004) as follows:

> The level of innovativeness represented in business ideas has important implications with respect to initiating opportunities and creating wealth ... Logically, when individuals generate a broader variety of unique business ideas, they are more likely to be able to select value-creating opportunities from that broader portfolio (DeTienne & Chandler, 2004, p. 248).

Research indicates that prior knowledge of customer needs (Shepherd & DeTienne, 2005) and business ownership experience (Ucbasaran et al., 2003a, 2009) are positively associated with both the number and the innovativeness of opportunities identified. Therefore "although the image of the novice who devises a path-breaking opportunity is a romantic one … experts are far more likely to be novel" (Short et al., 2010, p. 56).

Theoretically speaking, differences between experienced and inexperienced entrepreneurs concerning the quality or innovativeness of the opportunities they identify may be explained by the same cognitive theories outlined above. In other words, the innovativeness of opportunities identified may be attributed to "deeper and richer connections" (Shepherd & DeTienne, 2005, p. 94) or cognitive frameworks, which are utilised to guide the application of an extensive base of relevant knowledge:

> Knowledge – especially knowledge concerning specific markets or industries – often provide a solid base for opportunity recognition, and the broader this foundation, the more opportunities present themselves, and the higher the quality of such opportunities entrepreneurs will tend to recognize (Baron, 2006, p. 106).

Based on the above, experienced entrepreneurs are expected to identify opportunities that are more innovative than those identified by their inexperienced counterparts. This leads to the following hypothesis:

H_{1b}: *Higher levels of experience are associated with the identification of opportunities that are more innovative*

3.3 Hypotheses 2a to 2e: Intuition, Experience and Opportunity Identification

While the cognitive theories and empirical studies outlined above may insightfully account for the positive effects of prior entrepreneurial experience on opportunity identification in terms of the content and structure of the cognitive makeup of habitual entrepreneurs, theory and research on the cognitive processes or mechanisms that are involved in utilising such content and structures for the identification of opportunities is still somewhat lacking. Baron's work on pattern recognition (Baron, 2006; Baron & Ensley, 2006) begins to address this gap, but there is still a great deal to be learned about *how* the abovementioned "extensive cross-links to other schema" (Gaglio & Katz, 2001, p. 97), or the "deeper and richer connections" (Shepherd & DeTienne, 2005, p. 94) of experienced entrepreneurs enable them to detect patterns and identify opportunities.

This study's second set of hypotheses (H_{2a} to H_{2e}) suggest that intuition may be one of the cognitive processes responsible for enabling experienced entrepreneurs to leverage their vast knowledge and complex mental frameworks to enhance opportunity identification. The theoretical perspective underlying this proposition is the dual-process Cognitive-Experiential Self-Theory (CEST) developed by Epstein and colleagues (Epstein, 2003, 2010; Epstein et al., 1996, Pacini & Epstein, 1999). As shall be explained shortly, CEST's conceptualisation of intuition as being holistically-oriented and experientially-derived prompted the formulation of hypotheses which link intuition to both opportunity identification and entrepreneurial experience.

As briefly outlined in Chapter 2, the dual-process perspective refers to a collection of theories of cognition which share one common key assumption, namely that human beings process information by means of two parallel cognitive systems or "modes of processing" (Evans, 2008, p. 256) which are independent of one another, but which interact with each other on an ongoing basis. Although a multitude of labels have been assigned to these dual-process systems by their respective authors, there is general consensus that one system is rapid, automatic and non-conscious, while the other is slow, deliberate, and conscious (see Evans, 2008, for a review). The first system (labelled 'experiential' in the terminology of CEST) gives rise to the intuitive mode of processing, and is the focus of this study's second set of hypotheses, while the second system (termed 'rational' in CEST) generates analytical thought and will be discussed in relation to the third set of hypotheses in Section 3.4 below.

3.3.1 Hypotheses 2a and 2b: Intuition and Opportunity Identification

According to CEST, the non-conscious intuitive ('experiential') system is "holistic" and operates by making "associative connections between stimuli, responses and outcomes" (Epstein, 2010, p. 299). As explained in Chapter 2, such holistic associations arise from an automatic process of pattern recognition in which "environmental stimuli are matched with some deeply held (nonconscious) category, pattern or feature" (Dane & Pratt, 2007, p. 37). This form of cognitive processing resonates closely with the identification of opportunities which, as may be recalled from Section 3.2, is said to be based on a process of pattern recognition:

> In essence, then, pattern recognition, as applied to opportunity recognition, involves instances in which specific individuals "connect the dots" – perceive links between seemingly unrelated events and changes. These patterns they perceive then become the basis for identifying new business opportunities (Baron, 2006, p. 106).

In view of the above, it is highly plausible that intuition may be one of the cognitive processes underlying opportunity identification. If, as posited by CEST, intuitive processing is by its very nature holistic and associative, it may facilitate opportunity identification by rapidly accessing the entrepreneur's complex structures of non-consciously held knowledge (e.g., about markets, industries and technologies) and triggering the perception of novel patterns.

Although empirical research on the link between intuition and opportunity identification is scant, the conceptual literature on intuition in management and entrepreneurship (reviewed in Chapter 2) lends support to the above claim, as various authors suggest that intuition may play an integral role in opportunity identification. One may recall that Crossan et al. (1999) view intuition – in the context of their 4I Organisational Learning framework – as a "critical part of learning about opportunities" (p. 436), such that every business opportunity originates from an intuition about an unmet need, accompanied by an initial notion about how it could be met. Dimov (2007a) extends this 4I framework to entrepreneurial opportunities and argues that the "early gestation and transition of opportunities" is rooted in a process of "*intuiting* that generates ideas with perceived potential" (p. 562).

Based on the above, intuitive processing is expected to facilitate the identification of a larger number of opportunities. The following hypothesis is thus presented:

H_{2a}: *Greater use of intuition is associated with the identification of a larger number of opportunities*

Besides facilitating the identification of a larger number of opportunities, intuition may also play a role in enhancing the innovativeness of these opportunities. The identification of opportunities is a creative process (Hills, Shrader & Lumpkin, 1999) which involves the application of "mental operations to existing knowledge structures" in order to generate creative (novel and useful) ideas which "have the potential to be developed into appealing goods or services" (Ward, 2004, p. 173). Creative ideas can lead to innovation by treating every project as unique and approaching it with a clean slate (Andriopoulos & Lowe, 2000) or by combining existing ideas, thoughts, concepts, components or materials in a new way (El Murad & West, 2004; Heye, 2006). Either way, this requires breaking out of, or cutting across, established patterns and forming new ones (de Bono, 1993; Gaglio, 2004) and is therefore enhanced by the holistic and associative nature of the intuitive ('experiential') system (Epstein, 2003, 2010). This mode of processing provides a big-picture view (Hodgkinson & Clarke, 2007) of the business landscape encompassing a wide range of stimuli. This is likely to increase not only the quantity of opportunities identified, but also their degree of novelty, because the subconscious and associative nature of intuition allows "very distant content areas to be put together" (Raidl & Lubart, 2000-2001, p. 220). In other words, an intuitive approach increases the likelihood both of more gaps and trends being recognised, and of increasingly novel connections being made among distant and disparate – as opposed to proximal and similar – elements, thus leading to breakthrough business ideas and, in turn, to the identification of opportunities that are more innovative.

The above leads to the development of the following research hypothesis:

H_{2b}: Greater use of intuition is associated with the identification of opportunities that are more innovative

3.3.2 Hypothesis 2c: Intuition and Experience

In addition to being holistically-oriented as discussed in the previous section, another feature of the experiential / intuitive system according to CEST is that it is inherently linked to experience, to the extent that Epstein "named it the experiential system because its primary function is to learn from experience" (Epstein, 2010, p. 298). He explains that:

> The very essence of intuitive-experiential processing according to CEST is that it operates according to the principles and attributes of associative learning from experience, which is the source of the tacit information that constitutes the main body of intuitive information (Epstein, 2010, p. 307).

In this view, the process of pattern-recognition described above would act upon the knowledge accumulated through experience. Within the context of entrepreneurship, the more extensive the entrepreneurial experience, the larger is the pool of relevant knowledge (e.g., regarding markets, customer needs, emerging technologies, etc.) that can be intuitively drawn upon during opportunity identification. This is in line with the widely accepted notion that "the ability to intuit in particular domains is acquired through experience and learning ... and relies upon pattern recognition processes" (Hodgkinson et al., 2008, p. 7). One may recall from Chapter 2 that Miller and Ireland (2005) describe intuition as "automated expertise" which involves the "recognition of a familiar situation and the straightforward but partially subconscious application of previous learning related to that situation" (p. 21), while Sadler-Smith and Shefy (2004) speak of "intuition-as-expertise" which is based on "experience and analysis frozen over time into familiar routines and habitual responses" (p. 81).

Further support for this experience-based pattern-recognition view of intuition derives from the work of Gary Klein, whose research on expert decision making in emergency situations, under extreme pressure, in their natural environment (e.g., fire-fighting and intensive care nursing) led to the development of the Naturalistic Decision Making (NDM) tradition and the Recognition Primed Decision (RPD) model (see Klein, 2004). This portrays expert decision making as based on instant intuitive awareness of a situation by means of pattern recognition, which is in turn contingent upon experience:

> A 'pattern' is a set of cues that usually chunk together so that if you see a few of the cues you can expect to find the others. When you notice a pattern you may have a sense of familiarity – yes, I've seen that before! As we work in any area, we accumulate experiences and build up a reservoir of recognized patterns. The more patterns we learn, the easier it is to match a new situation to one of the patterns in our reservoir. When a new situation occurs, we recognize the situation as familiar by matching it to a pattern we have encountered in the past (Klein, 2004, p. 21).

Whilst acknowledging that other authors have proposed types of intuition which may be unrelated to domain-specific knowledge and experience, such as entrepreneurial intuition (Crossan et al., 1999, Dutta & Crossan, 2005) and creative intuition (Dane & Pratt, 2009), there is no reason to believe that experience-based intuition and entrepreneurial / creative intuition are mutually exclusive. Although by definition, the former falls only within the remit of experienced entrepreneurs, if the latter really is unrelated to experience, then it could be equally available to all entrepreneurs, regardless of whether they are novices or experts. In other words, experience does not rule out entrepreneurial / creative intuition.

This claim may be challenged by those who argue that there is a tension between experience and creativity – and, by extension, between experience and entrepreneurial / creative intuition – in the sense that "too much experience can leave one in ruts, so that one cannot go beyond stereotyped responding" (Weisberg, 1999, p. 226). A counterargument to this *tension view* lies in the *foundation view* which holds that there is a positive relationship between experience and creativity – and thus between experience and entrepreneurial / creative intuition – with creative thinkers building on their foundations of knowledge to generate novel ideas (Weisberg, 1999). Given that "novel and useful ideas are the lifeblood of entrepreneurship" (Ward, 2004, p. 174), it may be argued that if entrepreneurs were to fall into the ruts described by the tension view, then their businesses would soon become extinct. The foundation view therefore appears to be more appropriate to describe the relationship between experience and entrepreneurial / creative intuition within the domain of entrepreneurship.

The focus of this study is on the extent of intuitive processing in general, without making a distinction between the different types described in the literature. Therefore in view of what has been argued above, experienced entrepreneurs are expected to engage in a greater amount of intuitive processing than novices, because while they may be able to tap into both experience-based and entrepreneurial / creative intuition, novices are limited to entrepreneurial / creative intuition (if at all). This leads to the following hypothesis:

H_{2c}: *Higher levels of experience are associated with greater use of intuition*

3.3.3 Hypotheses 2d and 2e: Intuition as a Mediator between Experience and Opportunity Identification

The theory and supporting literature which have been cited to support the derivation of the above hypotheses converge to suggest a mediating role for intuition in the relationship between entrepreneurial experience and opportunity identification, leading to the last two in this second set of hypotheses (H_{2d} and H_{2e}). The logic underlying these hypotheses may be summarised as follows.

On the basis of cognitive theories (Baron, 2006; Baron & Ensley, 2006; Gaglio & Katz, 2001) and past research on entrepreneurial experience and opportunity identification (Gruber et al., 2008; Ucbasaran et al., 2009), experienced entrepreneurs are expected to identify a larger number of opportunities (H_{1a}) as well as opportunities that are more innovative (H_{2b}) than novices. The dual-process CEST (Epstein, 2003, 2010; Epstein et al., 1996, Pacini & Epstein, 1999) and the extant literature on intuition (Hodgkinson et al., 2008; Miller & Ireland, 2005) suggests that experienced entrepreneurs are better equipped (and therefore more likely) than novices to engage in intuitive processing (H_{2c}). CEST also indicates, together with the entrepreneurship literature (Dimov, 2007a; Ravasi & Turati, 2005; Ward, 2004), that intuition may in turn facilitate the identification of a larger number of opportunities (H_{2a}) as well as opportunities that are more innovative (H_{2b}).

Given these hypothesised relationships, it is possible that at least part of the enhancement in opportunity identification ability that occurs as entrepreneurs obtain experience may be due to – i.e., mediated by – intuition.

On the basis of the above, the following hypotheses are presented:

H_{2d}: Intuition mediates the relationship between experience and the number of opportunities identified

H_{2e}: Intuition mediates the relationship between experience and the innovativeness of opportunities identified

3.4 Hypotheses 3a to 3e: Cognitive Versatility, Experience and Opportunity Identification

As one may recall from Chapter 2, it was argued that intuition should not be studied in isolation, but should be anchored within a research framework that integrates both the intuitive and the analytical modes of processing. While H_{2a} to H_{2e} have proposed that intuition may be one of the cognitive processes responsible for the superior opportunity identification ability of experienced entrepreneurs, they do not account for any role that may be played by analysis. Although the extant literature suggests that analysis is not the ideal mode of processing in ambiguous, uncertain tasks such as those involved in entrepreneurship (Allinson et al., 2000), there are reasons to believe that analytical processing also has an important contribution to make to opportunity identification when utilised within a versatile cognitive strategy.

H_{3a} to H_{3e} are an extension of H_{2a} to H_{2e} in the sense that they are based on the same principles as far as the relationship between intuition, experience and opportunity identification are concerned. In addition, however, this third set of hypotheses brings analysis into the picture alongside intuition, and argues that while intuition is expected to mediate the relationship between experience and opportunity identification, it does so not by itself but together with analysis as applied in a versatile cognitive strategy.

Consistent with the derivation of the second set of hypotheses, the theoretical perspective underlying this third set is also CEST (Epstein, 2003, 2010; Epstein et al., 1996, Pacini & Epstein, 1999). Being a dual-process theory, CEST accounts for the interaction between intuition and analysis within a versatile cognitive strategy, as proposed by this third set of hypotheses. In contrast with unitary theory (Allinson & Hayes, 1996; Hammond, 2000; Hayes et al., 2003), which views intuition and analysis as lying at opposite ends on a single bipolar construct (as explained in Chapter 2), dual-process theory's view of the intuitive system as operating independently from, yet in parallel with, the analytical system allows the conceptualisation of both systems being activated – or deactivated – at once (Hodgkinson & Clarke, 2007).

The interaction between intuitive and analytical processing and the meaning of cognitive versatility are effectively illustrated by Hodgkinson and Clarke (2007), as explained in Chapter 2, Section 2.5.1.5. Their four-quadrant framework is adopted in this study as an ideal means of mapping out the cognitive strategy of research participants on the basis of both their intuitive and analytical processing, in line with the theoretical principles of CEST (Epstein, 2003, 2010). It was suggested in Chapter 1 that cognitive versatility may be the most effective strategy for opportunity identification, but on what grounds can such a relationship be hypothesised?

3.4.1 Hypotheses 3a and 3b: Cognitive Versatility and Opportunity Identification

In hypothesising that a versatile cognitive strategy is effective for the identification of opportunities, it must be shown that opportunity identification requires analytical processing *as well as* intuitive processing, and that entrepreneurs therefore need to be able to "shift between cognitive modes, from automatic processing to conscious engagement and back again" (Louis & Sutton, 1991, p. 55).

As argued in Section 3.3.1 with reference to the 4I Organisational Learning Framework (Crossan et al., 1999) which has been used to explain how entrepreneurial opportunities are identified and developed (Dimov, 2007a, 2007b; Dutta & Crossan, 2005), the seed of every opportunity lies in an intuitive "preconscious reflection ... about a potential business idea that the individual feels holds some potential" (Dutta & Crossan, 2005, p. 436). One may recall from Chapter 2 that according to this 4I Framework, the *intuiting* stage is followed by a process of *interpreting*, which involves explaining the idea to oneself and others; *integrating*, which involves developing shared understanding, coordinated action and mutual adjustment with others; and finally *institutionalizing*, which involves the establishment of routines for collective action (Crossan et al., 1999).

Interpreting to others, integrating and institutionalising take place after an opportunity has been identified and are therefore of no concern to this discussion. However, interpreting to oneself may be argued to form an important part of the opportunity identification process as it helps the entrepreneur make sense of the initial "fuzzy" idea, and to form a more coherent view – prior to any formal evaluation – about whether or not it may constitute an entrepreneurial opportunity. Interpreting takes place at a conscious level and involves analysis and reasoning (Crossan et al., 1999) and is therefore classified as an analytical ('rational') process according to CEST (Epstein, 2003, 2010).

Along similar lines, Gaglio (2004) suggests that opportunity identification entails a conscious, deliberate process of *mental simulation*, where entrepreneurs "mull over what will happen" or "mentally rehearse" (p. 537) what might take place if a business idea is pursued. This resonates with Klein's RPD model mentioned in Section 3.3.2, as this maintains that once a course of action has been intuitively identified, individuals then evaluate its appropriateness by "consciously *imagining* what would happen when they carried it out" (Klein, 2004, p. 26). This form of hypothetical thinking serves the same purpose as the interpreting process described above, in that it makes it possible to envision the potential costs and benefits associated with pursuing a business idea, and therefore establishes a belief in the entrepreneur's mind about whether or not it may constitute an opportunity.

Interpreting and mental simulation may lead to the provisional acceptance or to the rejection of an idea as a potential opportunity. To the extent that intuition is required to recognise new patterns or to trigger fresh ideas (Dimov, 2007a, 2007b; Dutta & Crossan, 2005), further opportunity identification will require the ability to switch back to the intuitive mode of processing to begin another cycle, before reverting back to analytical processing for the interpreting or mental simulation, and so on.

This sequential – or rather, cyclical – type of interaction may be described as a *default-interventionist model* (Glöckner & Ebert, 2011) as it portrays intuition as being the system which is activated by default to trigger the identification of opportunities, and analysis then intervening in order to consciously explore the potential opportunity. However, dual-process theory also allows for simultaneous interaction of the two systems in parallel (Glöckner & Ebert, 2011). In this view, intuition would be responsible for the initial pattern recognition or idea generation, and although interpreting and mental simulation would still occur at a conscious level, subtle intuitive intervention may carry on guiding the analysis and shaping the outcome. For example, as an individual consciously imagines what may happen if a product is launched in a particular market, intuitive associations might suggest alternative products or markets. These may be further consciously interpreted or mentally simulated, and accepted or rejected on the basis of either analysis, or intuition, or a mixture of both.

Although it is beyond the scope of this study to explore which model best describes the opportunity identification process, it is clear that they both demand a versatile cognitive strategy as this is what will allow entrepreneurs to switch readily between intuition and analysis in response to the different demands of the process, and hence to identify more opportunities. Entrepreneurs who employ a versatile cognitive strategy are therefore expected to identify a larger number of opportunities than those who employ a big picture conscious strategy (predominantly intuitive), a detail conscious strategy (predominantly analytical), or a non-discerning strategy (neither intuitive not analytical – see Chapter 2 or Hodgkinson & Clarke, 2007, for more details). The following hypothesis is thus presented:

H_{3a}: Cognitive versatility is associated with the identification of a larger number of opportunities

In keeping with this study's concern with the quality (as well as the quantity) of opportunities identified, it is important to explore whether a versatile cognitive strategy is also associated with the identification of opportunities that are more innovative. Although it was argued in Section 3.3.1 that the holistic and associative nature of intuition allows entrepreneurs to identify innovative opportunities by establishing novel connections among disparate elements, recent work on structural alignment (Grégoire, Barr & Shepherd, 2010; Grégoire & Shepherd, 2012) suggests that analytical processing may also play an important role in this respect. Grégoire and Shepherd (2012) view opportunity identification as a process in which "opportunity beliefs take shape through cognitive efforts to make sense of potential 'matches' between new means of supply (i.e., new products, services, technologies, or business models) and the markets in which these new means can be introduced" (p. 757). This sense-making process takes place at two distinct levels as follows.

At the lower level, entrepreneurs attempt to match – or align – the superficial features (basic elements) of mental representations of technologies or products to those of envisaged markets. For example, superficial features of a technology would include the entities responsible for developing the technology, the context or purpose for which it was developed, and the parts and components of which it is made up. The superficial features of a market would include the individuals or groups whose current needs might be met by the technology, and the offerings currently available to meet those needs (Grégoire & Shepherd, 2012). High levels of superficial similarity, where the basic features of the product or technology resemble those of the market, are unlikely to lead to unexpected applications or breakthrough ideas, as connections would only be made between proximal, similar elements, as opposed to distant, disparate elements.

On the other hand, the higher level of alignment focuses on structural features (intrinsic elements) of mental representations of products, technologies and markets, and on the relationships between them. Structural features of a technology would include its underlying scientific or functional mechanisms and how they work together, while those of a market would include latent demand which represent "not just consumer needs or demands, but also the underlying reasons why people in a market are not completely satisfied with current means of meeting their needs" (Grégoire & Shepherd, 2012, p. 760).

Grégoire et al. (2010) found that this higher-order type of matching facilitates technology transfer across domains, leading to the identification of opportunities that are not “superficially obvious” (p. 425), or in other words, that are unexpected and innovative.

According to this model of cognitive processing, superficial alignment requires minimal cognitive resources and may take place automatically, but structural alignment – which has just been argued to facilitate innovative opportunity identification – is cognitively demanding and requires deep and effortful analysis (Grégoire et al., 2010; Grégoire & Shepherd, 2012). In this view, analysis is therefore expected to play a role in the identification of innovative opportunities.

Furthermore, building upon what was stated earlier in this chapter that (1) opportunity identification is a creative process (Hills et al., 1999), (2) innovative opportunities stem from creative ideas (Ward, 2004), and (3) creative ideas are novel *and* useful (Ward, 2004), it is pertinent to note that creativity, and by extension innovative opportunity identification, involve both divergent and convergent thinking. Divergent thinking involves the generation of multiple ideas or solutions by “making unexpected combinations, recognizing links among remote associates, transforming information into unexpected forms, and the like” (Cropley, 2006, p. 391). Conversely, convergent thinking aims at producing a single optimal answer or solution by “reapplying set techniques” or by “applying conventional and logical search, recognition, and decision-making strategies” (Cropley, 2006. p. 391). Divergent thinking therefore forms part of the intuitive system while convergent thinking is an analytical process (Sadler-Smith, 2004).

Cropley (2006) elaborates on the notion that creative thinking requires both originality and appropriateness in order to generate ideas that are *effectively* novel, and argues that this may only be attained when convergent thinking is employed to explore the novelty generated by divergent thought:

> Free production of variability through unfettered divergent thinking holds out the seductive promise of effortless creativity but runs the risk of generating only quasicreativity or pseudocreativity if it is not adapted to reality. Therefore, creative thinking seems to involve 2 components: generation of novelty (via divergent thinking) and evaluation of the novelty (via convergent thinking) (p. 391).

In this sense, convergent thinking is required to evaluate the ideas or potential opportunities generated through divergent thinking in order to help ensure that they are not simply novel but that they are also useful and appropriate (and hence truly creative or potentially innovative). Therefore, similar to what was stated above about the purpose of the interpreting and mental simulation processes, convergent thinking enables the entrepreneur to make a preliminary assessment – prior to any formal evaluation – regarding the extent to which a business idea appears to meet the criteria for an innovative opportunity, and may therefore lead to its provisional acceptance or to its rejection.

If viewed according to the default-interventionist model described above (Glöckner & Ebert, 2011), entrepreneurs must be able to switch back to the intuitive divergent mode of processing in order to commence another cycle of opportunity identification, and then revert back to analytical convergent thinking to assess the novelty and usefulness of the ideas, and so on. If, on the other hand, one argues that the intuitive and analytical systems are activated simultaneously, their interaction would be viewed as taking place on an ongoing basis, with convergent thinking being shaped and guided to some degree by intuition (e.g., by making intuitive judgments about the market potential – and hence usefulness – of a novel idea).

As stated above, it is beyond the scope of this study to explore which model best describes the opportunity identification process. The point that is being made here is that regardless of whether intuition and analysis are argued to interact sequentially or to be activated simultaneously, the identification of innovative opportunities requires intuition *and* analysis, as well as the ability to readily switch from one to the other to meet the changing demands of the process. Entrepreneurs who employ a versatile cognitive strategy are therefore expected to identify not only a larger number of opportunities, but also opportunities that are more innovative than those who employ a big picture conscious, detail conscious, or non-discerning strategy. The following hypothesis is thus presented:

H_{3b}: Cognitive versatility is associated with the identification of opportunities that are more innovative

3.4.2 Hypothesis 3c: Cognitive Versatility and Experience

The third hypothesis in this final set concerns the relationship between experience and cognitive versatility. Consistent with the approach adopted above in deriving the first two hypotheses concerning this type of strategy, it must be shown that experienced entrepreneurs are able to engage in analytical processing *as well as* intuitive processing, and that experience enhances their ability to switch between these two modes of processing according to the demands of the task at hand.

It has been argued in Section 3.3.2 on the basis of CEST (Epstein, 2003, 2010) and supporting conceptual literature (Hodgkinson et al., 2008; Miller & Ireland, 2005) that intuition is positively associated with experience. Can, however, the same be said about analysis? While CEST provides the theoretical links necessary to hypothesise about the relationship between experience and intuition, it specifies no similar connection with respect to experience and analysis. Furthermore, there are indications in the literature that novice entrepreneurs are more likely to engage in analytical processing than any other type of cognition (Gustafsson, 2006), while the expert mode of processing is characterised by automaticity (Salas, Rosen & DiazGranados, 2010). Do these differences imply that experience stifles the ability to engage in analytical processing?

The expertise literature (Dreyfus & Dreyfus, 2005; Ericsson, Prietula & Cokely, 2007; Prietula & Simon, 1989; Salas et al., 2010) offers some insight into this issue. Novices are highly analytical because they have not yet accumulated sufficient knowledge, internalised the appropriate rules, or developed the rich cognitive structures necessary to process information and carry out tasks automatically. Their performance is typically slow, deliberate and rule-based, as they attempt to understand the nature of the task and devise an appropriate response strategy (Dreyfus & Dreyfus, 2005). As individuals gain experience in a given domain, they become increasingly capable of responding intuitively (as explained in Section 3.3.2). This, however, does not replace analytical processing (Prietula & Simon, 1989). On the contrary, automaticity enables experts to engage in a level of analysis that is more sophisticated and focused on the task at hand by freeing up valuable cognitive resources:

> Automaticity contributes to the expert's ability to understand the larger meaning of a set of events. That is, because the expert has tremendous experience in a specific domain, the cognitive resources necessary to make sense of the situation is not spent on what the decision maker has seen or experienced before. Rather, he or she can concentrate on the novelty of the situation and expend cognitive resources on understanding these novelties and examining past experiences that may assist him or her in determining a solution to the problem ... Therefore, what automaticity has been argued to do is allow for a higher working memory capacity that is directly related to one's capability for controlled attention (Salas et al., 2010, p. 957).

Therefore, as noted by Prietula and Simon (1989), "the ability to generate intuitive responses does not of course mean we are slaves to that sort of behaviour" (p. 122). Experts typically generate an immediate intuitive response to a given situation, but they also engage in analysis and reflection (if time permits) prior to making a decision or taking action. Dreyfus and Dreyfus (2005) propose a five stage model of the acquisition of expertise, from being a novice, to an advanced beginner, to being competent, proficient, and finally an expert. Of relevance to the present argument is that analysis features strongly in every stage. Therefore while expertise is not necessarily analogous to experience (Baron & Henry, 2010), entrepreneurs may always be expected to be capable of analytical processing, regardless of whether or not they ever attain a level of expertise.

With regards to the question of whether experience enhances the ability to switch between the two modes of processing, Louis and Sutton (1991) suggest that "prior experience and enduring characteristics of individuals ... may each be relevant to the entity's capacity to sense relevant environmental conditions and switch cognitive gears" (p. 60). The extant literature lends some support to this argument. As indicated in Chapter 2, experienced executives reportedly combine intuition with analysis in their decision making (Agor, 1986; Burke & Miller, 1999), while experienced entrepreneurs were found to be better able than novices at adapting their cognitive processing to suit the task at hand (Gustafsson, 2006). This suggests that experience facilitates the development of a versatile cognitive strategy, and that therefore, experienced entrepreneurs may be expected to be more cognitively versatile than novices in opportunity identification. This leads to the following hypothesis:

H_{3c}: *Higher levels of experience are associated with cognitive versatility*

3.4.3 Hypotheses 3d and 3e: Cognitive Versatility as a Mediator between Experience and Opportunity Identification

The theory and supporting literature which have been cited to support the derivation of this third set of hypotheses converge to suggest a mediating role for cognitive versatility in the relationship between entrepreneurial experience and opportunity identification. This leads to this study's final pair of hypotheses (H_{3d} and H_{3e}). The reasoning underlying their development is similar to that regarding the hypothesised mediating role for intuition, and may be summarised as follows.

On the basis of cognitive theories (Baron, 2006; Baron & Ensley, 2006; Gaglio & Katz, 2001) and past research on entrepreneurial experience and opportunity identification (Gruber et al., 2008; Ucbasaran et al., 2009), experienced entrepreneurs are expected to identify a larger number of opportunities (H_{1a}) as well as opportunities that are more innovative (H_{2b}). The expertise literature (Dreyfus & Dreyfus, 2005; Ericsson et al., 2007; Prietula & Simon, 1989; Salas et al., 2010) suggests that experienced entrepreneurs are better equipped (and therefore more likely) than novices to engage in both intuitive and analytical processing, and that they are able to switch readily between these two modes of processing in a versatile cognitive strategy (H_{2c}). The entrepreneurship literature (Dimov, 2007a, 2007b, Dutta & Crossan, 2005; Gaglio, 2004; Grégoire et al., 2010; Grégoire & Shepherd, 2012), indicates that cognitive versatility may, in turn, facilitate the identification of a larger number of opportunities (H_{2a}) as well as opportunities that are more innovative (H_{2b}).

Given these hypothesised relationships, it is possible that at least part of the enhancement in opportunity identification ability that occurs as entrepreneurs obtain experience may be due to – i.e., mediated by – cognitive versatility. On the basis of the above, the following hypotheses are presented:

H_{3d}: Cognitive versatility mediates the relationship between experience and the number of opportunities identified

H_{3e}: Cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified

3.5 Conclusion

This chapter has traced the development of the conceptual model underlying this study. Three sets of hypotheses were derived from cognitive theories and from various strands of literature (entrepreneurship, intuition, creativity and expertise) to address this study's research question. The first set of hypotheses (H_{1a} and H_{1b}) proposed that entrepreneurial experience is positively associated with opportunity identification; the second set (H_{2a} to H_{2e}) argued that intuition is positively associated with opportunity identification, that entrepreneurial experience is positively associated with intuition, and that intuition acts as a mediator between entrepreneurial experience and opportunity identification; and the third set (H_{3a} to H_{3e}) suggested that cognitive versatility is related to opportunity identification, that experience is related to cognitive versatility, and that cognitive versatility mediates the relationship between experience and opportunity identification.

The next chapter provides a detailed account of the methods employed to address these hypotheses.

CHAPTER 4

METHODS

4.1 Introduction

As explained in the literature review presented in Chapter 2, the methods that have been employed in empirical research on intuition in business settings (management and entrepreneurship) to date may be criticised on various grounds. Many of the earlier studies were exploratory and descriptive, based largely on anecdotal evidence and offering very little in terms of theory development (e.g., Agor, 1986; Hayashi, 2001; Isenberg, 1984). Researchers have so far relied almost exclusively on simplistic self-report measures (e.g., Khatri & Ng, 2000), but these may be argued to be inadequate for tapping into this complex, non-conscious phenomenon, one reason being that the reliability of self-report data is questionable since people's beliefs that their decisions are driven by intuition may be mistaken (Blume & Covin, 2011). Furthermore, the use of intuition has largely been inferred solely from cognitive style, which represents one's preference for intuition (Allinson & Hayes, 1996). Since "intuition is both a matter of cognition and personality" (Evans, 2010, p. 315), it is important to account for dispositional factors in research, however scholars have come to realise that intuitive preference does not necessarily determine whether or not intuition is used in situations where other factors, including experience and task characteristics, may come into play (e.g., Gustafsson, 2006; Sinclair & Ashkanasy, 2005).

The above shortcomings have led to calls for the adoption of multiple approaches to investigate intuition that combine traditional self-report measures of cognitive style with one or more of a range of alternative assessment techniques (Blume & Covin, 2011; Hodgkinson et al., 2008). One such technique is verbal protocol analysis (Hodgkinson & Sadler-Smith, 2011; Mitchell et al., 2005; Pretz, 2008, Salas et al., 2010).

In response to the above, this study adopted a multi-method approach consisting of a 'think-aloud' scenario-based opportunity identification exercise conducted in accordance with Ericsson and Simon's (1993) verbal protocol analysis methodology, together with an online survey. Research participants were 74 technology entrepreneurs (full details about their selection and recruitment are provided in Section 4.5.1.4 while their socio-demographic data are presented in Chapter 5), all of whom completed both the protocol analysis exercise, which was designed to measure cognitive strategy during a series of hypothetical but realistic opportunity identification tasks associated with three innovative technologies, and the survey, which was designed to measure entrepreneurial experience and a number of control variables including cognitive style.

The study was guided by a five-stage framework which was derived from the general literature on protocol analysis (e.g., Chi, 1997; Ericsson & Simon, 1993; Green, 2009; Trickett & Trafton, 2009), extended to incorporate the online survey together with the think-aloud exercise (as supplementary data may be gathered to complement or support the verbal protocol data: Green, 2009), and adapted for the purpose of this study on the basis of the intuition literature. Each of these five stages are described in detail in Section 4.5 below. First, Section 4.2 provides a brief overview of protocol analysis to familiarise readers with its general principles, Section 4.3 highlights why this method is appropriate for the study of intuition and therefore why it was selected for this study, while Section 4.4 explains why it was necessary and appropriate to carry out an online survey to complement the protocol analysis. This chapter also outlines the steps taken to maximise validity and reliability (Section 4.6), and to ensure that the research participants' rights were safeguarded at all times (Section 4.7).

4.2 What is Protocol Analysis?

Protocol analysis is a technique designed to "understand in detail the mechanisms and internal structure of cognitive processes" (Ericsson & Simon, 1993, p. 1) by eliciting verbal reports of thought sequences. These verbal reports are audio recorded, transcribed, broken down into segments and coded to shed light on the thinking processes which take place during task performance (Austin & Delaney, 1998; Ericsson & Simon, 1993; Hughes & Parkes, 2003).

There are two main forms of protocol analysis: The first is concurrent protocol analysis, where research participants are asked to think aloud while they work on a task, thereby providing "a real-time insight into the knowledge that a subject uses and the mental processes applied while performing a process of interest" (Hughes & Parkes, 2003, p. 127). The second is retrospective protocol analysis, where participants are asked to provide a trace of their thinking processes after they have completed a task, usually guided by questions concerning how they solved a problem or why they chose a particular strategy (Trickett & Trafton, 2009). There is broad consensus that the concurrent method is preferred, as "concurrent reports are far less susceptible to influences from unwanted variables than are retrospective reports" (Green, 2009, p. 6). Individuals are seldom in a position to provide an accurate account of "what they did or why they did it" (Trickett & Trafton, 2009, p. 333) due to difficulties with recall and retrieval of information, coupled with an inability to "directly report their own cognitive processes" (Green, 2009, p. 4). Furthermore, some individuals may filter or 'tidy up' their retrospective reports by stating what they believe is sought by the researcher, thus producing an incomplete and inaccurate picture of the phenomenon of interest (Green, 2009).

A further distinction in protocol analysis is between mediated and non-mediated procedures. This refers to the extent to which prompts or interventions are made by the researcher while participants are engaged in a think-aloud task (Green, 2009). In mediated studies, researchers interact with participants as they perform the task, for example by seeking clarification for ambiguous statements or requesting reasons for an action or decision. Ericsson and Simon (1993) – who are generally regarded as the main authority on this methodology – are, however, adamant that once instructions to think-aloud have been given, social interaction – including prompting and probing – should be kept to an absolute minimum so as not to interrupt or alter participants' natural cognitive processing. They suggest that researchers should instruct participants to pretend they are alone in the room, speaking to themselves, and to place themselves out of the participants' view to minimise socially-motivated communication. They specifically warn against asking participants for reasons, explanations or descriptions while performing a task because this "removes them from the process of problem solving, causing them to think about what they are doing rather than simply doing it, and as a result, such explanations may change their performances" (Trickett & Trafton, 2009, p. 333). If participants are silent for a period of time, they should succinctly be reminded to "keep talking" rather than asked questions such as “what are you thinking about?” as the former is less intrusive and less likely to be interpreted as a request for explanation or social interaction.

In view of the above, the concurrent, non-mediated form of protocol analysis was adopted in this study. The next section explains why this method is suitable for studying intuition.

4.3 Why is Protocol Analysis Suitable for Studying Intuition?

Protocol analysis has been recommended as appropriate for the “concurrent capturing of intuiting and intuitions at their moments of occurrence” (Hodgkinson & Sadler-Smith, 2011, p. 59). There are two main reasons for this.

First, as a type of cognitive processing, intuition lends itself well to protocol analysis which, as explained above, is designed to explore and understand “the mechanisms and internal structure of cognitive processes” (Ericsson & Simon, 1993, p. 1).

Second, protocol analysis enables researchers to overcome many of the challenges associated with studying intuition by means of traditional self-report methods such as interviews and questionnaires. In contrast to analytical processing, which operates within conscious awareness and which can therefore be reported by individuals, intuition is a non-conscious cognitive process characterised by the absence of logically defensible methodological processes (Allinson et al., 2000; Dutta & Thornhill, 2008). Although individuals are aware of the outcomes of their intuition, the process of how they arrived at such decisions is not accessible to conscious scrutiny (Dane & Pratt, 2007). While the intuitive sense of “knowing but without knowing why” (Hodgkinson et al., 2009a, p. 279) presents a challenge for traditional self-report methods (for if individuals are not aware of their cognitions then they cannot accurately report them), it does not constitute a problem in concurrent protocol analysis, as participants are required only to verbalise their thoughts and not to report the cognitive processes that produced them (Green, 2009). These cognitive processes are later inferred by the researcher on the basis of participants' verbalisations, which are seen to be "an accurate record of information that is (or has been) attended to as a particular task is (or has been) carried out" (Green, 2009, pp. 1-2).

In summary, concurrent protocol analysis allows researchers to capture intuitive processing in real time without having to rely on research participants' potentially inaccurate reports of and attributions to intuition. Yet in spite of the merits of protocol analysis, an online survey was still required to gather supplementary data in this study. The next section explains why.

4.4 Why Include an Online Survey?

As explained in Chapter 3, this study is concerned not only with intuition, cognitive versatility and opportunity identification (all of which can be measured through the protocol analysis tasks). Hypotheses include the role of entrepreneurial experience together with a number of controls – namely educational background, work experience, entrepreneurial expertise (deliberate practice), cognitive style, risk propensity and risk perception – which may play a role in one or more of the hypothesised relationships. An additional instrument was therefore required to gather the rest of the above mentioned data. An online survey was deemed to be the most suitable method for three reasons.

First, the nature of the data to be collected lends itself well to an online survey. Standardised quantitative tools are available to measure cognitive style, risk propensity and risk perception, and these may be converted into an online survey format without difficulty. Educational background, work experience and entrepreneurial experience (business ownership history) are easily quantifiable and can therefore also be measured by means of online survey. Although past research on deliberate practice in entrepreneurship has used a qualitative approach (Sonnentag & Kleine, 2000; Unger, Keith, Hilling, Gielnik & Frese, 2009), Section 4.5.1.2 will show that it was relatively straightforward to adapt and validate the qualitative measures used into a quantitative format for inclusion in an online survey. Second, the nature of the research sample (technology entrepreneurs) guaranteed that all participants would be proficient in the use of computers and that they would have access to a computer connected to the internet – two basic requirements for filling in an online survey. Third, the online survey was an efficient and convenient means of gathering supplementary data as it reduced the time needed for face-to-face meetings where the protocol analysis tasks were carried out.

The integration of the protocol analysis tasks and the online survey into a coherent research framework is explained in the sections that follow.

4.5 The Research Process: A Five-Stage Framework

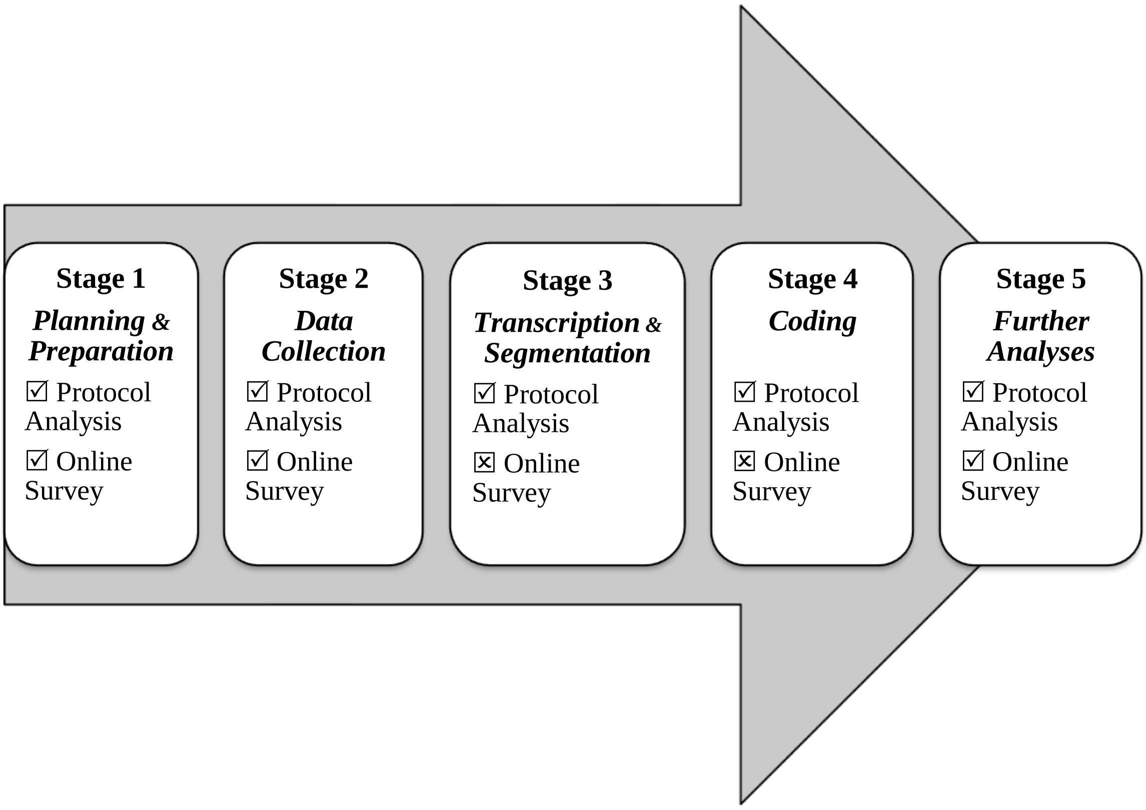
As outlined in the introduction to this chapter, the literature on protocol analysis was used to construct a five-stage research framework specifying the key tasks involved in conducting a study according to this methodology, and extended to incorporate the online survey. This literature, which includes several handbooks and guides (e.g., Chi, 1997;

Ericsson & Simon, 1993; Green, 2009; Trickett & Trafton, 2009), was very useful to indicate *what* needed to be done in generic terms (i.e., to stipulate the general principles of protocol analysis): As in all studies, a period of careful planning and preparation was required to design appropriate research instruments, which in this case included both the protocol analysis tasks and the online survey, and to select and recruit the research participants (Stage 1). Once all preparations were in place, the next step involved data collection, which also included both the protocol analysis and the survey (Stage 2). The survey data were then shelved for a while, until the verbal protocols gathered from the think-aloud tasks were transcribed, segmented (Stage 3) and coded (Stage 4). The final stage included further analysis of the verbal protocols, including content analysis to extract the opportunities identified by participants, and integration of the protocol data with the survey data for hypothesis testing (Stage 5). A graphical representation of this framework is presented in Figure 4.1.

However when the question arose of *how* these tasks should be carried out for the particular purpose of studying intuition, the literature was found to be lacking (especially where the segmenting and coding of the verbal protocols was concerned), as application of protocol analysis in this field has been very limited. Extensive reference was therefore made to the intuition literature to find out how the general principles of protocol analysis are best applied to the specific context of intuition research.

Further details are provided in Sections 4.5.1 to 4.5.5 below.

Figure 4.1 The Five-Stage Research Framework Employed in this Study



4.5.1 Stage 1: Planning and Preparation

Once the literature review had been conducted, the conceptual model and hypotheses formulated, and the multi-method approach selected, important decisions had to be made concerning what sort of tasks are to be assigned in the protocol analysis study, what instruments are the most appropriate for the online survey, who the research participants should be, and how many are needed. These all formed part of Stage 1: planning and preparation.

4.5.1.1 Constructing the Protocol Analysis Tasks

The aim of the think-aloud protocol analysis exercise was to explore the cognitive strategy (use of intuition and analysis) employed by entrepreneurs during opportunity identification, and to investigate whether a more intuitive and versatile cognitive strategy is related to the number and innovativeness of opportunities identified. Besides conforming to the protocol analysis technique, the tasks therefore had to be suitable for studying intuition and analysis as well as opportunity identification.

A number of general principles were identified in the protocol analysis literature concerning appropriate task construction. These include the following: tasks which involve reading of texts, such as newspaper articles, are suitable for protocol analysis; the level of difficulty of the tasks must be matched to the level of ability of the research participants; and tasks should be as realistic and as relevant – or as ecologically valid – as possible in order to trigger the same cognitive processes that would be used in real life scenarios (see e.g., Green, 2009; Witteman & van Geenen, 2010, for details). The issues of task difficulty and ecological validity therefore tie in with the selection of research participants (which is discussed in Section 4.5.1.4 below).

Given the domain-specific nature of some forms of intuition (e.g., the automated expertise described by Miller & Ireland, 2005; or the expert intuition discussed by Crossan et al., 1999; Dutta & Crossan, 2005; and Dane & Pratt, 2009), it may be argued that when studying intuition through protocol analysis, researchers should not only match the level of difficulty to the participants' ability, but also the task context to the participants' domain-relevant knowledge and experience. It may further be argued that intuition researchers should focus on a relatively narrow domain in order to ensure that the tasks they present are ecologically valid and that the research participants have the required competence to solve them. For example, if the general field of interest is intuitive decision making in the medical field, it would be sensible to focus on a particular area of medical practice (e.g., emergency room interventions or diagnosis of terminal illness), to construct tasks simulating situations that would be encountered in that field of practice, and to recruit research participants who are practitioners in that area of specialisation.

All of the above principles were adhered to when constructing the protocol analysis tasks for this study. The general field of interest was intuition in entrepreneurship, but (as will be explained in further detail below) this was narrowed down to focus on one sector, namely the Information and Communication Technologies (ICT) industry. In order to meet the criteria concerning level of difficulty and ecological validity, the study was made up of tasks (which involved reading as per Green's, suggestion above) with which all entrepreneurs are expected to possess some degree of familiarity (opportunity identification – see below for details). Industry experts were engaged to ensure that the tasks were realistic, domain-relevant (i.e., ICT-related), and challenging yet attainable for the intended sample.

Specifically, participants, who were all technology entrepreneurs, were asked to imagine that they were attending a technology fair with the aim of identifying business ideas for a new technology-related venture. This setting represents a hypothetical but realistic scenario for these participants. They were then presented with descriptions derived from breaking news items of three technologies (one at time, in rotation to minimise order effects) that they encountered at this imaginary fair, and asked to think aloud about what business opportunities could be possible for these technologies. Figure 4.2 provides a brief overview of the technology descriptions and the full protocol guide is available in Appendix E. The underlying cognitive processing would later be coded by the author into intuition and analysis, and the opportunities identified would be counted and rated.

The technology and entrepreneurship-related nature of these tasks ensured that the context was relevant and familiar to all the research participants, in line with what was stated above concerning the link between intuition and domain-specific knowledge and experience. Since the literature indicates that uncertainty is likely to trigger intuition (Sadler-Smith & Shefy, 2007), and since innovativeness is often viewed as analogous to uncertainty (see e.g., Choi & Shepherd, 2004; and Pérez-Luño, Wiklund & Cabrera, 2011), the technology-based tasks represented varying levels of innovativeness as a proxy for uncertainty (the higher the innovativeness, the higher the uncertainty) in order to explore its effect on cognitive strategy.

In summary, the tasks constructed for the think-aloud exercise were in line with the general principles of protocol analysis and were tailored to ensure that they were appropriate for studying cognitive strategy and opportunity identification as per the requirements outlined above.

Figure 4.2 Overview of the Three Technologies Used for the Think-Aloud Opportunity Identification Tasks

The Multi-Touch Frame

Innovativeness / Uncertainty: High

- A device that turns regular monitors into interactive touch screens when connected to a computer with a USB cable
- This technology was still at prototype stage and had not yet been launched at the time of the study
- It was therefore considered to be a highly innovative 'new to the world' technology
- The degree of uncertainty associated with it was very high as there was no market data available to guide the participants' thinking

The 3D Imaging Software

Innovativeness / Uncertainty: Moderate

- An affordable software package that turns photographs into 3D souvenirs
- This technology had not yet been launched at the time of the study, but 3D souvenirs created by other means were available for some time
- This was therefore a moderately innovative technology that would deliver existing products in a new way
- The degree of uncertainty was not as high as that of the Multi-Touch Screen as one could draw inferences about market potential on the basis of similar offerings

The Quick-Tap App

Innovativeness / Uncertainty: Low

- A mobile phone application that enables shoppers to pay for goods by tapping their handset against a payment terminal
- This technology was not available in the participants' domestic market, but it had been launched successfully in a familiar overseas market
- Although this technology would be innovative locally, it is considered to be the least innovative of the three presented (not 'new to the world')
- The degree of uncertainty would also be lowest as its availability in a familiar market would provide important information about its local potential

4.5.1.2 Constructing the Online Survey

The next task in the planning and preparation stage involved constructing the online survey. The aim of this survey was to gather data about the participants' entrepreneurial experience, or business ownership history, and to measure the control variables listed in Section 4.4. The survey was divided into five main parts. Part 1 measures cognitive style, Parts 2 and 3 risk perception and risk propensity, Part 4 deliberate practice and Part 5 educational background, employment history, and business ownership history. A review of the literature revealed that there were standardised tools available to measure cognitive style, risk propensity and risk perception, so decisions had to be made regarding which were the most appropriate for the purpose of this study. None were however found for deliberate practice, educational background, and work experience and entrepreneurial experience, so these had to be developed for the purpose of this study. Further details are provided below while the full survey is reproduced in Appendix C.

Part 1: Cognitive Style

Cognitive style is a construct that represents an individual's preferred manner of gathering, processing and evaluating information. A distinction is made between an intuitive (automatic, inductive, holistic) and an analytical (deliberate, deductive, detailed) cognitive style (see Chapters 2 and 3 for details). Although it has been argued that one's dispositional preference does not necessarily predetermine cognitive strategy, Sinclair (2003) found that intuition is enhanced by a holistic cognitive style, indicating that it is important to include cognitive style as a control variable in this study.

Various tools are available to measure cognitive style, and one's choice will depend on how one views the interrelationship between intuition and analysis, and this is in turn determined by which side of the 'single-process versus dual-process' debate one ascribes to. Consequently, this has been a bone of contention among scholars from the two opposing theoretical perspectives. As explained in Chapter 2, proponents of the unitary view tend to advocate the use of the CSI (Allinson & Hayes, 1996), while proponents of the dual-process view recommend the REI (Pacini & Epstein, 1999). A comparative investigation of the two instruments by Hodgkinson et al. (2009b) concluded that the REI is a superior measure of cognitive style and that the dual-process perspective is the one that best explains the analytical-intuitive nature of human information processing. They counsel that:

> Future cognitive style researchers would be well-advised to consider the REI to be a measure of two orthogonal constructs of information processing, and to abandon forthwith the unitary conception underpinning the CSI (Hodgkinson et al., 2009b, p. 346).

In view of the above, and since this study adopts the dual-process approach, the revised version of the REI (Pacini & Epstein, 1999) was selected as the most appropriate tool to measure cognitive style in this study. This measure consists of 40 items rated on a 5-point Likert scale anchored by "definitely not true of myself" (adapted for this study to read "not at all like me": 1) and "definitely true of myself" (adapted to read "totally like me": 5). Half of these items represent an experiential, or a pre-conscious, affective, holistic approach (termed "Experientiality"), and are measured by the Faith in Intuition Scale (FI). The other half represent a rational style, or a conscious, analytical approach (termed "Rationality"), and are an adaptation of Cacioppo and Petty's (1982) Need for Cognition (NFC) scale. Table 4.1 presents a sample of items from both these subscales, while the full scale is provided in Appendix C.

Table 4.1 Sample Items from the REI

Sample Experientiality Items	Sample Rationality Items
• I believe in trusting my hunches • I like to rely on my intuitive impressions • I don't like situations in which I have to rely on intuition (reverse scored) • I don't think it is a good idea to rely on one's intuition for important decisions (reverse scored)	• I have a logical mind • I enjoy intellectual challenges • I am not a very analytical thinker (reverse scored) • Reasoning things out carefully is not one of my strong points (reverse scored)

<u>Parts 2 and 3: Risk Perception and Risk Propensity</u>

Risk perception and risk propensity were included as control variables in this study because they may be associated with the extent to which an individual relies on intuition and because they are expected to influence an individual's attraction or aversion to innovative technologies and opportunities (Keh, Foo & Lim, 2002; Simon et al., 2003). The scales developed by Forlani and Mullins (2000) and later used in various studies (e.g., Foo, 2011; Mullins & Forlani, 2005) were selected for this study as they operationalised risk perception in terms of new venture creation, and risk propensity in terms of financial risk, as opposed to other forms of risk associated with situations or behaviours which are unrelated to entrepreneurship.

The risk perception scale includes four venture options that vary in their chances of being above or below target return on investment and in the value of their possible outcome. Each venture option is followed by a three-item, 7-point Likert scale, anchored by High / Low, Minimal / Extreme, and Very Risky / Not Risky, designed to assess the amount of risk participants perceived in each venture. The full scale is available in Appendix C.

The risk propensity scale, which Forlani and Mullins adapted from the Risk Style Scale (Schneider & Lopes, 1986, cited in Forlani & Mullins, 2000), includes five items, each with two options for participants to choose from. One option represented a sure but lesser financial gain while the other option represented a probabilistic but greater financial gain. Both options ultimately have the same expected value. For example: a) Receiving Euro 300 for sure, or b) A 20% chance of winning Euro 1,500. Selecting the former would indicate lower risk propensity than selecting the latter and would be scored accordingly. The full Risk Style Scale is provided in Appendix C.

Part 3: Deliberate Practice

As mentioned in Chapter 2, scholars have recently begun to argue that experience is a necessary but insufficient condition for expertise. For example according to Baron and Henry (2010):

> Another suggestion of conventional wisdom that has not been confirmed in systematic research is that exceptional levels of performance are the result of growing experience—the sheer amount of time spent in a given domain. In fact, there is little evidence for this contention. Across many different activities, most individuals show relatively rapid increments in performance up to levels they and others view as acceptable. This is then followed by a plateau and no further gains. As a result, most individuals remain at a particular level of competence for years or even decades (p. 51).

Following the general expertise literature, Baron and Henry (2010) posit that building entrepreneurial expertise requires extensive deliberate practice rather than merely owning one or more businesses for a number of years. Deliberate practice involves intense, effortful, prolonged, and highly focused efforts to improve current performance, and has been found to be a key ingredient in superior performance. Baron and Henry (2010) propose entrepreneurs can enhance their performance by engaging in highly focused forms of practice with respect to tasks they are performing as entrepreneurs (e.g., practicing their elevator pitches), by engaging in such practice vicariously (by carefully considering relevant cases or other information), or by transferring cognitive resources developed in other life activities (e.g., through deliberate practice in, sports, music, creative writing, etc.) to the domain of entrepreneurship. Participation in deliberate practice not only contributes to domain-related knowledge and skills, but also generates additional cognitive resources, namely enhanced perception, memory, metacognition, and intuition (e.g., Feltovich, Prietula & Ericsson, 2006). Baron and Henry's argument suggests that researchers must look beyond entrepreneurial experiences in terms of length of time or number of businesses started up, and seek further information about other ways in which expertise may have been nurtured.

An extensive search of the literature yielded no established instrument that measures deliberate practice in entrepreneurship, as research on this construct has been conducted almost exclusively in the domains of the arts and sports. Only two studies investigated deliberate practice in business settings – one was conducted among insurance agents (Sonnentag & Kleine, 2000), and the other among small business owner-managers (Unger et al., 2009). Both of these were qualitative in nature and therefore provided no measure which could be used directly in an online survey, but they did offer a useful framework which could be adapted for use in a quantitative study. Based on these studies, a scale composed of ten deliberate practice items was constructed and piloted among a small sample of technology entrepreneurs and industry experts.

The deliberate practice scale, presented in full in Appendix C, consists of ten items which represent deliberate practice activities for small business owner-managers. These activities, derived from Unger et al.'s (2009) study, include mental simulation, exploring new strategies, and consulting colleagues or experts. Each of these ten activities was accompanied by a question concerning the participants' frequency of engagement (every day, every week, every month, etc.) and another about the activity's effectiveness in enhancing knowledge, skills and performance related to technology entrepreneurship (to a great extent, to a large extent, to some extent, etc.). In line with Unger et al. (2009), activities would qualify as deliberate practice if they were performed on a regular basis (at least once a week) and if they were carried out for a goal related to competence improvement (as opposed to a goal not related to competence improvement, or with no goal).

Part 5: Educational Background, Employment History and Entrepreneurial Experience

The fifth part of the survey gathered data about the participants' educational background, work experience and business ownership history. Although the literature states that experience could be role-specific (e.g., managerial experience, start-up experience), industry specific, or both, past research has failed to investigate all of these aspects in a single study. It is therefore unclear which aspects of experience are the most salient for the enhancement of opportunity identification ability. Construction of Part 5 of this online survey, which aimed to provide a comprehensive picture of the participants' experience, was guided by several studies which have investigated entrepreneurial experience, including Gruber et al. (2008, 2012a, 2012b), Robson, Akuetteh, Westhead and Wright (2012), and Ucbasaran (2004).

The questions on educational background measure the highest level of education attained in general, and in three specific areas of study, namely ICT / computing, business / management, and entrepreneurship, creativity and/or innovation. The levels indicated by participants would later be converted into the number of years of formal education. The questions concerning employment history track the number of years of work experience in different roles (managerial and non-managerial) and in different industries (ICT or non-ICT) prior to becoming business owners. The section on entrepreneurial experience gathers data on the number of years of business ownership experience, number of businesses owned, and the industry in which they were based. For further details please refer to Appendix C.

4.5.1.3 Piloting

Once the protocol analysis tasks and the online survey had been constructed, the next step in the planning and preparation stage involved the piloting of both these instruments. This was carried out in two rounds. In the first round, six pilot interviews were held with technology entrepreneurs and industry experts (academics, managers). One of the aims of these interviews was to explore whether the technology-based think-aloud tasks were appropriate and effective for the purpose of this study or whether they needed any modification prior to the start of the main study. These interviews led to minor revisions to the technology descriptions and indicated that the amended versions met all the requirements stipulated during task construction.

Another aim of the pilot interviews was to refine and validate the deliberate practice scale which had been constructed for the purpose of this study (as explained in Section 4.5.1.2 above). These pilot participants were questioned about the face validity of the scale (relevance of the deliberate practice activities for the intended sample), and were requested to provide technology-related examples for each activity to be included in the final instrument for clarification purposes. These interviews led to minor adjustments to the scale and indicated that the refined version is appropriate for measuring deliberate practice among technology entrepreneurs.

The second round of piloting was dedicated to testing the online survey. The various scales were compiled into one instrument, uploaded onto the professional Qualtrics survey software platform (made available through Warwick Business School), and sent out to 15 individuals known to the researcher. Some of these individuals were entrepreneurs, others were knowledgeable about the ICT industry, and others had the task of proofreading it. They were asked to provide feedback about the contents, structure and length of the survey. This led to minor amendments and indicated that it was appropriate for its intended purpose (as detailed in Section 4.5.1.2 above).

4.5.1.4 Selection and Recruitment of Research Participants

The final task in the planning and preparation stage involved the selection and recruitment of research participants. The first important decision in this regard was about who the participants should be. As indicated in Section 4.5.1.1, a degree of alignment was required between the verbal protocol tasks and the participants selected to tackle them in terms of level of ability, domain-relevant knowledge, and industry experience. The technology-based opportunity identification tasks constructed for this study were designed with technology entrepreneurs in mind for the following reasons.

First, it has been shown that “someone with no knowledge ... could guess, but ... could not intuit” (Sadler-Smith, 2008, p. 29). In other words, if any evidence of intuitive processing was to be detected during the think-aloud opportunity identification tasks assigned in this study, participants needed to be familiar with identifying opportunities for new ventures. The first general selection criterion was therefore that all participants had to have experience of starting up at least one business, which is an activity which implicitly assumes that an opportunity had been identified (and exploited). Moreover, since one of the research questions addressed in this study concerns the way opportunity identification and intuition are shaped by entrepreneurial experience, it was desirable to recruit participants at various stages of their entrepreneurial career, ranging from novices in the early years of their first business to entrepreneurs with more extensive business ownership experience.

Second, it was suggested in Section 4.5.5.1 that intuition research should be focused on a relatively narrow domain in order to elicit – or at least to not inhibit – the phenomenon of interest. This implies that intuitive opportunity identification is more likely to occur within industries that are familiar to the research participants. For this reason, as well as to minimise inter-industry confounding effects, it was decided to select all the research participants for this study from the same industry. The ICT sector was chosen as the domain of interest on the basis of research findings which indicate that intuition is more prevalent and more effective in uncertain environments such as the dynamic and highly competitive high-technology industries (Covin et al., 1999; Khatri & Ng, 2000). In view of the above, the second selection criterion was that the current business owned by participants needed to be operating within the ICT sector.

In line with the International Standard Industrial Classification (United Nations, 2008) and the Statistical Classification of Economic Activities in the European Community (European Commission, 2008), the ICT sector was taken to include the following: 1) The ICT Manufacturing Industries (manufacture of computers, electronic components and boards, peripheral equipment, communication equipment, consumer electronics, and magnetic and optical media; 2) The ICT Trade Industries (wholesale and retail sale of electronic and telecommunications equipment, computers, computer peripheral equipment and software); and 3) The ICT Services Industries (software publishing, telecommunications, computer programming, consultancy, data processing, hosting of web portals, and repair of computers and communication equipment).

A final important decision to be made concerning the selection and recruitment of participants concerned the size of the sample to be used. Protocol analysis yields very rich data, but it is very labour intensive (Green, 2009; Witteman & van Geenen, 2010). Consequently, most studies based on this method have made use of relatively small samples (e.g., Grégoire et al., 2010: nine participants; Sarasvathy, 2008: twenty seven participants; Trickett & Trafton, 2009: one participant). The size of the sample ultimately depends on the research question/s one is trying to answer and on the type of analysis to be used (Trickett & Trafton, 2009). Although the set of protocols gathered in protocol analysis are qualitative in nature and may therefore be analysed using qualitative techniques, this study's conceptual model required testing of hypotheses by means of statistical analyses, and so a relatively large sample (compared to other protocol analysis studies) was needed.

In view of the above, recruitment of participants proceeded as follows: A list of businesses that fell within at least one of the ICT categories outlined above was drawn up from a number of sector-specific trade directories and registers. It was necessary to focus on a somewhat limited geographical region (the researcher's home country – Malta) due to the constraints associated with conducting the considerable number of face-to-face meetings required for the protocol analysis study. In all, this list was made up of 289 businesses, which together made up the original sampling frame for this study. Preliminary research established the names and contact details of the business owners, and an e-mail invitation was sent to each one (See Appendix B). Of these, 99 accepted the invitation and commenced their participation in the study, representing an initial response rate of 34.3%. However, 25 of these failed to complete the study, leaving a final sample of 74 research participants for a final response rate of 25.6%. This response rate is similar to those obtained in other studies using entrepreneur samples (e.g., Chaston & Sadler-Smith, 2012: 27.4%; Gruber et al., 2012b: 23%). Efforts aimed to maximise the response rate are outlined in Section 4.5.2 below.

4.5.2 Stage 2: Data Collection

The second stage in this study's research framework involved the collection of data from the protocol analysis tasks and the online survey. As outlined above, an e-mail was sent to all potential participants, inviting them to participate in a study concerning the thinking processes involved in the identification of entrepreneurial opportunities. In order to increase response rates, reminders were sent to non-respondents every fortnight over a six-week period (three reminders in all). As an added incentive, participants were promised a personalised report and tailored recommendations upon completion of the study.

4.5.2.1 The Online Survey

Participants began by filling in the survey so as to ensure that all those taking part in the time-consuming protocol analysis part of the study would have provided all the data necessary to test the research hypotheses. The risk of priming participants was minimal since they had no way of knowing which, if any, of the various phenomena addressed in the survey would be of interest during the protocol analysis tasks.

The survey was accessible through a unique and personalised link sent to participants in their e-mail invitation. In a further effort to increase response rates, participants had the option of completing the survey, which required approximately 20 minutes of their time, in multiple sittings. The data they entered was automatically saved in a safe repository on the Qualtrics survey platform and later transferred to a statistical programme for analysis.

4.5.2.2 The Protocol Analysis Study

Upon completion of the survey, arrangements were made for each participant to individually meet with the researcher to carry out the protocol analysis tasks. The literature highlights several important issues that must be considered to ensure that the data collected in a protocol analysis study is as complete and reliable as possible (see e.g., Ericsson & Simon, 1993; Green, 2009, for details). The main issues include the following:

The setting in which data collection takes place should be as quiet and free from distractions as possible; researchers should be prepared to audio record the session in full (with written consent from participants) as protocols later need to be transcribed; and a clear set of written instructions should be read to each participant before they commence their tasks to ensure that they are all aware of what is expected of them and that they all receive the same information in a standardised manner (see Ericsson & Simon, 1993, for general instructions). Furthermore, Green (2009) suggests that supplementary data could be collected to enrich the verbal protocols, but states that this should be carried out in a consistent, systematic fashion.

Each of these steps was followed in this study. Specifically, all reasonable precautions were taken to minimise distractions (turning off mobile phones, asking not to be disturbed, etc.); after obtaining informed consent from the participants (see Appendix D) the audio recording equipment was switched on; and an adaptation of Ericsson and Simon's (1993) general instructions were read out to the participants in preparation for the tasks that would ensue. As explained in Section 4.2, this study adopted the concurrent, non-mediated form of protocol analysis. Participants were therefore instructed to think aloud constantly while they carried out their opportunity identification tasks and were then left to do so uninterrupted. They were only prompted if they fell silent for more than 10 seconds, in which case they were simply instructed to "please think aloud" (as this was found to be more effective in the pilot study than the "keep talking" instruction recommended by Ericsson & Simon, 1993). Notes on the participants' non-verbal behaviour including tone of voice, speed of speech, and evidence of affect (e.g., excitement, apprehension) were recorded by the researcher in order to take full advantage of the richness of information provided by the personal nature of this method of data collection (Frankfort-Nachmias & Nachmias, 1996; Green, 2009).

4.5.3 Stage 3: Data Transcription and Segmentation

According to Ericsson and Simon (1993), the verbal protocols produced by participants must be audio recorded and accurately transcribed to ensure that the raw data is preserved "in as 'hard' a form" as possible (p. 4), and must then be broken down into chunks of text or 'segments' in preparation for coding and further analysis. These tasks made up the third stage in this study's research process.

One should note that the survey data was shelved during this stage and the next as these are dedicated to the protocol analysis. The survey data will be brought back in for analysis in Stage 5.

4.5.3.1 Transcribing the Verbal Protocols

As noted by Kasper (1998), "the same concerns apply to the transcription of verbal reports as apply to other kinds of spoken discourse" (p. 358). There are however two key issues that are particularly salient in transcribing verbal protocols.

First, verbalisations should be transcribed exactly as they are, even if they sound incoherent or incomplete (as is often the case in think-aloud tasks):

> Protocols should not be modified by adding or substituting words to achieve completeness, or by altering the verbalisation. Errors in language use should then be included in the transcript and should not be corrected (Green, 2009, p. 51).

Second, a systematic approach is needed to capture within the transcript all the non-linguistic information contained in the audio-recorded protocol including pauses, speed of speech, tone of voice and evidence of affect (such as excitement). This is especially important in intuition research as these supplementary data constitute valuable indicators about whether intuition or analysis is being used during a particular task, and even more so if more than one person is involved in transcribing the protocols.

Both of these recommendations were followed in this study. The protocols gathered from the 74 participants constituted a great deal more data than could be transcribed by a single individual within a reasonable length of time. A team of six research assistants was therefore engaged and trained for this purpose. They were all required to attend an introductory meeting where they were given full details about the study and provided with identical, unambiguous instructions on how to prepare the transcripts. They were told that they should accurately and fully transcribe the protocols, and that they should take note of non-linguistic elements such as tone of voice, speed of speech, and evidence of affect, such as excitement or apprehension, by including additional comments at the appropriate junctures in the transcripts. Furthermore, the researcher provided examples of transcribed audio clips for demonstration purposes.

At the end of the meeting, the research assistants were instructed to prepare one transcript each and to return them to the researcher for feedback. These transcripts were closely inspected by the researcher and feedback was provided before the next one was assigned. This was repeated until the transcripts were up to the required standard and the research assistants were deemed capable of carrying out the transcription without further supervision. Nevertheless, when all the transcripts had been completed, they were each carefully checked by the author against the audio recordings and amended as necessary, as recommended by Green (2009). Furthermore, the non-linguistic elements which were noted by the research assistants in the transcripts were cross-referenced with the notes taken by the researcher while the research participants carried out the protocol analysis (opportunity identification) tasks.

4.5.3.2 Segmenting the Verbal Protocols

Once the protocols had been transcribed, the next task was to break them down into segments which would then form the basic units of analysis. The literature on protocol analysis offered some guidelines about how this task should be carried out: Segments can range in "granularity" or "grain size" from "a proposition, a sentence, an idea, a reasoning chain, a paragraph, an interchange as in conversational dialogue, or an episode (such as an event, or a specific activity)..." (Chi, 1997, p. 284). The "subtle and complex decision" of selecting a grain size for analysis varies from one study to another and depends on the research questions one is trying to answer (Chi, 1997, p. 286). Segmentation is particularly important if the subsequent analysis makes use of frequencies of processes (Ericsson & Simon, 1993), as was the case in this study. Inaccurate or inconsistent segmentation will inevitably lead to flawed results.

The guiding principle used for segmentation in this study was that "protocols must be divided up so that each segment will constitute one instance of a general process" (Ericsson & Simon, 1993, p. 205) which would, at the next stage, be coded as either intuitive or analytical. The method that was found to be the most appropriate for this purpose was to segment the protocols according to ‘complete thought’ (Trickett & Trafton, 2009) or ‘thought units’ (Hensman & Sadler-Smith, 2011), which can be defined as phrases, sentences or clauses that convey only one idea or thought (Butterfield, Trevino & Ball, 1996). This method of segmentation is illustrated in the following excerpt from one of the transcribed protocols (segments are divided by //):

> // Yeah eh will this work, is there an opportunity for this? // The snags I see are eh the fact that you have to have a 100 Pound credit on the machine before you start, so that’s a 100 Pound of people’s money tied up. // In certain situations that probably wouldn’t be a hassle but for a lot of people, for a large percentage of the majority I think that threshold would be too high. // Emm. How would we get it across to people, how could we sell this? // Could we sell this as an add-on to an existing business, where we won’t have to retail outlets? Hmmm. // What’s the upside for us? What do I get for selling this? How much money would we make out of it? // It’s an easy one as well ’coz the money is paid upfront there’s no risk for the vendor or the retailer, all the money is paid up by the person who is going to use the service. (Mumbles…) // My experience in this country would say that people will be reluctant to take this on initially, // there would have to be a very very strong sales programme to support this, that would cost a lot of money. //

This approach was found to provide segments that are of the appropriate grain size to detect underlying cognitive (intuitive or analytical) processing. Segmenting the protocols at a more “microscopic” level would have provided insufficient indication of what kind of processing was going on, while a more “macroscopic” approach would have resulted in segments which may encompass multiple processes and would therefore have required further splitting (Green, 2009).

Another advantage of segmenting at this grain size was that it evened out individual differences in verbosity among participants. Some people use many more words than others to convey a single thought or idea. This does not necessarily imply that they are any more or less intuitive or analytical, but simply that they are more or less articulate or talkative. By segmenting protocols according to thought units (rather than counting the number of words or the time taken to solve a problem) these differences could be accounted for, thus increasing confidence that the variance in the number of segments across participants was a true reflection of their underlying cognitive processing rather than of superficial differences in verbosity (Chi, 1997).

4.5.4 Stage 4: Coding

Once the protocols had been transcribed and segmented, the next step was to code them in accordance with a theoretically-grounded coding scheme. According to Kasper (1998), researchers should first establish if they can adopt (or at least adapt) an existing coding scheme or if they need to construct a new one. Various authors have noted that developing an appropriate coding scheme is very time-consuming and labour-intensive (e.g., Green, 2009; Kasper, 1998; Trickett & Trafton, 2009). Researchers are therefore advised to carefully consider using a pre-established coding scheme rather than developing one of their own. This will not only facilitate the research process but it also carries the advantage of enabling the comparison of findings from different studies:

> Before settling for the second option, they ought to carefully examine available coding schemes for their suitability to the study at hand. Not only is the development of a valid and reliable coding scheme laborious and time-consuming, but the use of identical coding schemes is also a prerequisite for comparability across studies (Kasper, 1998, p. 359).

The aim of coding in this study was to distinguish intuitive from analytical processing in order to map out the cognitive strategy employed by entrepreneurs as they identify opportunities for new ventures. At the time, there was no coding scheme that was suitable for this purpose, so there was no option but to develop a new one.

Various scholarly sources were used to extract the key indicators of intuitive and analytical processing. The point of departure was Dane and Pratt's (2007) definition of intuition as "affectively charged judgments that arise through rapid, nonconscious, and holistic associations" (p. 40). In line with this definition, any processing that occurred rapidly (quickly, automatically), nonconsciously (originating beyond conscious thought) and holistically (pattern-recognition, big-picture view) was coded as intuitive (or as forming the basis of an intuitive judgment). For example:

> One of the major characteristics of intuition is that it is fast. Thus if participants immediately mention their decision and only then continue to give reasons pro (and con) they may be assumed to have reached their initial decision intuitively, and their reasons could be called post-hoc justifications (Witteman & van Geenen, 2010, p. 56).

Furthermore,

> Another characteristic of intuition is that it is associative... The more associations participants mention, for example: "this client reminds me of Mr X", the more they may be assumed to decide intuitively (Witteman & van Geenen, 2010, p. 57).

Conversely, analytical processing (or rationality) is "based on the process of establishing the parameters of the problem and its potential solution, assembling the necessary data, and reasoning the decision through by a process of analysis" (Sadler-Smith, 2008, p. 35). Processing which was carried out in a logical, deliberate manner with due attention to the relevant information was therefore coded as analytical (or as forming the basis of an analytical judgement). For example:

> If participants mention their decision only after their reasoning, they are more likely to have reached it by deliberate strategies in the narrower sense, namely by deliberately comparing information in a rule based manner ... The more reasons, the more deliberation is used in the process (Witteman & van Geenen, 2010, pp. 56-57).

The full set of criteria that were used to code segments as intuitive or analytical are provided in Tables 4.2 and 4.3 respectively. Segments were coded as intuitive if they fulfilled at least one of the criteria listed in Table 4.2 and as analytical if they fulfilled at least one from Table 4.3. Segments that fulfilled criteria from both tables were further subdivided until each segment could only be assigned to a single category (Green, 2009). Since "good examples may be worth many thousands of words" when describing a coding scheme (Trickett & Trafton, p. 344) several examples from the transcribed protocols are provided in order to "allow readers themselves to check how the categories were applied" (Kasper, 1998, p. 361).

Table 4.2 Criteria for Coding Segments as Intuitive (Rapid, Non-Conscious, Holistic, Automatic)

Coding Criteria	Sources	Examples from protocol
It is an initial reaction or automatic response	Epstein (2011)	"Hmm I like this" "Interesting!"
It represents recognition of patterns (largely based on experience, expertise and knowledge): ✓ The technology seems familiar, similar to others the participant has seen (despite that all three technologies were breaking news at the time of the study) ✓ Detection of problems, anomalies ✓ Detection of links between technology and changing market trends	Dutta & Crossan (2005) Hodgkinson et al., (2008) Klein (2004) Miller & Ireland (2005) Simon (1995) Witteman & van Geenen (2010)	"I've seen this somewhere" "This is old technology" "This is not particularly new but anyway" "Connected with a USB cable? No, that won't work" "People are realizing that plastic is a more convenient way to pay"
It is a spontaneous generation of an idea, alternative or solution, or what Sadler-Smith (2004) would call "divergent" (p. 161)	Sadler-Smith (2004)	"So for example the first thing that came to mind when I saw this was ee for example menus and people select the food that they want to eat..."
It is an intuitive projection, or what Crossan et al. (1999) would call "future possibility oriented" (p. 526)	Crossan et al., (1999)	"This is going to be huge" "I can see this happening in a few year's time"
It is emotionally-laden	Dane & Pratt (2007) Sinclair & Ashkanasy (2005)	"This is very exciting technology" "Ahh yesss!" (spoken in an excited voice)
It represents an instant judgment or a rapid, confident decision to exploit or reject the technology (despite the lack of information available)	Dane & Pratt (2007) Simon (1995)	"This is definitely something I would go for" "No. From what I see I wouldn't invest in this"
It represents an inability to give a rational justification for why the decision was made, or it makes reference to intuition, gut feeling, etc. BUT "if participants immediately mention their decision and only then continue to give reasons pro (and con) they may be assumed to have reached their (initial) decision intuitively, and their reasons could be called post-hoc justifications" (Witteman & van Geenen, 2010, p. 56)	Epstein (2011) Simon (1995) Simon (1987) Witteman & van Geenen (2010)	"I don't know why" "I can just see it" "My gut feeling is that right now em you can do away with an add-on technology like this" "Somehow it's more intuition, something is telling me that e this technology em might not work in all scenarios, in all conditions"

Once all segments have been coded, protocols are examined in a holistic manner in order to obtain supporting evidence for the above coding. The following additional indicators suggest intuitive processing:

- Rapid reading of the text and quick scanning of the task scenario (Dane & Pratt, 2007; Klein, 2004; Simon, 1995)
- High confidence in decision (Dane & Pratt, 2007; Simon, 1987; Witteman & van Geenen, 2010)
- Other observations noted during the data collection (excitement, etc.)

Table 4.3 Criteria for Coding Segments as Analytical (Conscious, Logical, Detail-Focused, Deliberate)

Coding Criteria	Sources	Examples from protocol
It represents what Klein (2004) describes as "the process of trying to understand a problem by breaking it down into its components and then performing logical and/or mathematical operations on these components" (p. 74)	Klein (2004)	"Ok so if I'm understanding this correctly..." "I'm still, I'm trying to understand what it's all about, and what it can be used for"
It involves a deliberate effort at what Sadler-Smith (2008) describes as "reasoning the decision through by a process of analysis" (p. 35)	Sadler-Smith (2008)	"We're talking here about entrepreneurship, so so we really have to think about the objectives in this case… normally the first objective that an entrepreneur tries to hit is the commercial objective…"
It is characterised by attention to objective data such as market trends and statistics, prices, and other information that is relevant to the task at hand	Dane & Pratt (2007) Dean & Sharfman (1993) Gustafsson (2006) Sadler-Smith (2008)	"And also even the investment, it's something that needs investment in the hardware itself, em it's something that needs investment in the technology" "There is penetration of mobiles in practically more than one phone in every pocket"
Reference is made to the lack of information available, or participant seeks more information (including re-reading / closer examination of the text provided)	Dean & Sharfman (1993)	"My only concern is that still repeatedly I have absolutely no idea what type of investment is required" "Bear with me I'm going to read quickly through it again"
It represents mental simulation, which Klein (2004) describes as "evaluating a course of action by consciously *imagining* what would happen when they carried it out" and "simulating and envisioning a scenario – playing out in their heads what they expect would happen if they implemented the decision in a particular case" (p. 26)	Klein (2004)	"What we are saying here is that I can use this on a monitor, nowhere did the CEO tell me that I can use it on any other device and I'm trying to think if I could actually use it on another device, maybe a fixed picture, and a fixed picture and you press one to the other…"
It represents a rational justification for a choice or decision: "The more reasons, the more deliberation is used in the process", especially if participants "mention their decision only after their reasoning" (Witteman & van Geenen, 2010, pp. 56-57)	Simon (1987) Witteman & van Geenen (2010)	"Well em first of all as I said I'm not into retailing because retailing doesn't create anything for myself, just buying and selling, don't do that boring stuff. And especially there's nothing you can do on a product, you have to buy it as it is and sell it as it is, so few things you might eventually change. And you have no control over the product so if there's something wrong you still have to go back to the producer"
It is a conscious search for alternatives, ideas, solutions	Coget (2011)	"Ok, what can this do for me? I'm not so much interested in in this technology per se, what does it do for the end user?" "I'm just seeing what possibilities there might be"
There is a comparison of alternatives	Coget (2011) Klein (2004)	"So whereas in the first case we were looking at developing applications for special needs where the market could be slightly a little bit more restricted, now we're looking into something which is on the opposite side of the scale where the market is huge"
It represents a delay in making a commitment to exploit or reject the technology until more information is gathered (search for more information)	Dean & Sharfman (1993)	"I need to look into this further" "It's an opportunity I would explore... Because unfortunately although it's very interesting I don't have enough information here..."

Once all segments have been coded, protocols are examined in a holistic manner in order to obtain supporting evidence for the above coding. The following additional indicators suggest analytical processing:

- Slower reading of the text and careful inspection of the task scenario (Dane & Pratt, 2007)
- Other observations noted during data collection (e.g., closely examining the text / attention to detail, etc.)

4.5.5 Stage 5: Further Analysis

The fifth and final stage in this study's research framework involved carrying out further analyses which culminated in the testing of the research hypotheses presented in Chapter 3. Green (2009) notes that:

> Some studies seek to quantify the data in particular ways, perhaps looking at the frequency with which certain behaviours occur... Various statistical analyses may then be carried out, perhaps to compare the protocols of different groups of subjects, or to construct profiles of cognitive activity as different tasks are carried out by different individuals. The data that comprise the verbal protocols then may, if the study requires it, be subjected to both qualitative and quantitative analyses (p. 2).

The above passage describes most of what was done in the 'further analyses' stage of this study. The verbal protocol data was indeed subjected to both qualitative and quantitative analyses as follows: First the protocols were 'quantified' by obtaining frequency counts of the segments in the two coding categories (intuition and analysis). Next, these frequency counts were used to construct profiles of cognitive strategy for each participant. A process of (qualitative) content analysis was carried out on the transcribed protocols in order to extract the opportunities identified by each participant. These were then counted and rated for their innovativeness. It was then time to bring the survey data back into the picture as it required statistical analysis before it could be entered with the protocol data into regression and mediation models for hypotheses testing. Sections 4.5.5.1 to 4.5.5.6 explain how each of these tasks was carried out. The descriptive statistics and preliminary results that emerged from these analyses are presented in Chapter 5, while the results of the regression and mediation analyses are presented in Chapters 6, 7 and 8.

4.5.5.1 Determining the Number of Intuition and Analysis Segments

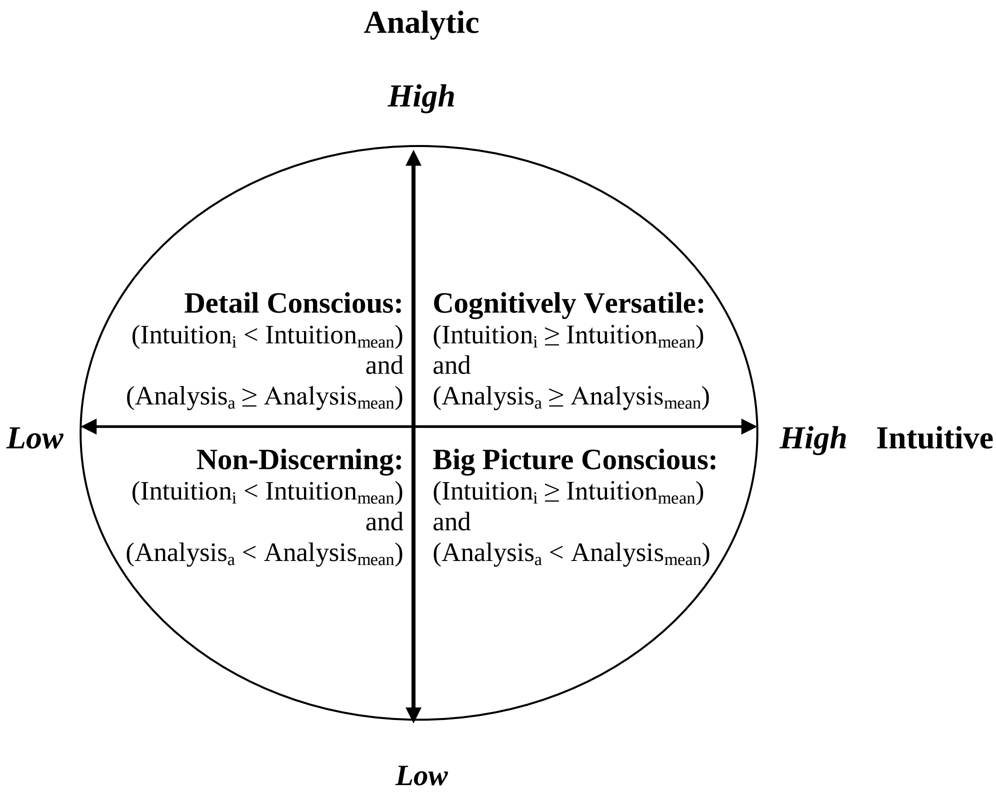
As outlined above, the intuition and analysis segments in each of the transcribed protocols were counted to create separate frequency-based intuition and analysis variables for the three technology-based opportunity identification tasks and then summed to create aggregate ‘overall’ counts for each participant. Descriptive statistics (frequencies, means, standard deviations, etc.) were then obtained using statistical analysis software.

4.5.5.2 Constructing the Cognitive Strategy Categories

The sample means and individual frequency counts for intuitive and analytical processing, as determined by the number of intuition and analysis segments, were then used to construct four categories of cognitive strategy, namely *Big Picture Conscious*, *Detail Conscious*, *Non-Discerning*, and *Cognitively Versatile*, in line with Hodgkinson and Clarke’s (2007) framework. As explained in Chapter 3, this framework is being applied in this study to map out cognitive strategy of participants on the basis of both their intuitive and analytical processing in accordance with dual-process theory.

Participants were assigned to one of the four categories on the basis of how many intuition and analysis segments they generated during their think-aloud tasks in comparison to the respective sample means. Those who were equal to or above average on intuition, but below average on analysis, were placed in the *Big Picture Conscious* category (high on intuition, low on analysis); those who were below average on intuition, but equal to or above average on analysis, were placed in the *Detail Conscious* category (low on intuition, high on analysis); those who were below average on both intuition and analysis were placed in the 'Non-Discerning' category (low on both intuition and analysis); and those who were above average on both intuition and analysis were placed in the *Cognitively Versatile* category (high on both intuition and analysis). This is illustrated in Figure 4.3 and better understood by referring to the examples from a relevant sub-sample from the data set provided in Table 4.4.

Figure 4.3 Categorisation of Participants according to Cognitive Strategy (adapted from Hodgkinson & Clarke, 2007)



Notes:
Intuition$_i$ is the number of intuition segments generated by each participant
Analysis$_a$ is the number of analysis segments generated by each participant
Intuition$_{mean}$ is the mean number of intuition segments across participants
Analysis$_{mean}$ is the mean number of analysis segments across participants

Table 4.4 Categorisation of a Relevant Sub-Sample of Participants according to Cognitive Strategy

Participant Code	Number of Intuition Segments	Is Participant's Number of Intuition Segments ≥ Sample Mean (29.16)?	Number of Analysis Segments	Is Participant's Number of Analysis Segments ≥ Sample Mean (25.00)?	Cognitive Strategy
E01	33	Yes	12	No	Big Picture Conscious
E05	33	Yes	24	No	Big Picture conscious
E06	26	No	26	Yes	Detail Conscious
E17	29	No	41	Yes	Detail Conscious
E22	49	Yes	47	Yes	Cognitively Versatile
E28	67	Yes	60	Yes	Cognitively Versatile
E30	14	No	11	No	Non-Discerning
E33	26	No	22	No	Non-Discerning

The above procedure was carried out first on the overall number of segments in each coding category for each participant (i.e., aggregated across all three tasks and then again for each of the three technologies separately). The resulting classification of participants according to their cognitive strategy, overall and per task, is presented in Chapter 5.

4.5.5.3 Determining the Number of Opportunities Identified

Once the protocol data had been segmented and coded in terms of the number of segments of intuitive and analytical processing, a separate round of analysis was required to derive the opportunity identification variables from the protocol data. The first variables required concerned the number of opportunities identified by participants in each of the tasks and overall.

This study adopted the 'simple count' approach, together with an innovativeness rating – both of which are widely used in studies of opportunity identification (e.g., DeTienne & Chandler, 2004; Shepherd & DeTienne, 2005; Ucbasaran et al., 2009) – to establish the number of opportunities identified by participants. This was not, however, a typical retrospective study where participants are asked to recall one or more opportunities that they have pursued in the past. As outlined in Section 4.5.5.1, participants in this study were asked to think aloud about "what business opportunities could be possible" for each of the three technologies presented to them in a hypothetical future-oriented scenario. In response to this, they offered various business ideas, some of which were less well-formed than others. This raised the question of whether all these ideas should be counted as entrepreneurial opportunities.

Some scholars argue that ideas are not the same as opportunities, and maintain that authors need to be clear as to what they are researching and reporting. For example Short et al. (2010) advise against use of the term "opportunity" as a "catchall phrase" as it could "lose its substance and meaning" (pp. 53-54). Scholars belonging to this school of thought might argue that the underdeveloped business ideas expressed by some of the participants in this study should not be counted as opportunities.

However it is widely recognised that opportunity identification is a process that occurs over a period of time and that it often involves various players besides the originator of an initial idea. Baron (2006) argues that entrepreneurs generally:

> did not, during early stages, have a fully-formed vision of the business they actually developed. Rather, it unfolded one step at a time as they gradually perceived more connections between the relevant factors and ways in which these could be used to develop a profitable business (p. 111).

Dimov (2007a, 2007b) shares this view and refers to the 4I Organisational Learning Framework (Crossan et al., 1999; Dutta & Crossan, 2005) to explain that "entrepreneurial opportunities do not simply 'jump out' in a final, ready-made form but emerge in an iterative process of shaping and development" (2007a, p. 561) which takes place within a "social process of discussion and interpretation" with other actors (2007b, p. 714). According to Dutta and Crossan, during the early stages of opportunity identification, "the idea is subtle or even so 'fuzzy' that the individual concerned only has a belief that it holds promise and is worth pursuing (p. 436).

As explained in Chapter 2, this initial stage in the 4I Framework, which bears the seed of every opportunity is termed *intuiting*, and it is followed by *interpreting*, which involves explaining the idea to oneself and others; *integrating*, which involves developing shared understanding, coordinated action and mutual adjustment with others; and finally *institutionalizing*, which involves the establishment of routines for collective action (Crossan et al., 1999). One should note, however, that the think-aloud scenario-based method employed in this study only provided space for participants to engage in the individual-level stages of intuiting and interpreting to oneself. They were unable to elaborate on their ideas through the social actions of interpreting with others, integrating and institutionalising. One can therefore only expect participants to have generated ideas for potential businesses based on the technology descriptions they were given and to have engaged in a process of interpretation – explaining and elaborating the idea to themselves – throughout the course of the exercise.

Furthermore, Dimov (2007b) maintains that it is impossible to judge ex ante whether or not an idea will eventually turn out to be a commercially viable opportunity. Similarly, Short et al. (2010) maintain that an opportunity is "an idea or dream that is ... revealed through analysis over time to be potentially lucrative" (p. 55). In the absence of this period of evaluation and analysis, on what grounds could the "fuzzy" ideas generated by participants at the time of data collection be eliminated from a count of potential opportunities? If, as stated by Dimov (2007b), "opportunities can be represented as a stream of continuously developed ideas, driven and shaped by one's social interaction, creative insights, and action at each stage" (p. 714), it may then be argued that each idea generated by the participants in the present study is the starting point of this opportunity identification stream.

In view of the above, it was decided that the number of opportunities identified in this study should include all the business ideas generated by participants. This approach has been adopted by entrepreneurship scholars such as DeTienne and Chandler (2004) whose study on opportunity identification tested hypotheses about "the number of potential business ideas generated" (p. 249).

The transcribed protocols were therefore content analysed and the business ideas extracted and coded as follows: All the relevant text concerning the business ideas was pasted onto one of three lists, one for each technology. Each idea was assigned a unique code comprising the participant code to identify its originator, an abbreviation of the technology it relates to – MT for the Multi-Touch Screen, 3D for the 3D Imaging software and QT for Quick-Tap Phone Payment application – and a number to indicate the order in which the ideas were generated (in the case of multiple ideas). For example, the first business idea generated by Participant E07 with respect to the Multi-Touch Screen was coded E07-MT-01, the fourth idea generated by Participant E16 for the 3D Imaging technology was coded E16-3D-4, and so on. The ideas were counted and scores were created for each of the 74 participants, per task and overall. These were then pooled together to provide a count of all the business ideas (or opportunities) identified by participants for each technology and overall. These figures, which are presented together with their associated descriptive statistics in Chapter 5, were used in the statistical tests which were performed to test the model, as will be reported in Chapters 6, 7 and 8.

4.5.5.4 Rating the Innovativeness of Opportunities Identified

Besides a general count of all the opportunities identified, this study was also concerned with the innovativeness of these opportunities. This balanced out the approach adopted in the all-inclusive opportunity-count variable, as implicit in the logic behind the innovativeness rating is the assumption that it is a way of estimating the likelihood that a particular business idea may eventually develop into a lucrative business opportunity.

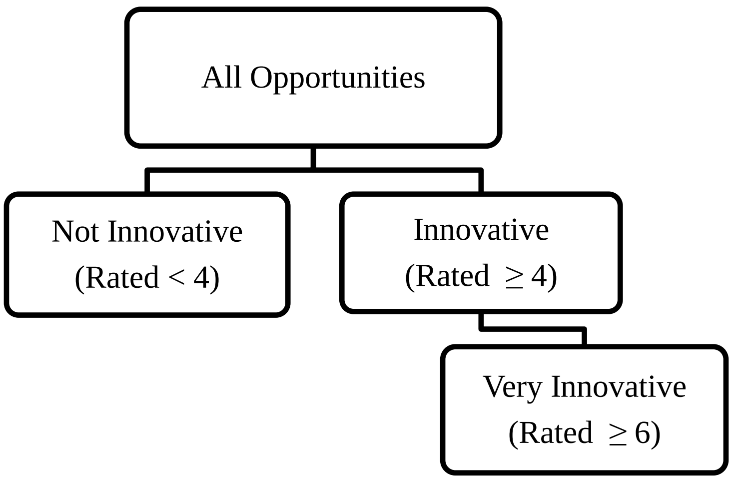
Following past research on opportunity identification, each opportunity was rated for its innovativeness on a 7-point Likert scale anchored by ‘not very innovative’ (1) and ‘very innovative’ (7) (Shepherd & DeTienne, 2005). A sample of the opportunities identified for the three technologies, together with their respective rating is available in Appendix H.

The definition of ‘innovative’ adopted in this study was based on the notion that innovation involves the “successful implementation of creative ideas” (Amabile, Conti, Coon, Lazenby & Herron, 1996, p. 1155), and that creative ideas are those which are “novel and useful” (Amabile et al., 1996, p. 1155) as well as “different and appropriate” in terms of “commercial application, … competitiveness and returns on investment” (Cook, 1998, pp. 179-180). The ‘very innovative’ opportunities (or business ideas) were therefore those which were not only high in originality, but which also held significant potential for profitable commercial application (rather than being different but pointless), while those rated as ‘not very innovative’ would be low on both originality and usefulness. Lying in the mid-range of the scale were the ‘moderately innovative’ opportunities (rated 4 or 5), which were slightly lower on one or both of the ‘novelty’ and ‘commercial potential’ criteria than those rated as ‘very innovative’.

Variations in ratings of opportunities along this Likert scale also reflected the difference between “new-to-market” or “truly innovative and radically new products” that offer “totally new perceived benefits” to customers (‘very innovative’), and “me-too products” or “trend-of-the-moment products” which would provide lower financial returns and have a shorter market life (‘not very innovative’) (Kuczmarski, 1996, p. 9). Opportunities for importing and reselling products was not considered to be innovative as there is very limited novelty value associated with such activity.

Once all the opportunities had been rated on the innovativeness scales, they were classified according to the framework illustrated in Figure 4.4 below. A distinction was first made between opportunities that were ‘not innovative’ (rated below 4 on the Likert Scale) and those that were ‘innovative’ (rated ≥ 4) in order to weed out opportunities with poor wealth-creating potential (as predicted by their level of innovativeness). Out of the ‘innovative’ category, a further subcategory was extracted comprising the ‘very innovative’ opportunties (rated ≥ 6). Testing of hypotheses concerning the identification of innovative opportunities excluded the first category (‘not innovative’) but explored the second category (‘innovative’) and its subset (‘very innovative’) by separately entering each of them as dependent variables in regression models. This would shed light on whether there is any difference in the effect of experience, intuition and cognitive versatility on opportunity identification when defined according to different degrees of innovativeness.

Figure 4.4 Classification of Opportunities According to their Innovativeness Rating



4.5.5.5 Analysis of the Survey Data

The data gathered from the online survey was entered into the statistical analysis programme SPSS. Several variables were computed from the raw data, and descriptive statistics including frequencies, means and standard deviations were obtained for each of the above variables. This data was then used in the next steps to test the research hypotheses. Further details on these variables are presented in the following sections while the relevant descriptive statistics are available in Chapter 5.

Cognitive Style

While the revised REI split the Experientiality and Rationality scales into Experiential Ability (EA: "ability with respect to one's intuitive impressions and feelings"), Experiential Engagement (EE: "reliance on and enjoyment of feelings and intuitions in making decisions"), Rational Ability (RA: "ability to think logically and analytically") and Rational Engagement (RE: "reliance on and enjoyment of thinking in an analytical, logical manner") (Pacini & Epstein, 1999, p. 974), this study heeded Hodgkinson et al.'s (2009b) advice that this tool "should be scored using the original and simpler formulation, avoiding any ability-engagement distinction" (p. 346). The scores for the 20 items on the Faith in Intuition (FI) Scale were therefore summed (after accounting for reverse-scored items) and averaged to create the 'Experientiality' variable. The process was repeated for the scores of the 20 items on the Need for Cognition (NFC) scale to create the 'Rationality' variable. Since the items were scored on a 5-point Likert scale, the Experientiality and Rationality composite scores range in value from 1 (low) to 5 (high).

Risk Perception and Risk Propensity

Risk perception was measured by summing and averaging the scores (after accounting for reverse-scored items) on all the three-item, seven-point Likert scales which followed each of the four new venture choices in the online survey. The resulting 'Risk Perception' composite scores could range in value from 1 (low) to 7 (high).

With regards to the risk propensity measure, each of the five pairs of statements was scored zero (if the participant selected the 'sure but lesser financial gain' option) or one (if the participant chose the 'probabilistic but greater financial gain' option). These scores were then summed to create the 'Risk Propensity' variable with values ranging from 0 (low) to 5 (high).

Deliberate Practice

Following Unger et al. (2009), the 'Deliberate Practice' variable was created by counting the number of activities that met both the frequency criterion of being performed at least once a week, and the competence improvement criterion of being carried out to enhance one's entrepreneurship-related knowledge and expertise. Since there were ten deliberate practice activities on the scale, the values on this variable could range from 0 (low) to 10 (high).

Educational Background, Employment History and Entrepreneurial Experience

The data collected from the survey concerning participants' educational background, employment history and entrepreneurial experience was formed into several variables which were used to test different variations of the conceptual model.

Educational background was measured in terms of general level of education as well as subject-specific level of education (as recorded by participants in the survey). This data was also converted into number of years of formal education in order to create a covariate variable for inclusion in regression analyses. Employment history was measured in various ways. Variables were created to represent the number of years of general work experience, industry-specific work experience, and work experience in a managerial role. Entrepreneurial experience was measured both in terms of the number of years of business ownership experience and in terms of the number of businesses owned in total. Furthermore, a distinction was made between business ownership in the ICT industry and that in other industries.

Preliminary analyses indicated that the most significant of the control variables were the number of years of general education, and number of years general work experience, so these were retained for the final model testing. With regards to entrepreneurial experience, a series of inferential tests which were carried out to obtain initial indications concerning its role in shaping cognitive strategy and opportunity identification suggested that an industry-based distinction should be made (See Section 4.5.5.6 for details and Chapter 5 for results). It was therefore decided to divide the number of years of business ownership experience and the number of businesses owned into ICT and non-ICT related variables.

4.5.5.6 Inferential Tests and Correlation Analyses

Once all the necessary variables had been constructed from the raw data, the ones derived from the online survey were integrated with those from the verbal protocols and used to run a series of preliminary analyses.

As a first step, inferential tests were carried out to explore various trends in the data, including whether there was a preference for an experiential or rational cognitive style, or for intuitive or analytical processing among this study's participants; whether cognitive strategy and opportunity identification varied across the three think-aloud tasks; and whether there were any differences between novices and experienced entrepreneurs on cognitive style, risk perception, risk propensity, deliberate practice, cognitive strategy and opportunity identification. The latter were carried out in view of ambiguities that exist in the literature concerning which are the most salient aspects of entrepreneurial experience, and served to help shape the regression and mediation models which were then carried out for full hypothesis testing.

Following Robson et al. (2012), entrepreneurial experience was operationalised in two ways for the purpose of these inferential tests. The first was based on the number of businesses owned by participants, where a distinction was made between novice or first-time entrepreneurs (those who only ever owned one business, i.e., the one they owned at the time of the study) and habitual or repeat entrepreneurs (those who had owned two or more businesses prior to or at the time of the study). The second operationalisation was based on the number of years participants had owned their business/es where, in line with the ‘Ten-Year Rule’ which, as explained in Chapter 2, is argued to be associated with the acquisition of expertise in a given domain (Weisberg, 1999), a distinction was made between early-stage entrepreneurs (those who had less than 10 years of business ownership experience) and later-stage entrepreneurs (those who had owned their business/es for 10 years or longer).

In order to determine whether parametric or non-parametric tests should be used, the normality of each of the test variables was assessed by means of Kolmogorov-Smirnov Tests, where significance values greater than .05 are indicative of a normal distribution (Pallant, 2005). Tables 4.5, 4.6 and 4.7 summarise the selection of the appropriate tests to address the questions of interest. In addition to the tests listed in these three tables, further analyses were carried out to obtain preliminary indications as to whether a significant relationship exists between entrepreneurial experience, operationalised as explained in the previous paragraph, and cognitive versatility. Since the variables involved were all categorical (dichotomous) variables, the appropriate inferential test was the non-parametric 2 X 2 Chi-Square (χ^2) Test for Independence which is designed to explore the relationship between two categorical variables (Pallant, 2005).

Table 4.5 Selection of Inferential Tests to Explore Differences in Cognitive Style, Risk Perception, Risk Propensity and Deliberate Practice

Test question: Is there a significant difference between:	Is the assumption of normality met in all subgroups / conditions?	Method
• Rationality and Experientiality among the entrepreneurs in this study?	Yes	Paired-Samples *t*-test
• Novices and habitual entrepreneurs in:		
○ Experientiality?	Yes	Independent-Samples *t*-test
○ Rationality?	No	Mann-Whitney
○ Risk Perception?	No	Mann-Whitney
○ Risk Propensity?	No	Mann-Whitney
○ Deliberate Practice?	No	Mann-Whitney
• Early-stage and later-stage entrepreneurs:		
○ Experientiality?	Yes	Independent-Samples *t*-test
○ Rationality?	Yes	Independent-Samples *t*-test
○ Risk Perception?	Yes	Independent-Samples *t*-test
○ Risk Propensity?	No	Mann-Whitney
○ Deliberate Practice?	No	Mann-Whitney

Table 4.6 Selection of Inferential Tests to Explore Differences in Intuitive and Analytical Processing

Test question: Is there a significant difference between:	**Is the assumption of normality met in all subgroups / conditions?**	**Method**
• Intuitive and analytical processing:		
○ Overall?	No	Wilcoxon
○ in the Multi-Touch Screen task?	No	Wilcoxon
○ in the 3D Imaging task?	No	Wilcoxon
○ in the Quick-Tap task?	No	Wilcoxon
• Novices and habitual entrepreneurs in intuitive processing:		
○ Overall?	Yes	Independent-Samples *t*-test
○ in the Multi-Touch Screen task?	No	Mann-Whitney
○ in the 3D Imaging task?	No	Mann-Whitney
○ in the Quick-Tap task?	No	Mann-Whitney
• Novices and habitual entrepreneurs in analytical processing:		
○ Overall?	No	Mann-Whitney
○ in the Multi-Touch Screen task?	No	Mann-Whitney
○ in the 3D Imaging task?	No	Mann-Whitney
○ in the Quick-Tap task?	No	Mann-Whitney
• Early-stage and later-stage entrepreneurs in intuitive processing:		
○ Overall?	Yes	Independent-Samples *t*-test
○ in the Multi-Touch Screen task?	No	Mann-Whitney
○ in the 3D Imaging task?	No	Mann-Whitney
○ in the Quick-Tap task?	No	Mann-Whitney
• Early-stage and later-stage entrepreneurs in intuitive processing:		
○ Overall?	No	Mann-Whitney
○ in the Multi-Touch Screen task?	No	Mann-Whitney
○ in the 3D Imaging task?	No	Mann-Whitney
○ in the Quick-Tap task?	No	Mann-Whitney
• Intuitive processing across the three tasks?	No	Friedman’s Test
• Analytical processing across the three tasks?	No	Friedman’s Test

Table 4.7 Selection of Inferential Tests to Explore Differences in the Number and Innovativeness of Opportunities Identified

Test question: Is there a significant difference between:	**Is the assumption of normality met in all subgroups / conditions?**	**Method**
• Novices and habitual entrepreneurs on the number of opportunities identified:		
○ Overall?	No	Mann-Whitney
○ in the Multi-Touch Screen task?	No	Mann-Whitney
○ in the 3D Imaging task?	No	Mann-Whitney
○ in the Quick-Tap task?	No	Mann-Whitney
• Early-stage and later-stage entrepreneurs on the number of opportunities identified:		
○ Overall?	No	Mann-Whitney
○ in the Multi-Touch Screen task?	No	Mann-Whitney
○ in the 3D Imaging task?	No	Mann-Whitney
○ in the Quick-Tap task?	No	Mann-Whitney
• The innovativeness of opportunities identified in the three tasks?	No	Friedman's Test
• Novices and habitual entrepreneurs on the number of innovative opportunities identified (rated ≥4 and ≥6):		
○ Overall?	No	Mann-Whitney
○ in the Multi-Touch Screen task?	No	Mann-Whitney
○ in the 3D Imaging task?	No	Mann-Whitney
○ in the Quick-Tap task?	No	Mann-Whitney
• Early-stage and later-stage entrepreneurs on the number of innovative opportunities identified (rated ≥4 and ≥6):		
○ Overall?	No	Mann-Whitney
○ in the Multi-Touch Screen task?	No	Mann-Whitney
○ in the 3D Imaging task?	No	Mann-Whitney
○ in the Quick-Tap task?	No	Mann-Whitney

Besides the above tests, four sets of correlation analyses were carried out to explore bivariate associations between this study's key variables. Specifically, the survey data was correlated first with the number of intuitive segments, analytical segments, total opportunities identified, and subsets of innovative opportunities identified (those rated ≥ 4, and those rated ≥ 6) overall, and then with these data from each of the three individual tasks. Due to the non-normal distribution of most of the data, the non-parametric Spearman's rho was used for this purpose (Dancey & Reidy, 2002).

The results of these preliminary analyses are presented in Chapter 5.

4.5.5.7 Regression and Mediation Analysis

The final phase of data analysis involved a series of regression and mediation analyses to test the research hypotheses proposed in this study. In brief, regression is a method that assesses the effect of one or more independent (or predictor) variables on a dependent (or outcome) variable (Dancey & Reidy, 2002), while mediation analysis is a technique that estimates the indirect effect of an independent variable on a dependent variable through an intervening (mediator) variable (Hayes, 2009).

The data analysis and statistical software package STATA was used to carry out three kinds of regression analyses, namely Robust Negative Binomial Regression, Poisson Regression, and Binary Logistic Regression. Negative Binomial Regression and Poisson Regression are used when the dependent variable is made up of count data, as is the case in most of the models tested in this study (e.g., number of intuition segments, number of opportunities identified, etc.). The former technique is appropriate for overdispersed data and the latter is appropriate for equidispersed data (Cameron & Trivedi, 1998; Gruber et al., 2008, 2012a, 2012b). Binary Logistic Regression is used when the dependent variable is dichotomous (Pallant, 2005).

Mediation analysis was carried out using the bootstrapping technique suggested by Preacher and Hayes (2004) as it is recommended as the "method of choice" (Hayes, 2009, p. 412), especially where small samples (such as the one used in this study) are involved. Other widely used mediation techniques include the now outdated and heavily criticised *causal steps approach* (Baron & Kenny, 1986) and the *product of coefficients* approach (known as the Sobel test: Sobel, 1982, 1986, cited in Hayes, 2009). The Sobel test overcomes some of the problems associated with the causal steps approach but is based on the assumption of a normal sampling distribution of the indirect effect and is therefore only suitable for large samples (see Hayes, 2009, for details). The bootstrapping method, which is best explained in Hayes' own words, makes no such assumptions:

> Bootstrapping generates an empirical representation of the sampling distribution of the indirect effect by treating the obtained sample of size *n* as a representation of the population in miniature, one that is repeatedly *resampled* during analysis as a means of mimicking the original sampling process. The resampling of the sample is conducted *with replacement*, so that a new sample of size *n* is built by sampling cases from the original sample but allowing any case once drawn to be thrown back to be redrawn as the resample of size *n* is constructed. Once a resample is constructed, *a* and *b* are estimated (from) this resampled data set and the product of the path coefficients recorded. This process is repeated for a total of *k* times, where *k* is some large number (typically at least 1000, although I recommend at least 5000). Upon completion, the analyst will have *k* estimates of the indirect effect, the distribution of which functions as an empirical approximation of the sampling distribution of the indirect effect when taking a sample of size *n* from the original population. An inference is made about the size of the indirect effect in the population sampled by using the k estimates to generate a *ci*% confidence interval ... if zero is not between the lower and upper bound, then the analyst can claim that the indirect effect is not zero with *ci*% confidence (Hayes, 2009, p. 412, italics in original).

A bootstrapping mediation analysis macro named 'PROCESS' which was developed by Hayes (2012) for use with the SPSS software analysis package was used to test the mediation effects of intuition (operationalised as the number of segments of intuitive processing) in the relationship between entrepreneurial experience and opportunity identification. However this Macro does not accommodate categorical mediators so it could not be used where cognitive versatility (operationalised as a dichotomous Yes/No-type dummy variable) was the hypothesised mediator. For this purpose, a code command provided by Hayes to test for bootstrapped mediation in the path analysis software M-Plus was used (see http://www.afhayes.com/macrofaq.html).

Each of the hypotheses was first tested with the overall data (aggregated from all three technology-based think-aloud opportunity identification tasks) and then repeated on each of the tasks separately to explore potential differences associated with task characteristics (innovativeness / uncertainty of technology). A summary of the analysis techniques used to test the hypotheses is presented in Table 4.8.

Table 4.8 Hypotheses Testing: Summary of Analysis Techniques Used

		Overall		Multi-Touch		3D Imaging		Quick-Tap	
		Type of DV/Mediator	**Method Used**	**Type of DV/Mediator**	**Method Used**	**Type of DV/Mediator**	**Method Used**	**Type of DV/Mediator**	**Method Used**
H1: Experience and Opportunity Identification									
H_{1a}:	Higher levels of experience are associated with the identification of a larger number of opportunities	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial	Count Data, Equidispersed	Poisson	Count Data, Overdispersed	Negative Binomial
H_{1b}:	Higher levels of experience are associated with the identification of opportunities that are more innovative (rated ≥ 4; rated ≥ 6)	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial
H2: Intuition, Experience and Opportunity Identification									
H_{2a}:	Greater use of intuition is associated with the identification of a larger number of opportunities	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial	Count Data, Equidispersed	Poisson	Count Data, Overdispersed	Negative Binomial
H_{2b}:	Greater use of intuition is associated with the identification of opportunities that are more innovative (rated ≥ 4; rated ≥ 6)	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial
H_{2c}:	Higher levels of experience are associated with greater use of intuition	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial
H_{2d}:	Intuition mediates the relationship between experience and the number of opportunities identified	Covariate	Hayes PROCESS	Covariate	Hayes PROCESS	Covariate	Hayes PROCESS	Covariate	Hayes PROCESS
H_{2e}:	Intuition mediates the relationship between experience and the innovativeness of opportunities identified (rated ≥ 4; rated ≥ 6)	Covariate	Hayes PROCESS	Covariate	Hayes PROCESS	Covariate	Hayes PROCESS	Covariate	Hayes PROCESS

Table 4.8 (Cont.) Hypotheses Testing: Summary of Analysis Techniques Used

		Overall		Multi-Touch		3D Imaging		Quick-Tap	
		Type of DV/Mediator	**Method Used**	**Type of DV/Mediator**	**Method Used**	**Type of DV/Mediator**	**Method Used**	**Type of DV/Mediator**	**Method Used**
H3: Cognitive Versatility, Experience and Opportunity Identification									
H_{3a}:	Cognitive versatility is associated with the identification of a larger number of opportunities	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial	Count Data, Equidispersed	Poisson	Count Data, Overdispersed	Negative Binomial
H_{3b}:	Cognitive versatility is associated with the identification of opportunities that are more innovative (rated $\geq$4; rated $\geq$6)	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial	Count Data, Overdispersed	Negative Binomial
H_{3c}:	Higher levels of experience are associated with cognitive versatility	Categorical (Dichotomous)	Logistic Regression	Categorical (Dichotomous)	Logistic Regression	Categorical (Dichotomous)	Logistic Regression	Categorical (Dichotomous)	Logistic Regression
H_{3d}:	Cognitive versatility mediates the relationship between experience and the number of opportunities identified	Categorical (Dichotomous)	Mplus Path Analysis	Categorical (Dichotomous)	Mplus Path Analysis	Categorical (Dichotomous)	Mplus Path Analysis	Categorical (Dichotomous)	Mplus Path Analysis
H_{3e}:	Cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified (rated $\geq$4; rated $\geq$6)	Categorical (Dichotomous)	Mplus Path Analysis	Categorical (Dichotomous)	Mplus Path Analysis	Categorical (Dichotomous)	Mplus Path Analysis	Categorical (Dichotomous)	Mplus Path Analysis

4.6 Validity, Reliability and Reduction of Bias

Several measures were taken throughout this study to maximise and test for validity and reliability. As a general precaution, bias due to demand characteristics, whereby participants may tend to provide responses that they believe are expected of them, was minimised by informing participants only of the general aims of the study (Frankfort-Nachmias & Nachmias, 1996). They were simply told that the study was concerned with exploring "the thinking processes involved in the identification of entrepreneurial opportunities" without specifying that the focus was on intuition and cognitive versatility. This ensured that participants were not primed (i.e., did not make an effort) to engage in intuitive or versatile processing simply to meet the expectations of the researcher.

Other validity and reliability measures that relate to particular aspects of data collection and analysis are presented in Sections 4.6.1 to 4.6.5.

4.6.1 Validity of Verbal Protocols

According to Green (2009), validity within the context of protocol analysis:

> centres on whether information that is captured within verbal reports corresponds with information that is usually heeded as a task is carried out. If verbal reports were shown to be incomplete, or if information within them were susceptible to distortion, or if verbal reports included additional information that may not have been heeded as the task was carried out, then the validity of the technique might be questioned (p. 10).

One of the key concerns raised by critics of the protocol analysis method is that thinking aloud may disrupt underlying cognitive processing and that consequently, verbal protocols are not a true or valid representation of the cognitive processing that occurs under silent conditions. In response to this, Ericsson and Simon (1993) reviewed numerous studies that compared the performance of participants on a think-aloud task with that of a silent control group in order to explore the effect of verbalisation. These studies were conducted in a wide range of domains including judgment and decision making, problem solving, learning and recall. Ericsson and Simon's findings indicate that although task performance under think-aloud conditions takes a little while longer than in silent conditions, verbalisation has no effect on information heeded or on thought sequences (i.e., does not affect the validity of the protocol) as long as researchers adhere closely to the recommended procedural guidelines for protocol analysis. These guidelines include the use of appropriate standardised instructions, avoidance of social interaction between the participant and the researcher, and of intrusive prompts (such as requests for explanation or clarification) during task performance, and minimisation of delay between task performance and production of the verbal reports. In other words, validity of verbal protocols is maximised by adopting the non-mediated, concurrent form of protocol analysis as described in Section 4.2 above (see Ericsson & Simon, 1993, for details).

All of the above guidelines were closely adhered to in this (concurrent, non-mediated) study. As explained in Section 4.5.2.2, a written set of instructions (adapted from Ericsson and Simon, 1993) was read out to participants at the beginning of each session. These instructions contained the information required to ensure that the verbal protocols yielded data that was complete and valid. Specifically, participants were told: that they should "think aloud constantly" throughout the task; that thinking aloud meant verbalising their thoughts as they occurred without planning out what to say; that they should refrain from explaining their thoughts to (or engage in any social interaction with) the researcher; and that they should imagine they were "alone in the room", speaking to themselves. Prompts were used only when necessary (in periods of silence exceeding 10 seconds) and were direct and unintrusive (“please think aloud”).

Besides providing clear instructions, many authors maintain that participants require some practice before they begin the actual tasks so that they can familiarise themselves with the think-aloud technique. This is said to add to the validity of the verbal protocol data. Although Ericsson and Simon (1993) advocate the use of practice items provided in their book, they admit that “subjects do not need to practice before being able to ‘think aloud’” (p. xiii) and that “thinking aloud ... can be elicited almost instantaneously by the appropriate instruction from virtually all human adults” (p. 224). It was discovered during the course of the pilot study that Ericsson and Simon’s practice items (what is the result of multiplying 24 x 36, how many windows are there in your parents’ house, name 20 animals) were so simplistic and far-removed from the actual research tasks that they caused more confusion than comprehension, that they were better replaced by practice items which resembled the actual tasks, and most importantly, that participants did not require any prior practice at all as they had no trouble thinking aloud right from the start of the first task assigned.

This could be explained by the high ecological validity of the tasks presented – which was ensured by consulting with experts to carefully match the tasks with the research participants’ ability and domain-specific knowledge and experience – coupled with the fact that thinking aloud is “not entirely alien to everyday life” (Ericsson & Simon, 1993, p. 78). If, as documented in the literature, entrepreneurs are constantly on the lookout for new opportunities (Ucbasaran et al., 2009), and if thinking aloud is a relatively ordinary activity for individuals, it may be inferred that combining the two added little or no additional challenge for participants over doing them separately, and therefore did not require any practice. This has important implications for future research using protocol analysis. While practice items may be necessary for unfamiliar tasks, they may not be needed for tasks that are undertaken by participants on a regular basis. Furthermore, if the study includes unfamiliar tasks and therefore requires training, the practice items should bear as much similarity to the actual tasks as possible. Researchers should therefore use their judgment based on extensive piloting.

In addition to the above, other measures were taken to maximise the validity of the verbal protocols gathered in this study. All participants were assigned the same set of tasks which were administered by the author after becoming well-acquainted with the protocol analysis method through an extensive review of the relevant literature and through insights gained in the (‘practice’) pilot study. This ensured that the correct technique was consistently applied with all participants. Furthermore, because it is “essential that the subject remains *focussed on the task*” (Ericsson & Simon, 1993, pp. xxxi-xxxii, italics in original), the technology descriptions that formed the basis of the think-aloud opportunity identification tasks were framed in such a way as to mimic the technology fair that participants were asked to imagine they were attending. The descriptions started with “The first stall to catch your eye” or “The next stall you see”, and were reported in the voice of key informants who might engage with participants at a fair, for example: “The representative manning the stall approaches you: ‘This is the first time that customers can use their mobile to pay for goods and services in shops across the UK...’, she says”, and “‘We can automatically generate a 3-D mesh at extreme detail from a set of photos...’ says the Vice President of the company as you stop to take a closer look” (See Appendix E for details). The order in which the technologies were presented to the participants was rotated to minimise order effects. Finally, the protocols were audio-recorded, transcribed by a well-trained team of research assistants, and checked by the author prior to analysis to ensure their accuracy and completeness, as explained in Chapter 4.

4.6.2 Reliability of Verbal Protocols

Besides the above issues related to the validity of the verbal protocols in terms of the way the study is conducted and data is collected, there are a number of concerns regarding reliability in analysing the data. These are explained in the sections that follow.

4.6.2.1 Inter-Coder Reliability: Segmenting and Coding of Intuition and Analysis

The first concern regarding reliability in analysing verbal protocols relates to the accurate and consistent segmentation and coding of data. Ericsson and Simon argue that:

> We must examine how the encoding of behavior into data can be made objective and unequivocal, so that the resulting data will be "hard" not "soft" … Data are "hard" when there is intersubjective agreement that they correspond to the facts of the observed behavior (Ericsson & Simon, 1993, p. 3).

The intersubjective agreement mentioned by Ericsson and Simon refers to the agreement between two individuals who encode the data independently of one another, or to what is known as inter-coder reliability. Establishing inter-coder reliability involves demonstrating that "inter-coder agreement is better than chance, and also that the differences between encoders are not systematic" (Ericsson & Simon, 1993 p. 293) to ensure that "coding does not reflect the biases or idiosyncrasies of one individual" (Green, 2009, p. 93). In this study, inter-coder reliability for the segmentation of protocols and coding of segments as intuition or analysis was established as follows:

After the author had coded the entire set of protocols (on the basis of the pre-specified literature-derived coding scheme to increase reliability of coding), a second coder (who was not previously involved in this study) was engaged to independently code a sample equivalent to approximately 20% of the data (15 protocols). This is in line with recommendations concerning the amount of double coding required for studies that generate large volumes of data and frequently occurring coding categories (as was the case in this study: see Austin & Delaney, 1998 and Trickett & Trafton, 2009). This second coder was selected for her ability to understand the nature of the phenomenon of interest (cognitive processing in general and entrepreneurial intuition in particular) and thus for her competence to effectively carry out this coding exercise. Specifically, this coder was a qualified psychologist (PhD) as well as an experienced entrepreneur, business consultant and entrepreneurship mentor. She was identified at a conference where she delivered a presentation on entrepreneurial intuition.

Following the procedure adopted by Grégoire et al. (2010), a preliminary 'training' meeting (Trickett & Trafton, 2009) was held where the author demonstrated the segmentation technique and the application of the coding scheme to the second coder. The second coder then segmented and coded one of the protocols with the guidance of the author in order to familiarise herself with the procedure. After discussing points of disagreement (which were negligible), the second coder was left to independently segment and code two more transcripts. Further discussion at that stage offered the possibility of adjusting the segmenting and coding technique being applied and/or refining the coding scheme, but neither was necessary as no major problems had emerged. The second coder therefore proceeded to independently segment and code the subset of protocols assigned to her before submitting them for comparative analysis with those encoded by the author.

According to Trickett and Trafton (2009):

> There are two approaches to establishing agreement. The first is simply to count the number of instances in which coders agreed on a given code and calculate the percent agreement. This approach, however, generally results in an inflated measure of agreement, because it does not take into account the likelihood of agreement by chance. A better measure of agreement is Cohen's kappa (p. 343).

In view of the above, both the simple percentage agreement and Cohen's *k* were calculated (by means of the statistical analysis software SPSS) to establish inter-coder reliability. Since model testing would later separately explore each of the three technology-based tasks as well as aggregated performance, Table 4.9 presents the inter-coder reliability figures per task and overall (based on an agreed total of 890 segments).

Table 4.9 Inter-Coder Reliability for Segmenting and Coding Protocols into Intuitive and Analytical Processing

	Multi-Touch	**3D Imaging**	**Quick-Tap**	**Overall**
Simple Percentage Agreement	91.88%	93.64%	88.37%	90.00%
Cohen's *k*	0.835***	0.855***	0.745***	0.802***

*** $p < 0.001$

All the above statistics are well within the acceptable range of inter-coder reliability as stipulated in the literature. For example Trickett and Trafton (2009) cite kappa figures between 0.6 and 0.8 as representing "good reliability" and those above 0.8 as "excellent" (p. 343), while Hensman and Sadler-Smith (2011) cite Landis and Koch who view kappa values between 0.61 and 0.80 as "substantial" and those between 0.81 and 1.00 as "almost perfect" (p. 55). According to these standards, this study's inter-coder reliability concerning the segmenting and coding of protocols may be considered to be "good" or "substantial" for the Quick-Tap Phone Payment task and "excellent" or "near perfect" for the Multi-Touch Screen task, the 3D Imaging task, and overall.

In line with past research (e.g., Grégoire et al., 2010), a final step in this process involved discussions between the author and second coder on the points of divergence in their respective encoding, upon which full agreement was reached.

4.6.2.2 Inter-Coder Reliability: Coding the Number of Opportunities Identified

The second concern regarding reliability in analysing the verbal protocols relates to the content analysis which was carried out to establish the opportunity count measures. After the full set of protocols had been content analysed by the author and the lists of opportunities identified by participants extracted (as described in Section 4.5.5.3 above), two additional coders were engaged to independently analyse a (combined) subset of 15 protocols (equivalent to approximately 20% of the data, in line with the principles discussed above concerning inter-coder reliability in studies with voluminous data: Trickett & Trafton, 2009; Austin & Delaney, 1998). These coders were selected for their ability to understand the phenomenon of interest (opportunity identification) and thus for their competence to effectively carry out this coding exercise. Specifically, one coder was qualified (Masters level) in the study of entrepreneurship, creativity and innovation and was employed at managerial level in a multinational organisation. The other coder was qualified (Masters level) in business administration (MBA), offered freelance business consultancy services, and was conducting postgraduate (Masters level) studies in entrepreneurship, creativity and innovation.

These coders met with the author for a preliminary ‘training’ meeting in which they were informed about the decision to operationalise opportunities in this study as business ideas (as justified in Section 4.5.5.3). As this process was more straightforward than segmenting the protocols and coding them as intuition or analysis, it was not necessary to hold an interim meeting after the coders had analysed their first two protocols. Instead, they submitted their extracted lists of opportunities for comparative analysis with those extracted by the author upon completion of the task.

In line with past research that employed multiple coders to establish the number of opportunities identified by entrepreneurs, inter-coder reliability in this study was first calculated by carrying out a Pearson Bivariate Correlation. However since the more conservative Cohen’s kappa has been recommended as being “a better measure of agreement” for taking into account agreement that occurs by chance (Trickett & Trafton, 2009, p. 343), this too was estimated. Table 4.10 presents these inter-coder reliability figures, per task and overall.

Table 4.10 Inter-Coder Reliability for the Number of Opportunities Identified

	Multi-Touch	**3D Imaging**	**Quick-Tap**	**Overall**
Pearson’s *r*	0.956***	0.960***	0.702**	0.942***
Cohen’s *k*	0.894***	0.896***	0.752***	0.831***

*** $p < 0.001$, ** $p < 0.01$

All these values are within the accepted range of inter-coder reliability (as explained in Section 4.6.2.1). The correlation coefficients for the opportunity count in the Multi-Touch Screen task, in the 3D Imaging task and over all the three tasks are close to those obtained in similar studies (e.g., Shepherd & DeTienne, 2005, who report a Pearson's r of 0.94 at the 0.001 level of significance), while their kappa values are in the "excellent" or "almost perfect range". The lowest kappa of all (0.752, $p < .001$) reported for the Quick-Tap Phone Payment task is still considered to be "good" or "substantial". All together, these figures indicate that a very high level of inter-coder reliability was obtained in this round of analysis.

In line with past research (e.g., Shepherd & DeTienne, 2005), the last step in this process was for the coders to discuss their points of disagreement, all of which were successfully resolved.

4.6.2.3 Inter-Rater Reliability: Rating the Innovativeness of Opportunities Identified

The third and final concern regarding reliability in analysing verbal protocols relates to the rating of opportunities on the 7-point Likert scale to determine the innovativeness of opportunities identified (as described in Section 4.5.5.4). As this task was less time consuming than segmenting, coding and content analysing the protocols, it was possible to engage an independent rater to rate all of the opportunities (rather than just a subset). As was the case in the two inter-coder reliability exercises outlined above, this independent rater was selected for her ability to understand the phenomenon of interest and thus for her competence to effectively carry out this rating task. Here, knowledge of innovation and familiarity with technology and the ICT industry were required, together with a good grasp of entrepreneurship and opportunity identification. Specifically, the rater engaged for this task had a Degree in Computer Science and Artificial Intelligence which included training in entrepreneurship, creativity and innovation, and held a lecturing post in IT and creative thinking.

After the full list of opportunities had been rated by the author, the independent judge was provided with full details about how to conduct the task assigned to her. She was instructed to adhere to the definition of innovation adopted for this study (as explained in Section 4.5.5.4) in order to maximise consistency of rating. The opportunity ratings produced by the independent judge were subjected to a comparative analysis to establish their level of agreement with those produced by the author. This involved the following three steps.

In line with past research that employed multiple judges to rate the innovativeness of opportunities identified by entrepreneurs (e.g., DeTienne & Chandler, 2004; Shepherd & DeTienne, 2005), a Pearson Bivariate Correlation was first carried out to assess the extent to which the two raters agreed regarding the innovativeness of each opportunity. Since the regression analyses which were later performed were based on the categorisation of opportunities into three 'levels' of innovativeness ('not innovative': rated < 4; 'innovative': rated ≥ 4; and 'very innovative': rated ≥ 6), the Pearson Bivariate Correlation was repeated to assess the reliability of this grouping based on the independent rating of the individual opportunities. In order to account for agreement occurring by chance (as explained above), the reliability of this grouping was again assessed by estimating Cohen's kappa. The full results, per task and overall, are presented in Table 4.11.

Table 4.11 Inter-Rater Reliability for the Innovativeness Rating and Grouping of Opportunities Identified

	Multi-Touch	**3D Imaging**	**Quick-Tap**	**Overall**
Pearson's *r* on the rating of each opportunity	0.789***	0.855***	0.842***	0.834***
Pearson's *r* on the grouping of opportunities into the specified innovativeness categories	0.844***	0.916***	0.898***	0.895***
Cohen's *k* on the grouping of opportunities into the specified innovativeness	0.745***	0.820***	0.810***	0.803***

*** $p < 0.001$

All the above statistics are well within the acceptable ranges of inter-rater reliability as stipulated in the literature. Notably, Pearson's *r* for the rating of individual opportunities and for the grouping of opportunities into the three specified innovativeness categories are close to those obtained in similar studies (e.g., DeTienne & Chandler, 2004: $r = 0.85$; Shepherd & DeTienne, 2005: $r = 0.82$). Furthermore, Cohen's *k* for the opportunity innovativeness categorisation is "good" or "substantial" for the Multi-Touch Screen task, and "excellent" or "almost perfect" for the 3D Imaging task, the Quick-Tap Phone Payment task, and overall. These figures are indicative of very high consistency between the coders.

Following past research, (e.g., DeTienne & Chandler, 2004; Shepherd & DeTienne, 2005), the final step in this process was for the author and the independent rater to discuss discrepancies in their rating, after which full agreement was reached.

4.6.3 Validity and Reliability of the Online Survey

In addition to the steps described above concerning the protocol analysis part of the study, several issues were considered with regards to the validity and reliability of the online survey. Standardised measures were used where possible, i.e., to measure cognitive style, risk perception and risk propensity. This was expected to add a degree of validity and reliability to the study due to the extensive prior testing and tweaking that would have been performed on these measures by past researchers. Where no established scales were available, i.e., for deliberate practice, a new scale was developed on the basis of previous research, and validated through a series of pilot interviews. Furthermore, the items on each of these scales were randomly rotated in order to minimise order effects. Finally, the full survey was pilot tested with 15 individuals including entrepreneurs and industry experts, and modified slightly in response to the feedback received.

The reliability of the Experientiality and Rationality subscales of the REI (used to measure cognitive style), of the Risk Perception scale and of the Deliberate Practice scale was confirmed with Cronbach's alpha values that are well above the recommended level of 0.7 (Pallant, 2005) (see Table 4.12 below). The Risk Propensity scale, however, failed to make the standard. Pallant (2005) notes that "with short scales (e.g., scales with fewer than ten items) it is quite common to find quite low Cronbach values" (p. 90). The low Cronbach's coefficient associated with the Risk Propensity scale may therefore be due to the fact that it was composed of only five (dichotomous) items. Ucbasaran (2004) argues that "scales with lower values can be retained" and "insightful conclusions may still be drawn" if they are "of primary conceptual importance", as long as the researcher duly acknowledges their weakness (p. 136). In view of the above, it was decided to retain the Risk Propensity scale for hypotheses testing, but conclusions based on its effects are made with caution.

Table 4.12 Cronbach's Alpha Values for Survey Composite Scales

	Experientiality	Rationality	Risk Perception	Risk Propensity	Deliberate Practice
Cronbach's alpha	0.875	0.868	0.937	0.388	0.804

4.7 Ethical Considerations

This study was conducted in accordance with the ethical standards stipulated by the American Psychological Association concerning the reporting and publishing of scientific information. These standards demand respect of research participants' rights, which include the right to non-participation, privacy, confidentiality and anonymity.

The e-mail invitation which was sent to all participants at the beginning of the study informed them about the general aims of the research, provided full details of what participation would entail, and assured them that their rights to anonymity, confidentiality and non-participation would be respected (See Appendix B). Informed consent was obtained from all participants prior to commencement of both parts of the study (electronically for the online survey and in hard copy for the protocol analysis tasks – see Appendices C and D). They were asked for permission to audio-record the verbal protocol tasks, and they were free to decline participation at any stage during the research process.

In order to minimise unnecessary intrusion of privacy, only information which was strictly relevant to the research hypotheses was collected, and participants were assured that their data would only be used for the purpose of this study. It is therefore assumed that all participants participated in the study voluntarily and with full informed consent.

Furthermore, all personal information that could reveal the participants' identity or that of their companies was masked before their data were made available to the research assistants and independent coders/rater involved in the transcription and inter-coder/inter-rater reliability analysis tasks. Nevertheless, confidentiality and non-disclosure agreements were signed by each of these individuals to further ensure that participants' rights were respected at all times.

4.8 Conclusion

This chapter provided full details about the methods employed in this study. It began by highlighting the shortcomings of past research on intuition which led to calls for use of robust methods such as protocol analysis to complement traditional self-report measures of cognitive style. This served as a justification for this study's mixed methods research design consisting of a think-aloud protocol analysis exercise and an online survey. The protocol analysis method was then briefly reviewed to familiarise readers with its general principles, and its suitability for the study on intuition was explained. Next, the rationale for including the online survey in the study was presented. The key tasks involved in this study were then presented within the five-stage framework that was used to guide the research process. This described in detail each step taken from planning and preparing for the study, through data collection and processing, to data analysis and model testing.

Issues related to validity and reliability were then discussed, followed by an overview of the ethical guidelines that were adhered to in this study.

The results of this study are presented in the next four chapters. Chapter 5 presents socio-demographic data, descriptive statistics and results of the inferential and correlation analyses to familiarise readers with the nature of the sample and data. Chapter 6 presents the results of the first set of hypotheses, which concern the effect of experience on opportunity identification. Chapter 7 explores the second set of hypotheses, which deal with the relationship between intuition and opportunity identification, between experience and intuition, and with intuition as a mediator between experience and opportunity identification. The results of the third set of hypotheses, which are concerned with the relationship between cognitive versatility and opportunity identification, between experience and cognitive versatility, and with cognitive versatility as a mediator between experience and opportunity identification, are presented in Chapter 8.

CHAPTER 5

DESCRIPTIVE STATISTICS AND PRELIMINARY FINDINGS

5.1 Introduction

This chapter describes the main features of the research sample and of the key data involved in this study, and reports results of the inferential tests and correlation analyses which were carried out to seek preliminary evidence of the effect of entrepreneurial experience on cognitive strategy and opportunity identification, as explained in Chapter 4. Section 5.2 presents the key socio-demographic characteristics of the research participants, including their educational background, work experience and business ownership history. Section 5.3 describes the sample in terms of cognitive style, risk perception, risk propensity and deliberate practice.

Section 5.4 quantifies the verbal protocol data in terms of the number of segments that were coded (and then counted) as intuitive and analytical during Stages 4 and 5 of the study, and explores differences in the use of intuition and analysis throughout the study in general, and between novices and habitual entrepreneurs, between early-stage and later-stage entrepreneurs, and across the three think-aloud tasks. Section 5.5 outlines the results of the cognitive strategy profiling exercise in terms of the number of participants assigned to each of the four quadrants (as explained in Chapter 4), and explores the relationship between entrepreneurial experience and cognitive versatility.

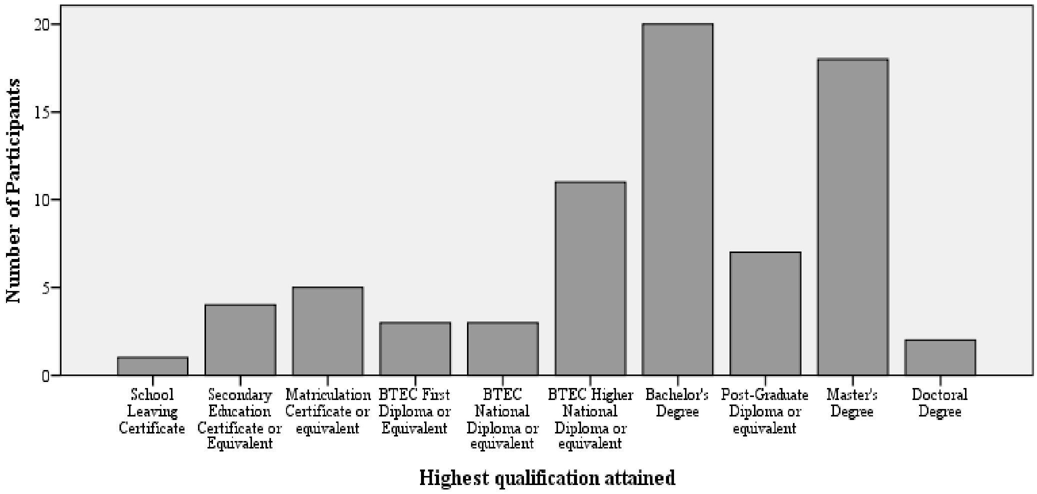
Sections 5.6 and 5.7 further quantify the verbal protocol data by reporting results of the content analysis and innovation rating exercises that determined the number and innovativeness of opportunities identified by participants. In keeping with this chapter's general flow, differences in opportunity identification are explored between novices and habitual entrepreneurs, between early-stage and later-stage entrepreneurs, and across the three different tasks. Finally, Section 5.8 presents a correlation matrix which explores bivariate associations between this study's key variables.

5.2 Research Participants: Socio-Demographic Data

As stated in Chapter 4, the final research sample was made up of 74 participants. Of these, 69 (93.2%) were male and 5 (6.8%) were female. Although this sample is gender-biased in favour of males, it is representative of the general population of technology entrepreneurs, where only between 5% and 15% of high-technology businesses in Europe are owned by women (European Commission, 2008). The youngest participant was 22 years old, while the oldest was 65. The mean age of participants was just below 42 years of age.

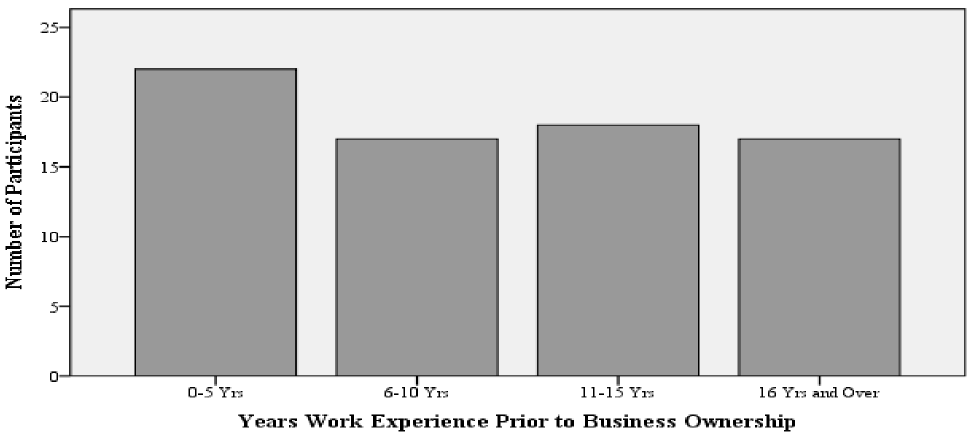
On average, participants had 15.7 years of formal education, with the majority (n = 47, 63.5%) holding an undergraduate or postgraduate degree. Figure 5.1 illustrates the distribution of participants according to the highest qualification they attained.

Figure 5.1 Distribution of Participants according to the Highest Qualification Attained



With regards to employment history, most of the entrepreneurs who participated in this study (n = 68, 91.9%) had some work experience before starting up their own business, with only six of them (8.1%) reporting that they took the plunge into business ownership without first gaining some work experience elsewhere. Participants worked for an average of 11.3 years before starting up their own business. Figure 5.2 presents the distribution of participants according to the number of years of work experience prior to business ownership.

Figure 5.2 Distribution of Participants according to Prior Work Experience



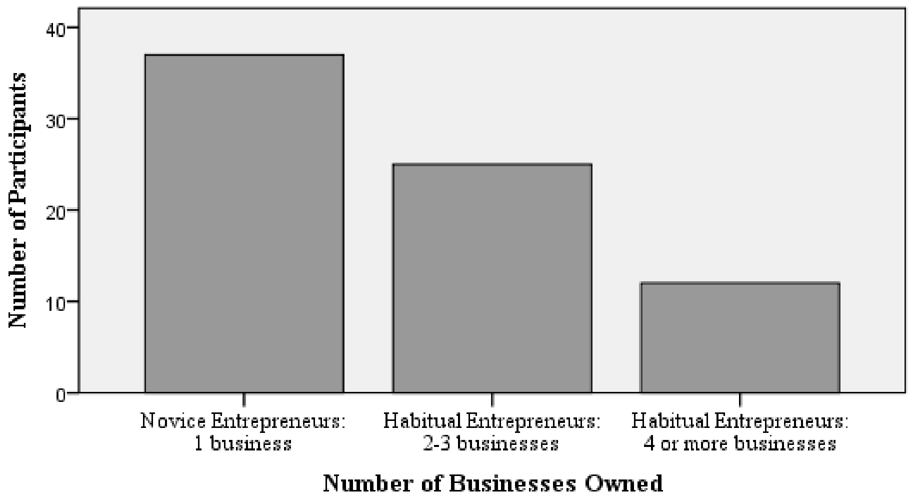
The majority had opted to gain industry-specific work experience, with 51 of the 74 participants (68.9%) reporting that they had worked in the ICT industry before becoming business owners. There was also a tendency among the participants to have gained some experience working in managerial positions before starting up, with 52 (70.2%) of them reporting general management experience, and 36 (of these 52, representing 69.2% of this subset and 48.6% of the overall sample) reporting (ICT) industry-specific management experience.

As explained in Chapter 4, entrepreneurial experience was operationalised in two ways for the purpose of these inferential tests. The first distinguishes between novice or first-time entrepreneurs (those who only ever owned one business, i.e., the one they owned at the time of the study) and habitual entrepreneurs (those who had owned two or more businesses prior to, or at the time of the study). The second operationalisation divides the sample into early-stage entrepreneurs (those who had less than 10 years of business ownership experience) and later-stage entrepreneurs (those who had owned their business/es for 10 years or longer). These alternative operationalisations are in line with past research on experience and opportunity identification (Robson et al., 2012).

With regards to the first operationalisation, the sample was equally split between novices (n = 37, 50%) and habitual entrepreneurs (n = 37, 50%). All together, the entrepreneurs in this study reported ownership (prior to, or at the time of, the study) of 172 businesses, most of which were/are in the ICT industry (n = 139, 80.8%) and were/are classified as micro or small enterprises employing fewer than 10 and 50 people respectively (n = 160, 93.0%). The entrepreneurs in this study reported ownership of an average of 2.32 businesses each.

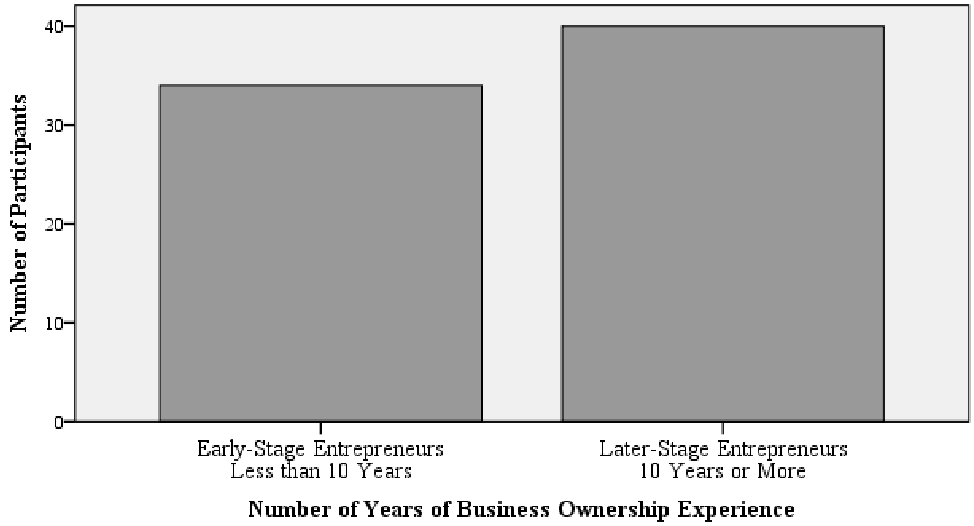
Of the habitual entrepreneurs, 25 (67.6% of this subset, 33.8% of the overall sample) had owned two or three businesses, while 12 (32.4% of this subset, 16.2% of the overall sample) had owned four businesses or more. This is illustrated in Figure 5.3. Most of these habitual entrepreneurs may be defined as portfolio entrepreneurs as 26 of them (70.2% of this subset, 35.1% of the overall sample) reported that they had owned at least two of their businesses concurrently (Ucbasaran et al., forthcoming).

Figure 5.3 Distribution of Participants according to the Number of Businesses Owned



In terms of this chapter's second operationalisation of entrepreneurial experience (based on the number of years of business ownership), Figure 5.4 illustrates that 34 (45.9%) of the 74 participants had owned their business/es for less than 10 years and will henceforth be referred to as early-stage entrepreneurs, while the remaining 40 participants (54.1%) had ten or more years of business ownership experience and will therefore be referred to as later-stage entrepreneurs. The mean number of years of business ownership experience in this sample was 11.51 years, of which 10.46 were ICT-related.

Figure 5.4 Distribution of Participants according to the Number of Years of Business Ownership



5.3 Cognitive Style, Risk Perception, Risk Propensity and Deliberate Practice

Table 5.1 presents descriptive statistics concerning cognitive style, risk perception, risk propensity and deliberate practice for the whole sample, for the novice and habitual entrepreneurs sub-groups, and for the early-stage and later-stage entrepreneurs sub-groups. These figures are discussed in Sections 5.3.1 to 5.3.3 below, together with the results of the inferential tests which were carried out to explore whether there were any significant differences on these measures as a function of entrepreneurial experience. As explained in Chapter 4, a series of Kolmogorov-Smirnov Tests determined whether parametric or non-parametric tests should be used for this purpose (see Section 4.5.5.6, Tables 4.5, 4.6 and 4.7 for details).

Table 5.1 Descriptive Statistics for Cognitive Style, Risk Perception, Risk Propensity and Deliberate Practice

		Novices (n = 37)	Habitual (n = 37)	Early-Stage (n = 34)	Later-Stage (n = 40)	Total Sample (N = 74)
Rationality	Mean [Median]	3.93 [3.90]	4.15 [4.20]	4.04 [4.03]	4.05 [4.05]	4.04 [4.05]
	SD	0.517	0.496	0.518	0.519	0.515
	Min [Max]	2.70 [4.80]	2.85 [4.95]	2.70 [4.95]	2.85 [4.80]	2.70 [4.95]
Experientiality	Mean [Median]	3.31 [3.30]	3.43 [3.45]	3.28 [3.30]	3.46 [3.45]	3.37 [3.35]
	SD	0.499	0.616	0.490	0.604	0.559
	Min [Max]	2.30 [4.30]	1.95 [4.70]	2.20 [4.95]	1.95 [4.70]	1.95 [4.70]
Risk Perception	Mean [Median]	3.55 [3.58]	3.38 [3.25]	3.34 [3.29]	3.57 [3.54]	3.47 [3.50]
	SD	1.066	0.994	1.002	1.048	1.027
	Min [Max]	2.00 [4.25]	1.50 [5.08]	1.50 [6.25]	1.67 [5.50]	1.50 [6.25]
Risk Propensity	Mean [Median]	1.54 [1.00]	1.62 [1.00]	1.71 [1.00]	1.48 [1.00]	1.58 [1.00]
	SD	0.931	1.063	1.031	0.960	0.993
	Min [Max]	0.00 [4.00]	0.00 [5.00]	0.00 [5.00]	0.00 [3.00]	0.00 [5.00]
Deliberate Practice	Mean [Median]	4.08 [4.00]	3.65 [3.00]	3.44 [3.00]	4.23 [4.00]	3.86 [4.00]
	SD	2.373	2.383	2.286	2.412	2.372
	Min [Max]	0.00 [9.00]	0.00 [9.00]	0.00 [9.00]	0.00 [9.00]	0.00 [9.00]

5.3.1 Cognitive Style

As one may recall from Chapter 4, cognitive style was measured using the REI (Pacini & Epstein, 1999). This was made up of two subscales, namely Rationality and Experientiality – which measured preference for the analytical and intuitive modes of processing respectively – each of which was composed of 20 items rated on a 5-point Likert scale. Scores for each subscale were summed and averaged to create the Experientiality and Rationality variables which could range in value from 1 (low) to 5 (high).

On average, the entrepreneurs who participated in this study obtained higher scores on the Rationality dimension than the Experientiality dimension of Cognitive Style, with respective means of 4.04 and 3.37. A Paired-Samples *t*-test revealed that this difference is statistically significant, $t(73) = 6.83$, $p < .001$, which implies that these participants prefer to process information analytically rather than intuitively.

An Independent-Samples *t*-test indicated that there is no significant difference in Experientiality between novices and habitual entrepreneurs, $t(72) = 0.86$, $p > .05$. Similarly, a Mann-Whitney test found no difference between these two sub-groups on Rationality, $U = 505.50$, $z = 1.94$, $p > .05$. There is thus no significant difference in cognitive style between novices and habitual entrepreneurs. The same conclusion applies when comparing early-stage and later-stage entrepreneurs, as Independent-Samples *t*-tests revealed no significant differences between these subgroups on Experientiality, $t(72) = 1.48$, $p > .05$, nor on Rationality, $t(72) = 0.08$, $p > .05$.

5.3.2 Risk Perception

As explained in Chapter 4, participants were presented with four venture choices as part of the online survey and asked to indicate the amount of risk they perceived in each one, by means of a three-item, seven-point Likert scale that followed each venture description. The scores of these scales were summed and averaged to create the Risk Perception composite scores which could range in value from 1 (low) to 7 (high).

The entrepreneurs in this study perceived a moderate amount of risk across the four venture choices which were presented in the Risk Perception scale in the online survey (*M*

= 3.47). A Mann-Whitney test revealed no significant difference between novices and habitual entrepreneurs on Risk Perception, $U = 655.50$, $z = 0.31$, $p > .05$. Similarly, an Independent-Samples *t*-test indicated that early-stage and later-stage entrepreneurs perceived similar amount of risk in this study, $t(72) = 0.97$, $p > .05$.

5.3.3 Risk Propensity

It may be recalled from Chapter 4 that risk propensity was measured by means of five pairs of statements, each of which represented one 'sure but lesser financial gain' option and one 'probabilistic but greater financial gain' option. Scoring involved assigning the former type of statement a value of zero and the latter a value of one, and then summing the total to create the 'Risk Propensity' variable which could range from 0 (low) to 5 (high).

The mean Risk Propensity of the entrepreneurs in this study is fairly low ($M = 1.58$). Mann-Whitney tests indicated that there are no significant differences between novices and habitual entrepreneurs, $U = 677.00$, $z = 0.09$, $p > .05$, nor between early-stage and later-stage entrepreneurs, $U = 618.00$, $z = -0.72$, $p > .05$ in Risk Propensity.

5.3.4 Deliberate Practice

As explained in Chapter 4, the 'Deliberate Practice' variable was created by counting how many out of the ten activities presented to participants were indicated as being performed at least once a week, and as being carried out to enhance their entrepreneurship-related knowledge and expertise.

This study's participants engage in a limited amount of deliberate practice: on average, they reported engaging in 3.9 out of the 10 deliberate practice activities presented. Once again, Mann-Whitney tests detected no significant differences between novices and habitual entrepreneurs, $U = 610.00$, $z = 0.81$, $p > .05$, nor between early-stage and later-stage entrepreneurs, $U = 552.50$, $z = 1.398$, $p > .05$.

5.4 Intuitive and Analytical Processing in Opportunity Identification

Segmentation of the verbal protocols gathered in this study yielded a total of 4,008 segments, of which 2,158 were coded as intuitive and 1,850 as analytical. Table 5.2 provides the relevant descriptive statistics in relation to these protocol data for the total sample and for the experience-based sub-groups, namely novices, habitual entrepreneurs, early-stage entrepreneurs and later-stage entrepreneurs.

Table 5.2 Descriptive Statistics for Intuitive, Analytical and Total Segments Overall

		Novices (n = 37)	**Habitual (n = 37)**	**Early-Stage (n = 34)**	**Later-Stage (n = 40)**	**Total Sample (N = 74)**
Intuition	No. of Segments	900	1258	893	1265	2158
	Mean [Median]	24.32 [23.00]	34.00 [29.00]	26.26 [25.00]	31.63 [29.00]	29.16 [26.00]
	SD	11.419	18.367	12.979	17.891	15.95
	Min [Max]	6 [50]	6 [78]	8 [67]	6 [78]	6 [78]
Analysis	No. of Segments	763	1087	825	1025	1850
	Mean [Median]	20.62 [16.00]	29.38 [23.00]	24.26 [21.00]	25.63 [20.50]	25.00 [21.00]
	SD	17.376	18.375	16.777	19.689	18.30
	Min [Max]	1 [78]	2 [77]	4 [78]	1 [77]	1 [78]
Total	No. of Segments	1663	2345	1718	2290	4008
	Mean [Median]	44.95 [43.00]	63.38 [56.00]	50.53 [48.50]	57.25 [46.00]	54.16 [47.00]
	SD	24.427	35.013	25.344	35.760	31.38
	Min [Max]	7 [104]	15 [146]	12 [127]	7 [146]	7 [146]

A Wilcoxon test indicated that participants engaged in a significantly greater amount of intuitive than analytical processing in this study overall, $z = 3.622$, $p < .001$. An Independent-Samples *t*-test revealed that habitual entrepreneurs produced a significantly greater number of intuitive segments than novices, $t(72) = 2.72$, $p < .01$, thus lending preliminary support to the hypothesis that entrepreneurial experience is positively associated with the use of intuition (H_{2c}). However no significant difference emerged when the *t*-test was repeated with the early-stage and later-stage entrepreneur subgroups, $t(72) = 1.45$, $p > .05$. This suggests that it may be the nature of entrepreneurial experience in terms of the number of businesses owned, rather than the duration of such experience in terms of the number of years of business ownership, that is associated with the use of intuition. A similar pattern was found when exploring the extent of analytical processing: Mann-Whitney tests indicated that habitual entrepreneurs surpassed novices in their use of analysis, $U = 444.50$, $z = 2.60$, $p < .01$, but no significant difference was found between early-stage and later-stage entrepreneurs, $U = 677.50$, $z = 0.03$, $p > .05$. These relationships are explored further in Chapter 7.

As illustrated in Table 5.3, the aggregate data were then broken down into the three technology-based tasks which, as one may recall from Chapter 4, varied in their level of uncertainty as follows: Multi-Touch Screen – high uncertainty; 3D Imaging software – moderate uncertainty; Quick-Tap phone payment application – low uncertainty. Wilcoxon tests were performed to explore differences in intuitive and analytical processing across the three tasks, with the following results: There was significantly more intuitive than analytical processing in both the Multi-Touch Screen task, $z = 2.84$, $p < .01$, and in the 3D Imaging task, $z = 3.94$, $p < .01$. In the Quick-Tap task, however, the number of intuition and analysis segments were statistically the same, $z = 0.43$, $p > .05$.

Table 5.3 Descriptive Statistics for Intuitive, Analytical and Total Segments Per Task

		Multi-Touch	3D Imaging	Quick-Tap
Intuition	No. of Segments	747	682	729
	Mean [Median]	10.09 [9.00]	9.22 [7.50]	9.85 [8.00]
	SD	6.76	6.02	7.01
	Min [Max]	0 [39]	2 [33]	0 [40]
Analysis	No. of Segments	605	523	722
	Mean [Median]	8.18 [6.00]	7.07 [4.50]	9.76 [8.00]
	SD	6.71	7.15	7.45
	Min [Max]	0 [38]	0 [32]	0 [29]
Total	No. of Segments	1352	1205	1451
	Mean [Median]	18.27 [15.00]	16.28 [13.00]	19.61 [17.00]
	SD	11.28	11.97	13.12
	Min [Max]	2 [63]	2 [60]	3 [69]

Friedman tests detected no significant difference in the number of intuitive segments produced for each of the three tasks, $X^2(2, N = 74) = 1.255$, $p > .05$, but found a difference in analytical processing, $X^2(2, N = 74) = 12.90$, $p < .01$. Specifically, Wilcoxon tests indicated that the Quick-Tap task involved significantly more analytical processing than both the Multi-Touch Screen task, $z = 2.22$, $p < .05$, and the 3D Imaging task, $z = 3.35$, $p < .001$. Together, these results indicate that intuition outweighs analysis in high and moderate uncertainty tasks but not in low uncertainty tasks which seem to trigger the use of analysis.

5.5 Cognitive Versatility in Opportunity Identification

As explained in Chapter 4, participants were grouped into four categories of cognitive strategy, namely *Big Picture Conscious*, *Detail Conscious*, *Cognitively Versatile* and *Non-Discerning* (Hodgkinson & Clarke, 2007) on the basis of whether they engaged in more or less intuitive and analytical processing than the respective sample means. Table 5.4 indicates how many participants were assigned to each category in each of the three tasks and overall.

Table 5.4 Classification of Participants According to Cognitive Strategy

	Multi-Touch		**3D Imaging**		**Quick-Tap**		**Overall**	
	n	**%**	***n***	***n***	**%**	**%**	***n***	**%**
Big Picture Conscious	12	16.2	8	10.8	13	17.6	13	17.6
Detail Conscious	9	12.2	12	16.2	7	9.5	7	9.5
Cognitively Versatile	16	21.6	21	28.4	18	24.3	18	24.3
Non-Discerning	37	50.0	33	44.6	36	48.6	36	48.6

The main category of interest in this study is the one representing cognitively versatile individuals. Table 5.5 disaggregates the participants who fell into this category into the experience-based sub-groups, namely novice, habitual, early-stage and later-stage entrepreneur groups, and shows how many of each of these sub-groups were classified as cognitively versatile in each of the three tasks and overall.

Table 5.5 Classification of Cognitively Versatile Participants

	Novices (*n* = 37)		**Habitual (*n* = 37)**		**Early-Stage (*n* = 34)**		**Later-Stage (*n* = 40)**		**Total Sample (*N* = 74)**	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Multi-Touch	6	16.2	11	29.7	16	21.6	10	25.0	16	21.6
3D Imaging	4	10.8	12	32.4	21	28.4	11	27.5	21	28.4
Quick-Tap	7	18.9	14	37.8	18	24.3	12	30.0	18	24.3
Overall	7	18.9	11	29.7	18	24.3	12	30.0	18	24.3

As explained in Chapter 4, a series of 2 X 2 Chi-Square Tests for Independence were carried out to explore the relationship between entrepreneurial experience and cognitive versatility. The results were non-significant for the overall data, both when participants were grouped into the novice versus habitual categories, $X^2(1, N = 74) = 1.18$, $p > .05$, and when they were grouped into the early-stage and later-stage categories, $X^2(1, N = 74) = 1.52$, $p > .05$. However when the tests were repeated for the three separate tasks, a significant difference emerged between novices and habitual entrepreneurs for the 3D Imaging task, $X^2(1, N = 74) = 5.10$, $p < .05$, and for the Quick-Tap task, $X^2(1, N = 74) = 3.26$, $p < .1$ (although the latter was significant at the .1 not .05 level).

In view of this study's research hypothesis that entrepreneurial experience is positively associated with cognitive versatility (H_{3c}), the above findings (which offered only weak preliminary support to this hypothesis) warranted further investigation. Following past research which argued that "launching only one venture does not make an entrepreneur experienced" (Podoynitsyna, Van der Bij & Song, 2011, p. 129), the above tests were carried out once more with redefined sub-groups which included participants who owned one or two businesses in one category and those with three or more businesses in the other, as shown in Table 5.6. This led to significant results for the Multi-Touch Screen task, $X^2(1, N = 74) = 4.92$, $p < .05$, while the chi square statistic for the Quick-Tap task increased along with its associated level of significance: $X^2(1, N = 74) = 6.21$, $p < .05$.

Table 5.6 Classification of Cognitively Versatile Participants in Redefined Sub-Groups

	Owners of ≤ 2 Businesses (*n* = 51)		**Owners of ≥ 3 Businesses (*n* = 23)**	
	n	**%**	***n***	**%**
Multi-Touch	8	15.7	9	39.1
3D Imaging	8	15.7	8	34.8
Quick-Tap	10	19.6	11	47.8
Overall	10	19.6	8	34.8

Taken together, the above findings lend preliminary support to the hypothesis that there is a relationship between entrepreneurial experience and cognitive versatility (H_{3c}). Similar to what was suggested above, that it is the nature and not the duration of entrepreneurial experience that is associated with the use of intuition, these results suggest that cognitive versatility is related to entrepreneurial experience in terms of the number of businesses owned and not in terms of the number of years of business ownership. Furthermore, the positive effects of business ownership on cognitive versatility seem to become more significant after starting up at least three businesses. These relationships will be explored further in Chapter 8.

5.6 Number of Opportunities Identified

Content analysis of the verbal protocols led to the extraction of a total of 204 opportunities which were identified by this study's participants in the three protocol analysis tasks. Of these, 74 were identified for the Multi-Touch Screen, 76 for the 3D Imaging software, and 54 for the Quick-Tap phone payment application. On average, respondents identified 2.76 opportunities overall. Table 5.7 presents descriptive statistics concerning the number of opportunities identified in this study by the primary experience-based subgroups being explored in this chapter, namely novices, habitual entrepreneurs, early-stage entrepreneurs, and later-stage entrepreneurs, and by the whole sample.

Table 5.7 Descriptive Statistics for the Number of Opportunities Identified

		Novices (*n* = 37)	**Habitual (*n* = 37)**	**Early-Stage (*n* = 34)**	**Later-Stage (*n* = 40)**	**Total Sample (*N* = 74)**
Multi-Touch	No. of Opport.	34	40	36	38	74
	Mean [Median]	0.92 [1.00]	1.08 [1.00]	1.06 [1.00]	0.95 [1.00]	1.00 [1.00]
	SD	0.954	1.256	1.229	1.011	1.110
	Min [Max]	0 [4]	0 [4]	0 [4]	0 [4]	0 [4]
3D Imaging	No. of Opport.	26	50	31	45	76
	Mean [Median]	0.70 [1.00]	1.35 [1.00]	0.91 [1.00]	1.13 [1.00]	1.03 [1.00]
	SD	0.845	1.736	1.240	1.522	1.394
	Min [Max]	0 [3]	0 [8]	0 [5]	0 [8]	0 [8]
Quick-Tap	No. of Opport.	22	32	26	28	54
	Mean [Median]	0.59 [1.00]	0.86 [1.00]	0.76 [1.00]	0.70 [0.50]	0.73 [1.00]
	SD	0.644	1.004	0.741	0.939	0.849
	Min [Max]	0 [2]	0 [4]	0 [3]	0 [4]	0 [4]
Overall	No. of Opport.	82	122	93	111	204
	Mean [Median]	2.22 [2.00]	3.30 [3.00]	2.74 [2.00]	2.78 [2.00]	2.76 [2.00]
	SD	1.417	2.548	2.020	2.224	2.118
	Min [Max]	0 [6]	0 [9]	0 [8]	0 [9]	0 [9]

Mann-Whitney tests revealed no significant differences between novices and habitual entrepreneurs, $U = 538.50$, $z = 1.61$, $p > .05$, or between early-stage and later-stage entrepreneurs, $U = 678.50$, $z = 0.02$, $p > .05$, with regards to the number of opportunities they identified overall. These findings were fully reflected in the three separate tasks where these three subgroups identified similar numbers of opportunities.

In view of this study's research hypothesis that entrepreneurial experience is positively associated with the identification of a greater number of opportunities (H_{1a}), it was deemed necessary to investigate the above findings (which offered no support for this hypothesis) in further depth. Building on the same logic as that argued in Section 5.4, that having prior experience as owner of a single business may be insufficient (Podoynitsyna et al., 2011), the above tests were repeated with the redefined subgroups reported in Section 5.5, and as indicated in Table 5.8.

Table 5.8 Descriptive Statistics for the Number of Opportunities Identified by the Redefined Sub-Groups

		Owners of $\leq$ 2 Businesses (n = 51)	**Owners of $\geq$ 3 Businesses (n = 23)**
Multi-Touch	No. of Opport.	41	33
	Mean [Median]	0.80 [1.00]	1.43 [1.00]
	SD	0.939	1.343
	Min [Max]	0 [4]	0 [4]
3D Imaging	No. of Opport.	45	31
	Mean [Median]	0.88 [1.00]	1.35 [1.00]
	SD	1.306	1.555
	Min [Max]	0 [8]	0 [5]
Quick-Tap	No. of Opport.	30	24
	Mean [Median]	0.59 [1.00]	1.04 [1.00]
	SD	0.606	1.186
	Min [Max]	0 [2]	0 [4]
Overall	No. of Opport.	116	88
	Mean [Median]	2.27 [2.00]	3.83 [3.00]
	SD	1.686	2.588
	Min [Max]	0 [9]	0 [9]

In these tests, the following significant difference emerged: Entrepreneurs who had owned at least three businesses identified significantly more opportunities overall than those who owned just one or two, U = 365.00, z = 2.63, p < .01. This was not however reflected in the three separate technologies, as a difference was found only on the Multi-Touch Screen task, and this was significant not at the .05 level but at the .1 level, U = 432.50, z = 1.90, p < .1. In other words, entrepreneurs who had owned three or more businesses identified no more opportunities on the separate tasks than those who had owned just one or two businesses.

These findings (which offered only weak preliminary support for H_{1a}) raised questions concerning the way experience was being operationalised in these inferential tests. Could it be that the positive effects of habitual entrepreneurship on opportunity identification kick in even later than the third business? Or could there be more to it than that? Following past research that distinguished between general and industry-specific business ownership experience (Zaleski, 2011), it seemed plausible that the effects of habitual entrepreneurship may be stronger for businesses started up in the same sector. Both of these avenues were explored further as follows.

First, participants were re-classified once again into a sub-group which included owners of up to three businesses and another sub-group which included those who owned four or more businesses in the other as shown in Table 5.9. This resulted in a larger effect size (z) with a higher associated level of significance (in the same direction) for the number of opportunities identified overall, $U = 155.00$, $z = 3.24$, $p < .001$. Furthermore, significant differences were now found on two of the three tasks. Specifically, entrepreneurs who owned four or more businesses identified significantly more opportunities than entrepreneurs who had owned three businesses or less in the Multi-Touch Screen task, $U = 208.50$, $z = 2.54$, $p < .01$, and in the Quick-Tap task, $U = 203.50$, $z = 2.73$, $p < .01$.

Table 5.9 Descriptive Statistics for the Number of Opportunities Identified by the Further Redefined Sub-Groups

		Owners of ≤ 3 Businesses (*n* = 62)	**Owners of ≥ 4 Businesses (*n* = 12)**
Multi-Touch	No. of Opport.	52	22
	Mean [Median]	0.84 [1.00]	1.83 [1.50]
	SD	0.995	1.337
	Min [Max]	0 [4]	0 [4]
3D Imaging	No. of Opport.	60	15
	Mean [Median]	0.97 [1.00	1.33 [1.00]
	SD	1.402	1.371
	Min [Max]	0 [8]	0 [5]
Quick-Tap	No. of Opport.	37	17
	Mean [Median]	0.60 [0.50]	1.42 [1.00]
	SD	0.735	1.084
	Min [Max]	0 [4]	0 [3]
Overall	No. of Opport.	149	55
	Mean [Median]	2.40 [2.00]	4.58 [4.00]
	SD	1.886	2.392
	Min [Max]	0 [9]	2 [9]

In order to explore the sector-related avenue mentioned above, two further sub-groups were formed based exclusively on industry-specific business ownership experience. Participants who owned a single ICT business were placed in one category, and those who owned two or more ICT businesses were placed in the other, as shown in Table 5.10. In contrast with the non-significant results reported above concerning novices and habitual entrepreneurs on the number of opportunities identified, entrepreneurs who had owned two or more businesses in the ICT industry identified significantly more opportunities overall than those who only had experience running one business in the ICT sector, $U = 426.00$, $z = 2.47$, $p < .05$.

Table 5.10 Descriptive Statistics for the Number of Opportunities Identified by the ICT Sub-Groups

		Owners of 1 ICT Businesses (n = 46)	**Owners of ≥ 2 ICT Businesses (n = 28)**
Multi-Touch	No. of Opport.	37	37
	Mean [Median]	0.80 [1.00]	1.32 [1.00]
	SD	0.910	1.335
	Min [Max]	0 [4]	0 [4]
3D Imaging	No. of Opport.	39	37
	Mean [Median]	0.85 [1.00]	1.32 [1.00]
	SD	1.349	1.442
	Min [Max]	0 [8]	0 [5]
Quick-Tap	No. of Opport.	27	27
	Mean [Median]	0.59 [1.00]	0.96 [1.00]
	SD	0.617	1.105
	Min [Max]	0 [2]	0 [4]
Overall	No. of Opport.	103	101
	Mean [Median]	2.24 [2.00]	3.61 [3.00]
	SD	1.689	2.485
	Min [Max]	0 [9]	0 [9]

Taking this investigation one step further, participants were reclassified for a final time into owners of one to two ICT businesses in one category, and those who had three or more ICT businesses in the other, as illustrated in Table 5.11. The latter were not only found to identify significantly more opportunities overall than the former, U = 196.50, z = 3.57, p < .001, but the difference between these subgroups was more pronounced than that reported in the previous paragraph, as indicated by a larger effect size (z) and greater level of significance. Furthermore, the exclusion of non-ICT businesses from this set of analyses led to a significant difference between subgroups emerging on the separate tasks, not from the fourth business owned (as reported when businesses from all sectors were counted) but from the third (ICT) business owned: Multi-Touch Screen, U = 297.50, z = 2.315, p < .05; 3D Imaging, U = 345.00, z = 1.67, p < .1; Quick-Tap, U = 320.50, z = 2.08; p < .05.

Table 5.11 Descriptive Statistics for the Number of Opportunities Identified by the Redefined ICT Sub-Groups

		Owners of ≤ 2 ICT Businesses (*n* = 58)	**Owners of ≥ 3 ICT Businesses (*n* = 16)**
Multi-Touch	No. of Opport.	48	26
	Mean [Median]	0.83 [1.00]	1.63 [1.50]
	SD	0.994	1.310
	Min [Max]	0 [4]	0 [4]
3D Imaging	No. of Opport.	52	24
	Mean [Median]	0.90 [1.00]	1.50 [1.00]
	SD	1.320	1.592
	Min [Max]	0 [8]	0 [5]
Quick-Tap	No. of Opport.	33	21
	Mean [Median]	0.57 [1.00]	1.31 [1.00]
	SD	0.596	1.302
	Min [Max]	0 [2]	0 [4]
Overall	No. of Opport.	133	71
	Mean [Median]	2.29 [2.00]	4.44 [4.50]
	SD	1.797	2.394
	Min [Max]	0 [9]	0 [9]

Taken together, these findings offer preliminary support for the hypothesis that experienced entrepreneurs identify a greater number of opportunities (H_{1a}), on the following conditions: (1) The positive effects of business ownership experience on opportunity identification seem to be due not to the number of years of business ownership but to the number of businesses owned; (2) These effects seem to start kicking in from the third or fourth business owned; and (3) These effects are stronger for businesses owned in the same industry. In other words, the positive effects of business ownership experience on opportunity identification seem to be largely due to the number of industry-specific businesses owned. These effects are explored in greater detail in Chapter 6.

5.7 Innovativeness of Opportunities Identified

As explained in Chapter 4, the opportunities identified by participants were rated for their innovativeness on a 7-point Likert scale anchored by ‘not very innovative (1) and ‘very innovative’ (7). Table 5.12 provides descriptive statistics concerning the innovativeness of opportunities identified overall and in each of the three tasks.

Table 5.12 Descriptive Statistics for the Innovativeness of Opportunities Identified

	Multi-Touch	3D Imaging	Quick-Tap	Overall
Mean [Median]	4.6 [4.3]	4.3 [4.0]	4.0 [3.5]	4.4 [4.0]
Standard Deviation	1.42	1.78	1.66	1.64
Min [Max]	1 [7]	2 [7]	1 [7]	1 [7]

The above figures indicate that on average, the opportunities identified by respondents in this study were rated as ‘moderately innovative’, with mean and median ratings derived from the 7-point Likert scale all falling between 4 and 5. Wilcoxon tests indicate that while there is no significant difference between the innovativeness of opportunities identified for the Multi-Touch Screen and for the 3D Imaging software, $z = 0.593$, $p > .05$, both of these technologies led to the identification of opportunities that were significantly more innovative than those identified for the Quick-Tap application: Multi-Touch, $z = 2.79$, $p < .01$; 3D Imaging: $z = 2.17$, $p < .05$.

The innovativeness rating of each opportunity determined if it would be placed in the ‘not innovative’ category (rated < 4) or in the ‘inovative’ category (rated ≥ 4), and if the latter, whether it would be further extracted as ‘very innovative’ (rated ≥ 6), as explained in

Chapter 4. The frequency counts and percentages ofopportunities that fell into these categories are presented in Tables 5.13 and 5.14 respectively.

Table 5.13 Number of Opportunities Rated < 4, ≥ 4

	Multi-Touch		**3D Imaging**		**Quick-Tap**		**Overall**	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Opportunities Rated < 4	15	20.3	30	39.5	28	51.9	73	35.8
Opportunities Rated ≥ 4	59	79.7	46	60.5	26	48.1	131	64.2
Total	74	100.0	76	100.0	54	100.0	204	100.0

Table 5.14 Number of Opportunities Rated < 6 and ≥ 6

	Multi-Touch		**3D Imaging**		**Quick-Tap**		**Overall**	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Opportunities Rated < 6	55	74.3	53	69.7	46	85.2	154	75.5
Opportunities Rated ≥ 6	19	25.7	23	30.3	8	14.8	50	24.5
Total	74	100.0	76	100.0	54	100.0	204	100.0

One of the purposes of this classification was to weed out ideas with poor potential for commercial application and return on investment (as predicted by a low innovativeness rating), since these may be argued not to be entrepreneurial opportunities at all. Table 5.13 demonstrates that 35.8% (n = 73) of all the opportunities identified in this study (N = 204) failed to obtain this minimum rating of 4 and were thus eliminated from further analysis of 'innovative' opportunities (rated ≥ 4). In other words, when using this definition of entrepreneurial opportunities that is more stringent than the all-inclusive 'simple count' approach reported in Section 5.6 above, the number of opportunities identified by participants in this study drops from 204 to 131.

Table 5.15 presents descriptive statistics concerning the number of ‘innovative’ opportunities identified in this study (rated ≥ 4) by the primary experience-based subgroups explored in this chapter, namely novices, habitual entrepreneurs, early-stage entrepreneurs, and later-stage entrepreneurs, and by the whole sample. Mann-Whitney tests revealed that habitual entrepreneurs identified a significantly greater number of ‘innovative’ opportunities than their novice counterparts overall, $U = 389.50$, $z = 3.29$, $p < .001$, and in two of the three tasks: 3D Imaging, $U = 451.00$, $z = 2.89$, $p < .01$; and Quick-Tap: $U = 514.50$, $z = 2.62$, $p < .01$. No differences were detected between early-stage and later-stage entrepreneurs on the number of innovative opportunities identified.

Table 5.15 Descriptive Statistics for the Number of Opportunities Rated ≥ 4

		Novices (n = 37)	**Habitual (n = 37)**	**Early-Stage (n = 34)**	**Later-Stage (n = 40)**	**Total Sample (N = 74)**
Multi-Touch	No. of Opport.	23	36	28	31	59
	Mean [Median]	0.62 [0.00]	0.97 [1.00]	0.82 [0.00]	0.78 [0.50]	0.80 [0.00]
	SD	0.953	1.166	1.193	0.974	1.072
	Min [Max]	0 [4]	0 [4]	0 [4]	0 [4]	0 [4]
3D Imaging	No. of Opport.	10	36	17	29	46
	Mean [Median]	0.27 [0.00]	0.97 [0.00]	0.50 [0.00]	0.73 [0.50]	0.62 [0.00]
	SD	0.450	1.323	0.929	1.132	1.043
	Min [Max]	0 [1]	0 [5]	0 [4]	0 [5]	0 [5]
Quick-Tap	No. of Opport.	4	22	10	16	26
	Mean [Median]	0.11 [0.00]	0.59 [0.00]	0.29 [0.00]	0.40 [0.00]	0.35 [0.00]
	SD	0.393	1.066	0.676	0.955	0.835
	Min [Max]	0 [2]	0 [4]	0 [3]	0 [4]	0 [4]
Overall	No. of Opport.	37	94	55	76	131
	Mean [Median]	1.00 [0.00]	2.54 [2.00]	1.62 [1.00]	1.90 [1.00]	1.77 [1.00]
	SD	1.225	2.305	1.826	2.134	1.990
	Min [Max]	0 [4]	0 [9]	0 [7]	0 [9]	0 [9]

Differences were also found for the ‘very innovative’ category (rated ≥ 6), where habitual entrepreneurs identified a significantly greater number of top-rated opportunities than novices overall, $U = 337.50$, $z = 4.37$, $p < .001$, and in all of the three tasks: Multi-Touch Screen: $U = 478.50$, $z = 3.19$, $p < .001$; 3D Imaging $U = 458.00$, $z = 3.27$, $p < .001$; and Quick-Tap: $U = 592.00$, $z = 2.30$, $p < .01$. Consistent with the results reported in the other sections of this chapter, no differences were found between early-stage and later-stage entrepreneurs in the identification of ‘innovative’ or ‘very innovative’ opportunities. Descriptive statistics concerning the number of ‘very innovative’ opportunities identified in this study by the different experience-based subgroups being explored in this chapter and by the whole sample are provided in Table 5.16.

Table 5.16 Descriptive Statistics for the Number of Opportunities Rated ≥ 6

		Novices (n = 37)	**Habitual (n = 37)**	**Early-Stage (n = 34)**	**Later-Stage (n = 40)**	**Total Sample (N = 74)**
Multi-Touch	No. of Opport.	2	17	9	10	19
	Mean [Median]	0.05 [0.00]	0.46 [0.00]	0.26 [0.00]	0.25 [0.00]	0.26 [0.00]
	SD	0.229	0.730	0.666	0.494	0.575
	Min [Max]	0 [1]	0 [3]	0 [3]	0 [2]	0 [3]
3D Imaging	No. of Opport.	3	20	8	15	23
	Mean [Median]	0.05 [0.00]	0.54 [0.00]	0.24 [0.00]	0.38 [0.00]	0.31 [0.00]
	SD	0.277	0.836	0.496	0.774	0.661
	Min [Max]	0 [1]	0 [4]	0 [2]	0 [4]	0 [4]
Quick-Tap	No. of Opport.	0	8	0	8	8
	Mean [Median]	0.00 [0.00]	0.22 [0.00]	0.00 [0.00]	0.20 [0.00]	0.11 [0.00]
	SD	0.000	0.630	0.000	0.608	0.455
	Min [Max]	0 [0]	0 [3]	0 [0]	0 [3]	0 [3]
Overall	No. of Opport.	5	45	17	33	50
	Mean [Median]	0.14 [0.00]	1.22 [1.00]	0.50 [0.00]	0.83 [0.00]	0.68 [0.00]
	SD	0.347	1.417	0.896	1.338	1.160
	Min [Max]	0 [1]	0 [6]	0 [4]	0 [6]	0 [6]

Together, these finding offer preliminary support for the hypothesised relationship between entrepreneurial experience and the identification of innovative opportunities that are more innovative (H_{1b}), and suggest once again that it is the nature (number of businesses owned) rather than the extent (number of years) of experience that is most salient. This is explored further in Chapter 6.

5.8 Correlation Analyses

As explained in Chapter 4, Spearman's correlations were performed to explore bivariate associations among the key variables derived from the survey and those from the protocol analysis (except for cognitive versatility which is a dichotomous variable and therefore does not lend itself to this type of analysis). These correlation coefficients are presented in Table 5.17 which is arranged in five tiers. The first tier contains the coefficients for the survey data (labelled as variable numbers 1 to 11). The second tier introduces the overall (aggregated) verbal protocol data, which are correlated with the survey data (labelled as 12OV to 17OV). The third, fourth and fifth tiers bring in the data from the three protocol analysis tasks separately (Multi-Touch Screen, labelled as 12MT to 17MT; 3D Imaging, labelled as 12TD to 17TD; and Quick-Tap, labelled as 12QT to 17QT). Each of these is correlated with the survey data but not with the protocol analysis data from the other tiers. Presenting all of these data in one table avoids repetition of the survey correlation coefficients and facilitates comparison of associations between the survey and protocol data across the three tasks. Noteworthy correlations are discussed below.

Table 5.17 Spearman's Correlation Matrix: Survey Data with Protocol Analysis Data

Survey Data		1	2	3	4	5	6	7	8	9	10	11					
1	Rationality																
2	Experientiality	-.292*															
3	Risk Propensity	-.110	-.068														
4	Risk Perception	.063	.007	-.002													
5	Deliberate Practice	.118	-.111	.229*	.129												
6	Years Education	.292*	-.189	.017	.094	-.072											
7	Years Work Experience	.191	-.067	-.117	-.127	-.110	.064										
8	Years ICT Business Ownership	.001	.084	-.212†	.109	.061	.101	-.157									
9	Years Non-ICT Business Ownership	-.097	.159	.117	-.116	-.091	.056	.029	-.287*								
10	No. of ICT Businesses Owned	.278*	.074	-.034	-.003	-.030	.220†	-.081	.353**	-.030							
11	No. of Non-ICT Businesses Owned	.078	.078	.056	-.133	-.215†	.123	.018	-.142	.682***	.160						
Verbal Protocol Data: Overall		1	2	3	4	5	6	7	8	9	10	11	12OV	13OV	14OV	15OV	16OV
12OV	No. of Intuition Segments	.216†	-.081	.113	.052	.176	.299**	.204†	.198†	.062	.334**	.101					
13OV	No. of Analysis Segments	.087	-.126	.156	.134	.174	.305**	.103	.016	.110	.380***	.168	.668***				
14OV	No. of Opportunities Identified	.222†	.041	.114	-.112	.025	.264*	.256*	.047	.027	.370***	.098	.454***	.360**			
15OV	No. of Opportunities Rated ≥ 4	.247*	.036	.063	-.045	-.037	.190	.137	.090	.087	.481***	.251*	.540***	.474***	.810***		
16OV	No. of Opportunities Rated ≥ 6	.164	.155	.026	-.107	-.079	.149	-.001	.042	.191	.536***	.380***	.347**	.407***	.562***	.726***	

†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed.

Table 5.17 (Cont.) Spearman's Correlation Matrix: Survey Data with Protocol Analysis Data

Verbal Protocol Data: Multi-Touch	1	2	3	4	5	6	7	8	9	10	11	12MT	13MT	14MT	15MT	16MT
12MT No. of Intuition Segments	.199†	.011	.174	-.013	.221†	.130	.133	.186	-.132	.300**	-.017					
13MT No. of Analysis Segments	.085	-.091	.158	.155	.175	.225†	-.008	.058	-.117	.356**	.007	.434***				
14MT No. of Opportunities Identified	.046	.124	.074	-.179	-.082	-.045	.025	.018	-.051	.232*	-.032	.369***	.133			
15MT No. of Opportunities Rated ≥ 4	.161	.142	.034	-.177	-.026	-.008	.029	.012	.020	.315**	.083	.428***	.154	.858***		
16MT No. of Opportunities Rated ≥ 6	.205†	.105	-.047	-.148	.000	.077	-.033	-.026	.110	.439***	.343**	.375***	.348**	.489***	.584***	
Verbal Protocol Data: 3D Imaging	1	2	3	4	5	6	7	8	9	10	11	12TD	13TD	14TD	15TD	16TD
12TD No. of Intuition Segments	.207†	-.083	.077	.092	.199†	.372***	.189	.182	.211†	.266*	.073					
13TD No. of Analysis Segments	-.020	-.162	.137	.110	.167	.225†	.051	.142	.113	.312**	.093	.575***				
14TD No. of Opportunities Identified	.174	.061	.101	-.019	.132	.167	.173	.069	.108	.222†	.148	.477***	.369***			
15TD No. of Opportunities Rated ≥ 4	.152	.013	.055	.113	.106	.087	.049	.147	.230*	.308**	.310**	.504***	.483***	.798***		
16TD No. of Opportunities Rated ≥ 6	.040	.121	.047	-.051	-.101	.064	-.047	.040	.236*	.365***	.278*	.276*	.387***	.526***	.729***	
Verbal Protocol Data: Quick-Tap	1	2	3	4	5	6	7	8	9	10	11	12QT	13QT	14QT	15QT	16QT
12QT No. of Intuition Segments	.161	-.114	.000	.083	.076	.185	.167	.095	.025	.326**	.159					
13QT No. of Analysis Segments	.154	-.048	.115	.066	.131	.240*	0.208†	-.051	.115	.310**	.190	.610***				
14QT No. of Opportunities Identified	.141	-.038	.067	.018	.077	.306**	.221†	-.038	-.012	.211†	.055	.343**	.299**			
15QT No. of Opportunities Rated ≥ 4	.212†	-.027	-.001	.028	-.067	.165	.175	.117	-.109	.469***	.181	.426***	.447***	.570***		
16QT No. of Opportunities Rated ≥ 6	.206†	.042	-.069	.100	.015	.100	.054	.287*	-.106	.455***	.208†	.295*	.296*	.366***	.572***	

†*p* < .10. **p* < .05. ***p* < .01. ****p* < .001, two-tailed.

The first general observation is that most correlations among the control and independent variables (located on the left hand side of the matrix) are relatively low and non-significant, indicating that there should not be any concerns with collinearity.

Second, there are significant correlations between hypothesised predictors and their outcome variables. In view of the results reported earlier in this chapter concerning the effects of owning several businesses in the same sector (Section 5.6), business ownership experience was split into ICT-related and non-ICT related, in order to obtain a more nuanced view of which aspects of entrepreneurial experience are the most salient in determining both cognitive strategy and opportunity identification. Consistent with this chapter's preliminary findings, the number of ICT businesses owned (labelled as variable number 10 in the matrix) is significantly correlated with virtually all the hypothesised outcome variables, namely the number of intuition segments, the number of opportunities identified, and the number of innovative opportunities identified at both levels (rated ≥ 4 and ≥ 6). Also consistent with this chapter's preliminary findings are the absence of significant correlations between the number of years of business ownership experience and most of the hypothesised outcome variables, even when the industry-specific distinction is made.

Another noteworthy set of correlations is that between the number of intuition and analysis segments and the number and innovativeness of opportunities identified by participants. Although both intuition and analysis are highly correlated with all the operationalisations of opportunity identification adopted in this study, the relationship is generally stronger for intuition than it is for analysis (with some exceptions).

Finally, it is interesting to note the following correlations concerning cognitive style and cognitive strategy. First, there is a significant negative correlation between the rationality and experientiality scores of cognitive style, suggesting that participants have a dispositional preference for one kind of cognitive processing over the other. This is in line with the results of the inferential tests reported in Section 5.2 above which indicated that the entrepreneurs in this study tend to prefer a rational rather than an intuitive mode of processing. Second, there is a significant positive correlation between the number of intuition segments and the number of analysis segments, indicating that (as argued by proponents of dual-process theory – e.g., Hodgkinson & Sadler-Smith, 2003a), intuition and analysis are used in tandem during cognitive processing. Third, no correlations were found between the experientiality scores (dispositional) and the number of intuition segments (strategy), or between the rationality scores (dispositional) and the number of analysis segments (strategy). This suggests that cognitive style does not determine cognitive strategy as has often been indicated in the literature (Evans, 2010; Sinclair & Ashkanasy, 2005). In contrast to previous suggestions that cognitive style influences cognitive strategy (Evans, 2010; Sinclair, 2003), this study finds no significant relationship between cognitive style and cognitive strategy.

5.9 Conclusion

This chapter presented descriptive statistics concerning the research sample and key data derived from the survey and verbal protocols, and reported results of the analyses that were carried out to obtain preliminary evidence for some of the relationships that were hypothesised in this study. The purpose of these preliminary tests was to obtain initial indications of which aspects of entrepreneurial experience are the most salient in determining cognitive strategy and opportunity identification, since the extant literature is somewhat ambiguous in this regard. The key outcomes of these analyses are the following.

First, the number of years of business ownership experience appears to be unrelated both to cognitive strategy and to opportunity identification. Notably, the ‘Ten-year rule’ (see Weisberg, 1999) concerning the development of expertise was not upheld, as no significant differences were found on any of the performance measures between entrepreneurs with more than 10 years business ownership experience and those who had owned businesses for a shorter length of time. This could be due to the fact that the quality of experience, which also matters in the acquisition of expertise (e.g., Baron & Henry, 2010), is not taken into account in the operationalisation of early-stage and later-stage entrepreneurs. Furthermore, no strong correlations emerged between the number of years of business ownership and any of the hypothesised outcome variables.

Second, ownership of multiple businesses was found to be associated with cognitive strategy as well as opportunity identification, as seen in the results of both the inferential tests and the correlation analyses reported above. Interestingly, the inferential tests offered indications that the positive effects of habitual entrepreneurship may in some cases begin to appear not from the second business (as suggested by the novice / habitual distinction that is often made in the literature, e.g., Ucbasaran, Wright, Westhead & Busenitz, 2003b), but from the third or fourth business owned. However, this delay may be reduced if business ownership occurs within the same industry, as suggested by the results reported in Section 5.6 and by the correlation analyses presented in Section 5.8.

In view of these preliminary findings, it was decided to delineate not only between years of business ownership experience and the number of businesses owned, but also between ICT-related and non-ICT-related business ownership experience in the regression and mediation analyses, which were subsequently carried out to fully test the research hypotheses. These multivariate analyses, which are reported in the next three chapters, provide more robust and extensive evidence concerning the nature of the various hypothesised relationships as they allow simultaneous investigation of the effects of multiple control and independent variables, thus ensuring that possible inter-relationships with the dependent variables of interest are not overlooked.

CHAPTER 6

ROBUST MODEL TESTING PART 1:

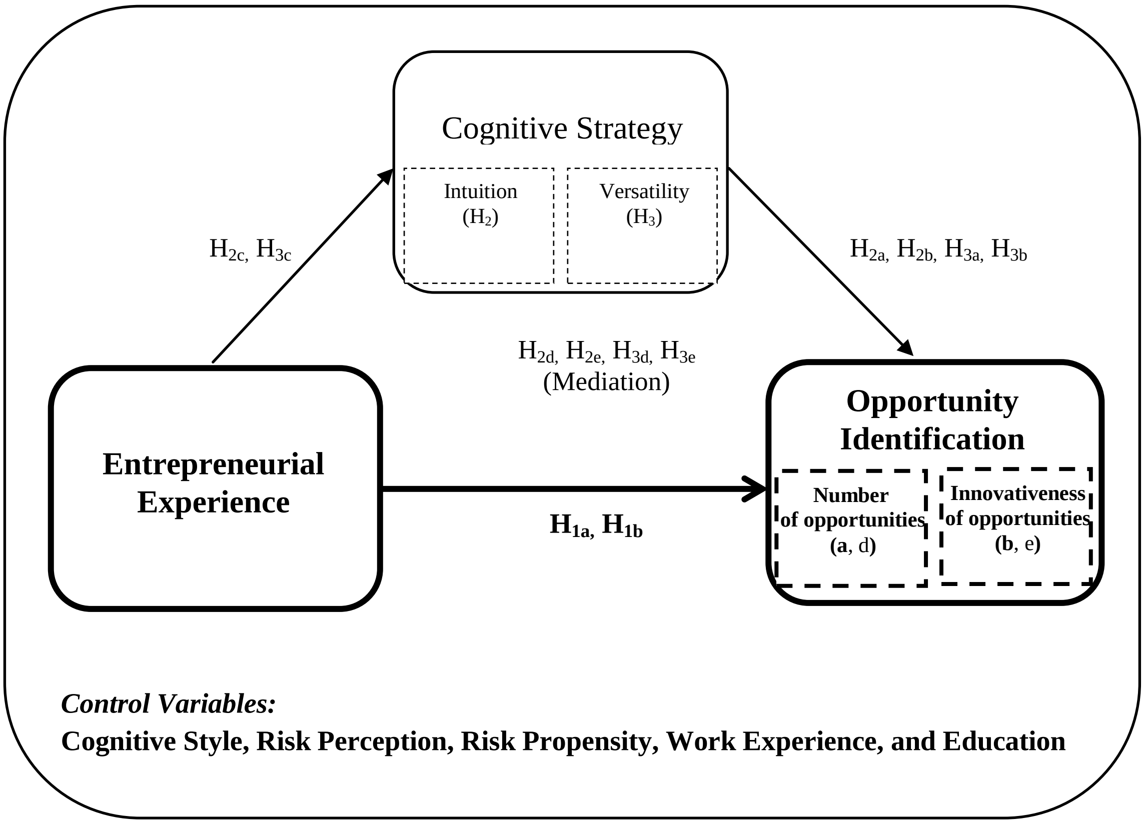
EXPERIENCE AND OPPORTUNITY IDENTIFICATION

6.1 Introduction

This chapter presents the results of the Robust Negative Binomial and Poisson Regression analyses that were carried out to test the first set of hypotheses concerning the effects of entrepreneurial experience on opportunity identification. One may recall from Chapter 3 that Hypothesis 1a (H_{1a}) predicts that entrepreneurial experience is positively associated with the number of opportunities identified, while Hypothesis 1b (H_{1b}) states that entrepreneurial experience is positively associated with the identification of opportunities that are more innovative. Figure 6.1 illustrates the section of the model being addressed in this chapter, indicated by the **bold** part of the figure.

Preliminary support for both of these hypotheses has been presented in Chapter 5, but the multivariate tests reported in this chapter were deemed necessary to provide more robust and extensive evidence concerning the nature of the hypothesised relationships, on the basis of which they may be supported (or rejected) with greater confidence.

Figure 6.1 Model Section Addressed in this Chapter: H_{1a} and H_{1b}



This chapter is organised as follows: Section 6.2 presents the results of both H_{1a} and H_{1b} with respect to the overall (aggregated) data from the three different tasks. This allows the comparison of the effects of entrepreneurial experience on opportunity identification as follows: (1) on all the opportunities identified by participants, based on the all-inclusive simple count; (2) on the 'innovative' opportunities identified by respondents, based on the more stringent count of opportunities rated ≥ 4; (3) and on the subset of 'very innovative' opportunities, namely those rated ≥ 6.

The aggregated data is then broken down into the three separate tasks and the regression analyses repeated for each one, in order to investigate whether the effect of experience on opportunity identification could vary as a function of task uncertainty. Section 6.3 presents the results for the 'all-inclusive' number of opportunities identified in each of the three tasks, while Sections 6.4.1 and 6.4.2 analyse the identification of innovative opportunities at the two specified levels of innovativeness (rated $\geq$ 4 and $\geq$ 6).

A baseline model of controls was first estimated for each of the dependent variables in the analyses, after which all the predictor variables were entered as a block to estimate the full models. As explained in Chapter 4, the control variables are rationality, experientiality, risk propensity, risk perception, number of years of formal education and number of years of general work experience. A brief commentary concerning the significant relationships that were detected between these control variables and the various dependent variables in these analyses is presented in Section 6.5. The predictor variables included in the full models are the number of years of business ownership experience and the number of businesses owned, both of which were divided into ICT-related and non-ICT-related, together with deliberate practice. All significance levels reported are based on conservative two-tailed tests. Due to the small number of the sample, significance levels up to 10% ($p < .1$) are reported, but these are flagged accordingly.

6.2 Experience and Opportunity Identification: Results Overall

Results of the Robust Negative Binomial Regressions that were carried out to test H_{1a} and H_{1b} for the overall data are presented in Table 6.1. All the models are significant and were improved as a result of adding the predictor variables. The full models were associated with lower Log Psuedolikelihoods and higher Wald Chi Squares than their respective control models.

Table 6.1 Robust Negative Binomial Regression Models for H_{1a} (higher levels of experience → identification of a larger number of opportunities) and H_{1b} (higher levels of experience → identification of opportunities that are more innovative) Overall

	Hypothesis 1a		**Hypothesis 1b**			
	DV: No. of Opportunities Identified		DV: Opportunities Rated ≥ 4		DV: Opportunities Rated ≥ 6	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:						
Rationality	0.144	-0.053	0.495†	0.238	0.682†	0.429
	[0.215]	[0.231]	[0.262]	[0.296]	[0.386]	[0.504]
Experientiality	0.273†	0.120	0.373†	0.091	0.701**	0.222
	[0.146]	[0.116]	[0.194]	[0.177]	[0.282]	[0.320]
Risk Propensity	0.133†	0.133†	0.153	0.188†	0.148	0.240
	[0.078]	[0.081]	[0.110]	[0.104]	[0.191]	[0.189]
Risk Perception	-0.105	-0.141*	-0.176	-0.143	-0.329	-0.213
	[0.091]	[0.071]	[0.141]	[0.107]	[0.236]	[0.163]
Years Education	0.085*	0.053	0.099*	0.031	0.147†	0.038
	[0.037]	[0.051]	[0.047]	[0.064]	[0.085]	[0.109]
Years Work Experience	0.015	0.016†	0.008	0.010	-0.003	0.006
	[0.010]	[0.008]	[0.017]	[0.013]	[0.026]	[0.022]
Predictor Variables:						
Years ICT Business Ownership		-0.001		0.005		0.027
		[0.011]		[0.018]		[0.029]
Years Non-ICT Business Ownership		0.010		0.004		0.068*
		[0.023]		[0.025]		[0.034]
No. of ICT Businesses Owned		0.180***		0.263***		0.357***
		[0.036]		[0.048]		[0.075]
No. of Non-ICT Businesses Owned		-0.086		0.006		0.068
		[0.077]		[0.090]		[0.100]
Deliberate Practice		0.013		-.016		-0.068
		[0.029]		[0.046]		[0.091]
Constant	-1.884	-0.346	-4.059**	-1.782	-7.047**	-4.417
	[1.177]	[0.869]	[1.585]	[1.249]	[2.491]	[2.702]
Log Pseudolikelihood	-142.472	-133.7271	-128.663	-118.906	-78.998	-67.406
Wald chi-square	23.93***	67.95***	16.82**	66.21***	11.91†	79.03***

Note: Coefficients are shown, with robust standard errors in parentheses.
†*p* < .10. **p* < .05. ***p* < .01. ****p* < .001, two-tailed.
Number of observations = 74

Of the predictor variables entered into these models, the number of ICT businesses owned was the only one that was positively and significantly associated with each of the dependent variables (p < .001), indicating that owning multiple businesses in the ICT industry significantly improves the ability of technology entrepreneurs to identify a greater number of ICT-related opportunities, as well as opportunities that are more innovative.

These results, which are in line with those of the inferential tests reported in Chapter 5, provide strong support for Hypotheses 1a and 1b which predicted that experienced entrepreneurs are more proficient at opportunity identification, both in terms of the number of opportunities identified and in terms of the innovativeness of these opportunities. Furthermore, these finding offer additional evidence that the most salient aspect of entrepreneurial experience for enhanced opportunity identification is the number of businesses owned within the target industry (i.e., in the same industry in which the opportunities are identified, which in this study was the ICT industry). Owning several businesses in different industries has no significant effect on opportunity identification in the ICT industry. As indicated in Chapter 5, the number of years of business ownership has no impact on opportunity identification, regardless of the industry in which it occurred, with one exception: The number of years of non-ICT business ownership experience emerged as a significant predictor of the identification of 'very innovative' opportunities (rated ≥ 6) overall, but the coefficient is fairly small and less significant (0.068, p < .05) than that of the number of ICT businesses owned (0.357, p < .001). This indicates that the effects of owning multiple businesses in the ICT industry outweigh those derived from the number of years of ownership experience in other sectors. No significant association was detected between deliberate practice and opportunity identification.

It is interesting to note that the coefficient for the number of ICT businesses owned increased from 0.180 ($p < .001$) for the total number of opportunities identified to 0.263 ($p < .001$) for the number of ‘innovative’ opportunities identified (rated ≥ 4), and further to 0.357 ($p < .001$) for the ‘very innovative’ (rated ≥ 6) subset. This indicates that the effects of owning multiple ICT businesses are more pronounced for the identification of opportunities that are more innovative.

The above findings are discussed further in Chapter 9. Next, H_{1a} and H_{1b} are separately explored in each of the three tasks.

6.3 Experience and Opportunity Identification: Results per Task

6.3.1 Experience and the Number of Opportunities Identified

Robust Negative Binomial Regressions were carried out to test H_{1a} in the Multi-Touch Screen and Quick-Tap tasks, while a Poisson Regression was performed to test this hypothesis in the 3D Imaging task (due to the equidispersed nature of this dependent variable as explained in Chapter 4). Results of these analyses are presented in Table 6.2.

Table 6.2 Robust Negative Binomial / Poisson Regression Models for H_{1a} (higher levels of experience → identification of a larger number of opportunities) Per Task

	Multi-Touch (Negative Binomial)		3D Imaging (Poisson)		Quick-Tap (Negative Binomial)	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:						
Rationality	0.370	0.225	-0.119	-0.290	0.237	-0.042
	[0.274]	[0.265]	[0.355]	[0.358]	[0.270]	[0.281]
Experientiality	0.335	0.117	0.229	0.127	0.307	0.137
	[0.228]	[0.211]	[0.231]	[0.232]	[0.245]	[0.201]
Risk Propensity	0.154	0.184	0.128	0.140	0.081	0.046
	[0.115]	[0.119]	[0.140]	[0.149]	[0.125]	[0.120]
Risk Perception	-0.175	-0.224†	-0.212	-0.233†	0.143	0.129
	[0.128]	[0.118]	[0.153]	[0.136]	[0.144]	[0.161]
Years Education	0.002	-0.035	0.128†	0.112	0.134†	0.103
	[0.045]	[0.051]	[0.075]	[0.085]	[0.069]	[0.064]
Years Work Experience	-0.003	-0.005	0.019	0.024	0.030*	0.031*
	[0.013]	[0.012]	[0.018]	[0.017]	[0.015]	[0.015]
Predictor Variables:						
Years ICT Business Ownership		-0.013		0.012		-0.012
		[0.019]		[0.019]		[0.020]
Years Non-ICT Business Ownership		0.020		0.004		-0.016
		[0.042]		[0.057]		[0.038]
No. of ICT Businesses Owned		0.254***		0.133†		0.171***
		[0.058]		[0.074]		[0.050]
No. of Non-ICT Businesses Owned		-0.369		0.047		-0.018
		[0.227]		[0.189]		[0.116]
Deliberate Practice		-0.049		0.064		0.019
		[0.047]		[0.057]		[0.053]
Constant	-2.320	-0.360	-2.046	-1.462	-5.499**	-3.485*
	[1.595]	[1.259]	[1.800]	[1.660]	[1.875]	[1.577]
Log Pseudolikelihood	-96.603	-90.164	-98.966	-96.327	-75.694	-72.919
Wald chi-square	9.44	32.71***	9.87	15.89	17.49**	49.11***

Note: Coefficients are shown, with robust standard errors in parentheses.
†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed.
Number of observations = 74

Focusing on the results of the three separate tasks, two of the three full models (the Multi-Touch Screen task and the Quick-Tap task) are highly significant and were improved as a result of adding the predictor variables. They were associated with lower Log Psuedolikelihoods and higher Wald Chi Squares than their respective control models.

Consistent with the overall results reported above regarding H_{1a}, the number of ICT businesses owned emerged as the sole significant predictor out of the entrepreneurial experience variables. Although the 3D Imaging model was not significant, the number of ICT businesses owned is still positively associated with the dependent variable, albeit at the .1 level of significance. These results offer additional support for Hypothesis H_{1a}.

It is interesting to note that the coefficient for the number of ICT businesses owned decreased from 0.254 ($p < .001$) for the Multi-Touch Screen task to 0.171 ($p < .001$) for the Quick-Tap task (which, as one may recall, were the ones with the highest and lowest levels of uncertainty respectively). This suggests that the effects of owning multiple ICT businesses are stronger for the identification of opportunities in high-uncertainty tasks.

6.3.2 Experience and the Innovativeness of Opportunities Identified

Results of the Robust Negative Binomial Regressions that were carried out to test H_{1b} in each of the three tasks at each of the two levels of innovativeness are presented in Tables 6.3, and 6.4. Significant results concerning the effects of experience on the identification of innovative opportunities are interpreted in the sections that follow, starting with the 'innovative' opportunities (rated ≥ 4) in Section 6.3.2.1, and followed by the subsets of 'very innovative' opportunities (rated ≥ 6) in Section 6.3.2.2.

6.3.2.1 Opportunities Rated ≥ 4

Table 6.3 demonstrates that all three full models testing the effects of entrepreneurial experience on the identification of 'innovative' opportunities on each of the three tasks are significant and were improved as a result of adding the predictor variables. They were associated with lower Log Psuedolikelihoods and higher Wald Chi Squares than their respective control models.

As expected, the number of ICT businesses owned was significantly and positively associated with the dependent variable in each of the three tasks, and was once again the sole significant predictor from among the entrepreneurial experience variables. These results offer further support for H_{1b}, as well as for the trend that is emerging very strongly in this study that owning multiple businesses in the ICT industry is the key predictor of opportunity identification (within that industry).

Table 6.3 Robust Negative Binomial Regression Models for H_{1b} (higher levels of experience → identification of opportunities that are more innovative – rated ≥ 4) Per Task

	Multi-Touch		**3D Imaging**		**Quick-Tap**	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:						
Rationality	0.822**	0.628†	-0.059	-0.321	0.748	0.286
	[0.313]	[0.325]	[0.427]	[0.492]	[0.575]	[0.756]
Experientiality	0.465†	0.190	-0.016	-0.261	0.674	0.251
	[0.267]	[0.240]	[0.272]	[0.319]	[0.453]	[0.595]
Risk Propensity	0.129	0.139	0.149	0.206	0.189	0.272
	[0.132]	[0.145]	[0.169]	[0.172]	[0.304]	[0.364]
Risk Perception	-0.271†	-0.286*	-0.160	-0.112	0.101	0.208
	[0.148]	[0.135]	[0.200]	[0.161]	[0.245]	[0.269]
Years Education	0.009	-0.048	0.114	0.062	0.250*	0.078
	[0.056]	[0.063]	[0.083]	[0.111]	[0.108]	[0.113]
Years Work Experience	-0.009	-0.012	0.006	0.017	0.042	0.049†
	[0.017]	[0.016]	[0.023]	[0.020]	[0.029]	[0.029]
Predictor Variables:						
Years ICT Business Ownership		-0.026		0.031		0.008
		[0.026]		[0.024]		[0.041]
Years Non-ICT Business Ownership		0.020		0.012		-0.223
		[0.041]		[0.059]		[0.201]
No. of ICT Businesses Owned		0.283***		0.211*		0.380*
		[0.063]		[0.085]		[0.158]
No. of Non-ICT Businesses Owned		-0.267		0.191		0.063
		[0.229]		[0.185]		[0.302]
Deliberate Practice		-0.032		0.023		-0.149
		[0.063]		[0.070]		[0.103]
Constant	-4.544*	-2.014	-1.775	-0.497	-11.783***	-6.763†
	[1.862]	[1.442]	[2.140]	[2.186]	[3.420]	[3.875]
Log Pseudolikelihood	-85.646	-80.100	-77.909	-72.377	-50.149	-43.413
Wald chi-square	13.20*	48.63***	4.30	19.90*	15.53*	47.37***

Note: Coefficients are shown, with robust standard errors in parentheses.
†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed.
Number of observations = 74

6.3.2.2 Opportunities Rated ≥ 6

With regards to the subset of opportunities which were rated as ‘very innovative’ (≥ 6 on the Likert scale), there was insufficient variation in the dependent variable for the Quick-Tap technology task, due to the small number of observations – only five out of the 74 participants identified ‘very innovative’ opportunities for this technology, causing econometrically unstable results. This dependent variable was therefore omitted from any further analyses.

Turning to the Multi-Touch Screen task and the 3D Imaging technology task, both full models are significant and were improved as a result of adding the predictor variables. They were associated with lower Log Psuedolikelihoods and higher Wald Chi Squares than their respective control models (See Table 6.4).

The results for both tasks were consistent with the overall findings, i.e., the number of ICT businesses owned was the sole significant predictor of the number of ‘very innovative’ opportunities identified.

Table 6.4 Robust Negative Binomial Regression Models for H_{1b} (higher levels of experience → identification of opportunities that are more innovative – rated ≥ 6) Per Task

	Multi-Touch		3D Imaging	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:				
Rationality	1.329**	1.167	-0.113	-0.493
	[0.499]	[0.752]	[0.446]	[0.657]
Experientiality	0.951†	0.498	0.308	-0.098
	[0.509]	[0.504]	[0.384]	[0.576]
Risk Propensity	0.263	0.203	0.049	0.104
	[0.244]	[0.264]	[0.203]	[0.197]
Risk Perception	-0.476†	-0.453†	-0.396	-0.276
	[0.282]	[0.261]	[0.273]	[0.220]
Years Education	0.095	-0.045	0.175†	0.083
	[0.118]	[0.119]	[0.101]	[0.120]
Years Work Experience	-0.011	-0.017	-0.018	-0.006
	[0.027]	[0.034]	[0.031]	[0.029]
Predictor Variables:				
Years ICT Business Ownership		-0.076		0.024
		[0.057]		[0.033]
Years Non-ICT Business Ownership		0.045		0.050
		[0.074]		[0.056]
No. of ICT Businesses Owned		0.456***		0.302**
		[0.121]		[0.100]
No. of Non-ICT Businesses Owned		0.001		0.152
		[0.308]		[0.180]
Deliberate Practice		0.000		-0.051
		[0.122]		[0.102]
Constant	-10.452**	-6.485*	-3.124	-0.381
	[3.523]	[2.999]	[3.144]	[3.685]
Log Pseudolikelihood	-41.359	-34.909	-50.950	-44.926
Wald chi-square	12.53†	67.87***	5.87	34.09***

Note: Coefficients are shown, with robust standard errors in parentheses.
†*p* < .10. **p* < .05. ***p* < .01. ****p* < .001, two-tailed.
Number of observations = 74

6.4 Control Variable Effects on Opportunity Identification

In addition to the effects of the main predictor of opportunity identification, which has emerged from the analyses reported so far as the number of ICT businesses owned, a number of significant relationships were detected between the control variables and the dependent variables in the different models. However, in contrast with the consistency of effects of the main predictor, there was little uniformity or discernible pattern in the effects of the control variables on opportunity identification in the different models, except that their explanatory power was repeatedly smaller than (or nullified by) that of the key predictor in each full model.

For example, while rationality and experientiality are positively associated with some (but not all) of the dependent variables in the baseline models, these effects became non-significant when the predictor variables were added to test the full model. This indicates that effects of cognitive style on opportunity identification are cancelled out by relevant entrepreneurial experience.

The effects of risk propensity on opportunity identification are negligible – some significant associations were detected (at the .1 level) in the full models for the overall data, but when the tests were repeated for the three separate tasks, the effect of risk propensity became non-significant.

Risk perception was associated with opportunity identification in a few of the models. Where a significant effect was found (e.g., for the number of opportunities identified overall), the relationship was negative. This indicates that high levels of risk perception may in some cases be detrimental to opportunity identification.

With regards to educational background, the number of years of formal education was positively associated with opportunity identification in a number of the baseline models tested. However, similar to what was reported above concerning rationality and experientiality, these effects became non-significant in the full models, indicating that while education may, in its own right, influence opportunity identification, its effects are cancelled out upon acquisition of the relevant entrepreneurial experience.

Finally, there was virtually no relationship between work experience and opportunity identification in the models tested, with the following exceptions: The number of years of work experience prior to starting up a business was associated with the number of opportunities identified overall (p < .1), with its effect being localised in the Quick-Tap task (p < .05), and where a (weak) positive association was also detected with respect to the identification of 'innovative' opportunities rated ≥ 4 (p < .1).

6.5 Conclusion

The results reported in this chapter, which are summarised in Table 6.5, provide strong support for both hypotheses (H_{1a} and H_{1b}) concerning the relationship between entrepreneurial experience and opportunity identification.

Table 6.5 Summary of Results: H_{1a} and H_{1b}: Experience and Opportunity Identification

		Overall	**Multi-Touch**	**3D Imaging**	**Quick-Tap**
H_{1a}:	Higher levels of experience are associated with the identification of a larger number of opportunities	✓	✓	n.s.	✓
H_{1b}:	Higher levels of experience are associated with the identification of opportunities that are more innovative	✓	✓	✓	✓
	Opportunities rated ≥ 4	✓	✓	✓	✓
	Opportunities rated ≥ 6	✓	✓	✓	n.a.

✓ = Hypothesis Supported, n.s. = Model not significant, n.a. = results not available due to insufficient variation in the dependent variable

H_{1a} was fully supported when the regression analyses were carried out on the basis of the overall data, as well as when they were repeated for the Multi-Touch Screen and Quick-Tap tasks separately. In the case of the 3D Imaging task, it was noted that although the model for H_{1a} was inadequate, a significant effect was still detected for entrepreneurial experience (in terms of the number of ICT businesses owned).

H_{1b} was also fully supported for the overall data, as well as for each of the tasks, at both specified levels of innovativeness. In other words, significant effects for entrepreneurial experience were consistently detected both with respect to the identification of 'innovative' opportunities (rated ≥ 4) and for the identification of 'very innovative' opportunities (rated ≥ 6), thus providing full support for H_{1b}.

In all the models reported in this chapter, the significant positive effects of entrepreneurial experience on opportunity identification may be attributed to the number of industry-specific businesses owned, relative to the sector in which the opportunities are identified (in this case the ICT industry). Apparently, the number of years of business ownership (industry-related or otherwise) and the number of businesses owned in other sectors are not associated with superior opportunity identification.

With regards to variations in the effect of entrepreneurial experience on opportunity identification according to task uncertainty, there was some indication that the effects of owning multiple ICT businesses on the identification of a greater number of opportunities may be stronger for high-uncertainty tasks, as seen by the larger coefficient and higher significance level for the Multi-Touch Screen task (see Section 6.3.1). However, this pattern did not hold when the analyses were carried out on the different subsets of innovative opportunities, so results in this respect are inconclusive.

In view of the results of the bivariate analyses reported in Chapter 5, and more importantly, on the basis of the robust results of the multivariate analyses presented in this chapter, it may confidently be concluded that habitual entrepreneurs who own or have owned multiple businesses in the ICT industry are more proficient at identifying a greater number of (ICT-related) opportunities, and that these opportunities are more innovative than those identified by less or differently experienced counterparts.

CHAPTER 7

ROBUST MODEL TESTING PART 2:

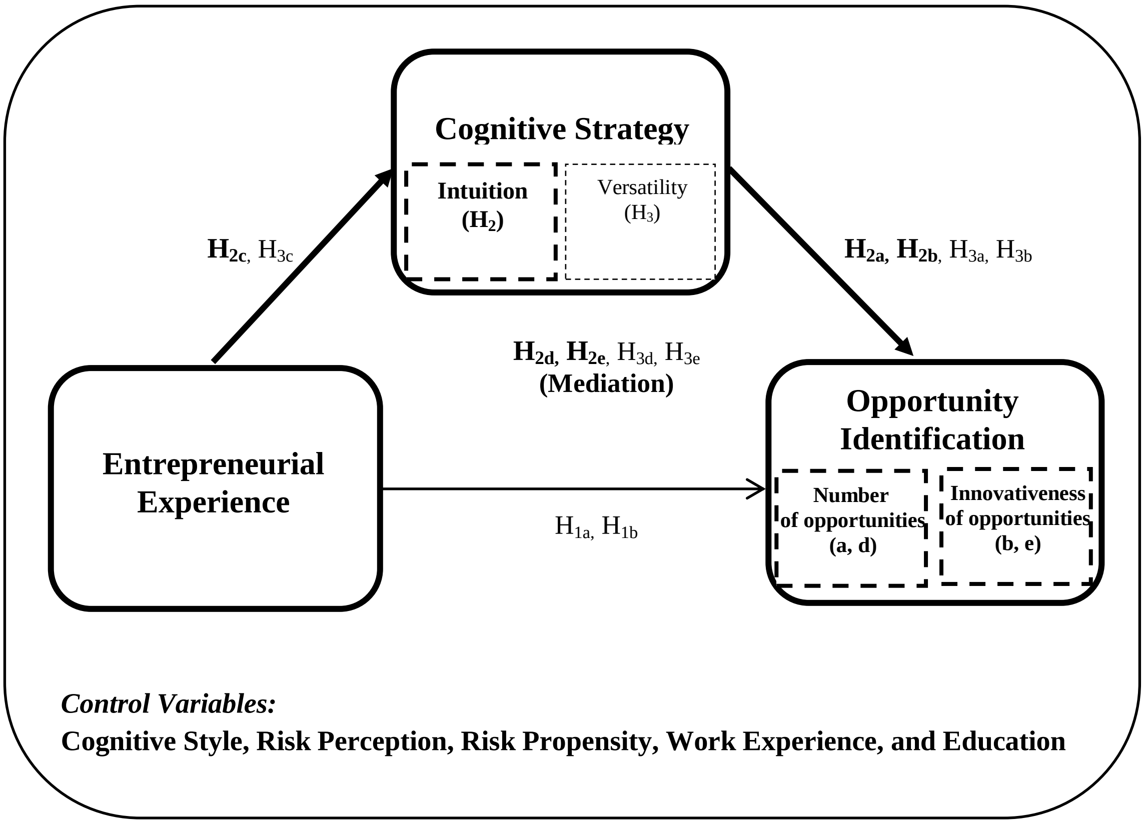
INTUITION, EXPERIENCE AND OPPORTUNITY IDENTIFICATION

7.1 Introduction

This chapter presents the results of the Robust Negative Binomial Regressions, Poisson Regressions, and Mediation Analyses that were carried out to test the second set of hypotheses, which concern the relationship between intuition, entrepreneurial experience and opportunity identification. As outlined in Chapter 3, Hypothesis 2a (H_{2a}) predicts that intuition is positively associated with the number of opportunities identified, while Hypothesis 2b (H_{2b}) states that intuition is positively associated with the identification of innovative opportunities. Hypothesis 2c (H_{2c}) concerns the effect of entrepreneurial experience on intuition, and predicts that experienced entrepreneurs will engage in a greater amount of intuitive processing in opportunity identification than their inexperienced counterparts. Hypotheses 2d (H_{2d}) and 2e (H_{2e}) argue that intuition mediates the relationship between entrepreneurial experience and opportunity identification, with H_{2d} being concerned with the number of opportunities identified and H_{2e} with the innovativeness of opportunities identified.

While preliminary support for H_{2c} was provided in the inferential test results reported in Chapter 5, the other four hypotheses in this second set have not yet been explored. The multivariate tests reported in this chapter shall provide robust evidence concerning the nature of the hypothesised relationships, upon which claims for their acceptance (or rejection) may be made with greater confidence. Figure 7.1 illustrates the sections of the model being addressed in this chapter, indicated by the **bold** parts of the figure.

Figure 7.1 Model Sections Addressed in this Chapter: H_{2a} to H_{2e}



This chapter is organised as follows: Section 7.2 presents the results of each of the five hypotheses in this second set (H_{2a} to H_{2e}) with respect to the aggregated data in order to seek overall support for these hypotheses. Section 7.2.1 reports the results of the regression analyses performed to test H_{2a} and H_{2b} concerning the effects of intuition on opportunity identification. The presentation of results in this section mirrors that in Chapter 6, Section 6.2, in that the models representing the total number of opportunities identified and the two subsets of innovative opportunities (rated ≥ 4, and rated ≥ 6) are presented alongside one another to facilitate comparison of the effects of intuition on the identification of opportunities that vary in their levels of innovativeness. Section 7.2.2 then reports the analyses of the effects of entrepreneurial experience on the use of intuition in opportunity identification overall. This section is straightforward as there is only one dependent variable (number of intuitive segments). Section 7.2.3 explores the mediating role of intuition in the relationship between experience and opportunity identification. The same three dependent variables representing the number and innovativeness of opportunities identified are used here as in Section 7.2.1, so the same structure is adopted to present these results.

Once the overall results of these five hypotheses have been presented, the aggregated data are broken down into the three separate tasks, and the findings related to each of the hypotheses are reported for each task in parallel in the various subsections of Section 7.3. This will shed light on whether the overall results hold in the three separate tasks and if there is any systematic variation in results that could be due to the differences in task uncertainty.

For each of the tests carried out, a baseline model of controls was first estimated before the predictor variables were entered as a block to estimate the full models. The control variables used are the same as those reported in Chapter 6 with regards to H_{1a} and H_{1b}. The relationships between these control variables and the various dependent variables in this second set of hypotheses are briefly noted in Section 7.4. The predictor variables included in the full models in this chapter vary according to which hypothesis is being tested and will be noted in the relevant sections below. Similar to the results reported in the previous chapters, all significance levels reported in this chapter are based on conservative two-tailed tests. Due to the small size of the sample, significance levels up to 10% ($p < .1$) are reported, but these are flagged accordingly.

7.2 Intuition, Experience and Opportunity Identification: Results Overall

As outlined above, the following sections present the results of H_{2a} to H_{2e} with respect to the aggregated data in order to seek overall support for these hypotheses.

7.2.1 Intuition and Opportunity Identification

Results of the Robust Negative Binomial Regressions that were carried out to test H_{2a} and H_{2b} for the overall data are presented in Table 7.1. All the models are significant and were improved as a result of adding the predictor variables. The full models were associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than their respective control models.

The predictor variables in these models were the total (overall) number of intuitive and analytical segments generated by participants in the protocol analysis tasks. A positive and significant relationship was detected between intuition and the number of opportunities identified ($p < .001$), thus providing supporting evidence for H_{2a}. Intuition was also found to be a significant predictor of the number of 'innovative' opportunities identified (rated $\geq$ 4), but not of the 'very innovative' opportunities (rated $\geq$ 6). Therefore H_{2b} is partially supported. Interestingly, analysis comes through as a significant predictor of the 'very innovative' opportunities identified, albeit at the .1 level of significance.

Table 7.1 Robust Negative Binomial Regression Models for H_{2a} (greater use of intuition → identification of a larger number of opportunities) and H_{2b} (greater use of inuition → identification of opportunities that are more innovative) Overall

	Hypothesis 2a		**Hypothesis 2b**			
	DV: No. of Opportunities Identified		DV: Opportunities Rated ≥ 4		DV: Opportunities Rated ≥ 6	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:						
Rationality	0.144	0.005	0.495†	0.239	0.682†	0.525
	[0.215]	[0.166]	[0.262]	[0.204]	[0.386]	[0.333]
Experientiality	0.273†	0.194†	0.373†	0.168	0.701**	0.294
	[0.146]	[0.108]	[0.194]	[0.144]	[0.282]	[0.261]
Risk Propensity	0.133†	0.035	0.153	-0.051	0.148	-0.136
	[0.078]	[0.073]	[0.110]	[0.111]	[0.191]	[0.178]
Risk Perception	-0.105	-0.161†	-0.176	-0.284*	-0.329	-0.562*
	[0.091]	[0.091]	[0.141]	[0.126]	[0.236]	[0.236]
Years Education	0.085*	0.051	0.099*	0.030	0.147†	0.064
	[0.037]	[0.034]	[0.047]	[0.046]	[0.085]	[0.081]
Years Work Experience	0.015	0.004	0.008	-0.013	-0.003	-0.032
	[0.010]	[0.010]	[0.017]	[0.015]	[0.026]	[0.024]
Model Variables:						
No. of Intuition Segments		0.021***		0.035***		0.025
		[0.007]		[0.010]		[0.016]
No. of Analysis Segments		-0.002		0.002		0.023†
		[0.005]		[0.009]		[0.012]
Constant	-1.884	-0.663	-4.059**	-1.501	-7.047**	-3.725
	[1.177]	[0.978]	[1.585]	[1.441]	[2.491]	[2.411]
Log Pseudolikelihood	-142.472	-135.183	-128.663	-117.619	-78.998	-71.264
Wald chi-square	23.93***	38.15***	16.82**	62.24***	11.91†	33.02***

Note: Coefficients are shown, with robust standard errors in parentheses.
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed.
Number of observations = 74

7.2.2 Intuition and Experience

Results of the Robust Negative Binomial Regressions that tested H_{2c} with respect to the overall data are presented in Table 7.2. The model is significant and was improved as a result of adding the predictor variables. The full model was associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than its control model.

Table 7.2 Robust Negative Binomial Regression Models for H_{2c} (higher levels of experience → greater use of intuition) Overall

	DV: No. of Intuition Segments	
	coeff. [SE]	coeff. [SE]
Control Variables:		
Rationality	0.158	0.045
	[0.112]	[0.104]
Experientiality	0.097	0.020
	[0.112]	[0.099]
Risk Propensity	0.130*	0.131*
	[0.054]	[0.055]
Risk Perception	0.042	0.006
	[0.052]	[0.045]
Years Education	0.057*	0.046*
	[0.023]	[0.021]
Years Work Experience	0.013	0.014*
	[0.007]	[0.006]
Model Variables:		
Years ICT Business Ownership		0.008
		[0.006]
Years Non-ICT Business Ownership		-0.010
		[0.009]
No. of ICT Businesses Owned		0.097***
		[0.024]
No. of Non-ICT Businesses Owned		-0.016
		[0.047]
Deliberate Practice		0.044*
		[0.021]
Constant	0.994	1.535*
	[0.779]	[0.649]
Log Pseudolikelihood	-291.954	-283.447
Wald chi-square	24.40***	110.00***

Note: Coefficients are shown, with robust standard errors in parentheses.
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed.
Number of observations = 74

The predictors in this model were the same experience-based variables as those in the H_{1a} and H_{1b} models reported in Chapter 6. Of these, the number of ICT businesses owned was positively and significantly associated with the dependent variable ($p < .001$), thus providing support for H_{2c} which predicted that experienced entrepreneurs will use intuition to a greater extent than their inexperienced counterparts. In this model, deliberate practice was also positively and significantly related to the dependent variable, although the coefficient was smaller and less significant (0.044, $p < .05$) than that of the number of ICT businesses owned (0.097, $p < .001$).

These results indicate that the number of ICT businesses owned is the most important predictor not only of opportunity identification but also of the use of intuition. However, intuition can also be enhanced by engaging in deliberate practice, as suggested by the significant positive relationship detected between these two variables in this model.

7.2.3 Intuition as a Mediator between Experience and Opportunity Identification

Results of the Bootstrapped Mediation Analyses that were carried out using the 'PROCESS' Macro for SPSS (Hayes, 2012) to test H_{2d} and H_{2e} for the overall data are presented in Table 7.3. As explained in Chapter 4, this technique involves the estimation of indirect effects of an independent variable on a dependent variable through a mediator. Since H_{2d} and H_{2e} concern the role of intuition as a mediator between experience and opportunity identification, the independent variable in these mediation models was specified as the number of ICT businesses owned (since the regression analyses reported above indicate that this is the key predictor of opportunity identification), the mediator was the number of intuition segments generated by participants in all three protocol analysis tasks, and the dependent variables were the three overall measures of opportunity identification adopted in this study, namely the number of opportunities identified, the number of ‘innovative’ opportunities identified (rated $\geq$ 4), and the number of ‘very innovative’ opportunities identified (rated $\geq$ 6). All the controls and independent variables which were entered into the regression analyses reported in Chapter 6 and in Sections 7.2.1 and 7.2.2 were also included in the mediation models to ensure that all possible inter-relationships between predictors are accounted for, however they are not reported below as the focus here is on establishing whether or not an indirect (mediation) effect exists between experience and opportunity identification through intuition.

In contrast to traditional mediation techniques (e.g., Baron & Kenny, 1986), inferences about indirect effects (i.e., about mediation) are based “not on the statistical significance of the paths that define it ... but, rather, on an explicit quantification of the indirect effect itself” (Hayes, 2012, p. 13). In this view, mediation effects are reported when the indirect effects are significantly different from zero. In turn, this claim can be made if the 95% upper and lower bias-corrected bootstrap confidence intervals produced in the analyses exclude the possibility of the indirect being zero: “if zero is not between the lower and upper bound, then the analyst can claim that the indirect effect is not zero with *ci*% confidence (Hayes, 2009, p. 412). In view of the above, *p* values are not shown for the Indirect Model Estimates in Table 7.3 in favour of the Bootstrapped Lower Level Confidence Intervals (LLCI) and Upper Level Confidence Intervals (ULCI) at 95% level of confidence.

Table 7.3 Mediation Analysis Models for H_{2d} (intuition mediates the relationship between experience and the number of opportunities identified) and H_{2e} (intuition mediates the relationship between experience and the innovativeness of opportunities identified) Overall

	Effect of X on M Coeff [SE]	Direct Effect of X on Y Coeff [SE]	Total Effect of X on Y coeff [SE]	Indirect Effect of X on Y with Bootstrapped Estimates coeff [Boot SE]	Boot LLCI	Boot ULCI
Model: No. of Opportunities Identified						
Constant	-28.469	0.109	-0.995			
	[21.433]	[2.893]	[2.949]			
No. of Intuition Segments		0.039*				
		[0.017]				
No. of ICT Businesses Owned	3.868***	0.535***	0.685***	0.150	0.002	0.404
	[1.068]	[0.157]	[0.147]	[0.098]		
R Squared	0.440	0.447	0.399			
F	4.433***	4.106***	3.744***			
Model: Opportunities Identified Rated ≥ 4						
Constant	-28.469	0.660	-0.831			
	[21.433]	[2.386]	[2.589]			
No. of Intuition Segments		0.052***				
		[0.014]				
No. of ICT Businesses Owned	3.868***	0.575***	0.778***	0.203	0.079	0.445
	[1.068]	[0.129]	[0.129]	[0.086]		
R Squared	0.440	0.574	0.475			
F	4.433***	6.844***	5.103***			
Model: Opportunities Identified Rated ≥ 6						
Constant	-28.469	0.493	-0.030			
	[21.433]	[1.476]	[1.496]			
No. of Intuition Segments		0.018*				
		[0.009]				
No. of ICT Businesses Owned	3.868***	0.388***	0.459***	0.071	-0.005	0.215
	[1.068]	[0.080]	[0.075]	[0.052]		
R Squared	0.440	0.520	0.484			
F	4.433***	5.506***	5.291***			

Notes: Coefficients are shown, with standard errors in parentheses. These represent the full models including all the control variables listed below. For the full results please refer to Tables I1, I2 and I3 in Appendix I.

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed;

Zero falls outside the LLCI and ULCI range in two of the three models reported in Table 7.3, which indicates the following: Intuition mediates the relationship between entrepreneurial experience (number of ICT businesses owned) and opportunity identification with respect to the number of opportunities identified, and the 'innovative' opportunities identified (rated ≥ 4). No mediation was detected where the identification of 'very innovative' opportunities (rated ≥ 6) is concerned.

These results offer support for both H_{2d} and H_{2e}, although reservations apply with regards to H_{2e} as the mediation effects of intuition between experience and the identification of innovative opportunities are limited to those rated ≥ 4.

7.3 Intuition, Experience and Opportunity Identification: Results per Task

The next sections report the results of the analyses that were carried out to test H_{2a} to H_{2e} in each of the three separate tasks in order to determine whether there could be any variation in the hypothesised relationships due to differences in task uncertainty.

7.3.1 Intuition and the Number of Opportunities Identified

Robust Negative Binomial Regressions were carried out to test H_{2a} in the Multi-Touch Screen and Quick-Tap tasks, while a Poisson Regression was performed to test this hypothesis in the 3D Imaging task (due to the equidispersed nature of this dependent variable as explained in Chapter 4). Results of these analyses are presented in Table 7.4.

Table 7.4 Robust Negative Binomial / Poisson Regression Models for H_{2a} (greater use of intuition → identification of a larger number of opportunities) Per Task

	Multi-Touch (Negative Binomial)		**3D Imaging (Poisson)**		**Quick-Tap (Negative Binomial)**	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:						
Rationality	0.370	0.059	-0.119	0.072	0.237	0.048
	[0.274]	[0.243]	[0.355]	[0.183]	[0.270]	[0.229]
Experientiality	0.335	0.204	0.229	0.019	0.307	0.333†
	[0.228]	[0.183]	[0.231]	[0.191]	[0.245]	[0.188]
Risk Propensity	0.154	-0.063	0.128	0.018	0.081	0.042
	[0.115]	[0.133]	[0.140]	[0.128]	[0.125]	[0.100]
Risk Perception	-0.175	-0.190	-0.212	-0.245	0.143	0.016
	[0.128]	[0.128]	[0.153]	[0.155]	[0.144]	[0.147]
Years Education	0.002	0.010	0.128†	-0.012	0.134†	0.096
	[0.045]	[0.047]	[0.075]	[0.063]	[0.069]	[0.062]
Years Work Experience	-0.003	-0.013	0.019	0.009	0.030*	0.013
	[0.013]	[0.012]	[0.018]	[0.018]	[0.015]	[0.014]
Model Variables:						
No. of Intuition Segments		0.068***		0.096***		0.057**
		[0.017]		[0.016]		[0.018]
No. of Analysis Segments		-0.012		-0.014		-0.009
		[0.022]		[0.019]		[0.019]
Constant	-2.320	-0.897	-2.046	-0.430	-5.499**	-4.061**
	[1.595]	[1.412]	[1.800]	[1.492]	[1.875]	1.359
Log Pseudolikelihood	-96.603	-90.061	-98.966	-89.033	-75.694	-71.131
Wald chi-square	9.44	48.61***	9.87	186.97***	17.49**	105.96***

Note: Coefficients are shown, with robust standard errors in parentheses.
†*p* < .10. **p* < .05. ***p* < .01. ****p* < .001, two-tailed.
Number of observations = 74

All three full models in Table 7.4 are highly significant and were improved as a result of adding the predictor variables. They were associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than their respective control models. Consistent with the overall results reported above regarding H_{1a}, a positive and significant relationship was detected between intuition and the number of opportunities identified in each of the three tasks (p < .001 for the Multi-Touch Screen and 3D Imaging tasks and p < .01 for the Quick-Tap task), thus providing full support for H_{2a}. Throughout the study, elevated intuitive processing led to the identification of a greater number of opportunities.

7.3.2 Intuition and the Innovativeness of Opportunities Identified

Results of the Robust Negative Binomial Regressions that were carried out to test H_{2b} in each of the three tasks at both levels of innovativeness are presented in Tables 7.5 and 7.6. Significant results concerning the effects of intuition on the identification of innovative opportunities are interpreted in the sections that follow, starting with the 'innovative' opportunities (rated ≥ 4) in Section 7.3.2.1, followed by the subset of 'very innovative' opportunities (rated ≥ 6) in Section 7.3.2.2.

7.3.2.1 Opportunities Rated ≥ 4

As seen in Table 7.5, all three full models testing the effects of intuition on the identification of 'innovative' opportunities (rated ≥ 4) on each of the three tasks are highly significant and were improved as a result of adding the predictor variables. They were associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than their respective control models. The number of intuition segments was significantly and positively associated with the dependent variable in each of the three tasks (p < .001 for the Multi-Touch Screen and 3D Imaging task, and p < .01 for the Quick-Tap task), thus providing further support for H_{2b}.

Table 7.5 Robust Negative Binomial Regression Models for H_{2b} (greater use of intuition → identification of opportunities that are more innovative – rated ≥ 4) Per Task

	Multi-Touch		**3D Imaging**		**Quick-Tap**	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:						
Rationality	0.822**	0.375	-0.059	0.198	0.748	0.263
	[0.313]	[0.273]	[0.427]	[0.260]	[0.575]	[0.521]
Experientiality	0.465†	0.293	-0.016	-0.316	0.674	0.799
	[0.267]	[0.225]	[0.272]	[0.229]	[0.453]	[0.504]
Risk Propensity	0.129	-0.182	0.149	0.003	0.189	0.014
	[0.132]	[0.155]	[0.169]	[0.160]	[0.304]	[0.198]
Risk Perception	-0.271†	-0.312*	-0.160	-0.251	0.101	-0.350†
	[0.148]	[0.150]	[0.200]	[0.224]	[0.245]	[0.209]
Years Education	0.009	0.027	0.114	-0.065	0.250*	0.091
	[0.056]	[0.060]	[0.083]	[0.066]	[0.108]	[0.102]
Years Work	-0.009	-0.024	0.006	-0.010	0.042	-0.014
Experience	[0.017]	[0.016]	[0.023]	[0.023]	[0.029]	[0.027]
Model Variables:						
No. of Intuition		0.100***		0.104***		0.122**
Segments		[0.020]		[0.019]		[0.041]
No. of Analysis		-0.032		0.008		0.012
Segments		[0.025]		[0.026]		[0.040]
Constant	-4.544*	-2.555	-1.775	0.493	-11.783***	-6.951*
	[1.862]	[1.697]	[2.140]	[1.873]	[3.420]	[2.909]
Log Pseudolikelihood	-85.646	-76.251	-77.909	-68.140	-50.149	-39.471
Wald chi-square	13.20**	69.35***	4.30	97.20***	15.53*	110.39***

Note: Coefficients are shown, with robust standard errors in parentheses.
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed.
Number of observations = 74

7.3.2.2 Opportunities Rated ≥ 6

Turning to the subset of opportunities which were rated as 'very innovative' (≥ 6 on the Likert scale), it was explained in Section 6.3.2.2 that the dependent variable for the Quick-Tap technology was leading to unstable results and was therefore dropped from further analyses. With regards to the Multi-Touch Screen and the 3D Imaging tasks, both full models are significant and were improved as a result of adding the predictor variables. They were associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than their respective control models (See Table 7.6).

As one may recall from Section 7.2.1, no significant relationship was detected between intuition and the identification of 'very innovative' opportunities overall. The regression analyses that were carried out to explore this relationship in each of the two tasks reveal that this non-significant result was determined primarily by the 3D Imaging task, where intuition did not significantly predict the dependent variable. However, a significant association was detected in the Multi-Touch Screen task ($p < .01$). Therefore while the overall results indicated that intuition does not predict the identification of 'very innovative' opportunities, these findings suggest that this may depend on the nature of the task. In high-uncertainty tasks (represented in this study by the Multi-Touch screen), intuition does appear to be associated with the identification of significantly more 'very innovative' opportunities. In moderate uncertainty task (represented in this study by the 3D Imaging technology) the positive effects of intuition are absent.

Table 7.6 Robust Negative Binomial Regression Models for H_{2b} (greater use of intuition → identification of opportunities that are more innovative – rated ≥ 6) Per Task

	Multi-Touch		**3D Imaging**	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:				
Rationality	1.329**	0.856*	-0.113	0.211
	[0.499]	[0.407]	[0.446]	[0.438]
Experientiality	0.951†	0.465	0.308	-0.011
	[0.509]	[0.459]	[0.384]	[0.370]
Risk Propensity	0.263	-0.486	0.049	-0.103
	[0.244]	[0.295]	[0.203]	[0.225]
Risk Perception	-0.476†	-0.753*	-0.396	-0.651†
	[0.282]	[0.316]	[0.273]	[0.392]
Years Education	0.095	0.077	0.175†	0.043
	[0.118]	[0.098]	[0.101]	[0.101]
Years Work Experience	-0.011	-0.042	-0.018	-0.042
	[0.027]	[0.027]	[0.031]	[0.033]
Model Variables:				
No. of Intuition Segments		0.111**		0.044
		[0.042]		[0.028]
No. of Analysis Segments		0.060†		0.065*
		[0.033]		[0.030]
Constant	-10.452**	-6.237*	-3.124	-0.995
	[3.523]	[2.928]	[3.144]	2.705
Log Pseudolikelihood	-41.359	-32.396	-50.950	-46.076
Wald chi-square	12.53†	126.07***	5.87	39.92***

Note: Coefficients are shown, with robust standard errors in parentheses.
†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed.
Number of observations = 74

It is interesting to note that analysis was found to be a significant predictor of the 'very innovative' opportunities identified in the moderately uncertain task (3D imaging, $p < .05$), and to a lesser extent in the high uncertainty task (Multi-Touch Screen, $p < .1$). The role of analysis in opportunity identification will be considered in the next set of hypotheses concerning cognitive versatility, so further comments would be premature at this stage.

In summary, the above analyses provide adequate support for the hypothesis that intuition is positively associated with the identification of innovative opportunities (H_{2b}), although some reservations (concerning the level of innovativeness of opportunities and the degree of uncertainty associated with the task) apply.

7.3.3 Intuition and Experience

Results of the Robust Negative Binomial Regressions that were carried out to test H_{2c} in each of the three tasks are presented in Table 7.7. All models are significant and were improved as a result of adding the predictor variables. The full models were associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than their respective control models.

Consistent with the overall results reported in Section 7.2.2, the number of ICT businesses owned was positively and significantly associated with the dependent variable in each of the three separate tasks ($p < .01$ in the Multi-Touch Screen and 3D Imaging tasks, and $p < .001$ in the Quick-Tap task), thus providing full support for H_{2c} which predicted that experienced entrepreneurs will use intuition to a greater extent than their inexperienced counterparts.

Table 7.7 Robust Negative Binomial Regression Models for H_{2c} (higher levels of experience → greater use of intuition) Per Task

	Multi-Touch		**3D Imaging**		**Quick-Tap**	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:						
Rationality	0.300*	0.198	0.040	-0.070	0.117	-0.032
	[0.125]	[0.122]	[0.188]	[0.170]	[0.119]	[0.126]
Experientiality	0.210	0.149	0.131	0.065	-0.011	-0.143
	[0.137]	[0.131]	[0.146]	[0.124]	[0.128]	[0.115]
Risk Propensity	0.194**	0.202**	0.091†	0.096†	0.083	0.073
	[0.064]	[0.069]	[0.052]	[0.057]	[0.070]	[0.067]
Risk Perception	-0.026	-0.092	0.057	0.006	0.099	0.094
	[0.064]	[0.063]	[0.065]	[0.056]	[0.064]	[0.061]
Years Education	0.023	0.015	0.101***	0.099***	0.050†	0.018
	[0.028]	[0.028]	[0.031]	[0.030]	[0.029]	[0.028]
Years Work Experience	0.008	0.009	0.013†	0.016**	0.018†	0.018*
	[0.008]	[0.007]	[0.007]	[0.006]	[0.010]	[0.009]
Model Variables:						
Years ICT Business Ownership		0.007		0.014*		0.002
		[0.008]		[0.007]		[0.009]
Years Non-ICT Business Ownership		-0.035†		0.037		-0.028
		[0.019]		[0.024]		[0.017]
No. of ICT Businesses Owned		0.094**		0.082**		0.137***
		[0.031]		[0.028]		[0.040]
No. of Non-ICT Businesses Owned		-0.085		-0.107		0.082
		[0.097]		[0.076]		[0.068]
Deliberate Practice		0.047†		0.065*		0.019
		[0.024]		[0.027]		[0.027]
Constant	-0.308	0.233	-0.499	-0.242	0.356	1.540†
	[0.810]	[0.698]	[1.012]	[0.875]	[0.941]	0.870
Log Pseudolikelihood	-229.455	-221.538	-213.180	-204.650	-226.557	-219.776
Wald chi-square	18.46**	76.17***	36.99***	101.95***	13.71*	47.82***

Note: Coefficients are shown, with robust standard errors in parentheses.
†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed.
Number of observations = 74

Additional significant effects of other experience-based predictors were detected in the three separate tasks as follows: In two of the models, deliberate practice was positively related to the dependent variable (Multi-Touch Screen, $p < .1$; 3D Imaging, $p < .05$); in one model, the number of years of ICT business ownership experience emerged as a significant predictor (3D Imaging, $p < .05$); and in another model, the number of years of non-ICT business ownership experience was negatively associated with intuition ($p < .1$). In all these relationships, the coefficients were smaller and less significant than those of the number of ICT businesses owned in their respective models.

These results provide additional evidence that the number of ICT businesses owned is the most important predictor not only of opportunity identification but also of intuitive processing. Deliberate practice and, in some cases the number of years of ICT business ownership experience, may also contribute to greater use of intuition, but since their effects were rather sporadic across the tasks, these particular findings are inconclusive.

7.3.4 Intuition as a Mediator between Experience and the Number of Opportunities Identified

Results of the Bootstrapped Mediation Analyses which were carried out to test H_{2d} in each of the separate tasks are presented in Table 7.8. As explained in Section 7.2.3 above, mediation can be inferred if the 95% upper and lower bias-corrected bootstrap confidence intervals produced in the analyses exclude the possibility of the indirect effect being zero (Hayes, 2009). Consistent with the overall results, this criterion was met in each of the three separate tasks, thus providing full support for H_{2d}: Throughout the study, the use of intuition mediated the relationship between experience (number of ICT businesses owned) and the number of opportunities identified.

Table 7.8 Mediation Analysis Models for H_{2d} (intuition mediates the relationship between experience and the number of opportunities identified) Per Task

	Effect of X on M	Direct Effect of X on Y	Total Effect of X on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	coeff [Boot SE]	Boot LLCI	Boot ULCI
Model: Multi-Touch						
Constant	-13.983 [9.805]	1.322 [1.620]	0.314 [1.732]			
No. of Intuition Segments		0.072*** [0.021]				
No. of ICT Businesses Owned	1.118* [0.489]	0.202* [0.083]	0.282** [0.086]	0.081 [0.042]	0.019	0.196
R Squared	0.348	0.371	0.246			
F	3.007**	3.002**	1.835†			
Model: 3D Imaging						
Constant	-14.058 [8.575]	2.486 [1.987]	0.457 [2.293]			
No. of Intuition Chunks		0.144*** [0.029]				
No. of ICT Businesses Owned	0.988* [0.427]	0.050 [0.101]	0.192† [0.114]	0.143 [0.074]	0.044	0.355
R Squared	0.371	0.406	0.162			
F	3.321***	3.478***	1.091			
Model: Quick-Tap						
Constant	-0.429 [10.167]	-1.743 [1.137]	-1.766 [1.252]			
No. of Intuition Segments		0.054*** [0.014]				
No. of ICT Businesses Owned	1.762*** [0.507]	0.117† [0.062]	0.211*** [0.062]	0.094 [0.052]	0.015	0.238
R Squared	0.348	0.453	0.325			
F	3.003**	4.202***	2.717**			

Notes: Coefficients are shown, with standard errors in parentheses. These represent the full models including all the control variables listed below. For the full results please refer to Tables I4, I5 and I6 in Appendix I.

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed;

7.3.5 Intuition as a Mediator between Experience and the Identification of Innovative Opportunities

Results of the Bootstrapped Mediation Analyses, which were carried out to test H_{2e} in each of the three tasks at the two levels of innovativeness, are presented in Tables 7.9 and 7.10. Significant mediation effects for intuition in the relationship between experience and the identification of opportunities that are more innovative are reported in the sections that follow, starting with the ‘innovative’ opportunities (rated ≥ 4) in Section 7.3.5.1, and followed by the subset of ‘very innovative’ opportunities (rated ≥ 6) in Section 7.3.5.2.

7.3.5.1 Opportunities Rated ≥ 4

As shown in Table 7.9, the LLCI and ULCI of each of the three separate tasks indicate that the bootstrapped estimates of their respective indirect effects are significantly different from zero. This reflects the overall results concerning the mediation effects of intuition on the identification of ‘innovative’ opportunities, and thus providing additional evidence in support of H_{2d}. Throughout the study, intuition mediated the relationship between experience (number of ICT businesses owned) and the identification of ‘innovative’ opportunities (rated ≥ 4).

Table 7.9 Mediation Analysis Models for H_{2e} (intuition mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 4) Per Task

	Effect of X on M	Direct Effect of X on Y	Total Effect of X on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	coeff [Boot SE]	Boot LLCI	Boot ULCI
Model: Multi-Touch						
Constant	-13.983	0.410	-0.750			
	[9.805]	[1.443]	[1.626]			
No. of Intuition Segments		0.083***				
		[0.018]				
No. of ICT Businesses Owned	1.118*	0.185*	0.278***	0.093	0.024	0.219
	[0.489]	[0.074]	[0.081]	[0.047]		
R Squared	0.348	0.466	0.287			
F	3.007**	4.428***	2.271*			
Model: 3D Imaging						
Constant	-14.058	2.942*	1.480			
	[8.575]	[1.443]	[1.661]			
No. of Intuition Chunks		0.104***				
		[0.021]				
No. of ICT Businesses Owned	0.988*	0.117	0.220**	0.103	0.040	0.261
	[0.427]	[0.073]	[0.083]	[0.049]		
R Squared	0.371	0.440	0.213			
F	3.321***	3.996***	1.529			
Model: Quick-Tap						
Constant	-0.429	-1.533	-1.561			
	[10.167]	[0.950]	[1.159]			
No. of Intuition Segments		0.066***				
		[0.012]				
No. of ICT Businesses Owned	1.762***	0.163**	0.280***	0.117	0.033	0.268
	[0.507]	[0.052]	[0.058]	[0.055]		
R Squared	0.348	0.605	0.402			
F	3.003**	7.788***	3.792***			

Notes: Coefficients are shown, with standard errors in parentheses. These represent the full models including all the control variables listed below. For the full results please refer to Tables I7, I8 and I9 in Appendix I.

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

7.3.5.2 Opportunities Rated ≥ 6

Turning to the identification of 'very innovative' opportunities, mediation is present in both the models which were tested, namely the Multi-Touch Screen and the 3D Imaging Tasks. In other words, the bootstrapped estimates of indirect effects are significantly different from zero (as evidenced by the 95% ULCI and LLC) in these two tasks. As explained earlier in this chapter, the analyses were not run for the Quick-Tap technology at this level of innovativeness, due to insufficient variation in the dependent variable.

Table 7.10 Mediation Analysis Models for H_{2e} (intuition mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 6) Per Task

	Effect of X on M	Direct Effect of X on Y	Total Effect of X on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	coeff [Boot SE]	Boot LLCI	Boot ULCI
Model: Multi-Touch						
Constant	-13.983	0.115	-0.554			
	[9.805]	[0.717]	[0.842]			
No. of Intuition Segments		0.048***				
		[0.009]				
No. of ICT Businesses Owned	1.118*	0.116**	0.169***	0.054	0.015	0.143
	[0.489]	[0.037]	[0.042]	[0.029]		
R Squared	0.348	0.541	0.335			
F	3.007**	5.990***	2.833**			
Model: 3D Imaging						
Constant	-14.058	1.731†	1.192			
	[8.575]	[0.993]	[1.019]			
No. of Intuition Chunks		0.038**				
		[0.014]				
No. of ICT Businesses Owned	0.988*	0.135**	0.173***	0.038	0.009	0.100
	[0.427]	[0.051]	[0.051]	[0.021]		
R Squared	0.371	0.339	0.262			
F	3.321***	2.606**	2.001*			

Notes: Coefficients are shown, with standard errors in parentheses. These represent the full models including all the control variables listed below. For the full results please refer to Tables I10 and I11 in Appendix I.

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Taken together, the results reported above provide further support for the hypothesis that intuition mediates the relationship between experience (number of ICT businesses owned) and the identification of innovative opportunities.

All the results reported in this chapter will be discussed further in Chapter 9. Next, a brief overview of the relationships between control variables and dependent variables is presented.

7.4 Control Variable Effects on Intuition and Opportunity Identification

Further to reporting the effects of the main predictors with respect to the hypotheses tested above, it is worth noting the relationships between the control variables and the dependent variables in the different models, as they may provide valuable additional insight to the research. These are outlined in the sections that follow, starting with the models where the dependent variables were those related to opportunity identification in Section 7.4.1, and then with the models where the dependent variables were the number of intuitive segments in Section 7.4.2.

7.4.1 Control Variable Effects on Opportunity Identification

Control variable effects on opportunity identification in the baseline models have already been presented in Chapter 6, so the focus here is on the full models.

Virtually no relationship was detected between cognitive style and opportunity identification, with rationality being positively related only to the identification of 'very innovative' opportunities in two of the tasks, and experientiality being (weakly) related ($p < .1$) with the identification of a greater number of opportunities overall and in one of the tasks.

No significant effects were detected for risk propensity on opportunity identification in these models, but risk perception was found to be negatively associated with opportunity identification in several models. This is in line with the findings reported in Chapter 6 and further suggests that high levels of risk perception are often detrimental to opportunity identification. Finally, no significant positive effects were found for education and work experience on opportunity identification in any of the models tested.

Therefore out of the control variables, it was risk perception that exerted the greatest influence on opportunity identification, and its effect was negative. Although the coefficients for risk perception were larger than those of the key predictor (which in this case was the number of intuitive segments), they were consistently associated with lower significance values.

7.4.2 Control Variable Effects on Intuition

Unlike the baseline models related to opportunity identification, those concerning intuition have not yet been presented elsewhere in this study. This section therefore reports control variable effects on intuition in both the baseline models and the full models.

The first interesting observation when examining the control variables in the models concerning entrepreneurial experience and intuition is that no significant relationship was detected between experientiality (or rationality) and the use of intuition in any of the tasks. This is in line with the preliminary results presented in Chapter 5, where it was reported that although there was a clear preference that emerged for a rational rather than experiential cognitive style, the intuitive segments significantly outnumbered the analytical ones in the protocol analysis tasks. Furthermore, no significant correlations were found between experientiality (on the REI) and intuitive processing (number of intuitive segments in the think-aloud tasks), or between rationality (on the REI) and analytical processing (number of analytical segments in the think-aloud tasks). Thus cognitive style did not appear to significantly impact cognitive strategy in this study. This suggests that although individuals may have a preference for one or the other mode of processing, the entrepreneurs in this study were able to override this preference and employ the cognitive strategy that was more appropriate for the tasks at hand. However before drawing any firm conclusions in this respect, the results of the third set of hypotheses concerning cognitive versatility need to be examined. This shall be the focus of Chapter 8.

Risk propensity was positively and significantly associated with the use of intuition overall ($p < .05$) in the high uncertainty task (Multi-Touch Screen, $p < .01$) and in the moderate uncertainty task (3D Imaging, $p < .1$), but not in the low uncertainty task (Quick-Tap). This implies that higher levels of risk propensity allow entrepreneurs to rely on their intuition to a greater extent in high and moderate uncertainty tasks. Conversely, risk perception was not significantly related to intuition in any of the models.

Finally, several significant effects were detected for education and work experience on intuition, indicating that while education and work experience are largely immaterial for opportunity identification (as reported in Chapter 6), they may play an important role in determining the extent of intuitive processing. This supports the notion that intuition is experience (and knowledge) based, and suggests that relevant experience (and knowledge) may be derived from education and employment.

It should be noted that the coefficients of the abovementioned control variables were smaller and less significant than those of the number of ICT businesses owned (in the full models), indicating that their effects are outweighed by the relevant type of entrepreneurial experience, with one exception: in the 3D Imaging Technology, the effect of education on intuition was more significant ($p < .001$) than that of the number of ICT businesses owned ($p < .01$).

7.5 Conclusion

As summarised in Table 7.11, the analyses reported in this chapter provide extensive support for all five hypotheses concerning intuition, experience and opportunity identification (H_{2a} to H_{2e}).

Table 7.11 Summary of Results: H_{2a} to H_{2e}: Intuition, Experience and Opportunity Identification

		Overall	Multi-Touch	3D Imaging	Quick-Tap
H_{2a}:	Greater use of intuition is associated with the identification of a larger number of opportunities	✓	✓	✓	✓
H_{2b}:	Greater use of intuition is associated with the identification of opportunities that are more innovative				
	Opportunities rated ≥ 4	✓	✓	✓	✓
	Opportunities rated ≥ 6	✕	✓	✕	n.a.
H_{2c}:	Higher levels of experience are associated with greater use of intuition	✓	✓	✓	✓
H_{2d}:	Intuition mediates the relationship between experience and the number of opportunities identified	✓	✓	✓	✓
H_{2e}:	Intuition mediates the relationship between experience and the innovativeness of opportunities identified				
	Opportunities rated ≥ 4	✓	✓	✓	✓
	Opportunities rated ≥ 6	✕	✓	✓	n.a.

✓ = Hypothesis Supported, ✕ = Hypothesis Not Supported, n.s. = Model not significant, n.a. = results not available due to insufficient variation in the dependent variable

The key outcomes of this chapter are as follows: The number of ICT businesses owned emerged once again as the most salient aspect of entrepreneurial experience. Thus owning multiple industry-specific businesses enhances not only opportunity identification as reported in Chapter 6 but also intuition. Indeed, the results of the Regression and Mediation Analyses provide evidence that this sort of experience has positive effects on opportunity identification both directly and indirectly via intuition. In view of the robust multivariate analyses reported in this chapter, it may confidently be concluded that as suggested in Chapters 1 and 3, intuition does appear to be one of the cognitive processes that links experience and opportunity identification. Experienced entrepreneurs appear to be more proficient at opportunity identification, due at least in part to their ability to engage their intuition to a greater extent than their less experienced counterparts.

In spite of the above, there were some indications that analysis may sometimes play a role, especially where the identification of 'very innovative' opportunities are concerned. This relationship between intuition, analysis and opportunity identification is explored further in the next set of hypotheses concerning cognitive versatility. These are analysed in Chapter 8.

CHAPTER 8

ROBUST MODEL TESTING PART 3:

COGNITIVE VERSATILITY, EXPERIENCE AND OPPORTUNITY IDENTIFICATION

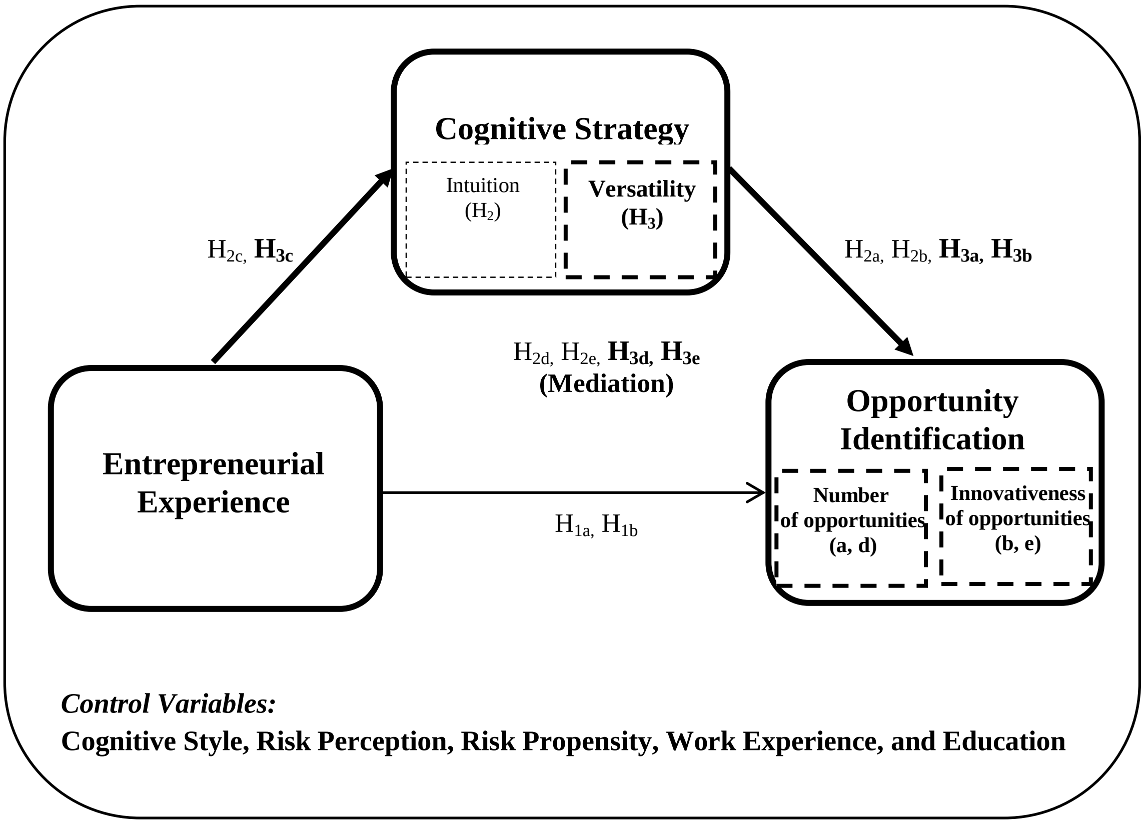
8.1 Introduction

This chapter presents the results of the Robust Negative Binomial Regressions, Poisson Regression, Logistic Regressions, and Mediation Analyses that were carried out to test the third set of hypotheses, which concern the relationship between cognitive versatility, entrepreneurial experience and opportunity identification. As explained in Chapter 3, Hypothesis 3a (H_{3a}) and 3b (H_{3b}) predict that cognitive versatility is positively associated with the number of opportunities identified and with the identification of opportunities that are more innovative respectively. Hypothesis 3c (H_{3c}) concerns the effect of entrepreneurial experience on cognitive versatility and predicts that experienced entrepreneurs are more likely than their inexperienced counterparts to employ a versatile cognitive strategy in opportunity identification. Hypotheses 3d (H_{3d}) and 3e (H_{3e}) propose a mediating role for cognitive versatility in the relationship between entrepreneurial experience and the number and innovativeness of opportunities identified.

Preliminary support for H_{3c} was provided in the inferential test results reported in Chapter 5, but the other four hypotheses in this third set have not yet been investigated. The multivariate analyses presented in this chapter shall provide robust evidence concerning the nature of the hypothesised relationships, upon which claims for their acceptance (or rejection) may be made with greater confidence.

Figure 8.1 illustrates the sections of the model being addressed in this chapter, indicated by the **bold** parts of the figure.

Figure 8.1 Model Sections Addressed in this Chapter: H_{3a} to H_{3e}



This chapter is organised in the same manner as Chapter 7. The results of H_{3a} to H_{3e} with respect to the overall data are presented in Section 8.2 to obtain overall support for these hypotheses. These are then each explored in the three separate tasks in Section 8.3 in order to explore whether there is any systematic variation in results that could be due to the differences in task uncertainty.

Once again, a baseline model of controls was first estimated for each of the tests carried out before the predictor variables were entered as a block to estimate the full models. The control and predictor variables entered into the various models are the same as the ones reported in Chapter 7, with the exception that the variables representing the number of intuition and analysis segments are replaced by the intuitive, analytical and versatile cognitive strategy dummy variables which were constructed as explained in Chapter 4. The relationships between control variables and the various dependent variables in this second set of hypotheses are briefly noted in Section 8.4. In keeping with this study's general approach, all significance levels reported in this chapter are based on conservative two-tailed tests and are reported up to the 10% level ($p < .1$).

8.2 Cognitive Versatility, Experience and Opportunity Identification: Results Overall

As outlined above, the following sections present the results of H_{3a} to H_{3e} with respect to the aggregated data in order to seek overall support for these hypotheses.

8.2.1 Cognitive Versatility and Opportunity Identification

Results of the Robust Negative Binomial Regressions that were carried out to test H_{3a} and H_{3b} for the overall data are presented in Table 8.1. All the models are significant and were improved as a result of adding the predictor variables. The full models were associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than their respective control models.

Table 8.1 Robust Negative Binomial Regression Models for H_{3a} (cognitive versatility → identification of a larger number of opportunities) and H_{3b} (cognitive versatility → identification of opportunities that are more innovative) Overall

	Hypothesis 3a		Hypothesis 3b			
	DV: No. of Opportunities Identified		DV: Opportunities Rated ≥ 4		DV: Opportunities Rated ≥ 6	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:						
Rationality	0.144	0.163	0.495†	0.523*	0.682†	0.925*
	[0.215]	[0.189]	[0.262]	[0.227]	[0.386]	[0.407]
Experientiality	0.273†	0.232*	0.373†	0.285*	0.701**	0.447†
	[0.146]	[0.105]	[0.194]	[0.130]	[0.282]	[0.230]
Risk Propensity	0.133†	0.080	0.153	0.046	0.148	0.019
	[0.078]	[0.065]	[0.110]	[0.088]	[0.191]	[0.161]
Risk Perception	-0.105	-0.138†	-0.176	-0.206†	-0.329	-0.443*
	[0.091]	[0.083]	[0.141]	[0.111]	[0.236]	[0.213]
Years Education	0.085*	0.041	0.099*	0.016	0.147†	0.076
	[0.037]	[0.033]	[0.047]	[0.042]	[0.085]	[0.088]
Years Work Experience	0.015	0.007	0.008	-0.005	-0.003	-0.016
	[0.010]	[0.010]	[0.017]	[0.014]	[0.026]	[0.021]
Model Variables:						
Intuitive Strategy		0.396*		0.749*		0.466
		[0.186]		[0.300]		[0.512]
Analytical Strategy		0.094		0.206		1.226†
		[0.333]		[0.509]		[0.742]
Versatile Strategy		0.798***		1.384***		1.678***
		[0.197]		[0.276]		[0.482]
Constant	-1.884	-1.162	-4.059**	-2.783*	-7.047**	-6.165**
	[1.177]	[0.966]	[1.585]	[1.207]	[2.491]	[2.398]
Log Pseudolikelihood	-142.472	-133.425	-128.663	-116.720	-78.998	-71.665
Wald chi-square	23.93***	49.21***	16.82**	58.81***	11.91†	29.72***

Note: Coefficients are shown, with robust standard errors in parentheses.
†*p* < .10. **p* < .05. ***p* < .01. ****p* < .001, two-tailed.
Number of observations = 74

The predictor variables in these models were the dummy variables representing the cognitive strategy (intuitive, analytical or versatile) employed by participants overall. A positive and significant relationship was detected between cognitive versatility and each of the dependent variables in these three models ($p < .001$), indicating that, as hypothesised in H_{3a} and H_{3b}, a versatile cognitive strategy leads to the identification of a greater number of opportunities, as well as to opportunities that are more innovative at each of the two levels of innovativeness specified in this study (rated ≥ 4 and ≥ 6).

Interestingly, the dummy variable representing an intuitive cognitive strategy was also significantly associated with the identification of a greater number of opportunities, as well as with 'innovative' opportunities (rated ≥ 4). Conversely, it was an analytical strategy that emerged as an additional significant predictor of the identification of 'very innovative' opportunities (rated ≥ 6), albeit at the .1 level of significance. These results are in line with those reported in Chapter 7, where intuition was found to be positively associated with the identification of 'innovative' opportunities, whereas analysis was related to the 'very innovative' opportunities identified. In the relationships reported above (concerning intuitive and analytical cognitive strategy), the coefficients were smaller and less significant than those of a versatile strategy in their respective models.

Together, these results indicate that while intuitive and analytical cognitive strategies may play different roles, it is cognitive versatility that is consistently the most effective strategy for opportunity identification. Since a versatile strategy is one which employs high levels of both intuition and analysis, it will be effective both when intuitive and when analytical processing is required.

8.2.2 Cognitive Versatility and Experience

As explained in Chapter 4, the appropriate regression technique to test H_{2c} concerning the effect of experience on cognitive versatility was Binary Logistic Regression, due to the dichotomous nature of the (dummy) dependent variable. Results of this test for the overall data are presented in Table 8.2. The model is significant and was improved as a result of adding the predictor variables. The full model was associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than its control model.

The predictors in this model were the same experience-based variables as those in the models testing H_{1a}, H_{1b} and H_{2c}, which were concerned with the effects of entrepreneurial experience either on opportunity identification or on the use of intuition (see Chapters 6 and 7). The number of ICT businesses owned was positively and significantly associated with the dependent variable ($p < .01$), thus providing support for H_{3c} which predicted that experienced entrepreneurs are more likely than their inexperienced counterparts to employ a versatile cognitive strategy.

In this model, deliberate practice was also positively and significantly related to the dependent variable, although the coefficient was smaller and less significant (0.350, $p < .05$) than that of the number of ICT businesses owned (0.522, $p < .001$).

Table 8.2 Logistic Regression Models for H_{3c} (higher levels of experience → cognitive versatility) Overall

	DV: Cognitive Versatility	
	coeff. [SE]	coeff. [SE]
Control Variables:		
Rationality	-0.201	-1.031
	[0.650]	[0.776]
Experientiality	0.182	-0.106
	[0.697]	[0.663]
Risk Propensity	0.165	0.190
	[0.339]	[0.481]
Risk Perception	0.127	-0.049
	[0.285]	[0.313]
Years Education	0.252†	0.297
	[0.150]	[0.207]
Years Work Experience	0.046	0.071†
	[0.036]	[0.042]
Model Variables:		
Years ICT Business Ownership		0.031
		[0.039]
Years Non-ICT Business Ownership		-0.099
		[0.104]
No. of ICT Businesses Owned		0.522**
		[0.202]
No. of Non-ICT Businesses Owned		0.200
		[0.310]
Deliberate Practice		0.350*
		[0.147]
Constant	-6.232	-5.251
	[4.755]	[4.530]
Log Pseudolikelihood	-37.775	-30.548
Wald chi-square	6.63	19.51†
Pseudo R Square	0.080	0.256

Note: Coefficients are shown, with standard errors in parentheses.
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed.
Number of observations = 74

These results indicate that the number of ICT businesses owned is the most important predictor not only of opportunity identification and of the use of intuition as reported in Chapters 6 and 7, but also of a versatile cognitive strategy. In contrast with opportunity identification but consistent with the use of intuition, cognitive versatility can also be enhanced by engaging in deliberate practice, as suggested by the significant positive relationship detected between these two variables in this model.

8.2.3 Cognitive Versatility as a Mediator between Experience and Opportunity Identification

As explained in Chapter 4, the 'PROCESS' macro (Hayes, 2012), which was used to test the mediation effects of intuition, was unsuitable to test H_{3d} and H_{3e} where the proposed mediator was cognitive versatility (a dichotomous dummy variable), as this macro does not accommodate categorical variables. A script command provided by Hayes to test for bootstrapped mediation in the path analysis software M-Plus was therefore used instead (see http://www.afhayes.com/macrofaq.html). This follows the same principles as those underlying the PROCESS macro, so the results are interpreted in the same way when inferring the presence or absence of significant mediation using M-Plus.

The results of the Mediation Analyses (H_{3d} and $H_{3e)}$ carried out with the overall data are presented in Table 8.3. Consistent with the way mediation results were reported in Chapter 7, the, *p* values are not shown for the Indirect Model Estimates, in favour of the Bootstrapped Lower Level Confidence Intervals (LLCI) and Upper Level Confidence Intervals (ULCI) at 95% level of confidence.

Table 8.3 Mediation Analysis Models Overall for H_{3d} (cognitive versatility mediates the relationship between experience and the number of opportunities identified) and H_{3e} (cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified) Overall

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
Model: No. of Opportunities Identified					
No. of ICT Businesses Owned	0.089*	0.554**	0.132	0.035	0.351
	[0.037]	[0.202]	[0.083]		
Versatile Strategy		1.481*			
		[0.716]			
Chi-Square		69.23***			
Model: Opportunities Identified Rated ≥ 4					
No. of ICT Businesses Owned	0.089*	0.624***	0.154	0.058	0.348
	[0.037]	[0.174]	[0.080]		
No. of Cognitive Versatility Segments		1.733***			
		[0.543]			
Chi-Square		86.83***			
Model: Opportunities Identified Rated ≥ 6					
No. of ICT Businesses Owned	0.089*	0.389**	0.070	0.022	0.179
	[0.037]	[0.124]	[0.041]		
Versatile Strategy		0.785*			
		[0.311]			
Chi-Square		81.37***			

Notes: Coefficients are shown, with standard errors in parentheses. These represent the full models including all the control variables listed below. For the full results please refer to Tables I12, I13 and I14 inAppendix I.

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

All the relevant controls and independent variables were entered into the mediation models as appropriate, but they are not reported below as the focus is on determining whether or not cognitive versatility is a significant mediator between experience and opportunity identification. The key predictor and dependent variables were the number of ICT businesses owned and the opportunity identification measures respectively.

The LLCI and ULCI of each of the three models reported in Table 8.3 indicate that their bootstrapped estimates of indirect effects are significantly different from zero, offering support for H_{3d} as well as for H_{3e}. In other words, cognitive versatility mediates the relationship between entrepreneurial experience (number of ICT businesses owned) and opportunity identification, both in terms of the number of opportunities identified, and in terms of the identification of innovative opportunities at each of the two levels of innovation specified in this study (rated ≥ 4 and ≥ 6).

8.3 Cognitive Versatility, Experience and Opportunity Identification: Results per Task

The next sections report the results of the analyses that were carried out to test H_{3a} to H_{3e} in each of the three separate tasks, in order to determine whether there could be any variation in the hypothesised relationships due to differences in task uncertainty.

8.3.1 Cognitive Versatility and the Number of Opportunities Identified

Robust Negative Binomial Regressions were carried out to test H_{3a} in the Multi-Touch Screen and Quick-Tap tasks, while a Poisson Regression was performed to test this hypothesis in the 3D Imaging task (due to the equidispersed nature of this dependent variable as explained in Chapter 4). Results of these analyses are presented in Table 8.4.

Table 8.4 Robust Negative Binomial / Poisson Regression Models for H_{3a} (cognitive versatility → identification of a larger number of opportunities) Per Task

	Multi-Touch (Negative Binomial)		3D Imaging (Poisson)		Quick-Tap (Negative Binomial)	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:						
Rationality	0.370	0.202	-0.119	-0.048	0.237	0.146
	[0.274]	[0.283]	[0.355]	[0.293]	[0.270]	[0.266]
Experientiality	0.335	0.258	0.229	0.342†	0.307	0.237
	[0.228]	[0.198]	[0.231]	[0.183]	[0.245]	[0.176]
Risk Propensity	0.154	0.104	0.128	0.006	0.081	0.071
	[0.115]	[0.112]	[0.140]	[0.115]	[0.125]	[0.117]
Risk Perception	-0.175	-0.215	-0.212	-0.243†	0.143	0.150
	[0.128]	[0.134]	[0.153]	[0.133]	[0.144]	[0.128]
Years Education	0.002	-0.023	0.128†	0.069	0.134†	0.108†
	[0.045]	[0.045]	[0.075]	[0.079]	[0.069]	[0.058]
Years Work Experience	-0.003	-0.006	0.019	0.003	0.030*	0.023
	[0.013]	[0.011]	[0.018]	[0.020]	[0.015]	[0.015]
Model Variables:						
Intuitive Strategy		0.425		0.693†		0.500
		[0.321]		[0.374]		[0.443]
Analytical Strategy		-0.170		0.319		0.373
		[0.404]		[0.323]		[0.312]
Versatile Strategy		0.754*		1.451***		0.890**
		[0.326]		[0.319]		[0.289]
Constant	-2.320	-1.001	-2.046	-1.927	-5.499**	-4.845***
	[1.595]	[1.649]	[1.800]	[1.679]	[1.875]	[1.518]
Log Pseudolikelihood	-96.603	-92.831	-98.966	-89.827	-75.694	-72.308
Wald chi-square	9.44	24.87**	9.87	38.31***	17.49**	28.73***

Note: Coefficients are shown, with robust standard errors in parentheses.
†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed.
Number of observations = 74

All three models for each of the separate tasks are highly significant and were improved as a result of adding the predictor variables. They were associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than their respective control models.

Consistent with the overall results reported above regarding H_{3a}, a positive and significant relationship was detected between cognitive versatility and the number of opportunities identified in each of the three tasks ($p < .05$ for the Multi-Touch Screen, $p < .001$ for the 3D Imaging technology, and $p < .01$ for the Quick-Tap task), thus providing full support for H_{3a}. Throughout the study, a versatile cognitive strategy was positively and significantly associated with the identification of a greater number of opportunities.

8.3.2 Cognitive Versatility and the Innovativeness of Opportunities Identified

Tables 8.5, 8.6 and 8.7 present the results of the Robust Negative Binomial Regressions that were carried out to test H_{3b} in each of the three tasks at the two levels of innovativeness. Significant associations between cognitive versatility and the identification of innovative opportunities are noted in the sections that follow, starting with the 'innovative' opportunities (rated ≥ 4) in Section 8.3.2.1, and followed by the subset of 'very innovative' opportunities (rated ≥ 6) in Section 8.3.2.2.

8.3.2.1 Opportunities Rated ≥ 4

Table 8.5 demonstrates that all three full models testing the effects of cognitive strategy on the identification of 'innovative' opportunities (rated ≥ 4) on each of the three tasks are highly significant and were improved as a result of adding the predictor variables. They were associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than their respective control models.

Table 8.5 Robust Negative Binomial Regression Models for H_{3b} (cognitive versatility → identification of opportunities that are more innovative – rated ≥ 4) Per Task

	Multi-Touch		**3D Imaging**		**Quick-Tap**	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:						
Rationality	0.822**	0.574†	-0.059	0.071	0.748	0.638
	[0.313]	[0.299]	[0.427]	[0.380]	[0.575]	[0.745]
Experientiality	0.465†	0.357	-0.016	0.165	0.674	0.403
	[0.267]	[0.219]	[0.272]	[0.194]	[0.453]	[0.341]
Risk Propensity	0.129	0.057	0.149	-0.009	0.189	0.060
	[0.132]	[0.125]	[0.169]	[0.133]	[0.304]	[0.252]
Risk Perception	-0.271†	-0.334*	-0.160	-0.240	0.101	0.157
	[0.148]	[0.155]	[0.200]	[0.198]	[0.245]	[0.259]
Years Education	0.009	-0.029	0.114	0.051	0.250*	0.160†
	[0.056]	[0.053]	[0.083]	[0.079]	[0.108]	[0.089]
Years Work	-0.009	-0.013	0.006	-0.014	0.042	0.023
Experience	[0.017]	[0.015]	[0.023]	[0.020]	[0.029]	[0.026]
Model Variables:						
Intuitive		0.711†		0.756		1.156
Strategy		[0.382]		[0.546]		[1.432]
Analytical		-0.209		0.746		1.840
Strategy		[0.528]		[0.559]		[1.158]
Versatile		1.078**		2.007***		3.094***
Strategy		[0.371]		[0.444]		[1.008]
Constant	-4.544*	-2.665	-1.775	-2.118	-11.783***	-10.833***
	[1.862]	[1.859]	[2.140]	[1.755]	[3.420]	[3.021]
Log Pseudolikelihood	-85.646	-80.181	-77.909	-66.505	-50.149	-40.916
Wald chi-square	13.20*	39.80***	4.30	37.65***	15.53*	37.19***

Note: Coefficients are shown, with robust standard errors in parentheses.
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed.
Number of observations = 74

A versatile cognitive strategy was significantly and positively associated with the dependent variable in each of the three tasks ($p < .01$ for the Multi-Touch Screen, and $p < .001$ for the 3D Imaging and Quick-Tap tasks), thus providing additional support for H_{3b}. Throughout the study, a versatile cognitive strategy was significantly associated with the identification of ‘innovative’ opportunities.

8.3.2.2 Opportunities Rated ≥ 6

As seen in Table 8.6, both of the full models which could be run for the identification of 'very innovative' opportunities, namely the Multi-Touch Screen and the 3D Imaging tasks, are significant and were improved as a result of adding the predictor variables. They were associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than their respective control models.

Cognitive versatility emerged as a predictor of the number of 'very innovative' opportunities identified for both these models ($p < .001$). These tests thus provide further support for H_{3b}.

As one may recall from the overall results reported in Section 8.2.1, an analytical cognitive strategy was indicated as the second most effective (following versatility) for the identification of 'very innovative' opportunities. This finding was reflected in the separate tasks, where significant associations were detected between analytical strategy and the dependent variable in the two significant models. It is interesting to note once again that these results reflect those presented in Chapter 7, where analysis was found to be a significant predictor of the identification of 'very innovative' opportunities identified in the Multi-Touch Screen and 3D Imaging tasks. Nevertheless, the smaller coefficients and lower significance levels of analytical cognitive strategy when compared to those of cognitive versatility indicate that the latter is still the most effective regardless of the task, probably because it allows entrepreneurs to deploy intuitive and analytical processing as necessary.

Table 8.6 Robust Negative Binomial Regression Models for H_{3b} (cognitive versatility → identification of opportunities that are more innovative – rated ≥ 6) Per Task

	Multi-Touch		3D Imaging	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:				
Rationality	1.329**	1.206*	-0.113	0.325
	[0.499]	[0.498]	[0.446]	[0.477]
Experientiality	0.951†	0.869*	0.308	0.579†
	[0.509]	[0.384]	[0.384]	[0.315]
Risk Propensity	0.263	0.039	0.049	-0.139
	[0.244]	[0.150]	[0.203]	[0.173]
Risk Perception	-0.476†	-0.731**	-0.396	-0.636*
	[0.282]	[0.230]	[0.273]	[0.320]
Years Education	0.095	-0.016	0.175†	0.139
	[0.118]	[0.107]	[0.101]	[0.108]
Years Work Experience	-0.011	-0.019	-0.018	-0.042
	[0.027]	[0.021]	[0.031]	[0.029]
Model Variables:				
Intuitive Strategy		0.206		-0.233
		[1.082]		[1.109]
Analytical Strategy		1.790*		1.825*
		[0.784]		[0.797]
Versatile Strategy		2.412***		2.130***
		[0.584]		[0.584]
Constant	-10.452**	-7.982*	-3.124	-4.976
	[3.523]	[3.703]	[3.144]	[3.115]
Log Pseudolikelihood	-41.359	-32.670	-50.950	-41.654
Wald chi-square	12.53†	47.43***	5.87	24.93***

Note: Coefficients are shown, with robust standard errors in parentheses.
†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed.
Number of observations = 74

8.3.3 Cognitive Versatility and Experience

Results of the Logistic Regressions that were carried out to test H_{3c} in each of the three tasks are presented in Table 8.7. All three full models are significant and were improved as a result of adding the predictor variables. They were associated with lower Log Pseudolikelihoods and higher Wald Chi Squares than their respective control models.

Table 8.7 Logistic Regression Models for H_{3c} (higher levels of experience → cognitive versatility) Per Task

	Multi-Touch		**3D Imaging**		**Quick-Tap**	
	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]	coeff. [SE]
Control Variables:						
Rationality	0.983	0.595	-0.109	-0.808	0.528	0.441
	[0.724]	[0.790]	[0.874]	[1.032]	[0.551]	[0.560]
Experientiality	1.036*	0.860†	-0.650	-1.330	0.461	0.173
	[0.487]	[0.511]	[0.837]	[1.086]	[0.645]	[0.666]
Risk Propensity	0.313	0.487	0.343	0.552	0.023	0.036
	[0.381]	[0.459]	[0.304]	[0.355]	[0.297]	[0.336]
Risk Perception	0.190	0.126	0.063	-0.201	-0.283	-0.372
	[0.281]	[0.330]	[0.320]	[0.326]	[0.261]	[0.264]
Years Education	0.327*	0.293†	0.162	0.104	0.163	0.117
	[0.131]	[0.165]	[0.131]	[0.167]	[0.130]	[0.152]
Years Work Experience	0.016	0.024	0.054	0.079†	0.037	0.045
	[0.043]	[0.049]	[0.038]	[0.042]	[0.033]	[0.036]
Model Variables:						
Years ICT Business Ownership		0.004		0.113*		0.006
		[0.051]		[0.056]		[0.041]
Years Non-ICT Business Ownership		-0.288		0.115		-0.181†
		[0.234]		[0.094]		[0.109]
No. of ICT Businesses Owned		0.512**		0.631**		0.469*
		[0.196]		[0.211]		[0.189]
No. of Non-ICT Businesses Owned		-0.623		-0.089		0.443
		[0.610]		[0.307]		[0.299]
Deliberate Practice		-0.026		0.189		0.149
		[0.128]		[0.164]		[0.138]
Constant	-15.433***	-13.543**	-2.753	-0.029	-6.744	-4.491
	[4.466]	[4.337]	[6.037]	[7.418]	[4.228]	[4.276]
Log Pseudolikelihood	-34.138	-29.681	-34.495	-26.324	-40.829	-35.928
Wald chi-square	14.84	26.42	8.31	24.30	6.25	19.01
Pseudo *R* square	0.144*	0.256**	0.107	0.319*	0.075	0.186†

Note: Coefficients are shown, with standard errors in parentheses.
†*p* < .10. **p* < .05. ***p* < .01. ****p* < .001, two-tailed.
Number of observations = 74

Consistent with the overall results reported in Section 8.2.2, the number of ICT businesses owned was positively and significantly associated with the dependent variable in each of the three separate tasks ($p < .01$ in the Multi-Touch Screen and 3D Imaging tasks, and $p < .05$ in the Quick-Tap task), thus providing full support for $H_{2c.}$ Experienced entrepreneurs employed a more versatile cognitive strategy than their inexperienced counterparts in each of the three tasks.

8.3.4 Cognitive Versatility as a Mediator between Experience and the Number of Opportunities Identified

Results of the Bootstrapped Mediation Analyses which were carried out to test H_{3d} in each of the separate tasks are presented in Table 8.8. As may be recalled from Chapter 7 and Section 8.2.3 above, mediation can be inferred if the 95% upper and lower bias-corrected bootstrap confidence intervals exclude the possibility of the indirect being zero (Hayes, 2009).

This criterion was met in two of the three separate tasks, namely in the 3D Imaging task and the Quick-Tap task. Cognitive versatility thus mediates the relationship between experience and the number of opportunities identified for these two technologies, but not for the Multi-Touch Screen. These results offer partial support for $H_{3d.}$

Table 8.8 Mediation Analysis Models for H_{3d} (cognitive versatility mediates the relationship between experience and the number of opportunities identified) Per Task

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
Model: Multi-Touch					
No. of ICT Businesses Owned	0.085*	0.242*	0.040	-0.013	0.149
	[0.036]	[0.121]	[0.047]		
Versatile Strategy		0.464			
		[0.431]			
Chi-Square		44.58**			
Model: 3D Imaging					
No. of ICT Businesses Owned	0.090**	0.054	0.138	0.053	0.320
	[0.033]	[0.153]	[0.072]		
Versatile Strategy		1.522*			
		[0.652]			
Chi-Square		54.877***			
Model: Quick-Tap					
No. of ICT Businesses Owned	0.088**	0.117**	0.034	0.003	0.092
	[0.034]	[0.069]	[0.026]		
Versatile Strategy		0.329			
		[0.245]			
Chi-Square		50.89***			

Notes: Coefficients are shown, with standard errors in parentheses. These represent the full models including all the control variables listed below. For the full results please refer to Tables I15, I16 and I17 in Appendix I.

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed;

8.3.5 Cognitive Versatility as a Mediator between Experience and the Innovativeness of Opportunities Identified

Tables 8.9 and 8.10 present the results of the Bootstrapped Mediation Analyses which were carried out to test H_{3e} in each of the three tasks at the two specified levels of innovativeness. Significant mediation effects for cognitive versatility on the relationship between experience and the identification of opportunities that are more innovative are reported in the sections that follow, starting with the 'innovative' opportunities (rated ≥ 4) in Section 8.3.5.1, and followed by the subset of 'very innovative' opportunities (rated ≥ 6) in Section 7.3.5.2.

8.3.5.1 Opportunities Rated ≥ 4

The results reported in Table 8.9 indicate the presence of mediation effects in two out of the three tasks where 'innovative' opportunities (rated ≥ 4) are concerned. Similar to the results of the analyses which tested the mediation effects of cognitive versatility on the number of opportunities identified presented in Section 8.3.4, the bootstrapped estimates of indirect effects are significantly different from zero (as evidenced by the 95% ULCI and LLCI) in the 3D Imaging and Quick-Tap tasks, but not in the Multi-Touch Screen task. These results provide partial support for H_{3e}.

Table 8.9 Mediation Analysis Models for H_{3e} (cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 4) Per Task

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
Model: Multi-Touch					
No. of ICT Businesses Owned	0.085*	0.228†	0.050	-0.003	0.160
	[0.036]	[0.117]	[0.049]		
Versatile Strategy		0.591			
		[0.420]			
Chi-Square		50.79***			
Model: 3D Imaging					
No. of ICT Businesses Owned	0.090**	0.111	0.109	0.048	0.242
	[0.033]	[0.125]	[0.052]		
Versatile Strategy		1.200**			
		[0.421]			
Chi-Square		62.31***			
Model: Quick-Tap					
No. of ICT Businesses Owned	0.088**	0.230**	0.050	0.015	0.121
	[0.034]	[0.084]	[0.030]		
Versatile Strategy		0.564*			
		[0.262]			
Chi-Square		65.74***			

Notes: Coefficients are shown, with standard errors in parentheses. These represent the full models including all the control variables listed below. For the full results please refer to Tables I18, I19 and I20 in Appendix I.

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

8.3.5.2 Opportunities Rated ≥ 6

Table 8.10 indicates that mediation is present in both models which could be tested at this level of innovativeness. Specifically, the bootstrapped estimates of indirect effects are significantly different from zero (as evidenced by the 95% ULCI and LLCI) in both the Multi-Touch Screen task and 3D Imaging task, thus providing additional support for H_{3e}.

Table 8.10 Mediation Analysis Models for H_{3e} (cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 6) Per Task

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
Model: Multi-Touch					
No. of ICT Businesses Owned	0.085*	0.121*	0.048	0.014	0.119
	[0.036]	[0.056]	[0.030]		
Versatile Strategy		0.562**			
		[0.208]			
Chi-Square		67.413***			
Model: 3D Imaging					
No. of ICT Businesses Owned	0.090**	0.123	0.050	0.016	0.116
	[0.033]	[0.101]	[0.028]		
Versatile Strategy		0.552*			
		[0.233]			
Chi-Square		59.473***			

Notes: Coefficients are shown, with standard errors in parentheses. These represent the full models including all the control variables listed below. For the full results please refer to Tables I21 and I22 in Appendix I.

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Taken together, the above results provide considerable support for the hypothesis that cognitive versatility mediates the relationship between experience (number of ICT businesses owned) and opportunity identification, although some reservations (concerning the level of innovativeness and the degree of uncertainty of the task) may apply. Specifically, these results suggest that in high uncertainty tasks (represented in this study by the Multi-Touch Screen), cognitive versatility only acts as a mediator between experience and opportunity identification with respect to 'very innovative' opportunities.

It is not clear whether the absence of mediation effects in the other cases is due to the level of uncertainty associated with the task or to other factors. For example, the high level of uncertainty of the Multi-Touch Screen task may require more of an intuitive rather than a versatile strategy, as suggested by the presence of mediation effects for intuition in this particular task (see Chapter 7, Section 7.3.4), but further research is required in order to draw any conclusions in this regard.

All the results reported in this chapter will be discussed further in Chapter 9. Next, a brief overview of the relationships between control variables and dependent variables is presented.

8.4 Control Variable Effects on Cognitive Versatility and Opportunity Identification

As argued in Chapters 6 and 7, it is worth noting the relationships between controls and dependent variables, as they may provide valuable additional insight concerning the hypotheses being tested. These relationships are outlined in the sections that follow, starting with the models where the dependent variables were those related to opportunity identification in Section 8.4.1, and then with the models where the dependent variables were cognitive versatility (overall and in the separate tasks) in Section 8.4.2.

8.4.1 Control Variable Effects on Opportunity Identification

Since the control variable effects on opportunity identification in the baseline models have already been presented in Chapter 6, the focus here is on the full models.

While rationality and experientiality were virtually unrelated to opportunity identification when entered as control variables into models where the number of intuition and analysis segments were predictors (as reported in Chapter 7), some significant associations were detected when the predictors were changed to the cognitive strategy (intuitive, analytical and versatile) categories. However, there was still no discernible pattern in the relationships between the rationality and experientiality (REI) scores on the one hand, and opportunity identification on the other.

Consistent with the results reported in Chapters 6 and 7, no significant effects were detected for risk propensity on opportunity identification in the models concerning H_{3a} and H_{3b}, but risk perception was found to have a negative effect in several models. This further suggests that high levels of risk perception are detrimental to opportunity identification.

Finally, the effects of education on opportunity identification are negligible, as a significant relationship was only found on two of the models. No significant association was detected for work experience. This indicates that the key predictor (which in this case was cognitive versatility) outweighs or nullifies any possible effects of education and experience with regards to opportunity identification.

Although several significant control variable effects were detected in the testing of this third set of hypotheses, their coefficients were consistently smaller and less significant than those of cognitive versatility, which suggests that they are outweighed by this key predictor.

8.4.2 Control Variable Effects on Cognitive Versatility

The baseline models concerning cognitive versatility have not yet been presented elsewhere in this study. This section therefore reports control variable effects on cognitive versatility in both the baseline models and the full models.

Similar to what was reported in Chapter 7 concerning the absence of a significant relationship between experientiality and the use of intuition, cognitive style was found to be virtually unrelated to cognitive versatility. It may therefore be concluded that in this study, there was no association between participants' preference for intuition and analysis and which mode of processing they actually used during their opportunity identification tasks.

While risk propensity was a significant predictor of intuition (as reported in Chapter 6), it no longer remained a significant predictor in any of these models. Risk perception remained non-significant.

The effects of education and work experience which were detected with respect to intuition seem to apply to a lesser extent where cognitive versatility is concerned.

Notwithstanding the above relationships between control variables and cognitive versatility, it should be noted that the coefficients of the controls were smaller and/or less significant than those of the number of ICT businesses owned (in the full models), indicating that their effects are outweighed by relevant entrepreneurial experience.

Apparently, it is primarily the number of ICT businesses owned that enables entrepreneurs to develop and employ a versatile cognitive strategy.

8.5 Conclusion

As summarised in Table 8.11, the analyses reported in this chapter provide extensive support for all five hypotheses concerning cognitive versatility, experience and opportunity identification (H_{3a} to H_{3e}).

Table 8.11 Summary of Results: H_{3a} to H_{3e}: Cognitive Strategy, Experience and Opportunity Identification

		Overall	**Multi-Touch**	**3D Imaging**	**Quick-Tap**
H_{3a}:	Cognitive versatility is associated with the identification of a larger number of opportunities	✓	✓	✓	✓
H_{3b}:	Cognitive versatility is associated with the identification of opportunities that are more innovative				
	Opportunities rated ≥ 4	✓	✓	✓	✓
	Opportunities rated ≥ 6	✓	✓	✓	n.a.
H_{3c}:	Higher levels of experience are associated with cognitive versatility	✓	✓	✓	✓
H_{3d}:	Cognitive versatility mediates the relationship between experience and the number of opportunities identified	✓	✕	✓	✓
H_{3e}:	Cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified				
	Opportunities rated ≥ 4	✓	✕	✓	✓
	Opportunities rated ≥ 6	✓	✓	✓	n.a.

✓ = Hypothesis Supported, ✕ = Hypothesis Not Supported, n.s. = Model not significant, n.a. = results not available due to insufficient variation in the dependent variable

The following are the main conclusions of this chapter: First, the most salient aspect of entrepreneurial experience emerged yet again as the number of ICT businesses owned. Owning multiple businesses in the same industry enhances not only opportunity identification and intuition as reported in Chapters 6 and 7 respectively, but also cognitive versatility. Second, cognitive versatility was found to mediate the relationship between experience and opportunity identification in most of the models tested. This implies that in general, experienced entrepreneurs are able to employ a versatile cognitive strategy, which in turn enhances opportunity identification.

In view of the results of the robust multivariate analyses reported in this chapter, it may be concluded with confidence that – as suggested in Chapters 1 and 3, and in line with dual-process theory – intuition is most effective at enhancing the proficiency of experienced entrepreneurs with respect to opportunity identification when it is combined with analysis within a versatile cognitive strategy.

The key results presented in Chapters 5, 6, 7 and 8 shall now be discussed in the next and final chapter.

CHAPTER 9

DISCUSSION AND CONCLUSION

9.1 Introduction

The aims of this chapter are to discuss this study's key findings in the light of the relevant literature and to reflect upon their implications for theory and practice. It begins by providing, in Section 9.2, a summary of the study and then proceeds to discuss, in Sections 9.3.1, 9.3.2 and 9.3.3, the key findings that emerged in relation to the three sets of hypotheses examined in this study. The focus is on the main hypothesised predictors in each regression model, highlighting confirmatory results and interpreting contradictory ones. After discussing the main findings, Section 9.4 states the academic contribution made by this study, while Section 9.5 indicates its practical significance, implications and recommendations for practice. Section 9.6 outlines the study's strengths and limitations, some of which pave the way to a number of promising avenues for future research, as discussed in Section 9.7. The concluding remarks in Section 9.8 bring this study to a close.

9.2 Research Summary

As explained in Chapter 1, this study set out to explore the cognitive processes underlying the enhanced ability of experienced entrepreneurs to identify opportunities. Guided by Cognitive-Experiential Self-Theory (CEST: Epstein, 2003, 2010; Epstein et al., 1996, Pacini & Epstein, 1999) and by a review of the scholarly literature, this study argued first, that intuition is a key process that links experience to an enhanced ability for opportunity identification, and second that intuition is most effective when used together with analysis in a versatile cognitive strategy. Building on these arguments, a model was developed in which intuition and cognitive versatility were hypothesised to mediate the relationship between experience and opportunity identification. This model sought to address the following general research question by means of three sets of hypotheses:

To what extent can the relationship between experience and opportunity identification be explained by cognitive strategy?

9.3 Discussion of Key Findings

Table 9.1 lists this study's hypotheses, summarises their results, and shows that they were largely supported. It also shows that, with the exception of a few minor variations, the findings were remarkably consistent across the three opportunity identification tasks that made up the protocol analysis part of the study. The following sections highlight the key findings and discuss them in relation to the relevant theory, conceptual literature and past empirical research, focusing primarily on the results derived from the multivariate analysis of the aggregated data from the entire study. Section 9.3.1 deals with the first set of hypotheses concerning the relationship between experience and opportunity identification, Section 9.3.2 deals with the second set of hypotheses which explore how intuition is related to experience and opportunity identification, while Section 9.3.3 shifts the focus from intuition to cognitive versatility in this relationship. In Section 9.3.4, the variations that occurred across the tasks in the three sets of hypotheses are summarised and discussed in terms of whether they may be due to differences in task uncertainty.

Table 9.1 Full Summary of Results

		Overall	Multi-Touch	3D Imaging	Quick-Tap
Experience and Opportunity Identification					
H_{1a}:	Higher levels of experience are associated with the identification of a larger number of opportunities	✓	✓	n.s.	✓
H_{1b}:	Higher levels of experience are associated with the identification of opportunities that are more innovative				
	Opportunities rated ≥ 4	✓	✓	✓	✓
	Opportunities rated ≥ 6	✓	✓	✓	n.a.
Intuition, Experience and Opportunity Identification					
H_{2a}:	Greater use of intuition is associated with the identification of a larger number of opportunities	✓	✓	✓	✓
H_{2b}:	Greater use of intuition is associated with the identification of opportunities that are more innovative				
	Opportunities rated ≥ 4	✓	✓	✓	✓
	Opportunities rated ≥ 6	✕	✓	✕	n.a.
H_{2c}:	Higher levels of experience are associated with greater use of intuition	✓	✓	✓	✓
H_{2d}:	Intuition mediates the relationship between experience and the number of opportunities identified	✓	✓	✓	✓
H_{2e}:	Intuition mediates the relationship between experience and the innovativeness of opportunities identified				
	Opportunities rated ≥ 4	✓	✓	✓	✓
	Opportunities rated ≥ 6	✕	✓	✓	n.a.
Cognitive Versatility, Experience and Opportunity Identification					
H_{3a}:	Cognitive versatility is associated with the identification of a larger number of opportunities	✓	✓	✓	✓
H_{3b}:	Cognitive versatility is associated with the identification of opportunities that are more innovative				
	Opportunities rated ≥ 4	✓	✓	✓	✓
	Opportunities rated ≥ 6	✓	✓	✓	n.a.
H_{3c}:	Higher levels of experience are associated with cognitive versatility	✓	✓	✓	✓
H_{3d}:	Cognitive versatility mediates the relationship between experience and the number of opportunities identified	✓	✕	✓	✓
H_{3e}:	Cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified				
	Opportunities rated ≥ 4	✓	✕	✓	✓
	Opportunities rated ≥ 6	✓	✓	✓	n.a.

✓ = Hypothesis Supported, ✕ = Hypothesis Not Supported, n.s. = Model not significant, n.a. = results not available due to insufficient variation in the dependent variable

9.3.1 Hypotheses 1a and 1b: Experience and Opportunity Identification

The first set of hypotheses derived in Chapter 3 concern the direct relationships between experience and the identification of a larger number of opportunities (H_{1a}) and opportunities that are more innovative (H_{1b}). As shown in Table 9.1, the results of the multivariate analyses presented in Chapter 6 – which were in line with those of the inferential tests presented in Chapter 5 – offer full support for both of these hypotheses. The experienced entrepreneurs in this study were consistently more proficient at opportunity identification, both in terms of the number of opportunities identified, and in terms of the innovativeness of these opportunities. These findings reflect those of past research which has found that experienced entrepreneurs identify a larger number of opportunities (Gruber et al., 2008, 2012a, 2012b) as well as opportunities that are more innovative (Ucbasaran et al., 2003a, 2009) than novices.

Extending past research, however, this study was able to identify which aspect of prior experience is the most salient for enhancing opportunity identification. In each of the regression models which were run to test this first set of hypotheses, the number of businesses owned in the ICT industry emerged as the only significant predictor of opportunity identification. Owning multiple businesses in other industries had little or no effect on identifying opportunities with respect to the three innovative technologies presented in the study, and neither did the number of years of business ownership experience, regardless of whether this was ICT or non-ICT related.

Linking this back to literature cited in Chapter 3, which attributes the superior opportunity identification ability of experienced entrepreneurs to their stock of relevant knowledge and complex mental structures (Baron, 2006; Baron & Ensley, 2006; Gaglio & Katz, 2001; Shane & Venkataraman, 2000; Shepherd & DeTienne, 2005), the above findings indicate that knowledge gained through experience in a particular industry – e.g., about the markets, customer needs, competitors and emerging technologies within that industry – is more focused and more conducive to the formation of relevant cognitive structures than knowledge attained in other industries. In other words, knowledge of one's own business context enhances one's ability to "connect the dots" (Baron, 2006) within that context, and hence to an increased likelihood for the identification of opportunities within that industry.

However, contrary to the belief espoused by the 'Ten-Year Rule' (see Weisberg, 1999), the positive effects of industry-specific experience were limited to ownership of multiple businesses within that sector, while the number of years of business ownership experience – even when derived from the same sector – was not found to be associated with superior opportunity identification. One explanation for this finding could be that, as suggested in Chapter 2, the quality of experience matters as well as the amount of experience in the acquisition of expertise (e.g., Baron & Henry, 2010), but this is not taken into account when using the number of years of business ownership experience as a predictor. Another explanation may be that entrepreneurs who own and run the same business for many years may fall victim to their own success by no longer feeling the need to seek fresh knowledge and pursue new opportunities, settling instead into mundane routines dictated by their corporate history. This "liability of staleness" is detrimental to opportunity identification (Starr & Bygrave, 1991; Ucbasaran, Alsos, Westhead & Wright, 2008), especially if such opportunities fall outside their regular operating channels, or in other words, outside their comfort zone. Conversely, starting up and running multiple businesses entails regularly breaking out of routines, thus preventing stagnation of ideas and indifference or aversion to new opportunities. Furthermore, with every business started, entrepreneurs add more to their "stock of knowledge" which they can then apply in subsequent opportunity identification efforts (Gruber et al., 2008, p. 1654).

The above findings offer some support to Baron and Henry's (2010) argument that "mere experience in a field" (p. 49) in terms of "the sheer amount of time spent in a given domain" (p. 51) plays an insufficient role in fostering expert performance. However, Baron and Henry's suggestion that entrepreneurs may enhance their performance by engaging in deliberate practice was not upheld in this study, as no significant effects were detected for this variable in the regression models which were run to test the hypotheses under discussion (H_{1a} and H_{1b}).

One possible explanation for this is that the deliberate practice scale used in this study – which as explained in Chapter 4 was constructed on the basis of past research, and refined and validated for this study during a piloting exercise – may have measured a form of deliberate practice that contributes to entrepreneurial effectiveness in general, rather than to the specific ability of opportunity identification as tested in this research. For example, one may argue that asking customers for feedback, holding staff meetings to brainstorm with employees to see what improvements are necessary, and monitoring which products are selling – which are three of the ten activities listed in the deliberate practice scale (see Appendix C for the full scale) – are more conducive to enhancing sales of current offerings than to the identification of new opportunities. However, to the extent that even these types of activities may add to an entrepreneur's stock of relevant knowledge, they should still play a role – directly or indirectly – in enhancing their ability to identify new opportunities.

A second explanation for the lack of a significant association between deliberate practice and opportunity identification could be that the effects of deliberate practice may occur indirectly through a moderated relationship with business ownership experience. This relationship was not tested in this study, so further research is required in order to explore this possibility.

A third possible explanation for the lack of deliberate practice effects that is worth reflecting upon, given the pattern of results which identified multiple ownership of ICT businesses as the only significant predictor of opportunity identification, is that perhaps "deliberate performance" (Fadde & Klein, 2010) may be more appropriate to enhance proficiency in the context of entrepreneurship than deliberate practice. The notion of deliberate practice was adopted from the fields of sports and the arts, where world-class performance requires long hours of intense and focused training on a daily basis (Baron & Henry, 2010). However, when applied to the business domain, Fadde and Klein (2010) question the feasibility of devoting so much time and effort to activities that are not always directly related to the running of the business. As an alternative, they propose and define "deliberate performance" as:

> A type of practice that professionals and business people can pursue while they work ... while engaged in routine work activity. As opposed to deliberate practice, which guides the use of offline sessions, deliberate performance seeks to guide the learning process online for people who lack the opportunity to engage in deliberate practice (pp. 5-6).

Fadde and Klein (2010) suggest that in order to qualify as deliberate performance, on-the-job activities require repetition, timely feedback, task variety and progressive difficulty. One could argue that starting up multiple businesses may involve a form of deliberate performance that is of relevance to opportunity identification, for it meets at least three of these requirements: (1) It involves repetition – starting up multiple businesses implies the identification (and pursuit) of multiple opportunities; (2) it is possible to obtain feedback – for example through *interpreting* or discussing business ideas with others involved in the start-up process (see Dutta & Crossan, 2005, with reference to the 4I Organizational Learning Framework); and (3) it entails a wide variety of tasks, some of which may further add to the entrepreneur's pool of knowledge and to the identification of additional opportunities – for example, exploring markets for new offerings, networking with new stakeholders, and so on. If one was to accept this line of reasoning, then it may further explain why the key predictor of opportunity identification in this study was found to be the number of ICT businesses owned.

9.3.2 Hypotheses 2a to 2e: Intuition, Experience and Opportunity Identification

The second set of hypotheses in this study were geared towards investigating whether the enhancement in opportunity identification ability that occurs as entrepreneurs obtain experience may be at least partly due to – or mediated by – intuition. As one may recall from Chapter 4, intuition was operationalised in this second set of hypotheses as the number of intuitive segments generated by respondents during the think-aloud protocol analysis exercise. The main findings of these hypotheses, which are listed in Table 9.1, are discussed in the sections that follow.

9.3.2.1 Hypotheses 2a and 2b: Intuition and Opportunity Identification

The results of the multivariate analyses presented in Chapter 7 offer full support for H_{2a}. In this study, a greater use of intuition was consistently associated with the identification of a larger number of opportunities. In line with Cognitive-Experiential Self-Theory's conceptualisation of intuition as an automatic process of holistic associations (Epstein, 2003, 2010), the results of this study support the notion that intuition is a key process that facilitates the pattern recognition that is said to occur during opportunity identification (Baron, 2006). It also provides empirical support for the conceptual work which suggests that intuition plays an integral role in opportunity identification (Dimov, 2007a, 2007b; Dutta & Crossan, 2005).

The results pertaining to H_{2b} – which posited that intuition would lead to the identification of opportunities that are more innovative – are somewhat less straightforward. Intuition was found to be positively associated with the identification of 'innovative' opportunities (rated ≥ 4 on the 7-point Likert scale), but was not related to the identification of 'very innovative' opportunities (rated ≥ 6). In the latter regression model, analysis was found to play a role. Up to a certain extent, the holistic, associative nature of intuitive processing enables entrepreneurs to break out of established patterns and form new ones (de Bono, 1993; Gaglio, 2004), to obtain a big-picture view of their environment (Hodgkinson & Clarke, 2007), and to link distant areas of content (Raidl & Lubart, 2000-2001) – which are all required to identify innovative opportunities. However, the work on structural alignment (Grégoire et al., 2010; Grégoire & Shepherd, 2012), which was cited in the development of the third set of hypotheses concerning cognitive versatility, appears to better explain the cognitive processing underlying the identification of breakthrough ideas or very innovative opportunities. In brief, the work of Grégoire and colleagues suggests that the identification of "superficially obvious" (2010, p. 425) opportunities may take place at an automatic level with minimal cognitive effort, whereas the identification of opportunities that are highly innovative and unexpected requires a cognitively demanding process of aligning the intrinsic elements of products, technologies and markets to detect their latent or concealed potential (see Chapter 3 for more details).

9.3.2.2 Hypothesis 2c: Intuition and Experience

With regards to the relationship between experience and the use of intuition, the results of the multivariate analyses provide full support for the hypothesis that experienced entrepreneurs will make use of significantly more intuitive processing than their inexperienced counterparts (H_{2c}). Consistent with the results concerning the effects of experience on opportunity identification, the best predictor of intuitive processing was found to be the number of businesses owned in the ICT industry. To the extent that intuition and opportunity identification both involve a process of holistic associations and pattern recognition (Epstein, 2003, 2010; Baron, 2006), the discussion presented in Section 9.3.1 to suggest why this particular aspect of experience is the most salient for opportunity identification also applies to intuition and need not be repeated. Additional noteworthy observations concerning the significant relationship between experience and intuition are as follows.

First, these results are consistent with Cognitive-Experiential Self-Theory which portrays intuition as being inherently related to experience (Epstein, 2003, 2010). They offer empirical support for the closely related notions of intuition as "automated expertise" (Miller & Ireland, 2005), "intuition-as-expertise" (Sadler-Smith & Shefy, 2004), and "expertise-based intuition" (Salas et al., 2010), and are in line with the widely held view that "the ability to intuit in particular domains is acquired through experience ... and relies upon pattern recognition processes" (Hodgkinson et al., 2008, p. 7), as explained in Chapter 3. Although some authors suggest that it is possible for novices to be entrepreneurially or creatively intuitive even in spite of their lack of domain-specific experience (Crossan et al., 1999; Dutta & Crossan, 2005; Dane & Pratt, 2009), the unequivocal results of this study – which showed that inexperienced entrepreneurs make use of significantly less intuitive processing than their experienced counterparts – offer no support for this claim.

This finding could be interpreted in one of two ways. The first explanation could be that, as argued in the derivation of H_{2c} in Chapter 3, experienced entrepreneurs may be able to tap into both experience-based intuition and entrepreneurial / creative intuition, but since by definition the former type of intuition is only available to experienced entrepreneurs, novices are limited to entrepreneurial / creative intuition (if at all). The second possibility is that there is no such thing as 'inexperienced' intuition, and that the novice entrepreneurs in this study were found to be less intuitive simply because they do not possess the necessary stocks of domain-relevant knowledge and cognitive frameworks to be able to engage in intuitive processing of any kind. One may recall from Chapter 3 that while Dutta and Crossan (2005) argue that entrepreneurial intuition "relies less on the knowledge base of the individual, but rather, on their creative capacity to recognize gaps and to identify possibilities" (p. 436), Dane and Pratt (2009) acknowledge that creative intuition – which they regard as similar to entrepreneurial intuition – "*may* be related to expertise" (p. 5, emphasis added) as it still involves the "integration of knowledge across different domains" (p. 5). It was beyond the scope of this study to assess which type of intuition was being used, therefore no firm conclusions can be drawn about the existence of 'inexperienced' intuition at this stage.

Moving on to the second noteworthy observation regarding the results of the regression analysis performed to examine the relationship between experience and intuition (H_{2c}), another significant predictor of intuitive processing, besides multiple ICT business ownership experience, was deliberate practice. While the results discussed in Section 9.3.1 offer no support for Baron and Henry's (2010) notion that deliberate practice may enhance performance in entrepreneurship, the significant relationship detected between deliberate practice and intuitive processing is consistent with their view that it "also generates actual enhancements in basic cognitive resources" including intuition (p. 54). As intimated in Section 9.3.1, the effects of deliberate practice on opportunity identification may be indirect rather than direct. These results suggest that this indirect effect could take place via intuition – i.e., deliberate practice contributes to the development of intuition, which in turn enhances opportunity identification. This specific mediated relationship was not, however, tested in this study, because the mediation analysis focused on the key predictor identified in the regression models – namely, the number of ICT businesses owned. Deliberate practice by itself does not constitute experience, which is the predictor of interest in this study, so it was entered only as a control variable. Further research is therefore required to explore the relationship between deliberate practice, intuition and opportunity identification.

9.3.2.3 Hypotheses 2d and 2e: Intuition as a Mediator between Experience and Opportunity Identification

In view of the significant positive relationships that were found between intuition and opportunity identification, and between experience and intuition, it comes as no surprise that H_{2d} – which predicted that intuition mediates the relationship between experience and the identification of a larger number of opportunities – was fully supported in this study. In other words, the increase in opportunity identification proficiency that takes place as entrepreneurs gain experience in the field may be attributed, at least in part, to their growing ability to make good use of their intuitive processing, and this, in turn, is due to an accumulation of domain-specific knowledge and experience. These results indicate that, as suggested in Chapters 1 and 3, intuition is a key cognitive process that links experience and opportunity identification. It allows experienced entrepreneurs to rapidly manoeuvre through the complex cognitive structures where their vast stores of experientially-derived knowledge are held (Gaglio & Katz, 2001; Shepherd & DeTienne, 2005), and to make fresh connections between seemingly unrelated stimuli, which in turn trigger ideas for new opportunities (Baron, 2006).

The above is partially applicable with regards to the innovativeness of opportunities identified (H_{2e}). Mediation effects were detected with respect to the identification of 'innovative' opportunities (rated $\geq$ 4), but not with respect to 'very innovative' opportunities (rated $\geq$ 6). These findings are consistent with those of the regression analyses performed on the direct relationship between intuition and the identification of innovative opportunities (H_{2b}), where intuition was found to be a predictor of the identification of 'innovative' opportunities but not of 'very innovative' opportunities. As discussed in Section 9.3.1, the recent work on structural alignment (Grégoire et al., 2010; Grégoire and Shepherd, 2012) may explain why analytical processing may play a greater role than intuition in the identification of top-rated opportunities. It may therefore be possible that it is analysis and not intuition that mediates the relationship between experience and the identification of ‘very innovative’ opportunities. Another possibility – which is more in line with dual-process theory, with the literature reviewed in Chapter 2, and with this study’s conceptual model – is that it is the combination of intuition together with analysis in a versatile cognitive strategy that mediates the relationship between experience and opportunity identification, rather than intuition or analysis in isolation. The former possibility – concerning the mediation effects of analysis – was not explored in this study, because the focus was primarily on intuition, with analysis being brought into the picture in order to explore cognitive versatility. Testing the meditational effects of analysis would have required a different body of literature and hypotheses than those underpinning the research presented herein. Conversely, cognitive versatility was the focus of this study’s third set of hypotheses, which culminated in its investigation as a mediator between experience and opportunity identification. The main findings of these hypotheses are discussed in the sections that follow.

9.3.3 Hypotheses 3a to 3e: Cognitive Versatility, Experience and Opportunity Identification

The third and last set of hypotheses in this study were based on the notion that while intuition plays a key role in the identification of opportunities and in mediating the relationship between experience and opportunity identification, as argued and subsequently supported in H_{2a} to H_{2e}, it does not do so by itself, but together with analysis within a versatile cognitive strategy (Hodginson & Clarke, 2007; Hodgkinson & Healey, 2011). As one may recall from Chapters 4 and 5, respondents were classified into four categories of cognitive strategy, namely *Big Picture Conscious* (predominantly intuitive), *Detail Conscious* (predominantly analytical), *Non-Discerning* (neither intuitive nor analytical) and *Cognitively Versatile* (high in both intuition and analysis), in accordance with the framework proposed by Hodgkinson and Clarke (2007). Each category was represented by a dichotomous variable and used to test this third set of hypotheses. The main findings of these hypotheses, which are summarised in Table 9.1, are discussed in the sections that follow.

9.3.3.1 Hypotheses 3a and 3b: Cognitive Versatility and Opportunity Identification

The results of the multivariate analyses presented in Chapter 8 offer full support for both H_{3a} and H_{3b}. In this study, cognitive versatility was consistently the most effective strategy for opportunity identification, both in terms of the number of opportunities identified and in terms of the innovativeness of these opportunities. As explained in Chapter 2, the literature suggests that cognitive versatility is the most effective approach for strategic decision making (Hodgkinson et al., 2009a) and for the dynamic capabilities of sensing and shaping opportunities in the context of strategic management (Hodgkinson & Healey, 2011). However, empirical evidence for this claim was limited and focused on strategic decision making in management (Woiceshyn, 2009). This study’s findings provide empirical support for the argument that it is both possible and highly desirable to combine high levels of intuition and analysis (Hodgkinson & Clarke, 2007; Hodgkinson et al., 2009a) for entrepreneurial opportunity identification, which can be viewed as a preliminary stage of strategic decision making.

These findings imply that contrary to what is sometimes suggested in the literature, that analysis is not the ideal mode of processing in uncertain, ambiguous tasks such as those involved in entrepreneurship (Allinson et al., 2000), both intuition and analysis have a role to play in opportunity identification. As suggested in Chapter 3, the combined role of intuition and analysis in opportunity identification may be explained with reference to the 4I Organisational Learning Framework (Crossan et al., 1999; Dutta & Crossan, 2005; Dimov, 2007a, 2007b) which suggests that after a business idea is triggered in the non-conscious *intuiting* stage, entrepreneurs engage in a conscious process of *interpreting* – or explaining the idea to themselves – in order to determine in their minds whether it appears to be an opportunity that is worth exploring further. It may also be explained in terms of what Gaglio (2004) and Klein (2004) refer to as *mental simulation* – or "consciously imagining what would happen" if they pursued a course of action (Klein, 2004, p. 26) – which is similar to the *interpreting* process as it also serves to clarify the idea or opportunity in the entrepreneur's mind prior to further evaluation or exploration. Both interpreting and mental simulation are important processes in opportunity identification as they serve as 'checks and balances', helping entrepreneurs avoid unfounded acceptance of poor ideas or premature rejection of promising ones.

In addition, reference is briefly made once again to the notion of structural alignment (Grégoire et al., 2010; Grégoire & Shepherd, 2012) to highlight the role of analysis in the identification of 'very innovative' opportunities. From this viewpoint, intuition is useful to draw one's attention to salient stimuli, but if entrepreneurs wish to go beyond the "superficially obvious" (Grégoire et al., 2010, p. 425) opportunities to ones that are truly innovative and unexpected, they must then engage in the cognitively demanding conscious process of structural alignment (see Section 9.3.2.1 and Chapter 3 for more details).

A final explanation as to why cognitive versatility is associated with the identification of more and increasingly innovative opportunities is that, as explained in Chapter 3, the switching from one mode of processing to another – which is another feature of cognitive versatility (Hodgkinson & Clarke, 2007) – enables the opportunity identification process to go on for longer, thus increasing the likelihood that additional opportunities are identified (see Section 3.4.1). Cognitive versatility is therefore more effective for opportunity identification than an overreliance on either of the two modes of processing, as it enables entrepreneurs to deal with the varying demands of the task.

9.3.3.2 Hypothesis 3c: Cognitive Versatility and Experience

Turning to the relationship between experience and cognitive versatility, the results of the Logistic Regressions provided full support for (H_{3c}). In this study, experienced entrepreneurs were consistently more cognitively versatile – i.e., they used a greater amount of both intuition and analysis – than their inexperienced counterparts. This study therefore provides empirical evidence to support the notion that an increase in intuition does not occur "at the expense" of analysis, and vice versa (Hodgkinson & Sadler-Smith, 2003a, p. 261).

Similar to the results concerning the effects of experience on opportunity identification and on intuitive processing, the best predictor of cognitive versatility was found to be the number of businesses owned in the ICT industry. When viewed together with the results concerning the link between experience and intuition, these findings provide support to what was suggested in Chapter 3, namely that as entrepreneurs gain relevant experience, they increase their familiarity with a broad range of domain-specific stimuli, and this enables them to intuitively – i.e., automatically and rapidly – make sense of their environment. This “automaticity” frees up valuable cognitive resources which can then be used for increasingly focused and sophisticated analytical processing (Dreyfus & Dreyfus, 2005; Salas et al., 2010). Furthermore, these results are consistent with Louis and Sutton’s (1991) view that prior experience helps individuals recognise when it is appropriate to switch from one mode of processing to the other.

In addition to the effects of multiple ICT business ownership on cognitive versatility, deliberate practice was also found to be significantly associated with a versatile cognitive strategy. One may recall that deliberate practice did not directly influence opportunity identification, but it did play a role in enhancing intuition. The finding that it is also linked to cognitive versatility lends further support to Baron and Henry’s (2010) view that deliberate practice is beneficial for the development of cognitive resources, as well as to the suggestion made in Section 9.3.2.2 that it may play an indirect role in enhancing opportunity identification via cognitive strategy. This relationship appears worthy of further scholarly attention and shall therefore be referred to in Section 9.7 where several avenues for future research are explored and discussed.

9.3.3.3 Hypotheses 3d and 3e: Cognitive Versatility as a Mediator between Experience and Opportunity Identification

The results of the Bootstrapped Mediation Analyses carried out to test H_{3d} and H_{3e} provide full support for this final pair of hypotheses. In this study, cognitive versatility was found to mediate the relationship between entrepreneurial experience and opportunity identification, both in terms of the number of opportunities identified, and in terms of the innovativeness of these opportunities. In other words, the enhancement in opportunity identification proficiency that takes place as entrepreneurs gain experience in their field may be attributed, at least in part, to their growing ability to make good use of *both* intuitive *and* analytical processing within a versatile cognitive strategy, which in turn is shaped by prior experience. Drawing upon the literature and discussion that has been presented thus far, the results of these two hypotheses – which are the culmination of all the elements of this study's conceptual model, and therefore represent the essence of this study – may be summarised as follows:

As entrepreneurs gain relevant experience – which this research has identified as ownership of multiple businesses in the ICT (i.e., in one's own) industry – they develop complex mental structures stocked with masses of knowledge about their particular business context (Baron & Ensley, 2006; Gaglio & Katz, 2001; Shane & Venkataraman, 2000; Shepherd & DeTienne, 2005). This enhances their ability to process information intuitively, and to "connect the dots" between subtle changes and emerging trends within that context (Baron, 2006). This is a vital process for opportunity identification as it "generate(s) ideas with perceived potential" (Dimov, 2007a, p. 526) which are the seed of all opportunities (Dutta & Crossan, 2005). As this *intuiting* process takes place at a non-conscious, automatic level (Crossan et al., 1999), it frees up scarce cognitive resources (Salas et al., 2010) which can be allocated to other aspects of opportunity identification. These include the conscious-level processes of *interpreting* (Crossan et al., 1999; Dutta & Crossan) and *mental simulation* (Gaglio, 2004; Klein, 2004) – both of which help entrepreneurs assess their ideas' worth as potential opportunities – as well as the cognitively demanding process of structurally aligning the intrinsic elements of products, technologies and markets (Grégoire et al, 2010, Grégoire & Shepherd, 2012) – which may lead to the detection of latent or concealed potential, and thus to the identification of truly innovative ideas. Furthermore, experience teaches entrepreneurs to "switch cognitive gears" (Louis & Sutton, 1991) in order to derive maximum benefit from both modes of processing. This extends opportunity identification efforts, increasing the likelihood that additional opportunities are identified.

9.3.4 Task Uncertainty, Cognitive Strategy and Opportunity Identification

As summarised in Table 9.1 earlier in this chapter, the findings of the Regression and Mediation Analyses that were carried out to explore this study's hypotheses were largely consistent across the three separate tasks, indicating that most of the effects tested did not vary as a function of task uncertainty. There were, however, a few instances where hypotheses were not supported in all three of the tasks presented, suggesting that in some cases, cognitive strategy and opportunity identification may be influenced by task uncertainty. What explanations could there be for these findings, and what are their implications for the conclusions of this study?

First, it is important to note that no variations across tasks occurred in the Regression models testing the effects of experience on cognitive strategy (H_{2c}: greater experience → greater use of intuition; and H_{3c}: greater experience → cognitive versatility). While past literature suggests that the level of task uncertainty may influence cognitive strategy, with high levels of uncertainty being likely to trigger intuition and low levels likely to trigger analysis (e.g., Sadler-Smith & Shefy, 2007), this study indicates that experienced entrepreneurs are more intuitive and more cognitively versatile than their less experienced counterparts, regardless of the level of uncertainty associated with the task.

Consistent results were also obtained in all but one of the Regression models testing the effects of experience and cognitive strategy on the number of opportunities identified (H_{1a}: greater experience → larger number of opportunities; H_{2a}: intuition → larger number of opportunities; and H_{3a}: cognitive versatility → larger number of opportunities). The only exception was the Regression analysis for H_{1a} in the moderate uncertainty (3D Imaging) task which, as one may recall from Chapter 6, resulted in a non-significant model. It may be argued that, had there been any systematic error variance from task uncertainty in this hypothesis, non-significant results would have emerged in the high uncertainty (Multi-Touch Screen) or the low uncertainty (Quick-Tap) tasks and not in the moderate uncertainty (3D Imaging) task. Furthermore, the number of ICT businesses owned still emerged as a significant predictor of the number of opportunities identified in this model, indicating that experience is positively related to the number and innovativeness of opportunities identified, regardless of the level of task uncertainty.

Turning to the Regression models testing the effects of experience and cognitive strategy on the innovativeness of opportunities identified (H_{1b}: greater experience → more innovative opportunities; H_{2b}: intuition → more innovative opportunities; and H_{3b}: cognitive versatility → more innovative opportunities), some inconsistent results emerged. All these three hypotheses were supported where the identification of ‘innovative’ opportunities (rated ≥ 4) was concerned, but two issues should be noted with respect to the identification of ‘very innovative’ opportunities (rated ≥ 6).

First, it was explained in Chapters 6, 7 and 8, that only five out of the 74 participants identified ‘very innovative’ opportunities in the Quick-Tap (low innovativeness / low uncertainty) task, with the consequence that this dependent variable had to be excluded from further analyses. This finding could suggest that it may be more difficult to identify very innovative opportunities for a technology that is low in innovativeness.

Second, while H_{1b} (greater experience → more innovative opportunities) and H_{3b} (cognitive versatility → more innovative opportunities) were supported for opportunities rated ≥ 6 in the two tasks remaining, H_{2b} (intuition → more innovative opportunities) was supported for opportunities rated ≥ 6 in the Multi-Touch Screen task but not in the 3D Imaging task. Thus while no significant relationship was detected between intuition and the identification of ‘very innovative’ opportunities overall (see Chapter 7), these results suggest that this may depend on the nature of the task. In moderate uncertainty tasks, represented in this study by the 3D Imaging technology, there is no significant relationship between intuition and the identification of ‘very innovative’ opportunities. However, when the level of task uncertainty is high, as represented in this study by the Multi-Touch Screen task, intuition does appear to be positively associated with the identification of ‘very innovative’ opportunities.

The work on structural alignment (Grégoire et al., 2010; Grégoire & Shepherd, 2012) could be used to shed light on these variations across tasks. When entrepreneurs are faced with a technology that is not so high in innovativeness – which as one may recall from Chapter 4, was used in this study as a proxy for uncertainty (Choi & Shepherd, 2004; Pérez-Luño et al., 2011) – they need to engage in the cognitively demanding process of aligning the intrinsic elements of products, technologies and markets to detect their latent or concealed potential, in order to identify very innovative opportunities. However, when faced with a technology that is very high in innovativeness, aligning even its superficial features, which takes place at an automatic level with minimal cognitive effort, may lead to the identification of highly innovative and unexpected opportunities, simply because of the novelty that is inherent to breakthrough technologies. In view of the above, conclusions concerning the lack of a significant relationship between intuition and the identification of 'very innovative' opportunities based on analyses of data aggregated from all the three tasks should therefore be made with caution and with due consideration to the level of uncertainty associated with the task.

The final models to be discussed, with respect to variations which may be due to task uncertainty, are those testing the mediation effects of cognitive strategy. One may recall from Chapters 7 and 8 that results were consistent across all the tasks where intuition was the mediator being tested (H_{2d}: experience → intuition → larger number of opportunities; and H_{2e}: experience → intuition → more innovative opportunities), but when testing the mediating role of cognitive versatility, non-significant results emerged in the high uncertainty (Multi-Touch Screen) task for H_{3d} (experience → cognitive versatility → larger number of opportunities) and H_{3e} (experience → cognitive versatility → more innovative opportunities – rated ≥ 4). This suggests that the mediating role of cognitive versatility could also depend, at least to some extent, on the level of uncertainty of the task. As suggested by the literature (e.g., Agor, 1986; Burke & Miller, 1999; Elbanna et al., 2010) high levels of uncertainty call for greater reliance on intuitive processing:

> When deliberative rational thought is not achievable or desirable (for example, where unambiguous or sufficient 'hard' data is not immediately at hand, might never be available at all, or where creative solutions to problems are needed), one way of managing and coping with uncertainty and complexity and of 'thinking outside of the box' is by relying upon intuition (Sadler-Smith & Shefy, 2004, p. 78).

Such circumstances may require more of an intuitive rather than a versatile strategy, as suggested by the presence of significant effects for the former and some non-significant effects for the latter in the high uncertainty (Multi-Touch Screen) task in this study. This implies that conclusions concerning the mediating role of cognitive versatility based on analyses of data aggregated from all the three tasks should be made with caution and with due consideration to the level of uncertainty associated with the task.

9.4 Contributions

As stated in Chapter 1, this study aimed to contribute to two strands of literature: entrepreneurship and intuition. These intended contributions are now revisited in view of the outcomes of this study in order to assess the extent to which they have been fulfilled.

9.4.1 Contribution to the Entrepreneurship Literature

This study's primary intended contribution was to explain the link that had been established in past research between entrepreneurial experience and opportunity identification. While previous scholars had found that the ability of entrepreneurs to identify opportunities is enhanced as they gain experience (Gruber et al., 2008, 2012a, 2012b; Ucbasaran et al., 2009; Baron & Ensley, 2006), little was known about the cognitive processes underlying this enhancement, so there was a gap in our knowledge as to how it occurs. This study was the first to suggest – and to empirically support – the notion that experience contributes to the development of both intuition and cognitive versatility, and that these – particularly the latter – enable experienced entrepreneurs to identify more and better quality opportunities than novices. In addition, while past research has been somewhat ambiguous concerning which aspect of entrepreneurial experience is the most salient for enhancing opportunity identification, this study was able to identify industry-specific multiple business ownership as the strongest predictor of the ability to identify more and better quality opportunities. These findings make a contribution to knowledge concerning one of the core questions in entrepreneurship research, namely “why, when, and how” (Shane & Venkataraman, 2000, p. 218) some people – in this case experienced entrepreneurs – are more proficient at opportunity identification than others.

The second intended contribution to the entrepreneurship literature was to provide much needed empirical evidence to support (or negate) the conceptual work that linked intuition to opportunity identification (Dimov, 2007b; Dutta & Crossan, 2005), while the third was to paint a more complete picture of this core entrepreneurial process by accounting for the role played by intuition in the presence of analysis. In showing that entrepreneurs who made use of a greater amount of intuitive processing consistently identified a larger number of opportunities, this study may claim to have fulfilled the second contribution. Additionally, in demonstrating that the most effective approach for identifying more and better quality opportunities involves the combination of intuition and analysis in a versatile cognitive strategy, this study provides a fresh and comprehensive account of the cognitive processes – and strategies – that enhance opportunity identification, thus fulfilling the third contribution.

9.4.2 Contribution to the Intuition Literature

With regards to the intuition literature, the first intended contribution stated in Chapter 1 was to provide robust, empirical evidence on the actual use of intuition. In adopting a multi-method approach which recorded entrepreneurs' intuitive (and analytical processing) in real time while controlling for cognitive style, risk propensity, risk perception, and experience, this study contributes to the literature on intuition by providing robust empirical evidence derived from a unique, comprehensive and authentic dataset, which overcomes some of the shortcomings of past research such as an overreliance on self-report measures of dispositional cognitive style.

The second contribution listed in Chapter 1 with respect to the intuition literature was to develop dual-process theory by shedding light on the extent to which intuition and analysis can be used concurrently and by providing empirical evidence to support (or negate) the under-explored claim that intuition and analysis are most effective when used together in a versatile cognitive strategy. This study may claim to have made both of these contributions, as it showed that experienced entrepreneurs are able to make extensive use of both intuition and analysis during their opportunity identification tasks, and that a versatile cognitive strategy was consistently the strongest predictor of the identification of more and better quality opportunities.

Finally, this study also makes a methodological contribution to the intuition literature. Although various authors have recommended protocol analysis as a suitable method for studying intuition (Hodgkinson & Sadler-Smith, 2011; Mitchell et al., 2005; Pretz, 2008), there was little indication as to how this technique could be used for this particular purpose. In fully documenting the five-stage research process which was adopted in this study, and in providing a clear set of criteria for coding think-aloud protocols into intuitive and analytical segments, this study may guide and simplify the efforts of future scholars who wish to apply this method in their intuition research.

9.5 Significance, Implications and Recommendations

In addition to making scholarly contributions, some authors (e.g., Anderson, Herriot & Hodgkinson, 2001; Hodgkinson, Herriot & Anderson, 2001; Hodgkinson & Rousseau, 2009; Hodgkinson & Starkey, 2011; Huff, 2000; Huff & Huff, 2001; Pettigrew, 2001; Starkey & Madan, 2001; Van de Ven & Johnson, 2006) argue that research should also have real-world relevance and an impact on practice: "It is necessary to strike a new balance between scientific rigor and practical relevance" (Bennis & O'Toole, 2005, p. 98). The academic contributions of this study have been stated above, but to what extent can it also be claimed to have a practical impact, and therefore to clear this double hurdle of both rigour and relevance?

It was stated in Chapter 1 that entrepreneurship is regarded to be the engine of economic growth (Wymenga et al., 2012) and "one of the roads to future prosperity" (Iversen et al., 2008, p. 1), therefore learning about what contributes to prosperous entrepreneurship may be argued to have an impact on the cultivation of a thriving economy. Recent research has indicated that prosperous entrepreneurship – in terms of superior venture outcomes, such as higher early-stage sales revenues and market diversification – is linked to the ability of entrepreneurs to identify and explore multiple opportunities prior to launching new ventures (Gruber et al., 2008, 2012b). It is therefore reasonable to argue that understanding what leads to an enhanced opportunity identification ability – which was the focus of this study – has not only academic value, but also economic significance, as the knowledge gleaned from such research may then be used, for example, in entrepreneurship education and training programmes to better enable budding and established entrepreneurs to identify profitable opportunities. However, considering the results of this study, which clearly indicate that experience is a key predictor of opportunity identification, both directly and indirectly via intuition and cognitive versatility, how can this study's findings be used for the benefit of entrepreneurs and the economy?

With regards to the direct effects of experience, the finding that ownership of multiple businesses in one's own industry is the most salient form of experience – and that, conversely, running the same business for many years has no effect on opportunity identification ability – has important implications for entrepreneurs. First, entrepreneurs who are thinking of starting up additional businesses may be well advised to seek new opportunities within their current sector. The stock of domain-specific knowledge that they would have accumulated from their prior start-up experience will enhance their ability to identify lucrative new opportunities, while the new knowledge they attain as they start up additional businesses will further enhance this ability for future endeavours. Second, entrepreneurs who have chosen to focus their energies on a single business may need to get out of their comfort zone and 'shake the apple tree', so to speak. As noted by Ward (2004), "novel and useful ideas are the lifeblood of entrepreneurship" (p. 174), and opportunity identification is crucial not only for the purpose of starting up new businesses but also to breathe new life into existing ones. It is therefore important for all entrepreneurs – including those who run a thriving, established business – to shape up their opportunity identification skills.

How can entrepreneurs who do not have the relevant business ownership experience enhance their opportunity identification ability? From the perspective of this study, the answer to this question lies in the findings that intuition and cognitive versatility play a key role in opportunity identification. One of the advantages of taking a cognitive approach to study entrepreneurship is that cognitive skills can be learned and developed for the benefit of entrepreneurs (Forbes, 2005). This implies that entrepreneurs can – and should – make an effort to develop their cognitive versatility as this will help them become more proficient at opportunity identification.

As explained in Chapter 3, most entrepreneurs – including novices – are able to engage in analytical processing (Dreyfus & Dreyfus, 2005). It is therefore intuition that will most likely need to be enhanced in order for entrepreneurs to attain cognitive versatility. Although intuition is widely regarded – and has been found in this study – to be associated with domain-specific experience (Hodgkinson et al., 2008), the literature suggests that there are ways of “educating intuition” (Hogarth, 2001) or of developing “intuitive intelligence” (Sadler-Smith, 2010). The significant association that was detected in this study between deliberate practice and both intuition and cognitive versatility is also a positive sign. Entrepreneurs do not have to wait until they gain experience in order to develop their intuition, but they can actively enhance their ability to effectively employ this mode of processing. It is beyond the scope of this study to provide full details about all the methods that have been suggested for this purpose. Readers are therefore referred to the works of Hogarth (2001), Klein (2004), Sadler-Smith (2010), and Sadler-Smith and Shefy (2004, 2007), for some excellent suggestions on how to enhance one’s ability to engage in effective intuitive processing, and to the works of Baron and Henry (2010) and Salas et al.

(2010) for further details about how deliberate practice can contribute to the development of intuition.

A final implication of this study is that entrepreneurs need to understand that opportunity identification depends very much on both intuition and analysis. There are some who may be led to naively believe the tales that abound in the popular literature of famous entrepreneurs who claim that they make all their important decisions based on intuition and gut feeling. Intuition is certainly important – as has been argued in the literature (e.g., Dutta & Crossan, 2005) and as shown in this study – for it is the source of new business ideas and opportunities. However, it has also been demonstrated that analysis is required – both to engage in mental simulation (Gaglio, 2004; Klein, 2004) and for interpreting to oneself (Dutta & Crossan, 2005), in order to avoid the unfounded acceptance of poor ideas or the premature rejection of promising ones, and to perform the cognitively demanding task of structural alignment (Grégoire et al., 2010; Grégoire & Shepherd, 2012), which may facilitate the identification of truly innovative opportunities.

9.6 Strengths and Limitations

Although this study was designed to closely and accurately address the research hypotheses and to overcome as many as possible of the shortcomings of past research, there are a number of limitations associated with the research design and methods adopted in this study that need to be acknowledged.

The first limitation associated with this study arises from its use of a hypothetical scenario for the think-aloud opportunity identification (protocol analysis) exercise, and concerns the predictive validity of its findings. In other words, to what extent can these entrepreneurs be expected to engage the same cognitive processes when identifying opportunities in the real world? One way to answer this question with any degree of certainty is to conduct further research in natural settings. However it is worth noting that every reasonable measure was taken to ensure that the tasks in this study were as ecologically valid – i.e., as realistic – as possible in an attempt to mimic natural settings and elicit the same kind of cognitive processing. As explained in Chapter 4, industry experts were consulted and a pilot study was conducted during the planning and preparation stage, and all those involved confirmed that the 'technology fair' setting represented a realistic scenario for the participants in this study, all of whom were technology entrepreneurs and very familiar with this kind of scenario. In view of the above, it may be argued that the research setting closely resembled the entrepreneurs' natural opportunity identification settings, and that the cognitive processes which would be utilised would therefore be very similar or the same. Furthermore, it should also be noted that this think-aloud concurrent protocol analysis method overcomes several shortcomings associated with retrospective bias and self-report methods, as explained in Chapter 4.

A second limitation associated with this study's research design – or, more specifically, with the protocol analysis method – is that while it yields very rich data, it is very time consuming and labour intensive (Green, 2009; Witteman & van Geenen, 2010) and is therefore prohibitive in terms of the number of participants that can reasonably be involved. Although a larger sample than that used in this study – which as one may recall, comprised 74 entrepreneurs – would be preferable for the statistical analysis which was conducted on the protocal data, it was not feasible to recruit any additional participants given the length of time necessary to process and analyse each of the verbal protocols, and the time constraints and resource limitations associated with a PhD. Nevertheless, it should be stated that this study involved a substantially larger number of participants and generated considerably more data than other studies that have made use of protocol analysis. For example, while methodologically similar studies in the field of entrepreneurship have included samples of nine participants (Grégoire et al., 2010), 27 participants (Sarasvathy, 2008), and 55 particpants (Gustafsson, 2006), this study involved 74 participants, each of whom completed three think-aloud opportunity identification tasks. Furthermore, the bootstrapping technique which was used to test for mediation in this study compensates for issues related to small samples, thus allowing for confident conclusions to be drawn regardless of this limitation (see Chapter 4 and Hayes, 2009 for further details about bootstrapping).

A third limitation – which is in part associated with the small sample size as stated above, and in part associated with the sampling procedure adopted – concerns the generalisability of the findings. One may recall from Chapter 4 that a purposive sampling technique was required to ensure that all participants were competent to perform the technology-related opportunity identification tasks involved in the study (Green, 2009), and that the task context would be relevant to their domain-specific knowledge and experience, in order to minimise the influence of confounding variables which may facilitate or hinder cognitive processing. While this ensured the selection of a theoretically relevant sample that was well-suited for the purpose of this study, and that is highly recommended for entrepreneurship research (Davidsson, 2005), it led to a sample that was made up exclusively of entrepreneurs from the ICT industry, most of whom were males (93.2%). Although it was explained in Chapter 5 that this gender-biased sample is representative of the general population of technology entrepreneurs, where only between 5% and 15% of high-technology businesses are owned by women (European Commission, 2008), one may question the extent to which findings derived largely from male technology entrepreneurs can confidently be generalised to entrepreneurs in other sectors. Although further research is required to address this concern, one may argue that opportunity identification involves similar cognitive processes – such as “connecting the dots” (Baron, 2006) – regardless of the setting in which it takes place and of whether the entrepreneur is male or female. There is therefore no reason to believe that the results of this study would be seriously challenged if it were to be extended to other domains.

A fourth limitation which may be associated with this study concerns the nature of the think-aloud protocol analysis technique, which has been criticised for potentially disrupting the underlying cognitive processing that occurs under silent conditions. It was, however, clearly explained in Chapter 4 under the section relating to the validity of verbal protocols, that thinking aloud has no effect on cognitive processing, as long as the researcher adheres closely to the recommended procedures, such as avoiding social interaction and intrusive prompts during task performance. It was also explained that all of these procedures were closely adhered to in the study (see Section 4.6.1 for more details). Therefore it may be argued that thinking aloud had little or no effect on the cognitive processing of participants, and hence on the results of this study.

A fifth limitation which may be associated with this study is that the entrepreneurial experience indicators used – namely the number of businesses owned and the number of years of business ownership experience – provided no indication of the quality of experience, besides the industry in which it was gained. Although the use of these quantitative indicators are standard practice in entrepreneurship research (e.g., Robson et al., 2012), they may be overlooking important insights which might be gleaned from accounting for other aspects of experience, such as the outcomes (success or failure) of previous ventures.

A sixth limitation concerns the poor Cronbach's Alpha value for the Risk Propensity scale which, as reported in Chapter 4, failed to reach the minimum recommended value of 0.7. Although this could be due to the fact that it was a "short scale(s) ... with fewer than ten items (Pallant, 2005, p. 90), one may suggest that, in hindsight, retaining this scale in the final analyses was a marginal decision. It is therefore important to acknowledge its weakness and to be cautious when drawing conclusions on its effects.

In order to conclude this section, it is worth highlighting once again the robustness of this study's findings. While there were some differences in the innovativeness of opportunities identified in the three different tasks which reflect their different levels of uncertainty, the results of the multivariate analyses concerning the association between experience, cognitive strategy (intuition and versatility) and opportunity identification were remarkably consistent throughout the study, indicating a pervasive relationship that appears to supercede environmental conditions.

9.7 Future Research Directions

The findings of this study, together with the abovementioned limitations, open up a number of avenues for future research in the areas of entrepreneurial experience, cognitive strategy (intuition and versatility) and opportunitiy identification. These are outlined below.

An important issue that needs to be addressed by future researchers in the wake of this study concerns the nature of the interaction between intuition and analysis, and how it is related to experience on the one hand and opportunity identification on the other. This study has indicated that, as stated by dual-process theory, these two modes of processing can effectively be used together without undermining one another (Hodgkinson & Sadler-Smith, 2003a), and it demonstrated that this can explain at least part of the relationship between experience and opportunity identification. Future researchers could adopt alternative methods of operationalising cognitive versatility. As explained in Chapter 4, participants in this study were classified as cognitively versatile on the basis of how many segments of intuition and analysis they generated in the think-aloud tasks. Another approach could be to enter the intuition X analysis interactions (suitably centred to avoid multicollinearity) into a series of regression analyses. Additionally, since this study did not offer details about the way entrepreneurs switch from one mode of processing to the other, which is an important element of cognitive versatility, future researchers could explore several questions in extending this line of research. These include: Does the opportunity identification process begin with intuition and then switch to analysis when the need arises, as suggested by the default-interventionist model, or do intuition and analysis operate in parallel, interacting with one another on a moment-to-moment basis (Glöckner & Ebert, 2010)? What happens if there is a conflict between what entrepreneurs 'feel' (intuition) is a poor or promising opportunity and what they deduce from the information they have available (analysis)? Hodgkinson and Healey (2011) argue that "when individuals' reasoned reflective responses and visceral reflexive reactions are discordant, effective sensing requires resolution of the disequilibria" (p. 1504), but little is known about how this occurs.

Furthemore, is the nature of the interaction between intuition and analysis also influenced by experience (as has been found in this study concerning the extent of this interaction), and does it have any effect on the number and innovativeness of opportunities identified? The think-aloud protocol analysis technique used in this study is well-suited to explore these questions, but a different approach would be required to analyse the data. This would include looking beyond the number of intuitive and analytical segments generated by respondents, to mapping out the code transitions in the protocols in order to trace the nature of the interaction between the two modes of processing.

Another promising future direction would be to adopt a finer-grained level of analysis in order to explore the different forms of intuition which have been proposed in the literature (e.g., Crossan et al., 1999; Dane & Pratt, 2009; Gore & Sadler-Smith, 2011). The protocol analysis method would also be appropriate for this purpose, but it would require further development of the coding criteria used in this study, as it only distinguished general intuitive from analytical processing without disaggregating intuition into different types. Such finer grained analysis may help shed fresh light, for example, on the nature of entrepreneurial and creative intuition and on how they are related to experience and opportunity identification (Crossan et al., 1999; Dane & Pratt, 2009).

The first limitation discussed in Section 9.6, concerning the predictive validity of the hypothetical scenario-based method used in this study, suggests the need for future research to be carried out in natural settings to explore the extent to which entrepreneurs' cognitive processing in real life scenarios would reflect those employed in this study. The most natural of settings would be the entrepreneur's day-to-day running of the business, where an ethnographic study could be carried out with researchers ‘shadowing’ entrepreneurs to observe their use of intuition and analysis in real life scenarios. However this method would be associated with significant challenges, not least of which is that opportunity identification may not be a regular occurrence for many entrepreneurs in natural settings, therefore some sort of intervention may be required to trigger the process. A reasonable middle ground may be to transform the hypothetical ‘technology fair’ setting used in this study into an authentic one. Rather than asking entrepreneurs to imagine that they were attending a technology fair (as was done in this study), they could be accompanied by a researcher to a real technology fair and asked to engage in the same think-aloud process as they identified business ideas for the technologies on display.

Another of the limitations listed above concerns the generalisability of this study’s findings, given that it focuses on a single industry. Ideally, future researchers would develop a method that is industry-neutral to allow for generalisability. However, given that intuition is experientially derived (e.g., Epstein, 2003, 2010; Hodgkinson et al., 2008) this will be a significant challenge. In the meantime, future research is required – preferably with larger samples, if adequate resources are available – and certainly with entrepreneurs hailing from different industries to explore the extent to which this study’s findings are applicable to different industries. When extending this research into different industries, however, it is important to adapt the context of the study to ensure that it is ecologically valid for the participants (see Chapter 4 for more details). Further thought could be given as to how research on intuition can be designed to allow for meaningful comparative analysis across industries.

The limitation mentioned in Section 9.6 concerning the lack of information on the quality of business ownership history in this study suggests that future researchers should take into consideration not only the number of years of business ownership history and the number of businesses owned. They should also look at other aspects of entrepreneurial experience, such as the routes of entry (founded / purchased / inherited), the routes of exit (closed / sold) and the reasons for exit (poor performance / bankruptcy / capital gain / other opportunity) of previous businesses. This information about the nature of previous experience would augment the data on the amout of experience, both of which are important for the acquisition of expertise (Baron & Henry, 2010).

Future research could explore the use of intuition – and cognitive strategy in general – by means of several other techniques which have been developed in recent years in base disciplines and related fields, such as those which make use of cognitive mapping, eye-tracking tools and physiological measures. These methods provide promising avenues for future research on intuition in business settings, as they offer sophisticated methods of measuring intuition which overcome many of the shortcomings for which past research has been criticised. It is beyond the scope of this study to provide a full account of these methods, therefore readers are referred to the relevant literature (e.g., Glöckner & Witteman, 2010; Hodgkinson & Sadler-Smith, 2011; Maule et al., 2003; Sinclair, forthcoming) for further details.

As mentioned in Section 9.3, further research is required to better understand the effects of deliberate practice on cognitive strategy and opportunity identification. This study indicates that deliberate practice does not directly influence opportunity identification, but it does influence intuition and cognitive versatility. Given that intuition and cognitive versatility in turn have positive effects on opportunity identification, it is worth exploring the nature of the overall relationship – which may best be represented by a moderated mediation model – to better understand how to capitalise on the benefits of deliberate practice. Readers are referred to the work of Hayes (2009, 2012) and Preacher, Rucker and Hayes (2007) for further details about mediation and moderated mediation analysis.

A final suggestion for future research that emerges from this study is to explore the role that different cognitive processes and strategies play throughout the different parts of the entrepreneurial process. Opportunity identification is a vital initial step, but it is not sufficient for entrepreneurship. Entrepreneurs must evaluate the opportunity, and then must make a decision – and take action – to exploit the opportunity (Baron, 2006; Shane & Venkataraman, 2000). Questions that may arise in this respect include: What is the role of intuition in the evaluation and exploitation of opportunities? Is a versatile cognitive strategy as beneficial for the evaluation and exploitation of opportunities as it is for their identification? To what extent does cognitive strategy mediate the relationship between experience and opportunity evaluation and exploitation? In exploring these questions, future researchers may contribute further to existing knowledge about the core processes involved in entrepreneurship.

9.8 Concluding Remarks

The core research question that was addressed in this study concerns the extent to which the relationship between experience and opportunity identification can be explained by cognitive strategy. In view of the results which have been presented and discussed in the preceding chapters, the following final conclusions may be drawn:

Cognitive strategy plays a key role in explaining why experienced entrepreneurs are better equipped than novices to identify more and better quality opportunities. Specifically, domain-specific multiple business ownership experience enhances the ability of entrepreneurs to make effective use of both intuition and analysis, and this in turn enables them to identify more and better quality opportunities than novices. Not only do experienced entrepreneurs use their intuition to help them identify potentially lucrative opportunities, but they also employ a process of analysis to complement their intuition and to ensure that this intuition is not leading them astray.

Thus while intuition is an important predictor of opportunity identification – as well as a key mediator between experience and opportunity identification – this study has provided evidence that intuition is most effective not when used in isolation, but when used together with analysis in a versatile cognitive strategy. Overall, these results suggest that scholars need to consider cognitive versatility, rather than simply looking at intuition or analysis in isolation, and to think about how this can be shaped to benefit opportunity identification.

REFERENCES

Agor, W. H. (1986). The logic of intuition: How top executives make important decisions. *Organizational Dynamics, 14*(3), 5-18.

Akinci C. & Sadler-Smith, E. (2012). Intuition in management research: A historical review. *International Journal of Management Reviews, 14*, 104-122.

Allinson, C. W., Chell, E., & Hayes, J. (2000). Intuition and entrepreneurial behaviour. *European Journal of Work and Organizational Psychology, 9*(1), 31-43.

Allinson, C. W., & Hayes, J. (1996). The Cognitive Style Index: A measure of intuition analysis for organizational research. *Journal of Management Studies, 33*(1), 119-135.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., Herron, M. (1996). Assessing the work environment for creativity. *The Academy of Management Journal, 39*(5), 1154 – 1184.

Anderson, N., Herriot, P. & Hodgkinson, G. P. (2001). The practitioner–researcher divide in Industrial, Work and Organizational (IWO) psychology: Where are we now, and where do we go from here? *Journal of Occupational and Organizational Psychology, 74*, 391–411.

Andriopoulos, C., & Lowe, A. (2000). Enhancing organisational creativity: The process of perpetual challenging. *Management Decision, 38*(10), 734 – 742.

Armstrong, S. J., Cools, E. & Sadler-Smith, E. (2012). Role of cognitive styles in business and management: Reviewing 40 years of research. *International Journal of Management Reviews, 14*, 238-262.

Athayde, R. (2009). Measuring enterprise potential in young people. *Entrepreneurship Theory and Practice, 33*(2), 481-500.

Austin, J. & Delaney, P. F. (1998). Protocol analysis as a tool for behavior analysis. *The Analysis of Verbal Behavior, 15*, 41-56.

Baldacchino, L., Cassar, V. & Caruana, A. (2008). Start-up success in a small island state: A study among entrepreneurs in Malta. *Island Studies Journal, 3*(1), 73-96.

Baron R. A. (2006). Opportunity recognition as pattern recognition: How entrepreneurs 'connect the dots' to identify new business opportunities. *Academy of Management Perspectives 20*, 104–119.

Baron, R. A. (2008). The role of affect in the entrepreneurial process. *Academy of Management Review, 33(2),* 328-340.

Baron, R. A. & Ensley, M. D. (2006). Opportunity recognition as the detection of meaningful patterns: Evidence from comparisons of novice and experienced entrepreneurs. *Management Science, 52*, 1331-1344.

Baron, R. A. & Henry, R. A. (2010). How entrepreneurs acquire the capacity to excel: Insights from research on expert performance. *Strategic Entrepreneurship Journal, 4*, 49-65.

Baron, R. M. & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173-1182.

Bennis, W. G., & O'Toole, J. (2005). How business schools lost their way. *Harvard Business Review* (May), 96-104.

Bhaskar, R. (1975/2008). *A realist theory of science*. London: Routledge.

Blackman, D. & Sadler-Smith, E. (2009). The silent and the silenced in organizational knowing and learning. *Management Learning, 40*(5), 569–585.

Blume, B. D. & Covin, J. G. (2011). Attributions to intuition in the venture founding process: Do entrepreneurs actually use intuition or just say that they do? *Journal of Business Venturing, 26*(1), 137-151.

Bonabeau, E. (2003). Don't trust your gut. *Harvard Business Review* (May), 116-123.

Brigham, K. H., De Castro, J. O., & Shepherd, D. A. (2007). A person-organization fit model of owner-managers' cognitive style and organizational demands. *Entrepreneurship Theory and Practice, 31*(1), 29-51.

Burke, L. A. & Miller, M. K. (1999). Taking the mystery out of intuitive decision making. *Academy of Management Executive, 13*(4), 91-99.

Butterfield, K. D., Trevino, L. K. & Ball, G. A. (1996). Punishment from the manager's perspective: A grounded investigation and inductive model. *Academy of Management Journal, 39*(6), 1479-1512.

Cameron A. C. & Trivedi, P. K. (1998). *Regression analysis of count data*. Cambridge University Press.

Chaston, I. & Sadler-Smith, E. (2012). Entrepreneurial cognition, entrepreneurial orientation and firm capability in the creative industries. *British Journal of Management*, *23*, 415–432.

Chi, M. T. (1997). Quantifying qualitative analyses of verbal data: A practical guide. *Journal of the Learning Sciences*, *6*(3), 271-315.

Choi, Y. R. & Shepherd, D. A. (2004). Entrepreneurs' decisions to exploit opportunities. *Journal of Management, 30*(3), 377-395.

Clarke, I. & Mackaness, W. (2001). Management 'intuition': An interpretative account of structure and content of decision schemas using cognitive maps. *Journal of Management Studies, 38*(2), 147-172.

Coget, J. F. (2011). The critical decision vortex – interplay of intuition, reason, and emotion: comparison of three dynamic industries. In M. Sinclair (Ed.) *Handbook of Intuition Research,* 133-144. Cheltenham: Edward Elgar.

Cook, P. (1998). The creativity advantage – is your organisation the leader of the pack? *Industrial and Commercial Training, 30*(5), 179 – 184.

Covin, J. G., Slevin, D. P., & Heeley, M. B. (1999). Strategic decision making in an intuitive vs. technocratic mode: Structural and environmental considerations. *Journal of Business Research, 52*, 51-67.

Cropley, A. (2006). In praise of convergent thinking. *Creativity Research Journal, 18*(3), 391-404.

Crossan, M. M., Lane, H. W. & White, R. E. (1999). An organizational learning framework: From intuition to institution. *Academy of Management Review, 24*(3), 522-537.

Cummings (2005). Open systems. In N. Nicholson, P. Audia, & M. Pillutla (Eds.). *The Blackwell Encyclopedia of Management (Vol. XI: Organizational Behavior)*. Oxford: Blackwell Publishing Ltd.

Dancey, C. & Reidy, J. (2002). *Statistics without maths for psychology*. NY: Pearson Education.

Dane, E. (2011). Paying attention to mindfulness and its effects on task performance in the workplace. *Journal of Management, 37*(4), 997-1018.

Dane, E. & Pratt, M. G. (2007). Exploring intuition and its role in managerial decision making. *Academy of Management Review, 32*(1), 33-54.

Dane, E. & Pratt, M. G. (2009). Conceptualising and measuring intuition: A review of recent trends. In G. Hodgkinson & J. K. Ford (Eds.) *International Review of Industrial and Organizational Psychology, 24*, 1-40.

Davidsson, P. (2005). Researching entrepreneurship. NY: Springer Science + Business Media, Inc.

de Bono, E. (1993). *Serious creativity*. USA : Advanced Practical Thinking Training Inc.

Dean, J. W. Jr. & Sharfman, M. P. (1993). Procedural rationality in the strategic decision-making process. *Journal of Management Studies*, *30*(4), 587-610.

DeTienne, D. & Chandler, G. (2004). Opportunity identification and its role in the entrepreneurial classroom: A pedagogical approach and empirical test. *Academy of Management Learning and Education, 3*(3), 242-257.

Dew, N., Read, S., Sarasvathy, S. D., & Wiltbank, R. (2009). Effectual versus predictive logics in entrepreneurial decision-making: Differences between experts and novices. *Journal of Business Venturing, 24*, 287-309.

Dimov, D. (2007a). From opportunity insight to opportunity intention: The importance of person-situation learning match. *Entrepreneurship Theory and Practice, 31*(4), 561–583.

Dimov, D. (2007b). Beyond the single-person, single-insight attribution in understanding entrepreneurial opportunities. *Entrepreneurship Theory and Practice, 31*(5), 713-731.

Dörfler, V. & Ackermann, F. (2012). Understanding intuition: The case for two forms of intuition. *Management Learning, 43*(5), 545–564.

Dreyfus, J. L. & Dreyfus, S. E. (2005). Peripheral vision: Expertise in real world contexts. *Organization Studies, 26*(5), 779-792.

Dutta, D. K. & Crossan, M. (2005). The nature of entrepreneurial opportunities: Understanding the process using the 4I Organizational Learning Framework. *Entrepreneurship Theory and Practice, 29*(4), 425-449.

Dutta, D. K. & Thornhill, S. (2008). The evolution of growth intentions: Toward a cognition-based model. *Journal of Business Venturing, 23*(3), 307-332.

Eckhardt, J. T. & Shane, S. A. (2003). *Journal of Management, 29*(3), 333–349.

Eisenhardt, K. M. & Zbaracki, M. J. (1992). Strategic decision making. *Strategic Management Journal, 13,* 17-37.

Elbanna, S. (2006). Strategic decision-making: Process perspectives. *International Journal of Management Reviews, 8*(1), 1-20.

Elbanna, S. & Child, J. (2007). Influences on strategic decision effectiveness: Development and test of an integrative model. *Strategic Management Journal, 28,* 431-453.

Elbanna, S., Child, J., & Braga Rodriguez, S. (2010). Intuition in strategic decision-making: The role of context. *Academy of Management Conference working paper*.

El Murad, J. & West, D. (2004). The definition and measurement of creativity: What do we know? *Journal of Advertising Research, 44*(2), 188 – 201.

Epstein, S. (2003). Cognitive-Experiential Self-Theory of personality. In T. Millon & M. J. Lerner (Eds). *Handbook of Psychology, Personality and Social Psychology, Volume 5,* 159-184. NJ: John Wiley & sons Inc.

Epstein, S. (2010). Demystifying intuition: What it is, what it does, and how it does it. *Psychological Inquiry, 21*(4), 295-312.

Epstein, S. (2011). The influence of valence and intensity of affect on intuitive processing. In M. Sinclair (Ed.) *Handbook of Intuition Research*: 37-51. Cheltenham: Edward Elgar.

Epstein, S., Pacini, R., Denes-Raj, V. & Heider, H. (1996). Individual differences in intuitive-experiential and analytical-rational thinking styles. *Journal of Personality and Social Psychology, 71*(2), 390-405.

Ericsson, K. A. & Simon, H. A. (1993). *Protocol analysis: Verbal reports as data*. MA: MIT Press.

Ericsson, K. A., Prietula, M. J. & Cokely, E. T. (2007). The making of an expert. *Harvard Business Review* (Jul-Aug), 1-8.

European Commission (2008). *Evaluation on policy: Promotion of women innovators and entrepreneurship – Final report*. Retrieved from: http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=3815

European Commission (2008). NACE Revision 2: Statistical classification of economic activities in the European Community. *Eurostat Methodologies and Working Papers*. Retrieved from: http://epp.eurostat.ec.europa.eu/portal/page/portal/nace_rev2/introduction

Evans, JStBT. (1989). *Bias in Human Reasoning: Causes and Consequences*. Brighton, UK: Erlbaum

Evans, JStBT. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. *Annual Review of Psychology,* 59, 255–78.

Evans, JStBT. (2010). Intuition and reasoning: A dual-process perspective. *Psychological Inquiry*. *21*(4), 313-326.

Fadde, P. J & Klein, G. A (2010). Deliberate performance: Accelerating expertise in natural settings. *Performance Improvement, 49*(9), 5-14.

Feltovich, P. J, Prietula, M. .J, & Ericsson, K. A. (2006). Studies of expertise from psychological perspectives. In K. A. Ericsson, N. Charness, R. Hoffman R, P. J. Feltovich (Eds). *The Cambridge Handbook of Expertise and Expert Performance,* 41-68. Cambridge University Press: New York.

Foo, M. D. (2011). Emotions and entrepreneurial opportunity evaluation. *Entrepreneurship Theory and Practice, 35*, 375–393.

Forbes, D. P. (2005). Are some entrepreneurs more overconfident than others? *Journal of Business Venturing*, *20*, 623-640.

Forlani, D. & Mullins, J. W. (2000). Perceived risks and choices in entrepreneurs' new venture decisions. *Journal of Business Venturing, 15*, 305-322.

Frankfort-Nachmias, C., & Nachmias, D. (1996). *Research methods in the social sciences*. London: Arnold.

Gaglio, C. M. (2004). The role of mental simulations and counterfactual thinking in the opportunity identification process. *Entrepreneurship Theory and Practice, 28*, 533-552.

Gaglio, C. M., & Katz, J. A. (2001). The psychological basis of opportunity identification: Entrepreneurial alertness. *Small Business Economics, 16*, 95-111.

Gibcus, P., Vermeulen, P. A., & Radulova, E. (2008). The decision-making entrepreneur: A literature review. In P. A. Vermeulen & P. L. Curşeu (Eds.) *Entrepreneurial strategic decision-making: A cognitive perspective*. UK: Edward Elgar Publishing Ltd.

Gigerenzer, G. (2008). *Gut feelings*. London: Penguin Books.

Glöckner, A. & Ebert, I. D. (2011). Legal intuition and expertise. In M. Sinclair (Ed.) *Handbook of intuition research*, 157-167. Cheltenham: Edward Elgar.

Glöckner, A. & Witteman, C. (2010) (Eds). *Foundations for tracing intuition: Challenges and methods*. East Sussex: Psychology Press.

Gore J. & Sadler-Smith E. (2011). Unpacking intuition: A process and outcome framework. *Review of General Psychology, 15*(4), 304-316.

Green, A. (2009). Verbal protocol analysis in language testing research: A handbook. *Studies in Language Testing (5)*. Cambridge University Press.

Grégoire, D., Barr, P. & Shepherd, D. (2010). Cognitive processes of opportunity recognition. *Organization Science, 21*, 413–431.

Grégoire, D. & Shepherd, D. (2012). Technology-market combinations and the identification of entrepreneurial opportunities: An investigation of the opportunity-individual nexus. *Academy of Management Journal*, 55(4), 753–785.

Groves, K., Vance, C. & Choi, D. (2011). Examining entrepreneurial cognition: An occupational analysis of balanced Linear and NonLinear thinking and entrepreneurship success. *Journal of Small Business Management, 49*(3), 438–466.

Gruber, M., MacMillan, I. C. & Thompson, J. D. (2008). Look before you leap: Market opportunity identification in emerging technology firms. *Management Science, 51*, 1652-1665.

Gruber, M., MacMillan, I. C. & Thompson, J. D. (2012a). From minds to markets: How human capital endowments shape market opportunity identification of technology start-ups. *Journal of Management, 38*, 1421.

Gruber, M., MacMillan, I. C. & Thompson, J. D. (2012b). Escaping the prior knowledge corridor: What shapes the number and variety of market opportunities identified before market entry of technology start-ups? *Organization Science*, forthcoming.

Gustafsson, V. (2006). *Entrepreneurial decision making: Individuals, tasks and cognitions*. MA: Edward Elgar.

Hammond, K. R. (2000). *Judgments under stress*. Oxford University Press.

Harvey, C., Kelly, A., Morris, H., & Rowlinson, M. (2010) (Eds). *Academic Journal Quality Guide, Version 4*. London: The Association of Business Schools.

Hayashi, A. M. (2001). When to trust your gut. *Harvard Business Review* (Feb), 59-65.

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs*, *76*(4), 408-420.

Hayes, A. F. (2012). *PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling* [White paper]. Retrieved from http://www.afhayes.com/public/process2012.pdf

Hayes, J., Allinson, C. W., Hudson, R. S. & Keasey, K. (2003). Further reflections on the nature of intuition-analysis and the construct validity of the Cognitive Style Index. *Journal of Occupational and Organizational Psychology, 76*, 269-278.

Haynie, J. M. & Shepherd, D. A. (2009). A measure of adaptive cognition for entrepreneurship research. *Entrepreneurship Theory and Practice*, *33*(3), 695-714.

Hensman, A. & Sadler-Smith, E. (2011). Intuitive decision making in banking and finance. *European Management Journal*, *29*, 51-66.

Heye, D. (2006). Creativity and innovation: Two key characteristics of the 21st century information professional. *Business Information Review, 23*(4), 252 – 257.

Hills, G. E., Shrader, R. C., & Lumpkin, G. T. (1999). Opportunity recognition as a creative process. *Frontiers of Entrepreneurship Research*. MA: Babson College. Retrieved from http://www.babson.edu/entrep/fer/papers99/X/X_A/X_A.html

Hmieleski, K. M. & Baron, R. A. (2008). When does entrepreneurial self-efficacy enhance versus reduce firm performance? *Strategic Entrepreneurship Journal*, *2*(1), 57-72.

Hodgkinson, G. P. & Clarke, I. (2007). Exploring the cognitive significance of organizational strategizing: A dual-process framework and research agenda. *Human Relations, 60*(1), 243-255.

Hodgkinson, G. P. & Healey, M. P. (2011). Psychological foundations of dynamic capabilities: Reflexion and reflection in strategic management. *Strategic Management Journal, 32*, 1500–1516.

Hodgkinson, G. P., Herriot, P. & Anderson, N. (2001). Re-aligning the stakeholders in management research: Lessons from Industrial, Work and Organizational psychology. *British Journal of Management, 12* (Special Issue), S41-S48.

Hodgkinson, G. P. & Langan-Fox, J. & Sadler-Smith, E. (2008). Intuition: A fundamental bridging construct in the behavioural sciences. *British Journal of Psychology, 99*, 1-27.

Hodgkinson, G. P. & Rousseau, D. (2009). Bridging the rigour–relevance gap in management research: It's already happening! *Journal of Management Studies, 46*(3), 534-546.

Hodgkinson, G. P. & Sadler-Smith, E. (2003a). Complex or unitary? A critique and empirical re-assessment of the Allinson-Hayes Cognitive Style Index. *Journal of Occupational and Organizational Psychology, 76*, 243-268.

Hodgkinson, G. P., & Sadler-Smith, E. (2003b). Reflections on reflections ... on the nature of intuition, analysis and the construct validity of the Cognitive Style Index. *Journal of Occupational and Organizational Psychology, 76*, 279-281.

Hodgkinson, G. P. & Sadler-Smith, E. (2011). Investigating intuition: Beyond self-report. In M. Sinclair (Ed). *Handbook of Intuition Research*, 52-66. Cheltenham: Edward Elgar.

Hodgkinson, G. P. & Sadler-Smith, E. (forthcoming). Self-report assessment of individual differences in preferences for analytic and intuitive processing. In M. Sinclair (Ed). *Handbook of Intuition Research Methods*. Cheltenham: Edward Elgar.

Hodgkinson, G. P., Sadler-Smith, E., Burke, L. A., Claxton, G. & Sparrow, P. R. (2009a). Intuition in organizations: Implications for strategic management. *Long Range Planning, 42*, 277-297.

Hodgkinson, G. P., Sadler-Smith, E., Sinclair, M. & Ashkanasy, N. M. (2009b). More than meets the eye? Intuition and analysis revisited. *Personality and Individual Differences, 47*, 342-346.

Hodgkinson, G. P. & Starkey, K. (2011). Not simply returning to the same answer over and over again: Reframing relevance. *British Journal of Management, 22*, 355-369.

Hodgkinson, G. P. & Starkey, K. (2012). Extending the foundations and reach of design science: Further reflections on the role of critical realism. *British Journal of Management, 23*, 605-610.

Hogarth, R. (2001). *Educating intuition*. University of Chicago Press.

Hough, J. R. & ogilvie, dt (2005). An empirical test of cognitive style and strategic decision outcomes. *Journal of Management Studies*, *42*(2), 417-448.

Huff, A. S. (2000). 1999 Presidential address: Changes in organizational knowledge production. *Academy of Management Review, 25*(2), 288–293.

Huff, A. S. & Huff, J. O. (2001). Re-focusing the business school agenda. *British Journal of Management, 12* (Special Issue), S49–S54.

Hughes J. & Parkes, S. (2003). Trends in the use of verbal protocol analysis in software engineering research. *Behaviour and Information Technology*, *22*(2), 127-140.

Isaack, T. S. (1978). Intuition: An ignored dimension of management. *Academy of Management Review, 3*(4), 917-922.

Isaack, T. (1981). Intuition: Needed in managing the small business. *Journal of Small Business Management*, 74-76.

Isenberg, D. J. (1984). How senior managers think. *Harvard Business Review* (Nov-Dec), 81-90.

Iversen, J., Jørgensen, R., Malchow-Møller, N. (2008). Defining and measuring entrepreneurship. *Foundations and Trends® in Entrepreneurship, 4,* 1-63.

Kahneman, D. (2011). *Thinking, fast and slow*. London: Penguin.

Kahneman, D. & Klein, G. (2009). Conditions for intuitive expertise: A failure to disagree. *American Psychologist, 64*(6), 515-526.

Kahneman, D. & Klein, G. (2010). Strategic decisions: When can you trust your gut? *McKinsey Quarterly, 2*, 58-67.

Kasper, G. (1998). Analysing verbal protocols. *TESOL (Teachers of English to Speakers of Other Languages) Quarterly, 32*(2), 358-362.

Keh, H. T., Foo, M.D., & Lim, B. (2002). Opportunity evaluation under risky conditions: The cognitive processes of entrepreneurs. *Entrepreneurship Theory and Practice, 27*(2), 125-148.

Khatri, N., & Ng, H. A. (2000). The role of intuition in strategic decision making. *Human Relations, 53*, 57-86.

Kickul, J., Gundry, L. K., Barbosa, S. D. & Whitcanack, L. (2009). Intuition versus analysis? Testing differential models of cognitive style on entrepreneurial self-efficacy and the new venture process. *Entrepreneurship Theory and Practice, 33*(2), 439-453.

Kirzner, I. (1979). *Perception, opportunity, and profit*. Chicago: University of Chicago Press.

Klein, G. (2004). *The power of intuition: How to use your gut feelings to make better decisions at work*. New York: Currency Doubleday.

Kreuger, N. F. (2005). The cognitive psychology of entrepreneurship. In Z. J. Acs & D. B. Audretsch (Eds). *Handbook of Entrepreneurship Research.* International Handbook Series on Entrepreneurship. The Netherlands: Kluwer Academic Publishers.

Kuczmarski, T. (1996). What is innovation? The art of welcoming risk. *Journal of Consumer Marketing, 13(5)*, 7-11.

Louis, M. R. & Sutton, R. I. (1991). Switching cognitive gears: From habits of mind to active thinking. *Human Relations*, *44*, 55-76.

Matzler, K., Bailom, F. & Moordian, T. A. (2007). Intuitive decision making. *MIT Sloan Management Review, 49*(1), 12-15.

Maule, A. J., Hodgkinson, G. P. & Bown, N. J. (2003). Cognitive mapping of causal reasoning in strategic decision making. In D. Hardman & L. Macchi (Eds.) *Thinking: Psychological perspectives on reasoning, judgment and decision making*, 253-272. Chichester, UK: Wiley.

Miller, C. C. & Ireland, R. D. (2005). Intuition in strategic decision making: Friend or foe in the fast-paced 21st century? *Academy of Management Executive, 19*(1), 19-30.

Mitchell, R. K., Busenitz, L., Lant, T., McDougall, P. P., Morse, E. A. & Smith, J. B (2002). Toward a theory of entrepreneurial cognition: Rethinking the people side of entrepreneurship research. *Entrepreneurship Theory and Practice, 27*(2), 93-104.

Mitchell, J. R., Friga, P. N., & Mitchell, R. K. (2005). Untangling the intuition mess: Intuition as a construct in entrepreneurship research. *Entrepreneurship Theory and Practice, 29*(6), 653-679.

Mosakowski, E. (1998). Entrepreneurial resources, organizational choices, and competitive outcomes. *Organization Science, 9*(6), 625-643.

Mullins, J. W. & Forlani, D. (2005). Missing the boat or sinking the boat: A study of new venture decision making. *Journal of Business Venturing, 20*(1), 47-69.

Noddings, N. & Shore, P. J. (1998). *Awakening the inner eye: intuition in education*. NY: Educator's International Press, Inc.

Pacini, R. & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology, 76*(6), 972-987.

Pallant, J. (2005). *SPSS survival manual: A step by step guide to data analysis using SPSS*. Open University Press.

Parikh, J., Neubauer, F. and Lank, A. G. (1994) *Intuition: The new frontier in management*. Cambridge, MA: Blackwell.

Pérez-Luño, A., Wiklund, J. & Cabrera, R. V. (2011). The dual nature of innovative activity: How entrepreneurial orientation influences innovation generation and adoption. *Journal of Business Venturing 26*, 555–571.

Peters, E., Västfjäll, D., Gärling, T. & Slovic, P. (2006). Affect and Decision Making: A "Hot" Topic. *Journal of Behavioral Decision Making, 19*, 79–85.

Pettigrew, A. M. (2001). Management research after modernism. *British Journal of Management, 12* (Special Issue), S61–S70.

Podoynitsyna, K., Van der Bij, H. & Song, M. (2011). The role of mixed emotions in the risk perception of novice and serial entrepreneurs. *Entrepreneurship Theory and Practice, 36*(1), 115-140.

Preacher, K. J. & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers, 36*(4), 717-731.

Preacher, K. J., Rucker, D. D. & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42*(1), 185–227.

Pretz, J. E. (2008). Intuition versus analysis: Strategy and experience in complex everyday problem solving. *Memory and Cognition*, *36*(3): 554-566.

Prietula, M. J. & Simon, H. A (1989). The experts in your midst. *Harvard Business Review* (Jan-Feb), 120-124.

Raidl, M. H. & Lubart, T. I (2000-2001). An empirical study of intuition and creativity. *Imagination, Cognition and Personality, 20*(3) 217-230.

Ravasi, D. & Turati, C. (2005). Exploring entrepreneurial learning: A comparative study of technology development projects. *Journal of Business Venturing, 20*(1), 137-164.

Robson, P. J., Akuetteh, C. K., Westhead, P. & Wright, M. (2012). Exporting intensity, human capital and business ownership experience. *International Small Business Journal, 30*(4), 367–387.

Sadler-Smith, E. (2004). Cognitive style and the management of small and medium-sized enterprises. *Organization Studies, 25*(2), 155-181.

Sadler-Smith, E. (2008). *Inside intuition*. Oxon: Routledge.

Sadler-Smith, E. (2010). *The intuitive mind: Profiting from the power of your sixth sense*. West Sussex: John Wiley & Sons Ltd.

Sadler-Smith, E., Hodgkinson, G. P. & Sinclair, M. (2008). A matter of feeling? The role of intuition in entrepreneurial decision-making and behaviour. In W. J. Zerbe, C. E. Härtel & N. M. Ashkanasy (Eds). *Emotions, Ethics and Decision-Making*, 35-55.

Sadler-Smith, E. & Shefy, E. (2004). The intuitive executive: Understanding and applying 'gut feel' in decision-making. *Academy of Management Executive, 18*(4), 76-91.

Sadler-Smith, E. & Shefy, E. (2007). Developing intuitive awareness in management education. *Academy of Management Learning and Education, 6*(2), 186-205.

Salas, E., Rosen, M. A., & DiazGranados, D. (2010). Expertise-based intuition and decision-making in organizations. *Journal of Management, 36*(4), 941-973.

Sarasvathy, S. D. (2008). *Effectuation: Elements of entrepreneurial expertise*. New Horizons in Entrepreneurship. MA: Edward Elgar.

Schoemaker, P. J. & Russo, J. E. (1993). A pyramid of decision approaches. *California Management Review* (Fall), 9-31.

Shane, S. & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review, 25*(1), 217-226.

Shepherd, D. A. & DeTienne, D. R. (2005). Prior knowledge, potential financial reward, and opportunity identification. *Entrepreneurship Theory and Practice, 29*(1), 91-112.

Short, J. C., Ketchen, D. J., Shook, C. L. & Ireland, R. D. (2010). The concept of "opportunity" in entrepreneurship research: Past accomplishments and future challenges. *Journal of Management*, *36*: 40-65.

Simon, H. A. (1987). Making management decisions: The role of intuition and emotion. *Academy of Management Executive, 1*(1), 57-64.

Simon, H. A. (1995). *Explaining the ineffable: AI on the topics of intuition, insight and inspiration*. Complex Information Processing Working Paper #529. Carnegie Mellon University.

Simon, H. A. (2000). Bounded rationality in social science: Today and tomorrow. *Mind and Society, 1*(1), 29-39.

Simon, M., Houghton, S. M. & Savelli, S. (2003). Out of the frying pan...? Why small business managers introduce high-risk products. *Journal of Business Venturing, 18*, 419-440.

Sinclair, M. (2003). *The use of intuition in managerial decision-making: Determinants and affective moderators*. Doctoral dissertation submitted to University of Queensland, Australia.

Sinclair, M. (2011) (Ed). *Handbook of intuition research*. MA: Edward Elgar

Sinclair, M. (forthcoming) (Ed). *Handbook of intuition research methods*. MA: Edward Elgar

Sinclair, M. & Ashkanasy, N. (2005). Intuition: Myth or a decision-making tool? *Management Learning, 36*(3), 353-370.

Sonnentag, S. & Kleine, B. M. (2000). Deliberate practice at work: A study with insurance agents. *Journal of Occupational and Organizational Psychology, 73,* 87-102.

Stanovich K. E. (1999). *Who is rational? Studies of individual differences in reasoning*. Mahwah, NJ: Elrbaum

Stanovich K. E. (2004). *The robot's rebellion: Finding meaning in the age of Darwin*. Chicago: Chicago University Press.

Starkey, K. & Madan, P. (2001). Bridging the relevance gap: Aligning stakeholders in the future of management research. *British Journal of Management, 12* (Special Issue), S3–S26.

Starr, J. & Bygrave, W. (1991). The assets and liabilities of prior start-up experience: an exploratory study of multiple venture entrepreneurs. In N. C. Churchill, W. D. Bygrave, J. G. Covin, D. L. Sexton, D. P. Slevin, K. H. Vesper & W. E. Wetzel (Eds). *Frontiers of Entrepreneurship Research*, 213-227. MA: Babson College.

Strack F, Deutsch R. 2004. Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review, 8*(3): 220-47.

Tang, J., Kacmar, K. M., & Busenitz, L. (2012). Entrepreneurial alertness in the pursuit of new opportunities. *Journal of Business Venturing, 27*(1), 77-94.

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal, 28,* 1319–1350.

Trickett, S. B., & Trafton, J. G. (2009). A primer on verbal protocol analysis. In D. Schmorrow, J. Cohn, & D. Nicholson (Eds). *The PSI Handbook of Virtual Environments for Training and Education, Volume 1,* 332-346. Westport, CT: Praeger Security International.

Ucbasaran, D. (2004). *Business ownership experience, entrepreneurial behaviour and performance: Novice, habitual, serial and portfolio entrepreneurs*. Thesis submitted to the University of Nottingham for the degree of Doctor of Philosophy.

Ucbasaran, D., Alsos, G. A., Westhead, P., & Wright, M. (2008). Habitual Entrepreneurs. *Foundations and Trends® in Entrepreneurship, 4,* 309-449.

Ucbasaran, D., Baldacchino, L. & Lockett, A. (forthcoming). Do it again! Recent developments in the study of habitual entrepreneurship and a look to the future. In F. Welter & T. Baker (Eds). *Routledge Companion to Entrepreneurship*.

Ucbasaran, D., Westhead, P. & Wright, M. (2009). The extent and nature of opportunity identification by experienced entrepreneurs. *Journal of Business Venturing*, *24*, 99-115.

Ucbasaran, D., Westhead, P., Wright, M. & Binks, M. (2003a). Does entrepreneurial experience influence opportunity identification? *The Journal of Private Equity*, *7*(1), 7-14.

Ucbasaran, D., Wright, M., Westhead, P., and Busenitz, L. (2003b). The impact of entrepreneurial experience on opportunity identification and exploitation: Habitual and novice entrepreneurs. In J. A. Katz & D. A. Shepherd (Eds). *Cognitive Approaches to Entrepreneurship*, 231-263. Advances in Entrepreneurship, Firm Emergence and Growth, 6.

Unger, J. M., Keith, N., Hilling, C., Gielnik, M. M. & Frese, M. (2009). Deliberate practice among South African small business owners: Relationships with education, cognitive ability, knowledge and success. *Journal of Occupational and Organizational Psychology*, *82*, 21-44.

United Nations Statistics Division (2008). International Standard Industrial Classification of All Economic Activities (ISIC), Revision 4 (2008). *Statistical papers Series M No. 4/Rev.4*. NY: United Nations.
Retrieved from http://unstats.un.org/unsd/cr/registry/isic-4.asp

Vaghley, I. P. & Julien, P. A. (2010). Are opportunities recognized or constructed? An information perspective on entrepreneurial opportunity identification. *Journal of Business Venturing*, *25*, 73-86.

Vance, C. M., Groves, K. S. & Kindler, H. (2007). Understanding and measuring Linear–NonLinear thinking style for enhanced management education and professional practice. *Academy of Management Learning & Education*, *6*(2), 167–185.

Van de Ven, A. H. & Johnson, P. E. (2006). Knowledge for theory and practice. *Academy of Management Review*, *31*(4), 802-821.

Wally, S. & Baum, J. R. (1994). Personal and structural determinants of the pace of strategic decision making. *Academy of Management Journal*, *37*(4), 932-956.

Ward, T. B. (2004). Cognition, creativity, and entrepreneurship. *Journal of Business Venturing 19*, 173–188.

Weisberg, R. W. (1999). Creativity and knowledge: A challenge to theories. In R. J. Sternberg (Ed). *Handbook of creativity*. Cambridge University Press.

Wickham, P. (2006). *Strategic entrepreneurship*. London: Pearson Education Ltd.

Witt, P. (2004). Entrepreneurs' networks and the success of start-ups. *Entrepreneurship and Regional Development, 16*, 391 – 412.

Witteman, C. & van Geenen, E. (2010). Cognitive process analysis. In A. Glöckner & C. Witteman (Eds). *Foundations for tracing intuition: Challenges and methods,* 45-60. East Sussex: Psychology Press.

Wymenga, P., Spanikova, V., Barker, A., Konings , J. & Canton, E. (2012). *EU SMEs in 2012: At the crossroads. Annual Report on Small and Medium-Sized Enterprises in the EU, 2011/12.* Rotterdam: Ecorys.
Retrieved from: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/files/supporting-documents/2012/annual-report_en.pdf

Woiceshyn, J. (2009). Lessons from "good minds": How CEOs use intuition, analysis and guiding principles to make strategic decisions. *Long Range Planning, 42*, 298-319.

Zaleski, P. A. (2011). Start-ups and external equity: The role of entrepreneurial experience. *Business Economics, 46*(1), 43-50.

APPENDIX A

METHOD OF THE LITERATURE REVIEW

APPENDIX A

METHOD OF THE LITERATURE REVIEW

Introduction

As explained in Chapter 2, the literature reviewed on intuition in management and entrepreneurship was sourced primarily from journals ranked at Grade 3, Grade 4 and Grade 4* in six of the subject areas listed in the Association of Business Schools (ABS) Academic Journal Quality Guide, Version 4 (Harvey et al., 2010). To these, six additional studies were identified from other sources and included in the literature review.

This Appendix provides further details of, and justification for, the selection of the literature reviewed in Chapter 2. It should be noted that a more inclusive approach was adopted for the other chapters in the thesis as a broader base, covering a variety of additional topics and sources, was required to construct the hypotheses, research design and methodology for this study. The criteria for inclusion of the literature reviewed in Chapter 2 as described herein thus do not apply to the rest of the thesis.

Selection of Academic Journals Listed in the ABS Guide as the Primary Sources for the Literature Review

The decision to select the Association of Business Schools (ABS) Academic Journal Quality Guide, Version 4 (Harvey et al., 2010) as the primary source for the literature review was made in an attempt to cut down the potentially infinite number of journals that might otherwise have been consulted, while at the same time including "the most important means of publishing and disseminating the results of academic research and scholarship" (Harvey et al., 2010, pp. 1-2).

Selection of Subject Areas

Once the ABS Guide (Harvey et al., 2010) was selected as the primary source for the literature review, the first step in the literature search was to select the relevant subject areas from the ones listed therein. The aim of this selection process was to include the journals which publish research on cognition, entrepreneurship and management while excluding those which focus on unrelated subjects such as finance, economics and ethics.

The first subject area to be selected was the *Entrepreneurship and Small Business* subject area since this is the primary focus of this study. The subject areas of *General Management* and *Strategic Management* were the next to be included as they are the primary publication outlets for management-related research. The *Psychology* category was also deemed highly relevant, given that intuition is a psychological construct.

After excluding the subject areas which were clearly unrelated to managerial or entrepreneurial cognition, such as *Accountancy*, *Economics*, *Finance*, *Business History*, *Business Ethics and Governance*, and *Sector Studies*, a few 'grey areas' remained – that is, it was not immediately clear whether or not they should be included in the literature review. A general search was therefore carried out in the electronic databases for papers on intuition in entrepreneurship and management without specifying the journal title. This revealed that all the key articles were published in journals belonging to six of the ABS subject areas, four of which had already been selected, and two which were new, namely *Management Development and Education* and *Organization Studies*. These six categories were therefore selected as the focus of the literature review.

Selection of Quality Rating

The next step was to select which of the journals in each of these six subject categories should be retained for the literature review. The aim of this second round of selection was to focus the review on the top-quality and highest-impact journals to ensure that that the articles are not only relevant but that they also represent cutting edge theoretical and empirical knowledge in the field. The ABS Guide (Harvey et al., 2010) specifies the following levels of quality ratings:

- *Grade 1* – Journals which are “refereed relatively lightly according to accepted conventions” and which publish research “of a recognized standard”, largely with no citation impact factor;
- *Grade 2* – Journals which are “fully refereed according to accepted standards and conventions” and which publish “original research of an acceptable standard”, with “modest” (if any) citation impact factors;
- *Grade 3* – Journals which are “heavily refereed” and which publish “original and well executed research papers” with “fair to good” citation impact factors;
- *Grade 4* – Journals which are “highly refereed” and which publish “the most original and best executed research” with “the highest citation impact factors within their field”;
- *Grade 4**– These are a subset of the *Grade 4* rated journals sharing their qualities but are further described as “World Elite Journals” and “exemplars of excellence” (Harvey et al., 2010, p. 5).

On the basis of the above quality and impact descriptions, a decision was made to include journals rated as Grade 3 and Grade 4 (including 4*) but to exclude those rated Grade 1 and Grade 2. Whilst acknowledging that there may be noteworthy publications that may have narrowly missed publication in top-tier journals due to aggressive competition and low acceptance rates, it may be argued with confidence that this study is guided by literature of the highest quality which "represent(s) scientifically validated knowledge" that is the most influential in the field (Armstrong et al., 2012, p. 2).

The above selection criteria led to the inclusion of a total of 63 journals, 30 of which are rated as Grade 4 (or 4*), and 33 which are rated as Grade 3 (Harvey et al., 2010). The next sections describe the steps taken to carry out the literature search and selection of articles from within these journals.

Search for Intuit* in the Abstracts Field

An advanced search was first conducted for the Boolean term *intuit** in the Abstracts field with a date range up to – and including – December 2012 within each of the selected journals, using appropriate electronic databases including *Business Source Premier*, *Science Direct* and *Wiley Online Library*. This search yielded a total of 1062 abstracts, each of which was read in order to determine whether or not they should be retained for further analysis. Book reviews were immediately eliminated, as were those abstracts which contained the terms intuition / intuitive / intuitively in their everyday / common use (e.g., "it makes intuitive sense", "it may sound counterintuitive", etc.), rather than as a key concept in the research. The inclusion criterion for articles was that they should make a significant conceptual or empirical contribution to knowledge about intuition in entrepreneurship or management. Articles which were in no way related to the fields of management and entrepreneurship, such as those in general education or psychology, were therefore discarded from the pool of publications for detailed review.

An exception to this rule was to retain articles which were concerned with the construction and / or validation of measures (scales) of cognitive style, even if this did not occur within the domains of management or entrepreneurship (e.g., Epstein, et al., 1996; Pacini & Epstein, 1999; Hodgkinson et al., 2009b). The reason for retaining these articles was that they contributed in some way to the development and / or establishment of dual-process theory – which is the general theory underlying this research – and were therefore deemed to be highly relevant.

The above selection process resulted in the retention of 49 articles. These were downloaded in full and content analysed to identify their key concepts and contributions. Table A1 presents the number of articles extracted in this search, together with the number of articles retained for further analysis, organised according to the ABS subject area to which they belong.

Table A1 Number of Articles Extracted and Retained in the Search for intuit* in the Abstract Field

Category	Extracted	Retained
Entrepreneurship and Small Business Management	40	6
General Management	151	22
Strategic Management	38	2
Management Development and Education	22	4
Organization Studies	44	8
Psychology	767	7
TOTALS	**1062**	**49**

Search for Intuit* AND Entrepreneur* in the Full Text Fields

An inspection of the articles that had been identified in the preliminary literature review that was carried out prior to this literature review revealed that there were a few publications that contained important information about entrepreneurial intuition which had slipped through the net of the Abstracts search described above. The main focus of these papers was not on intuition (and so no terms derived from the Boolean *intuit** appeared in the abstract). However, they included minor but meaningful information about intuition in entrepreneurship and were therefore still considered to make a significant contribution to knowledge in the field (e.g., Haynie & Shepherd, 2009). This raised the possibility that limiting the search to the abstracts of articles was overly restrictive and that other similarly relevant papers had gone undetected.

A second, more extensive search was therefore conducted for the Boolean terms *intuit** AND *entrepreneur** in the Full Text fields with a date range up to – and including – December 2012 within each of the selected journals, using appropriate electronic databases including *Business Source Premier*, *Science Direct* and *Wiley Online Library*. This search yielded a total of 2806 articles, but a screening process which relied on the CTRL+F function to search for terms derived from the Boolean *intuit** in the full text of each article revealed that the vast majority were of no relevance to this study, either because they only contained the terms intuition / intuitive / intuitively in their everyday / common use, or because they only made marginal reference to intuition as a concept, or because they simply cited other work on intuition, and thus made no contribution to knowledge in their own right. Book reviews were once again discarded from further analysis.

This process of elimination resulted in the identification of 22 articles that dealt in some way with entrepreneurial intuition. Of these, nine had already been extracted in the earlier Abstracts search, such that 13 were new additions to the pool of literature. This brought the current total up to 62 articles.

Each of these papers was read carefully and content analysed to identify the key concepts and contributions. Table A2 shows how many articles were extracted in this second search and how many were retained for further analysis, organised according to the ABS subject area to which they belong.

Table A2 Number of Articles Extracted and Retained in the Search for intuit* AND entrepreneur* in the Full Text Fields

Category	Extracted	Retained
Entrepreneurship and Small Business Management	699	16
General Management	869	3
Strategic Management	486	1
Management Development and Education	100	0
Organization Studies	434	1
Psychology	215	1
TOTALS	**2806**	**22**

Addition of Six Other Studies

As a final step in this review, six other studies from other sources which came to the researcher’s attention during the course of the literature review as being highly relevant for this research were added to the final sample.

The first is the seminal work on intuition in management by Parikh et al. (1994). This book was cited by many of the key papers extracted in the primary literature search and therefore deemed worth of inclusion in the final pool of literature for review.

The second is an empirical paper by Allinson et al., (2000), published in a journal rated as Grade 2 in the ABS list (*European Journal of Work and Organizational Psychology*). Although it did not meet the quality or impact criteria specified above, this paper was the first to investigate intuition (in terms of cognitive style) among a sample of entrepreneurs and was therefore considered to be groundbreaking at the time. This, too, was cited by many of the key papers extracted in this literature review, thus further justifying its inclusion.

The third is another empirical study which explored the relationship between intuitive and technocratic (analytical) decision making style, organisational structure and high/low technology environments (Covin et al., 2001). This article, which was discovered because it was cited by some of the key papers extracted in the literature review, was published in a Grade 3 rated journal from the *Marketing* subject area, therefore meeting the quality criterion specified above.

The fourth publication to be added to the literature reviewed in Chapter 2 is a paper by Baron and Ensley (2006), who found that intuition or gut feeling form part of the opportunity profiles of novices but not of experienced entrepreneurs. This was published in a Grade 4* rated journal from the *Operations Research and Management Science* subject area of the ABS Guide, therefore also meeting the quality criterion specified above.

In order to eliminate the possibility of other similarly relevant articles in these two additional subject areas (*Marketing* and *Operations Research and Management Science)* having gone undetected, the same Boolean searches described above were carried out within their journals rated as Grade 3, 4 and 4*, with the results sorted by relevance. An inspection of the extracted articles in each search yielded no other relevant findings, so these subject areas were eliminated from the final analysis.

The fifth addition to the literature sample is an Academy of Management Conference working paper by Elbanna et al. (2010). This research, based upon the earlier work of Elbanna and Child (2007) that was extracted in the literature search, was deemed to be relevant for this study as it investigates the antecedents of intuition in strategic decision making.

The sixth and final addition to the list is a published Doctoral thesis on entrepreneurial intuition and expertise (Gustafsson, 2006). This study investigates the use of intuition and analysis in opportunity identification among novice and expert entrepreneurs. Since this bears some similarity to the present study, it was important to include it in the literature review, to learn from it and build upon it, thus avoiding "needless duplication of effort" (Akinci & Sadler-Smith, 2012, p. 15). Further details on this study, including its limitations, are available in Chapter 2.

Description of the Final Literature Sample

It total, this literature search yielded 68 publications from 34 different sources. Of these, 64 are journal articles, one is a conference working paper, one is a published Doctoral thesis, one is a book, and one is an invited book chapter in an annual book series. Just under one half of these (33 of the 68 articles) are conceptual. Eight of these articles are concerned with developing and validating measures of cognitive style and with developing / establishing dual-process theory, and are derived largely from the psychology literature, 36 articles contribute primarily to knowledge on managerial intuition, and 24 articles contribute to knowledge on entrepreneurial intuition.

As seen in Table A3, the journal with the highest number of relevant publications is *Entrepreneurship Theory and Practice* (eight articles), closely followed by the *Journal of Business Venturing* (seven articles). In third place is the *Academy of Management Executive* with four articles. The *General Management* subject area yielded the largest number of articles (22 articles), followed by the *Entrepreneurship and Small Business Management* group (18 articles).

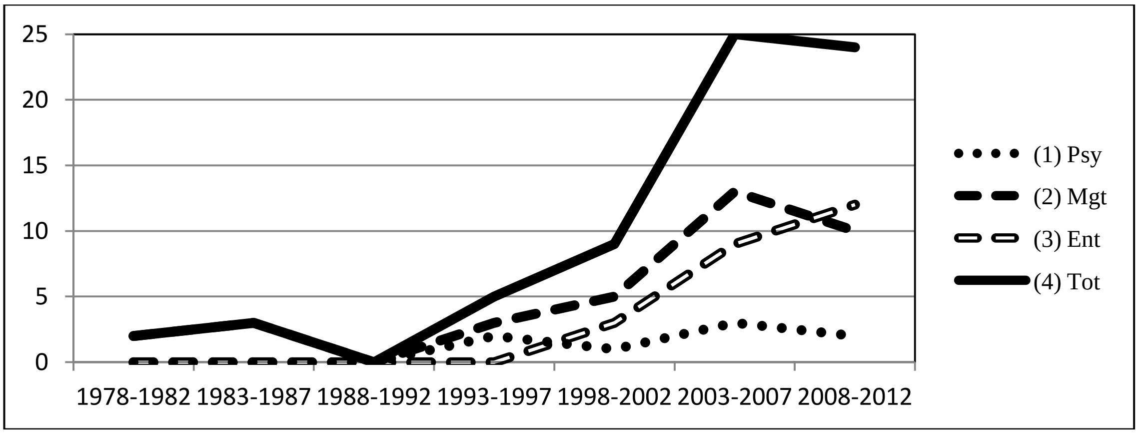
Table A3 Number of Articles Retained in each Category

ABS Category	Journal Name	Abbrev.	No. of Articles			
			Psy	**Mgt**	**Ent**	**Tot**
Entrepreneurship and Small Business Management	Entrepreneurship Theory and Practice	ET&P	0	0	8	**8**
	Journal of Business Venturing	JBV	0	1	6	**7**
	Journal of Small Business Management	JSBM	0	1	1	**2**
	Strategic Entrepreneurship Journal	SEJ	0	0	1	**1**
	Category Total		**0**	**2**	**16**	**18**
General Management	Academy of Management Executive	AME	0	4	0	**4**
	Academy of Management Review	AMR	0	2	1	**3**
	Journal of Management Studies	JMS	1	2	0	**3**
	Harvard Business Review	HBR	0	3	0	**3**
	International Journal of Management Reviews	IJMR	0	3	0	**3**
	Journal of Management	JoM	0	2	0	**2**
	British Journal of Management	BJoM	0	0	1	**1**
	Academy of Management Journal	AMJ	0	1	0	**1**
	California Management Review	CMR	0	1	0	**1**
	MIT Sloan Management Review	MIT-SMR	0	1	0	**1**
	Category Total		**1**	**19**	**2**	**22**
Strategic Management	Strategic Management Journal	SMJ	0	2	0	**2**
	Long Range Planning	LRP	0	2	0	**2**
	Category Total		**0**	**4**	**0**	**4**
Management Development and Education	Management Learning	ML	0	3	0	**3**
	Academy of Management Learning and Education	AMLE	0	1	0	**1**
	Category Total		**0**	**4**	**0**	**4**
Organization Studies	Organizational Studies	OSt	0	1	1	**2**
	Human Relations	HR	0	2	0	**2**
	Organization Science	OSc	0	0	1	**1**
	Organizational Dynamics	OD	0	1	0	**1**
	Category Total		**0**	**4**	**2**	**6**
Psychology	Journal of Occupational and Organizational Psychology	JOOP	3	0	0	**3**
	Personality and Individual Differences	PAID	1	0	0	**1**
	British Journal of Psychology	BJP	1	0	0	**1**
	International Review of Industrial and Organizational Psychology (Edited Annual Book Series)	IRIOP	0	0	1	**1**
	Journal of Personality and Social Psychology	JPSP	1	0	0	**1**
	European Journal of Work and Organizational Psychology	EJWOP	0	0	1	**1**
	Personality Processes and Individual Differences	PPID	1	0	0	**1**
	Category Total		**7**	**0**	**2**	**9**
Other	Journal of Business Research	JBR	0	1	0	**1**
	Management Science	MS	0	0	1	**1**
	Academy of Management Conference Working Paper	AoM	0	1	0	**1**
	Published Doctoral Dissertation	PhD	0	0	1	**1**
	Book	Bk	0	1	0	**1**
	Category Total		**0**	**3**	**2**	**5**
	OVERALL TOTAL		**8**	**36**	**24**	**68**

Note: Psy = Psychology; Mgt = Management; Ent = Entrepreneurship; Tot = Total

Figure A1 illustrates the number of articles published per five-year period since 1978, which is the date of publication of the oldest article in this literature review (Isaack, 1978). The separate data series represent: (1) *Psy* – the articles concerned with developing and validating measures of cognitive style and with developing / establishing dual-process theory; (2) *Mgt* – those which contribute to knowledge on managerial intuition; (3) *Ent* – those which contribute to knowledge on entrepreneurial intuition; and (4) *Tot* – the total number of articles overall.

Figure A1 Number of Articles Published per Five-Year Period



Overall, there has been a steady growth in interest on intuition in business settings, as shown by the steep increase in the total number of articles published, since the early 1990s and especially during the last ten years. Of the 68 studies in this review, the first five were published over a 15-year period since Isaack's (1978) article appeared 35 years ago (1978-1992), 14 articles were published in the next ten years (1993-2002), and the majority – 49 articles – were published in the last decade (2003-2012).

Looking at the three categories into which the articles were split for the purpose of this review (psychology / theory building, management, and entrepreneurship), one finds comparatively few theory building papers. However it should be noted that the search was limited to business-related journals, as the *Psychology* subject area in the ABS list contains only "a small sub-set of the psychology journals that attract contributions from business and management academics" (Harvey et al., 2010, p. 11). There are other publications in the psychology domain concerned with dual-process theory development but these were not included in this review due to the search criteria used.

Interestingly, all five articles published on intuition in business settings during the first 15 years were in the management domain. After that, there was a steady increase in the number of articles published on managerial intuition, with 8 of the 36 articles having been published between 1992 and 2002, and the majority – 23 articles – appearing during the last ten years (2003-2012). A slight decline may be observed in scholarly interest on managerial intuition (see Figure A1), with the number of articles published decreasing from 13 between 2003 and 2007 to 10 were between 2008 and 2012. Conversely, research on entrepreneurial intuition, which only started to appear in the late 1990s (Mosakowski, 1998), has continued to accelerate, and has recently surpassed the management domain. Of the 24 articles published on entrepreneurial intuition, nine were published between 2003 and 2007, and 12 between 2008 and 2012. These trends augur well for future studies on entrepreneurial intuition as they are indicative of fertile research territory and of a scholarly community that is becoming increasingly receptive to a phenomenon that was for many years relegated to the periphery of the field of psychology (Hodgkinson et al., 2008).

APPENDIX B

SAMPLE EMAIL INVITATION

SENT TO RESEARCH PARTICIPANTS

APPENDIX B

SAMPLE EMAIL INVITATION SENT TO RESEARCH PARTICIPANTS

Dear ....,

I would like to invite you, as Owner of .... Ltd., to participate in a research project which I am currently conducting, in collaboration with researchers at the University of Warwick and the University of Nottingham, on the thinking processes involved in the identification and exploitation of opportunities by entrepreneurs in the ICT industry.

What would participation entail?

Participation in this research would entail the following two steps:

1. Filling in an online survey which would take around 20 minutes to complete. If you are unable to complete it in one sitting, you may exit the survey and return to your saved data up to one week later.

2. Meeting with me for an interview in which I would guide you through a series of hypothetical opportunity identification tasks concerning a few of the latest technological innovations. This meeting would last around 30 minutes, and would ideally be held during the month of July. You would be welcome to visit me at University, or if you prefer, I could come to your office to save you the journey.

The entrepreneurs who participated in the piloting of this research have found it to be a mentally stimulating and enjoyable experience.

What's in it for you?

Upon completion of this research, I would send you a personalised report and tailor-made recommendations, based both on your personal data and on the collective findings of the study, to help you further capitalise on your strengths and to target possible areas for improvement. You would also receive a copy of the final research report containing the key findings and conclusions of this study.

Who would have access to your data?

This study is being conducted in strict accordance with the ethical standards stipulated by the American Psychological Association concerning the collection, reporting and publishing of scientific information, and has been approved by the University's Research Ethics Committee. This means that:

- Your identity and that of your enterprise/s would be known only to myself and would in no way be disclosed to third parties – your data would be identified only by means of a code number to ensure that your answers would remain anonymous;
- Your data would be treated in strictest confidence and would only be used for the purposes of this study;

- You would not be asked to divulge any sensitive information about yourself or your business/es;
- You would be free to withdraw from the study at any time.

How do you participate in this study?

If you would like to participate in this study, could you please begin by filling in the online survey, which is available at the following link:

Take the Survey

Just in case the link does not work, you may copy and paste the following URL into your internet browser:

https://wbs.qualtrics.com/WRQualtricsSurveyEngine/?Q_SS=5drMGwYPRV5A4VS_42uzUHMLwU4PIBm&_=1

Once I receive your completed survey I will contact you to set up an appointment for our meeting at a time and venue of your convenience.

If you would like any further information about this study please do not hesitate to contact me via email, phone or Skype (details below) at any time and I will be happy to answer all of your questions to the best of my ability.

I look forward to receiving your completed survey and thank you in advance for your time and support.

Kind Regards,

Leonie

Leonie Baldacchino
B.Psy(Hons), M.A.
Email ....
Mob. ....
Skype ....

APPENDIX C

HARD COPY OF THE ONLINE SURVEY

APPENDIX C

HARD COPY OF THE ONLINE SURVEY

INTRODUCTION

Welcome to this research project on ICT entrepreneurship. This survey is made up of five parts and will take you approximately 20 minutes to fill in. If you cannot complete it in one sitting, you may exit the survey and return to your data, which will be saved and stored for a period of one week, by clicking again on the link you received via email. You are free to go back to review your answers to previous questions until you have submitted your completed survey. If you require any clarification on any part of the survey, please feel free to contact Leonie Baldacchino via email (...................), phone (...................), or Skype (...................).

THANK YOU

DECLARATION BY RESPONDENT

I have read and understood the information provided by Leonie Baldacchino in her email invitation and in the above introduction, and I have had the opportunity to obtain any additional information that I may have requested about this study. I hereby confirm that I am participating in this survey voluntarily and with full informed consent, on the following conditions:

a) My identity and that of my enterprise/s will not be disclosed to third parties

b) The data collected will be treated in strictest confidence

c) The data collected will only be used for the purposes of this research

d) I may withdraw from this research at any time

❍ **I AGREE - PLEASE BEGIN SURVEY**

❍ **I DISAGREE - PLEASE EXIT SURVEY**

PART 1 - COGNITIVE STYLE SCALE

The questions in this section will help us better understand your cognitive style. This refers to the way you prefer to process information and make decisions. Please indicate to what extent each of the following statements are an accurate description of your cognitive style. There are no right or wrong answers, we only ask that you are open and truthful in your responses.

	Not at All Like Me 1	**2**	**3**	**4**	**Totally Like Me 5**
I don't like situations in which I have to rely on intuition	○	○	○	○	○
I am not a very analytical thinker	○	○	○	○	○
I usually have clear, explainable reasons for my decisions	○	○	○	○	○
When it comes to trusting people, I can usually rely on my gut feelings	○	○	○	○	○
I hardly ever go wrong when I listen to my deepest gut feelings to find an answer	○	○	○	○	○
I'm not that good at figuring out complicated problems	○	○	○	○	○
I don't think it is a good idea to rely on one's intuition for important decisions	○	○	○	○	○
My snap judgements are probably not as good as most people's	○	○	○	○	○
Reasoning things out carefully is not one of my strong points	○	○	○	○	○
I prefer complex problems to simple problems	○	○	○	○	○
I suspect my hunches are inaccurate as often as they are accurate	○	○	○	○	○
Knowing the answer without having to understand the reasoning behind it is good enough for me	○	○	○	○	○
I have a logical mind	○	○	○	○	○
Learning new ways to think would be very appealing to me	○	○	○	○	○
I don't like to have to do a lot of thinking	○	○	○	○	○
Thinking hard and for a long time about something gives me little satisfaction	○	○	○	○	○
I think there are times when one should rely on one's intuition	○	○	○	○	○

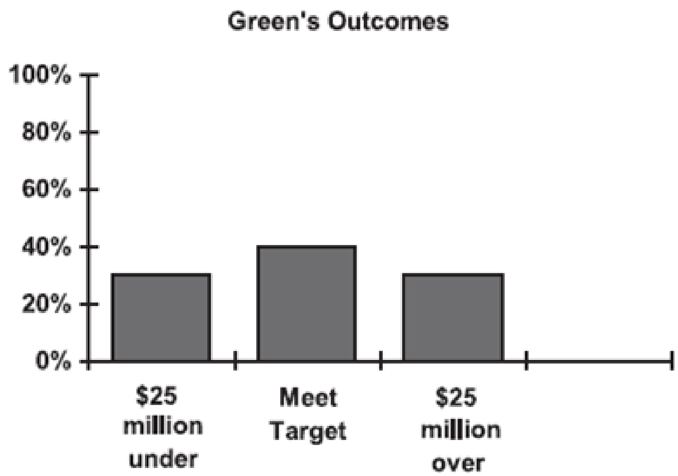
(Cont...)	Not at All Like Me 1	2	3	4	Totally Like Me 5
I have no problem thinking things through carefully	○	○	○	○	○
If I were to rely on my gut feelings, I would often make mistakes	○	○	○	○	○
I can usually feel when a person is right or wrong, even if I can't explain how I know	○	○	○	○	○
I don't have a very good sense of intuition	○	○	○	○	○
I think it is foolish to make important decisions based on feelings	○	○	○	○	○
Using logic usually works well for me in figuring out problems in my life	○	○	○	○	○
I tend to use my heart as a guide for my actions	○	○	○	○	○
I often go by my instincts when deciding on a cours of action	○	○	○	○	○
I enjoy solving problems that require hard thinking	○	○	○	○	○
I trust my initial feelings about people	○	○	○	○	○
I am much better at figuring things out logically tha most people	○	○	○	○	○
I would not want to depend on anyone who described himself or herself as intuitive	○	○	○	○	○
Thinking is not my idea of an enjoyable activity	○	○	○	○	○
I try to avoid situations that require thinking in dept about something	○	○	○	○	○
I enjoy intellectual challenges	○	○	○	○	○
Using my gut feelings usually works well for me in figuring out problems in my life	○	○	○	○	○
I like to rely on my intuitive impressions	○	○	○	○	○
I generally don't depend on my feelings to help me make decisions	○	○	○	○	○
Intuition can be a very useful way to solve problem	○	○	○	○	○
I believe in trusting my hunches	○	○	○	○	○
I enjoy thinking in abstract terms	○	○	○	○	○
I am not very good at solving problems that require careful logical analysis	○	○	○	○	○
I don't reason well under pressure	○	○	○	○	○

PART 2 - RISK PERCEPTION SCALE

The following questions will help us better understand the way you perceive risk. For this section, please imagine that you are about to undertake a new venture and that you are presented with the four venture options described below. All four of the ventures are in the ICT industry, they all require similar and manageable levels of start-up capital, and they all have met their targets for return on investment (ROI). Each of the venture descriptions is followed by a set of three scales designed to record the amount of RISK you perceive in each venture. There are no right or wrong answers, we only ask that you are open and truthful in your responses.

VENTURE GREEN

Please read this venture description, then indicate how much risk you perceive in Venture Green. In Venture Green there is a 30% chance of being under target by Euro 25 million, a 40% chance of meeting target ROI and a 30% chance of going over target by Euro 25 million. Graphically, the distribution appears as follows:

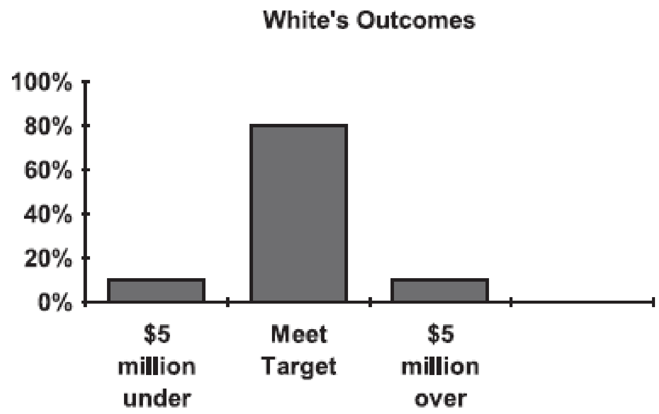


How would you describe the RISK associated with Venture Green? Please tick one point on each of the following three scales.

	1	2	3	4	5	6	7	
High	○	○	○	○	○	○	○	Low
Minimal	○	○	○	○	○	○	○	Extreme
Not Risky	○	○	○	○	○	○	○	Very Risky

VENTURE WHITE

Please read this venture description, then indicate how much risk you perceive in Venture White. In Venture White there is a 10% chance of being under target by Euro 5 million, an 80% chance of meeting target ROI and a 10% chance of going over target by Euro 5 million. Graphically, the distribution appears as follows:

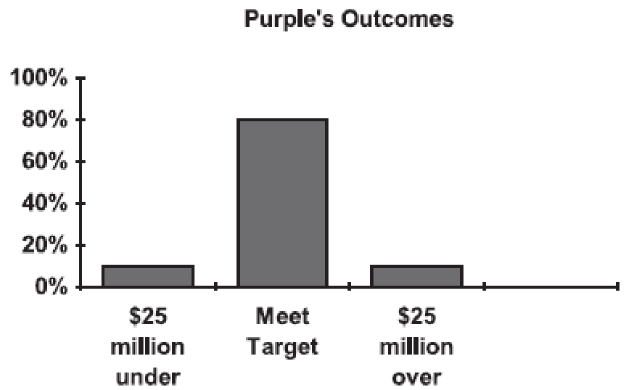


How would you describe the RISK associate with Venture White? Please tick one point on each of the following three scales:

	1	2	3	4	5	6	7	
High	○	○	○	○	○	○	○	Low
Minimal	○	○	○	○	○	○	○	Extreme
Not Risky	○	○	○	○	○	○	○	Very Risky

VENTURE PURPLE

Please read this venture description, then indicate how much risk you perceive in Venture Purple. In Venture Purple there is a 10% chance of being under target by Euro 25 million, an 80% chance of meeting target ROI and a 10% chance of going over target by Euro 25 million. Graphically the distribution appears as follows:

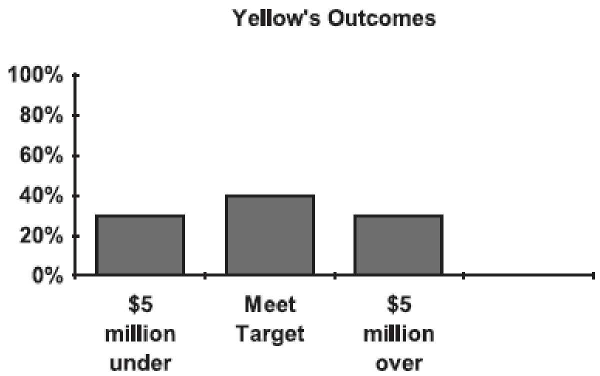


How would you describe the RISK associated with Venture Purple: Please tick one point on each of the following three scales.

	1	2	3	4	5	6	7	
High	○	○	○	○	○	○	○	Low
Minimal	○	○	○	○	○	○	○	Extreme
Not Risky	○	○	○	○	○	○	○	Very Risky

VENTURE YELLOW

Please read this venture description, then indicate how much risk you perceive in Venture Yellow. In Venture Yellow there is a 30% chance of being under target by Euro 5 million, a 40% chance of meeting target ROI and a 30% chance of going over target by Euro 5 million. Graphically the distribution appears as follows:



How would you describe the amount of RISK associated with Venture Yellow? Please tick one point on each of the following three scales:

	1	2	3	4	5	6	7	
High	○	○	○	○	○	○	○	Low
Minimal	○	○	○	○	○	○	○	Extreme
Not Risky	○	○	○	○	○	○	○	Very Risky

Having assessed the amount of risk associated with each of the above four ventures, which one would you choose to undertake?

- ❍ Venture Green
- ❍ Venture White
- ❍ Venture Purple
- ❍ Venture Yellow

PART 3 - RISK PROPENSITY SCALE

The following questions will help us better understand your personal feelings about risk. Please answer the following 5 items by ticking the alternative "a" or "b" that you would feel most comfortable with. There are no right or wrong answers, we only ask that you are open and truthful in your responses.

1. Would you feel more comfortable with:
   - ❍ a) An 80% chance of winning Euro 400, or
   - ❍ b) Receiving Euro 320 for sure

2. Would you feel more comfortable with:
   - ❍ a) Receiving Euro 300 for sure, or
   - ❍ b) A 20% chance of winning Euro 1,500

3. Would you feel more comfortable with:
   - ❍ a) A 90% chance of winning Euro 300, or
   - ❍ b) Receiving Euro 180 for sure

4. Would you feel more comfortable with:
   - ❍ a) Receiving Euro 160 for sure, or
   - ❍ b) A 10% chance of winning Euro 1,600

5. Would you feel more comfortable with:
   - ❍ a) A 50% chance of winning Euro 500, or
   - ❍ b) Receiving Euro 250 for sure

PART 4 - DELIBERATE PRACTICE SCALE

The following questions will help us better understand the ways in which you enhance your entrepreneurial knowledge, skills and performance. For each of the ten activities listed below, kindly indicate how often you engage in that activity, and to what extent you would say that activity enhances your knowledge, skills and performance as an ICT entrepreneur. For the activities which you answer question "a" with "never", kindly select the "n/a" option from the drop-down menu of question "b"; then move on to the next activity in the row beneath it. There are no right or wrong answers, we only ask that you are open and truthful in your responses.

a) How often do you engage in this activity?

Deliberate Practice Scale	Every Day	Every Week	Every Month	Every 3 Months	Every 6 Months	Every Year	Less than Once a Year	Never
1. Mental Simulation (e.g., viewing / testing your website / products through the eyes of a customer, envisaging different uses for your products)	○	○	○	○	○	○	○	○
2. Exploring new strategies (e.g., trying out new products or services, trying out new designs and observing people’s reaction)	○	○	○	○	○	○	○	○
3. Consulting colleagues or experts (e.g., seeking advice from and networking with other like-minded entrepreneurs to share knowledge and experiences)	○	○	○	○	○	○	○	○
4. Asking customers for feedback (e.g., having a feedback function on your website, asking existing clients about their needs)	○	○	○	○	○	○	○	○
5. Firm / staff meetings (e.g., brainstorming with employees to see where improvements are necessary)	○	○	○	○	○	○	○	○
6. Private conversation (e.g., talking to family members, friends, and acquaintances to pick up ideas for new or improved products)	○	○	○	○	○	○	○	○
7. Professional reading (e.g., reading business and ICT related journals and magazines, books, brochures, scanning the internet, watching domain related videos)	○	○	○	○	○	○	○	○
8. Workshops / training / courses (locally, overseas or online)	○	○	○	○	○	○	○	○
9. Observing others (e.g., keeping an eye on the competition to see what they are offering in terms of products, prices, etc.)	○	○	○	○	○	○	○	○
10. Monitoring (e.g., keeping track of which of your products are selling the most, keeping records of statistics related to your website's traffic such as number of clicks, duration of visits, etc.)	○	○	○	○	○	○	○	○

b) To what extent does it enhance your knowledge, skills and performance as an ICT entrepreneur?

Deliberate Practice Scale (Cont...)	To a great extent	To a large extent	To some extent	To a minor extent	To no extent	N/A
1. Mental Simulation (e.g., viewing / testing your website / products through the eyes of a customer, envisaging different uses for your products)	○	○	○	○	○	○
2. Exploring new strategies (e.g., trying out new products or services, trying out new designs and observing people's reaction)	○	○	○	○	○	○
3. Consulting colleagues or experts (e.g., seeking advice from and networking with other like-minded entrepreneurs to share knowledge and experiences)	○	○	○	○	○	○
4. Asking customers for feedback (e.g., having a feedback function on your website, asking existing clients about their needs)	○	○	○	○	○	○
5. Firm / staff meetings (e.g., brainstorming with employees to see where improvements are necessary)	○	○	○	○	○	○
6. Private conversation (e.g., talking to family members, friends, and acquaintances to pick up ideas for new or improved products)	○	○	○	○	○	○
7. Professional reading (e.g., reading business and ICT related journals and magazines, books, brochures, scanning the internet, watching domain related videos)	○	○	○	○	○	○
8. Workshops / training / courses (locally, overseas or online)	○	○	○	○	○	○
9. Observing others (e.g., keeping an eye on the competition to see what they are offering in terms of products, prices, etc.)	○	○	○	○	○	○
10. Monitoring (e.g., keeping track of which of your products are selling the most, keeping records of statistics related to your website's traffic such as number of clicks, duration of visits, etc.)	○	○	○	○	○	○

PART 5 - BACKGROUND INFORMATION

The questions in this section concern your educational, employment, and business ownership history. Reference will be made to micro, small, medium and large enterprises.

Please use the following (EU) criteria to classify businesses according to size:

- Micro enterprise: Up to 10 employees
- Small enterprise: Between 11 and 50 employees
- Medium enterprise: Between 51 and 250 employees
- Large enterprise: More than 250 employees

May we remind you that all the information you are providing in this survey will be treated in strictest confidence and that your anonymity is guaranteed. We ask that you please answer all questions openly and truthfully.

EDUCATIONAL BACKGROUND

What is the highest qualification you attained? (Please select from the drop-down menu)

- ❍ School Leaving Certificate
- ❍ Secondary Education Certificate or equivalent
- ❍ Matriculation Certificate or equivalent
- ❍ BTEC First Diploma or equivalent
- ❍ BTEC National Diploma or equivalent
- ❍ BTEC Higher National Diploma or equivalent
- ❍ Bachelor's Degree
- ❍ Post-Graduate Diploma
- ❍ Master's Degree
- ❍ Doctoral Degree

Have you ever studied / received training in the following subjects? (please tick all that apply)

	YES, I studied this subject at the following level/s:								
	SEC	**Matric-ulation**	**Diploma**	**Bachelor**	**PGDip**	**Master**	**Doctoral**	**Other training**	**Never**
ICT / Computing									
Business / Management									
Entrepreneurship, Creativity and/or Innovation									

EMPLOYMENT HISTORY

In this section, reference is made to your work experience in managerial and non-managerial positions in the ICT and non-ICT industries. We define managerial positions as those involving responsibility for managing and organising people (e.g., hiring, firing and / or appraisals) and resources (e.g., budgetary responsibility).

What sort of work experience did you have prior to becoming a business owner? (please tick all that apply)

- ❍ ICT industry: managerial position/s
- ❍ ICT industry: non-managerial position/s
- ❍ Non-ICT industry: managerial position/s
- ❍ Non-ICT industry: non-managerial position/s
- ❍ No work experience

How many years did you spend working in each of the following prior to becoming a business owner? (Please type "0" where you have no experience)

	Size of Enterprise			
	Micro **< 10**	**Small** **< 50**	**Medium** **< 250**	**Large** **> 250**
ICT industry: Managerial position/s				
ICT industry: Non-managerial position/s				
Non-ICT industry: Managerial position/s				
Non-ICT industry: Non-managerial position/s				

BUSINESS OWNERSHIP HISTORY

How many companies have you owned in total (including your current business/es)?
For each of the businesses you own / have owned, please provide the following details in the table below:

- The year of entry and exit - i.e., the year in which you gained an ownership stake in (i.e., when you legally founded, purchased or inherited) the business; and the year in which you exited the business (If you are still an owner of the business, please type "n/a");
- The route of entry - i.e., the way in which you gained an ownership stake in the business (were you the founder of the business, did you purchase it or did you inherit it?);
- Industry and Size - i.e., whether the business is / was in the ICT or in another industry, and whether it classifies/d as a micro (< 10 employees), small (< 50 employees), medium (< 250), or large (> 250) enterprise, as per the headcount criterion of the EU definition of SMEs specified above.

- Route of exit - if you are still an owner of the business, please select the "n/a" option from the drop-down menu. If, however, you are no longer an owner of this business, please indicate whether you closed the business, whether you sold it, or whether you exited the business by means of any other route.
- Reason of exit - if you are still an owner of the business, please select the "n/a" option from the drop-down menu. If, however, you are no longer an owner of this business, please indicate the reason why from among the following:
  - The Performance was too low in relation to your expectations (select "Performance");
  - Bankruptcy / Liquidation / Receivership (select "B/L/R");
  - There was an opportunity to realise a Capital Gain (select "Capital Gain");
  - A better opportunity presented itself (select "Opportunity");
  - Any other reason (select "Other")

Year of		**Route of**	**Industry**		**Route of**	**Reason for**
Entry	**Exit**	**Entry**	**and Size**		**Exit**	**Exit**
		Founded ○	ICT Micro ○	Non-ICT Micro ○	n/a ○	n/a ○
		Purchased ○	ICT Small ○	Non-ICT Small ○	Closed ○	Performance ○
		Inherited ○	ICT Medium ○	Non-ICT Medium ○	Sold ○	B/L/R ○
			ICT Large ○	Non-ICT Large ○	Other ○	Capital Gain ○
						Opportunity ○
						Other ○

(Note: This table was repeated as many times as necessary in the online survey to allow respondents to fill in details of every business owned)

PART 5.4 PERSONAL DETAILS

As outlined in the introductory email sent to you by Leonie Baldacchino, we would like to be able to provide you with feedback about your responses, and also possibly to arrange a brief interview as a follow-up to this survey. Could you therefore please provide your contact details (including name and email address) in the spaces below.

Name .... Surname ....
Sex .... Age ....
email address ....

YOU HAVE REACHED THE END OF THIS SURVEY

Kindly note that once you click on the ">>" button below, your responses will be submitted and you will no longer be able to go back to review your answers. If you are ready to submit your responses, please click on the ">>" button below. If you would like to review your answers one more time, please click on the "<<" button to do so now, or exit the survey and return to your saved data to complete this survey up to one week from today.

THANK YOU << >>

APPENDIX D

INFORMED CONSENT FORM

APPENDIX D

INFORMED CONSENT FORM

Research Project with ICT Entrepreneurs
Spring/Summer 2011

conducted by:

LEONIE BALDACCHINO
Warwick Business School, University of Warwick, UK
and The Edward de Bono Institute, Unversity of Malta
Email ....; Mob. ....

Declaration by Respondent:

I have read and understood the information provided by Ms. Leonie Baldacchino in her introductory e-mail concerning the research in caption and I have had the opportunity to obtain any additional information I requested about this research.

I hereby offer my full informed consent to participate in this research and grant permission for my interview to be audio-recorded and transcribed to facilitate data analysis, on the following conditions:

- my identity and that of my enterprise/s will not be disclosed to third parties
- the data collected will be treated in strictest confidence
- the data collected will only be used for the purposes of this research
- I may withdraw from all or part of this research at any time

Respondent Name: ....

Respondent Signature: ....

Date: ....

APPENDIX E

VERBAL PROTOCOL GUIDE,

INSTRUCTIONS AND

TECHNOLOGY DESCRIPTIONS

APPENDIX E

VERBALPROTOCOL GUIDE, INSTRUCTIONS and TECHNOLOGY DESCRIPTIONS

Instructions to be read by Researcher to the Participants (adapted from Ericsson & Simon, 1993).

In this experiment we are interested in the thinking processes involved in the identification of entrepreneurial opportunities in the ICT industry.

In order to explore these processes I am going to present you with a number of scenarios and ask you to THINK ALOUD as you work on the tasks that will be presented to you. What I mean by think aloud is that I want you to verbalise EVERYTHING you are thinking from the moment you begin reading the scenario (even while you are reading it) until you have completed the tasks presented. I would like you to talk aloud CONSTANTLY from the time I present the scenario until you have given your final answer to the tasks presented.

I do not want you to plan out what you say or to try to explain to me what you are saying. Just act as if you are alone in the room speaking to yourself. It is most important that you keep talking. If you are silent for any period of time I will ask you to talk. Do you understand what I want you to do?

TASK CONTEXT:

Imagine that you are thinking of starting up a new company based in Malta in the ICT industry and you are looking around for new business ideas.
You are abroad attending a technology fair with an eye for identifying opportunities for your new venture.

TASK 1:
As you read the following scenario, your task is to think of what business opportunities could be possible for the described technology.
Please start reading and thinking aloud.

(Respondent to read Scenario 1 and to identify opportunities as s/he goes along)

SCENARIO 1 – The Multi-Touch Screen
(to be read by respondent)

The first stall that attracts your attention is one which displays the following banner: “Turn Air Into a Multi-Touch Screen”. You stop to have a closer look, and the CEO approaches you to explain further.

“Touch-sensitive frames have enabled surfaces to become interactive for years, but their size and responsiveness tend to be limited. Our prototype might look like an empty frame, but it's actually full of advanced capabilities”. The 28-inch ZeroTouch frame with scalloped edges can detect whatever moves around inside it. Fingertips, hands, arms, and even inanimate objects pass through an invisible two-dimensional optical web that tracks them. Put ZeroTouch on a computer screen and it turns into an interactive surface that can be manipulated with a stylus.

The technology itself is straightforward. The ZeroTouch frame contains 256 infrared sensors and 32 LEDs, and each light blinks at a specific frequency that is read in sequence by the sensors. The prototype is so responsive because each LED is blinked in sequence about 2,400 times a second, says the CEO. The frame is connected to a computer via USB, which provides power and collects the data.

The CEO points out that the technology creates more possibilities for interaction than capacitive interfaces like the glass touch-screens on smart phones and laptops. The technology simply requires the user to break the light beams - there's no force required to activate the sensor.

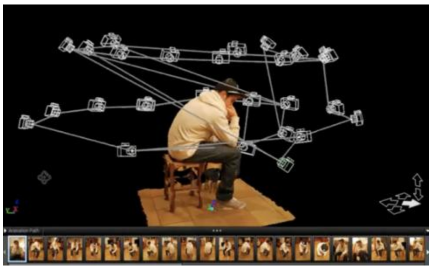
(When Respondent has nothing further to add, the Researcher presents the next Scenario and explains that the above sequence of tasks is to be repeated).

TASK 2:
As you read the following scenario, your task is to think of what business opportunities could be possible for the described technology.
Please start reading and thinking aloud.

(Respondent to read Scenario 2 and to identify opportunities as s/he goes along)

SCENARIO 2 – 3D Imaging Software
(to be read by respondent)

The next stall to catch your eye is that of a design software company which has recently developed a software that can turn photographs into a three-dimensional souvenir.



"We can automatically generate a 3-D mesh at extreme detail from a set of photos—we're talking the kind of density captured by a laser scanner," says the Vice President of this company as you stop to take a closer look. "However, unlike a laser scanner, the equipment needed to capture the 3-D rendering doesn't cost tens or hundreds of thousands of dollars. An overlapping set of approximately 40 digital point-and-shoot photos is enough to capture a person's head and shoulders in detailed 3-D".

After downloading the software, which will be available only for Windows computers, users can upload their photos to a cloud server for processing. After downloading the results, the 3-D renderings appear as a wire-frame model of the captured scene with realistic surface color and texture. Users can then send that model to a 3-D printing service.

According to the Vice President, models produced from a set of well-taken photos will be spatially accurate to within 1 percent or less.

(When Respondent has nothing further to add, the Researcher presents the next Scenario and explains that the above sequence of tasks is to be repeated).

TASK 3:
As you read the following scenario, your task is to think of what business opportunities could be possible for the described technology.
Please start reading and thinking aloud.

(Respondent to read Scenario 3 and to identify opportunities as s/he goes along)

SCENARIO 3 – The "Quick-Tap" Phone Payment App
(to be read by respondent)

The next stall you see is one which displays a new software which has recently been introduced in the UK, enabling shoppers to pay for high street goods with a simple tap of their mobile phone.

Under the scheme people will be able to buy items costing up to £15 simply by tapping their mobile phone against a contactless payment terminal.

The terminals have been installed in more than 50,000 stores across the UK. Orange customers who use a 'Quick Tap' enabled handset will be able to use the facility. It will initially be launched on one of the network's most popular handsets, which will be available on both a 'pay as you go' and monthly plan basis.

Users will need to load up to £100 on their phone using a Barclaycard, Barclays debit card or Orange credit card. They will receive electronic statements on their mobile screen detailing their spending.

The representative manning the stand approaches you: "This is the first time that customers can use their mobile to pay for goods and services in shops across the UK rather than using cards or cash", she says.

"We no longer use our mobile phones simply for talking and texting - apps, cameras and music players allow us to use them for a lot more", adds her colleague. "So, making contactless payments with your mobile is a natural and really exciting innovation which we're pleased to be leading on in the UK".

APPENDIX F

CONFIDENTIALITY AGREEMENT

APPENDIX F

CONFIDENTIALITY AGREEMENT

Research Title: Entrepreneurial Experience and Opportunity Identification: The Role of Intuition and Cognitive Versatility

Researcher: Leonie Baldacchino

Institution: Warwick Business School, University of Warwick, UK and The Edward de Bono Institute, University of Malta

Declaration by Research Assistant:

I agree to maintain **full confidentiality** regarding any and all audio files and documentation received from Leonie Baldacchino related to the study in caption. Furthermore, I agree:

- To hold in strictest confidence the identification of any individual that may be inadvertently revealed during the transcription of audio-recorded interviews, or in any associated documents;
- To not disclose to third parties the online depository location to be used for the electronic transfer of all study-related audio and text files between the researcher and the research assistants;
- To store all study-related audio and text files in a safe and secure location for as long as they are in my possession;
- To delete all electronic copies of study-related audio and text files from my computer hard drive and any back-up devices, upon completion of this assignment;
- To destroy all hard copies of study-related text files, such as printouts of the transcribed interviews, upon completion of this assignment.

I am aware that I can be held legally liable for any breach of this confidentiality agreement and for any harm incurred to individuals if I disclose identifiable information contained in the audiotapes and/or files to which I have access.

Research Assistant's Name: ....

Research Assistant's Signature: ....

Date: ....

APPENDIX G

SAMPLE CODED PROTOCOL

APPENDIX G

SAMPLE CODED PROTOCOL

Quick-Tap Phone Payment Application

Notes:

Respondent: E16 (Owner of multiple ICT businesses)

Segments separated by //

Number of *Intuitive* Segments – marked in *Italics*: 11

Number of **Analytical** Segments – marked in **Bold**: 14

Cognitive Strategy: Versatile

Opportunties Identified: 1, Rated ≥ 6 (See Appendix H, Code E16-QT-01)

Respondent reads from text: The next stall you see is one which displays a new software which has recently been introduced in the UK, enabling shoppers to pay for high street goods with a simple tap on their mobile phone.

Respondent verbalisation: // *Fantastic!* //

Respondent reads from text: Under the scheme, people will be able to buy items costing up to £15 simpl… up to fifteen pounds simply by tapping their phone… haw the phone against a a a contactless payment terminal. The terminals have been installed in more than 50,000 stores across the UK. Orange customers who use a 'Quick Tap' enabled handset will be able to use the facility. It will initially be launched on one of the network's...

Respondent verbalisation: // **Eee mela are the current ee machines (pause)... in the local shops in Malta, if I'm bringing this technology into Malta, ee do I need to replace them? // Hence do I need to go through the bureaucracy of convincing the banks and all that?** // *So that again my take to market route, is going to be a lengthy one cause of theee conservatism within banks.* // **So that is a caveat I need to ask that on the stall while I'm here. // Eee if that is the case, my level of interest will decrease eeeee from something I can do immediately but something I can start working on.** // *The idea is brilliant // Eee I am not happy with the fifteen pound threshold, it.* // **is that**

programmable or not? // *And if this thing is actually responding to (pause)... eee ... (pause) a point of sale pay machine like that, potentially it can actually also respond to an ATM in a bank, I mean ATM in a wall.* // **I will ask that question too.** // *If it does, there are more applic more applicabilities that you can do with it.* // **Why? I have a 21-year old son, that goes out to Paceville**. // **I have to pick him up,** // **no not 21, 16, now he's driving, eee but when he was 16 I used to have to pick him up at 2 o'clock in the morning,** // **there were days when I was really tired, I ask him to get a cab and he would say I have no money on me.** // *Can I in any effect a phone through my account, through my mobile, send money to my son and he can go, plug in a number through his mobile da da da and get some money out of an ATM. So I won't have… I won't be stuck.* // *Eee so that applicability is very very fancy.* // **Eee I have another issue for sure, I am one person who has about three credit cards and I don't remember any pin number.** // **What happens if I lose my phone?** // **If that is something which can be automated through my mobile phone?** // **These were all the thin… the questions I would be asking (pause)...** *// At, at face value I am convinced in my mind that ee there are people out there with a lot of problems like I have, you know I never have cash on me, I always need an ATM.* // *If I could actually.. Imagine if I could pay a taxi driver through my mobile!!!* // *So I don't know. Yes, the answer is yes ... Yep for sure.*//

APPENDIX H

SAMPLE OF OPPORTUNITIES IDENTIFIED

APPENDIX H

SAMPLE OF OPPORTUNITIES IDENTIFIED

Multi-Touch Screen: Very Innovative Opportunities (Rated $\geq$ 6)
I would find an interesting application for 3D, in terms of.. I mean if I think nowadays ok, there's remote medicine for example, or remote technologies.. that it's essentially scanning what I do here with my hands, visualizing what I see at the other end, and that's being projected and that's ah, scanning what I'd do. (E28-MT-03) Glass would require most probably more (pause)... production (pause)... quality than this frame, so in terms of who can produce this, from spare parts, in a third world country, most probably much easier than having the glass touch screen, so finding an application for that in third world countries might be easier.. In terms of recycling, producing it from recycled parts ... It's quite interesting because it should be cheap to manufacture. It's not a, it mostly relies on software and very simple hardware, eem so basically simple relays and connectivities ... Yeah, emm what what is interesting I find is the simplicity of the technology, that makes it very eemm attractive, because it can be it can be generally generated from recycled parts, spare parts, even in third world countries that basically emm don't have higher technologies... (E28-MT-04) I could see a big application for this in the areas of accessibilities where you have people who have problems moving eh moving limbs and arms eh they will be able to use this technology … people with disabilities … What what's really good about it for people who don't even have arms is that they could use that with a pencil from their mouth and be and be able to work with this as well. You don't have to apply pressure so if your movement is very limited it will detect that also, so that I could see that working eh immediately ehm in that area, and ah the there are lots of people who have the brains to work in IT but eh they cannot move the mouse or the keyboard, lots and lots of those people, you can unlock a huge area with this with this technology. Governments would buy it, institutes would buy it so.. And eh there's a big drive for accessibility throughout Europe and even America so ehm I see immediately, that would be the first thing that comes to my mind for this application. (E67-MT-01)

Multi-Touch Screen: Moderately Innovative Opportunities (Rated 4-5)
Or the ideal thing to have in a kitchen to browse your cookery book, you know I mean just swipe through the air and you have the monitor and like you do on an iPad but without actually touching. (E54-MT-04) One day you are going to sit down at a restaurant, you are going to have one of these boards, you're going to flip through the menu using this, you might decide to order using this, you might pay by putting your credit card through that, so I can see a lot of scope for this … to order, even to display menus rather than chalk it or print it, it will be more interactive ... and you can, and you can have the option to Tweet. So in the restaurant business, I think it will be quite innovative. (E55-MT-01) I can see opportunities for it not only in home users and business users but in retail, in retail technology. There is very expensive retail technology out there with touch screen point of sale terminals. This could make a very very cheap alternative for that if it's cost effective. That then speeds up retail point of sale transactions etc., eliminates the use of the mouse... there are lots of good reasons for this to to be a successful opportunity. (E59-MT-01)

Multi-Touch Screen: Not Very Innovative Opportunities (Rated < 4)

The possibilities for something like this I think are areee qee quite numerous, qemm, particularly qeee in applications in various fields - in retail would be qeee a definite example ... I would say there would be a market for it … There is a certain amount of unearned revenue that one can actually generate obviously from selling the equipment itself… (E05-MT-01)

This formula seems to be basically getting an agency agreement done, and promoting it. Nothing too complicated, get the deal to promote it in Malta. Eeeemm I would list any users who would be interested in it … Is the cost prohibitive for personal? I mean how many people would actually buy it for their home? (E20-MT-01)

Em what I'd probably try to do as a business initiative on this one would be to get either one of the people we partner with or work with to do the import and whatever, and we would be more con, we would be more a reseller as part of our eeem servicing, coz that's what we do, we don't really sell technology hardware. (E47-MT-02)

3D Imaging Software: Very Innovative Opportunities (Rated ≥ 6)

I can take photos of a city like Valletta, I can literally have a 3-D model of it, from having a 3D model of it I can then use some other software where I can interact with the actual 3D model so I can walk through Republic Street and I can offer a virtual shop, where people can go and order their lunch… My brother lives in Scotland, I live in Malta, we can virtually meet... walk Republic Street together, ok? And online buy.. buy a present for my mother on Mother's Day. Ok?… I want to produce the Malta Mall! (E16-3D-01)

It would definitely be very useful for people who want to show off their products with a 3 dimensional element. So when you're selling online in e-commerce it would be great to be able to move the product around and see it… If they have something of a sort which you can print, wire frame model, I imagine that it can also be displayed and produced ee for for web display... I would sit down with this vice president I would discuss with him this issue and this how I would want to adapt his software for use on a web.. So not for printing of photos but for using the technology for products, and I think it co could be something fantastic... A big problem when you're selling online is the fact that a person wants to know exactly what they're buying. If we're talking of buying expensive jewellery for example, and that's the way the e-commerce world is going, people are actually buying luxury.. buy items on the web, then in that case it would be great to actually move around it and see the item to give me peace of mind.. If you're buying a sculpture, I mean it would be great to get a feel of the dimensions etc. So something like this I would try to partner with this company to use the software that they have em as an adaptation of the current current system. So I would tell them I am not interested in selling 3D photos but I am interested in having a partnership with you to develop this product further to come up with software that can be used for items. (E41-3D-01)

We could use it to possibly create realistic scenarios for dangerous mission training for em like emergency service for example, and create a really truly life-style, em life-like em training situation for firemen going through em different kinds of buildings, hazardous environments, maybe even em nuclear reactor incidents for instance like in Japan, em. (E36-3D-02)

3D Imaging Software: Moderately Innovative Opportunities (Rated 4-5)

I can see a lot of opportunity, definitely for instance in digital conservation, where you would use this to take a photo of Hagar Qim, so you can capture it on a 3D... Statues that can be preserved and shown online ... Fine Arts Museum... Statues which exist on a 3D level... And the person can watch these comfortably from home. And it's much more popular. Fine Arts Museum I think sees only 18 people a day, so online we're getting lots of hits from abroad, tremendous... Now I imagine this is on a small scale, so on a on an object alone. Doing Hagar Qim might be bit more complicated, in that I'd like to see how it exports to ACad, whether it can be exported to ACad, whether it can be em rapid prototyping... (E33-3D-01)

This could be turned into just more than just souvenirs, this could become em something that people could use as an avatar online em, could be animated, could it be em turned into ahm artificial intelligence to become emotionally contextually aware ehh ... I'm assuming that it's fairly high density and therefore we could have really quite high resolution images for avatars. (E36-3D-01)

This would be great for prototyping for example, that eee you have eee, you built something, then you take a picture which gives you a 3D image of it which you can then feed into Auto Cad for example... (E49-3D-02)

3D Imaging Software: Not Very Innovative Opportunities (Rated < 4)

There could beee quite a number of opportunities with regards either to souvenirs... If we can call them that (pause)… There is ... a wide range of, eh possibilities (E14-3D-01)

It's like something that parents want, to print a 3D version of their kid's leg or something like... Mothers, you know, expecting mothers they'll always happily buy everything for their kids you know I mean and now 3D prints, stuff like that. (E26-3D-01)

Tourists who want to take something as practical as possible em from something that they enjoyed looking at or doing (pause)… Something like this, exactly as he is describing it here, that you can take a souvenir of what you are seeing, but you can create it in 3D. (E37-3D-01)

Quick-Tap Phone Payment App: Very Innovative Opportunities (Rated ≥6)

The idea is brilliant! And if this thing is actually responding to (pause)... eee ... (pause) a point of sale pay machine like that, potentially it can actually also respond to an ATM in a bank, I mean ATM in a wall... If it does, there are more applic.. more applicabilities that you can do with it. Why? I have a 21-year old son that goes out to Paceville. I have to pick him up, no not 21, 16, now he's driving, eee but when he was 16 I used to have to pick him up at 2 o'clock in the morning. There were days when I was really tired, I ask him to get a cab and he would say "I have no money on me". Can I in any effect a phone, through my account, through my mobile, send money to my son, and he can go, plug in a number through his mobile da da da and get some money out of an ATM? So I won't have… I won't be stuck? Eee so that applicability is very very fancy. Eee I have another issue for sure, I am one person who has about three credit cards and I don't remember any pin number. If that is something which can be automated through my mobile phone? I am convinced in my mind that ee there are people out there with a lot of problems like I have, you know, I never have cash on me, I always need an ATM... If I could actually... Imagine if I could pay a taxi driver through my mobile! (E16-QT-01)

You could have a payment method which is tied up to buying.. transport tickets, bus tickets, from a vending machine with a mobile phone, or even, or even using the phone as you go on the bus as a kind of Oyster Card, that would be intriguing. So so yeah ok, so that would be moving away from the traditional merchant into into aaa, into a place where payments are made where credit cards are not typically used. Ok that seems to be the kind of idea to go forward with, at least one that I would go forward with, that since this provides a method of payment which is easier than the credit card, and easier than cash, identify the areas like eem, bus trips, where eeh payments... Yep so em so yeah, so the notion of aa using a this as a payment device in aa areas where at the moment electronic payments are not made is probably one of the more intriguing intriguing ee areas to to to look at. (E34-QT-02)

One notion is, they say here that electronic statements on their mobile screen detailing their.. They will receive electronic statements on their mobile screen detailing their spending. There might be some opportunity there for some application development which might make that a bit more interesting. In the sense that electronic statements sound like the usual run of the mill, sending statements but receiving them on mobile screen. So there isn't anything too extraordinary or innovative about that. But... one could write applications which already kind of exist, with bar codes and so on, to find the best deal for something, but this really isn't a payment thing, this is something else, something like Foursquare and all those those barcode-reading applications which, which would tell you em once you scan a barcode eem, what price that item is available in other places, and if there's one close by that you can buy cheaper, and so on. It might be interesting to integrate that sort of application with this, leaving it as a holistic application, although I don't quite totally see it at the moment. Yeah the em forsi the more interesting thing would be integration of, of this payment method with other applications. There can be applications which will see what you buy and come up with suggestions as to what you should be buying to complement what you buy. You bought a Kindle for example, come up with suggestions as to.. and noticing that you haven't bought a cover for your Kindle kind of.. come up with suggestions as to where you can get the best deals for buying a cover for your Kindle... (E34-PP-03)

Quick-Tap Phone Payment App: Moderately Innovative Opportunities (Rated 4-5)

You need an intermediary for something like this to happen, which would be something like a company that offers this service to Vodafone or to Go. So that is interesting, because Go and Vodafone will not have the infrastructure to do it themselves, they need an IT infrastructure, which includes the comfortable aspect of being that company providing that service to other parties. So not really engaging the customers directly, you have two clients or three clients that will be Melita, Vodafone, Go and whoever the supplier is, and they are selling it on your behalf. So so something like this definitely interested yes... The market is is is humungous for something like this, and and you're not investing a lot of money in marketing it. Why? Because the marketing is gonna be done by, marketing this service is gonna be done by Vodafone and Go Mobile on your behalf, so all you're doing is marketing it to a very few customers, convincing them, and they sell it to their customers. So all of a sudden you have the clients of, the customers of Vodafone buying your service through Vodafone, or Go... (E35-PP-01)

These devices and paying by phone could be useful in these countries where they have betting shops and they don't want to worry about cash... Could it be used for betting? I think so... There is potential in this. How can we earn money off it? By we speak to a client who is looking at new payment methods to resolve the betting shop issue, and see if this can be done in conjunction with his existing project we're working on. Maybe we can then get a commission based on that... We are going to have these shops in Malta as well, and maybe there'd be a small market in Malta, and we can use Malta as a test base, and if it works here we use that as a case study. I have a client who is operating a shop and I'm doing their sales so I can ask him if he'd be interested in this. Yes, there is potential... Mobile phone is used by everybody. Cash, people want to get it out of the system because of money laundering and all this sort of stuff, so this is a possible solution... Talking about Germany, they have a lot of betting shops there, so if I can get into Germany with this idea for the betting shop, there is potential, I can sit back and money will roll in on its own, so it's not something to be ignored... It would be interesting enough that I would talk to somebody and we'd work together on it in a partnership... starting up with new partners who can dedicate as much time, you know, and we would all work together, on speaking to Vodafone here, speaking to Go, and this sort of thing. I know people who produce terminals. I know GO, I know Vodafone, so I can use all my contacts and that would be my contribution to the new company. The other people can then find out the situation in other countries and we can explore the possibilities in other countries. And then, once we explore and we get into that, we may start with betting shops, coz that's where the real issue is, so the demand will be greater, but then you can go into other retail outlets... (E52-PP-01)

I'll also see how it can be to a certain extent exploited to be actually used at home. A simple device, call it simple home device, which basically through Bluetooth or whatever you can actually do your online purchases with it, you know to actually maximize on it. Online purchases are growing, so you that's what you need to look at. (E54-PP-03)

Quick-Tap Phone Payment App: Not Very Innovative Opportunities (Rated < 4)

The first thing one thinks of is introducing something like that into the market here in Malta... Certainly an area which is a massive potential area, so I would think this is something that is worth looking at... (E01-PP-01)

Ok recently introduced, so that's good as eeemmm that could be an opportunity for Malta... This is something that is probably revolutionary in Malta and yes that would be interesting qeee I suppose... Yes, it's an opportunity... It would be interesting yes... because as such, as far as I I I know, eemm there are no people interested in the product at the moment, it is not established yet, eeemmm aaand people are, Malt.. Maltese are yes quite innovative in using their mobile phone. They they like mobile phones and having, doing, I mean having the facility of doing a payment through a mobile phone, yes it would be interesting to go into. Yes. (E06-PP-01)

Qem so as such over here the only way that I could do business with this is selling the terminals, that could be one thing, to the banks.. Getting a contract with these guys selling the terminals (E71-PP-01)

APPENDIX I

MEDIATION ANALYSIS MODELS: FULL RESULTS

Table I1 Mediation Analysis Models for H_{2d} (intuition mediates the relationship between experience and the number of opportunities identified) Overall

	Effect of X on M	Direct Effect of X on Y	Total Effect of X on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	Coeff [SE]	Coeff [SE]	Coeff [SE]	coeff [Boot SE]	Boot LLCI	Boot ULCI
Constant	-28.469 [21.433]	0.109 [2.893]	-0.995 [2.949]			
No. of Intuition Segments		0.039* [0.017]				
No. of ICT Businesses Owned	3.868*** [1.068]	0.535*** [0.157]	0.685*** [0.147]	0.150 [0.098]	0.002	0.404
Rationality	1.726 [3.335]	-0.181 [0.445]	-0.114 [0.459]			
Experientiality	0.962 [2.984]	0.189 [0.398]	0.226 [0.411]			
Risk Propensity	4.163* [1.609]	0.225 [0.225]	0.387† [0.221]			
Risk Perception	0.797 [1.549]	-0.333 [0.207]	-0.303 [0.213]			
Years Education	1.105 [0.720]	0.082 [0.098]	0.125 [0.099]			
Years Work Experience	0.539** [0.189]	0.032 [0.027]	0.053* [0.026]			
Years ICT Business Ownership	0.239 [0.219]	-0.014 [0.029]	-0.005 [0.030]			
Years Non-ICT Business Ownership	-0.135 [0.647]	0.014 [0.086]	0.009 [0.089]			
No. of Non-ICT Businesses Owned	-0.350 [2.037]	-0.120 [0.285]	-0.134 [0.294]			
Deliberate Practice	1.336† [0.677]	-0.015 [0.093]	0.037 [0.932]			
R Squared	0.440	0.447	0.399			
F	4.433***	4.106***	3.744***			

Notes: Coefficients are shown, with standard errors in parentheses;
X = Number of ICT Businesses Owned, M = Number of Intuition Segments Overall, Y = Number of Opportunities Identified Overall;
Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;
Number of Observations = 74; Bootstrap re-sampling = 5000;
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I2 Mediation Analysis Models for H_{2e} (intuition mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 4) Overall

	Effect of X on M Coeff [SE]	Direct Effect of X on Y Coeff [SE]	Total Effect of X on Y Coeff [SE]	Indirect Effect of X on Y with Bootstrapped Estimates coeff [Boot SE]	Boot LLCI	Boot ULCI
Constant	-28.469	0.660	-0.831			
	[21.433]	[2.386]	[2.589]			
No. of Intuition Segments		0.052***				
		[0.014]				
No. of ICT Businesses Owned	3.868***	0.575***	0.778***	0.203	0.079	0.445
	[1.068]	[0.129]	[0.129]	[0.086]		
Rationality	1.726	0.207	0.298			
	[3.335]	[0.367]	[0.403]			
Experientiality	0.962	-0.027	0.024			
	[2.984]	[0.328]	[0.361]			
Risk Propensity	4.163*	0.097	0.315			
	[1.609]	[0.186]	[0.194]			
Risk Perception	0.797	0.260	-0.218			
	[1.549]	[0.170]	[0.187]			
Years Education	1.105	-0.070	-0.012			
	[0.720]	[0.081]	[0.087]			
Years Work Experience	0.539**	-0.005	0.023			
	[0.189]	[0.022]	[0.023]			
Years ICT Business Ownership	0.239	-0.005	0.008			
	[0.219]	[0.024]	[0.027]			
Years Non-ICT Business Ownership	-0.135	-0.011	-0.018			
	[0.647]	[0.071]	[0.078]			
No. of Non-ICT Businesses Owned	-0.350	0.129	0.111			
	[2.137]	[0.235]	[0.258]			
Deliberate Practice	1.336	-0.086	-0.016			
	[0.677]	[0.077]	[0.082]			
R Squared	0.440	0.574	0.475			
F	4.433***	6.844***	5.103***			

Notes: Coefficients are shown, with standard errors in parentheses;
X = Number of ICT Businesses Owned, M = Number of Intuition Segments Overall, Y = Number of Opportunities Rated ≥ 4 Overall;
Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;
Number of Observations = 74; Bootstrap re-sampling = 5000;
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I3 Mediation Analysis Models for H_{2e} (intuition mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 6) Overall

	Effect of X on M Coeff [SE]	Direct Effect of X on Y Coeff [SE]	Total Effect of X on Y Coeff [SE]	Indirect Effect of X on Y with Bootstrapped Estimates coeff [Boot SE]	Boot LLCI	Boot ULCI
Constant	-28.469 [21.433]	0.493 [1.476]	-0.030 [1.496]			
No. of Intuition Segments		0.018* [0.009]				
No. of ICT Businesses Owned	3.868*** [1.068]	0.388*** [0.080]	0.459*** [0.075]	0.071 [0.052]	-0.005	0.215
Rationality	1.726 [3.335]	0.084 [0.227]	0.116 [0.233]			
Experientiality	0.962 [2.984]	-0.038 [0.203]	-0.020 [0.208]			
Risk Propensity	4.163* [1.609]	0.028 [0.115]	0.104 [0.112]			
Risk Perception	0.797 [1.549]	-0.137 [0.105]	-0.122 [0.108]			
Years Education	1.105 [0.720]	-0.049 [0.049]	-0.029 [0.050]			
Years Work Experience	0.539** [0.189]	-0.007 [0.014]	0.003 [0.013]			
Years ICT Business Ownership	0.239 [0.219]	0.007 [0.015]	0.011 [0.015]			
Years Non-ICT Business Ownership	-0.135 [0.647]	0.023 [0.044]	0.020 [0.045]			
No. of Non-ICT Businesses Owned	-0.350 [2.137]	0.158 [0.145]	0.152 [0.149]			
Deliberate Practice	1.336 [0.677]	-0.048 0.047	-0.023 [0.047]			
R Squared	0.440	0.520	0.484			
F	4.433***	5.506***	5.291***			

Notes: Coefficients are shown, with standard errors in parentheses;
X = Number of ICT Businesses Owned, M = Number of Intuition Segments Overall, Y = Number of Opportunities Rated ≥ 6 Overall;
Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;
Number of Observations = 74; Bootstrap re-sampling = 5000;
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I4 Mediation Analysis Models for H_{2d} (intuition mediates the relationship between experience and the number of opportunities identified) in the Multi-TouchScreen Task

	Effect of X on M Coeff [SE]	Direct Effect of X on Y Coeff [SE]	Total Effect of X on Y Coeff [SE]	Indirect Effect of X on Y with Bootstrapped Estimates coeff [Boot SE]	Boot LLCI	Boot ULCI
Constant	-13.983 [9.805]	1.322 [1.620]	0.314 [1.732]			
No. of Intuition Segments		0.072*** [0.021]				
No. of ICT Businesses Owned	1.118* [0.489]	0.202* [0.083]	0.282** [0.086]	0.081 [0.042]	0.019	0.196
Rationality	2.368 [1.526]	0.088 [0.253]	0.259 [0.270]			
Experientiality	1.804 [1.365]	0.026 [0.225]	0.156 [0.241]			
Risk Propensity	2.385** [0.736]	0.020 [0.129]	0.192 [0.130]			
Risk Perception	-0.512 [0.709]	-0.148 [0.116]	-0.185 [0.125]			
Years Education	0.039 [0.330]	-0.051 [0.054]	-0.048 [0.058]			
Years Work Experience	0.127 [0.086]	-0.010 [0.014]	-0.001 [0.015]			
Years ICT Business Ownership	0.073 [0.100]	-0.014 [0.016]	-0.009 [0.018]			
Years Non-ICT Business Ownership	-0.212 [0.296]	0.031 [0.048]	0.016 [0.052]			
No. of Non-ICT Businesses Owned	-0.447 [0.978]	-0.169 0.159	-0.201 0.173			
Deliberate Practice	0.504 [0.310]	-0.074 [0.051]	-0.038 [0.055]			
R Squared	0.348	0.371	0.246			
F	3.007**	3.002**	1.835†			

Notes: Coefficients are shown, with standard errors in parentheses;
X = Number of ICT Businesses Owned, M = Number of Intuition Segments in the Multi-Touch Screen Task,
Y = Number of Opportunities Identified in the Multi-Touch Screen Task;
Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;
Number of Observations = 74; Bootstrap re-sampling = 5000;
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I5 Mediation Analysis Models for H_{2d} (intuition mediates the relationship between experience and the number of opportunities identified) in the 3D Imaging Task

	Effect of X on M	Direct Effect of X on Y	Total Effect of X on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	Coeff [SE]	Coeff [SE]	Coeff [SE]	coeff [Boot SE]	Boot LLCI	Boot ULCI
Constant	-14.058 [8.575]	2.486 [1.987]	0.457 [2.293]			
No. of Intuition Segments		0.144*** [0.029]				
No. of ICT Businesses Owned	0.988* [0.427]	0.050 [0.101]	0.192† [0.114]	0.143 [0.074]	0.044	0.355
Rationality	-0.602 [1.334]	-0.260 [0.303]	-0.347 [0.357]			
Experientiality	0.689 [1.194]	-0.124 [0.272]	-0.024 [0.319]			
Risk Propensity	0.872 [0.644]	0.022 [0.148]	0.148 [0.172]			
Risk Perception	0.263 [0.620]	-0.252† [0.141]	-0.214 [0.166]			
Years Education	0.865** [0.288]	-0.027 [0.070]	0.098 [0.077]			
Years Work Experience	0.180* [0.076]	0.000 [0.018]	0.026 [0.020]			
Years ICT Business Ownership	0.125 [0.088]	-0.005 [0.020]	0.013 [0.023]			
Years Non-ICT Business Ownership	0.277 [0.259]	-0.046 [0.059]	-0.006 [0.069]			
No. of Non-ICT Businesses Owned	-0.674 [0.855]	0.194 [0.195]	0.097 [0.229]			
Deliberate Practice	0.602* [0.271]	-0.037 [0.064]	0.050 [0.072]			
R Squared	0.371	0.406	0.162			
F	3.321***	3.478***	1.091			

Notes: Coefficients are shown, with standard errors in parentheses;
X = Number of ICT Businesses Owned, M = Number of Intuition Segments in the 3D Imaging Task, Y = Number of Opportunities Identified in the 3D Imaging Task;
Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;
Number of Observations = 74; Bootstrap re-sampling = 5000;
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I6 Mediation Analysis Models for H_{2d} (intuition mediates the relationship between experience and the number of opportunities identified) in the Quick Tap Task

	Effect of X on M Coeff [SE]	Direct Effect of X on Y Coeff [SE]	Total Effect of X on Y Coeff [SE]	Indirect Effect of X on Y with Bootstrapped Estimates coeff [Boot SE]	Boot LLCI	Boot ULCI
Constant	-0.429 [10.167]	-1.743 [1.137]	-1.766 [1.252]			
No. of Intuition Segments		0.054*** [0.014]				
No. of ICT Businesses Owned	1.762*** [0.507]	0.117† [0.062]	0.211*** [0.062]	0.094 [0.052]	0.015	0.238
Rationality	-0.040 [1.582]	-0.024 [0.117]	-0.026 [0.195]			
Experientiality	-1.531 [1.416]	0.177 [0.160]	0.095 [0.174]			
Risk Propensity	0.906 [0.763]	-0.001 [0.086]	0.048 [0.094]			
Risk Perception	1.046 [0.735]	0.040 [0.084]	0.096 [0.091]			
Years Education	0.202 [0.342]	0.064 [0.083]	0.075† [0.042]			
Years Work Experience	0.232* [0.090]	0.015 [0.011]	0.028* [0.011]			
Years ICT Business Ownership	0.041 [0.104]	-0.011 [0.012]	-0.009 [0.013]			
Years Non-ICT Business Ownership	-0.200 [0.307]	0.010 [0.035]	-0.001 [0.038]			
No. of Non-ICT Businesses Owned	0.771 [1.014]	-0.071 [0.114]	-0.030 [0.125]			
Deliberate Practice	0.230 [0.321]	0.013 [0.036]	0.025 [0.040]			
R Squared	0.348	0.453	0.325			
F	3.003**	4.202***	2.717**			

Notes: Coefficients are shown, with standard errors in parentheses;
X = Number of ICT Businesses Owned, M = Number of Intuition Segments in the Quick Tap Task; Y = Number of Opportunities Identified in the Quick-Tap Task;
Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;
Number of Observations = 74; Bootstrap re-sampling = 5000;
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I7 Mediation Analysis Models for H_{2e} (intuition mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 4) in the Multi-TouchScreen Task

	Effect of X on M Coeff [SE]	Direct Effect of X on Y Coeff [SE]	Total Effect of X on Y Coeff [SE]	Indirect Effect of X on Y with Bootstrapped Estimates coeff [Boot SE]	Boot LLCI	Boot ULCI
Constant	-13.983 [9.805]	0.410 [1.443]	-0.750 [1.626]			
No. of Intuition Segments		0.083*** [0.018]				
No. of ICT Businesses Owned	1.118* [0.489]	0.185* [0.074]	0.278*** [0.081]	0.093 [0.047]	0.024	0.219
Rationality	2.368 [1.526]	0.286 [0.225]	0.483† [0.253]			
Experientiality	1.804 [1.365]	0.040 [0.200]	0.190 [0.226]			
Risk Propensity	2.385** [0.736]	-0.055 [0.115]	0.143 [0.122]			
Risk Perception	-0.512 [0.709]	-0.156 [0.103]	-0.198† [0.118]			
Years Education	0.039 [0.330]	-0.056 [0.048]	-0.052 [0.055]			
Years Work Experience	0.127 [0.086]	-0.016 [0.013]	-0.005 [0.014]			
Years ICT Business Ownership	0.073 [0.100]	-.0017 [0.015]	-0.011 [0.017]			
Years Non-ICT Business Ownership	-0.212 [0.296]	0.030 [0.043]	0.012 [0.049]			
No. of Non-ICT Businesses Owned	-0.447 [0.978]	-0.091 [0.142]	-0.128 [0.162]			
Deliberate Practice	0.504 [0.310]	-0.059 [0.046]	0.017 [0.051]			
R Squared	0.348	0.466	0.287			
F	3.007**	4.428***	2.271*			

Notes: Coefficients are shown, with standard errors in parentheses;
X = Number of ICT Businesses Owned, M = Number of Intuition Segments in the Multi-Touch Screen Task,
Y = Number of Opportunities Rated ≥ 4 in the Multi-Touch Screen Task;
Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;
Number of Observations = 74; Bootstrap re-sampling = 5000;
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I8 Mediation Analysis Models for H_{2e} (intuition mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 4) in the 3D Imaging Task

	Effect of X on M Coeff [SE]	Direct Effect of X on Y Coeff [SE]	Total Effect of X on Y Coeff [SE]	Indirect Effect of X on Y with Bootstrapped Estimates coeff [Boot SE]	Boot LLCI	Boot ULCI
Constant	-14.058 [8.575]	2.942* [1.443]	1.480 [1.661]			
No. of Intuition Segments		0.104*** [0.021]				
No. of ICT Businesses Owned	0.988* [0.427]	0.117 [0.073]	0.220** [0.083]	0.103 [0.049]	0.040	0.261
Rationality	-0.602 [1.334]	-0.167 [0.220]	-0.230 [0.259]			
Experientiality	0.689 [1.194]	-0.324 [0.197]	-0.253 [0.231]			
Risk Propensity	0.872 [0.644]	0.029 [0.108]	0.120 [0.125]			
Risk Perception	0.263 [0.620]	-0.122 [0.102]	-0.095 [0.120]			
Years Education	0.865** [0.288]	-0.075 [0.051]	0.015 [0.056]			
Years Work Experience	0.180* [0.076]	-0.010 [0.013]	0.009 [0.015]			
Years ICT Business Ownership	0.125 [0.088]	0.004 [0.015]	0.017 [0.017]			
Years Non-ICT Business Ownership	0.277 [0.259]	-0.044 [0.043]	-0.015 [0.050]			
No. of Non-ICT Businesses Owned	-0.674 [0.855]	0.283 [0.142]	0.213 [0.166]			
Deliberate Practice	0.602* [0.271]	-0.050 [0.046]	0.013 [0.053]			
R Squared	0.371	0.440	0.213			
F	3.321***	3.996***	1.529			

Notes: Coefficients are shown, with standard errors in parentheses;
X = Number of ICT Businesses Owned, M = Number of Intuition Segments in the 3D Imaging Task, Y = Number of Opportunities Rated ≥ 4 in the 3D Imaging Task;
Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;
Number of Observations = 74; Bootstrap re-sampling = 5000;
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I9 Mediation Analysis Models for H_{2e} (intuition mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 4) in the Quick Tap Task

	Effect of X on M Coeff [SE]	Direct Effect of X on Y Coeff [SE]	Total Effect of X on Y Coeff [SE]	Indirect Effect of X on Y with Bootstrapped Estimates coeff [Boot SE]	Boot LLCI	Boot ULCI
Constant	-0.429	-1.533	-1.561			
	[10.167]	[0.950]	[1.159]			
No. of Intuition Segments		0.066***				
		[0.012]				
No. of ICT Businesses Owned	1.762***	0.163**	0.280***	0.117	0.033	0.268
	[0.507]	[0.052]	[0.058]	[0.055]		
Rationality	-0.040	0.047	0.045			
	[1.582]	[0.148]	[0.180]			
Experientiality	-1.531	0.188	0.087			
	[1.416]	[0.134]	[0.161]			
Risk Propensity	0.906	-0.007	0.053			
	[0.763]	[0.072]	[0.087]			
Risk Perception	1.046	0.005	0.074			
	[0.735]	[0.070]	[0.084]			
Years Education	0.202	0.011	0.025			
	[0.342]	[0.032]	[0.039]			
Years Work Experience	0.232*	0.005	0.020†			
	[0.090]	[0.009]	[0.010]			
Years ICT Business Ownership	0.041	-0.001	0.002			
	[0.104]	[0.010]	[0.012]			
Years Non-ICT Business Ownership	-0.200	-0.002	-0.015			
	[0.307]	[0.029]	[0.035]			
No. of Non-ICT Businesses Owned	0.771	-0.025	0.026			
	[1.014]	[0.095]	[0.116]			
Deliberate Practice	0.230	-0.028	-0.013			
	[0.321]	[0.030]	[0.037]			
R Squared	0.348	0.605	0.402			
F	3.003**	7.788***	3.792***			

Notes: Coefficients are shown, with standard errors in parentheses;
X = Number of ICT Businesses Owned, M = Number of Intuition Segments in the Quick Tap Task, Y = Number of Opportunities Rated ≥ 4 in the Quick-Tap Task;
Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;
Number of Observations = 74; Bootstrap re-sampling = 5000;
†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed;

Table I10 Mediation Analysis Models for H_{2e} (intuition mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 6) in the Multi-TouchScreen Task

	Effect of X on M Coeff [SE]	Direct Effect of X on Y Coeff [SE]	Total Effect of X on Y Coeff [SE]	Indirect Effect of X on Y with Bootstrapped Estimates coeff [Boot SE]	Boot LLCI	Boot ULCI
Constant	-13.983	0.115	-0.554			
	[9.805]	[0.717]	[0.842]			
No. of Intuition Segments		0.048***				
		[0.009]				
No. of ICT Businesses Owned	1.118*	0.116**	0.169***	0.054	0.015	0.143
	[0.489]	[0.037]	[0.042]	[0.029]		
Rationality	2.368	0.089	0.202			
	[1.526]	[0.112]	[0.131]			
Experientiality	1.804	-0.010	0.076			
	[1.365]	[0.100]	[0.117]			
Risk Propensity	2.385**	-0.024	0.090			
	[0.736]	[0.057]	[0.063]			
Risk Perception	-0.512	-0.061	-0.086			
	[0.709]	[0.051]	[0.061]			
Years Education	0.039	-0.027	-0.025			
	[0.330]	[0.024]	[0.028]			
Years Work Experience	0.127	-0.006	-0.001			
	[0.086]	[0.006]	[0.007]			
Years ICT Business Ownership	0.073	-0.008	-0.005			
	[0.100]	[0.007]	[0.009]			
Years Non-ICT Business Ownership	-0.212	0.027	0.016			
	[0.296]	[0.021]	[0.025]			
No. of Non-ICT Businesses Owned	-0.447	0.033	0.012			
	[0.978]	[0.070]	[0.084]			
Deliberate Practice	0.504	-0.024	0.000			
	[0.310]	[0.023]	[0.027]			
R Squared	0.348	0.541	0.335			
F	3.007**	5.990***	2.833**			

Notes: Coefficients are shown, with standard errors in parentheses;
X = Number of ICT Businesses Owned, M = Number of Intuition Segments in the Multi-Touch Screen Task,
Y = Number of Opportunities Rated ≥ 6 in the Multi-Touch Screen Task,
Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;
Number of Observations = 74; Bootstrap re-sampling = 5000;
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I11 Mediation Analysis Models for H_{2e} (intuition mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 6) in the 3D Imaging Task

	Effect of X on M	Direct Effect of X on Y	Total Effect of X on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	Coeff [SE]	Coeff [SE]	Coeff [SE]	coeff [Boot SE]	Boot LLCI	Boot ULCI
Constant	-14.058 [8.575]	1.731† [0.993]	1.192 [1.019]			
No. of Intuition Segments		0.038** [0.014]				
No. of ICT Businesses Owned	0.988* [0.427]	0.135** [0.051]	0.173*** [0.051]	0.038 [0.021]	0.009	0.100
Rationality	-0.602 [1.334]	-0.143 [0.152]	-0.166 [0.159]			
Experientiality	0.689 [1.194]	-0.131 [0.136]	-0.105 [0.142]			
Risk Propensity	0.872 [0.644]	-0.025 [0.074]	0.008 [0.077]			
Risk Perception	0.263 [0.620]	-0.099 [0.070]	-0.089 [0.074]			
Years Education	0.865** [0.288]	-0.029 [0.035]	0.005 [0.034]			
Years Work Experience	0.180* [0.076]	-0.011 [0.009]	-0.004 [0.009]			
Years ICT Business Ownership	0.125 [0.088]	0.001 [0.010]	0.006 [0.010]			
Years Non-ICT Business Ownership	0.277 [0.259]	-0.009 [0.030]	0.001 [0.031]			
No. of Non-ICT Businesses Owned	-0.674 [0.855]	0.157 [0.097]	0.131 [0.107]			
Deliberate Practice	0.602* [0.271]	-0.032 [0.032]	-0.009 [0.032]			
R Squared	0.371	0.339	0.262			
F	3.321***	2.606**	2.001*			

Notes: Coefficients are shown, with standard errors in parentheses;
X = Number of ICT Businesses Owned, M = Number of Intuition Segments in the 3D Imaging Task, Y = Number of Opportunities Rated ≥ 6 in the 3D Imaging Task;
Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;
Number of Observations = 74; Bootstrap re-sampling = 5000;
†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed;

Table I12 Mediation Analysis Models for H_{3d} (cognitive versatility mediates the relationship between experience and the number of opportunities identified) Overall

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
No. of ICT Businesses Owned	0.089* [0.037]	0.554** [0.202]	0.132 [0.083]	0.035	0.351
Versatile Strategy		1.481* [0.716]			
Rationality	-0.130 [0.099]	0.078 [0.545]			
Experientiality	-0.011 [0.105]	0.242 [0.352]			
Risk Propensity	0.023 [0.068]	0.352 [0.225]			
Risk Perception	-0.002 [0.047]	-0.300 [0.210]			
Years Education	0.034 [0.026]	0.075 [0.117]			
Years Work Experience	0.011 [0.007]	0.036 [0.030]			
Years ICT Business Ownership	0.004 [0.007]	-0.011 [0.029]			
Years Non-ICT Business Ownership	-0.006 [0.024]	0.018 [0.109]			
No. of Non-ICT Businesses Owned	0.008 [0.080]	-0.146 [0.361]			
Deliberate Practice	0.046† [0.024]	-0.031 [0.089]			
Chi-Square		69.23***			

Notes: Coefficients are shown, with standard errors in parentheses;

X = Number of ICT Businesses Owned, M = Cognitively Versatile Strategy (Y/N) Overall, Y = Number of Opportunities Identified Overall;

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed;

Table I13 Mediation Analysis Models for H_{3e} (cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 4) Overall

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	Coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
No. of ICT Businesses Owned	0.089*	0.624***	0.154	0.058	0.348
	[0.037]	[0.174]	[0.080]		
Versatile Strategy		1.733***			
		[0.543]			
Rationality	-0.130	0.522			
	[0.099]	[0.417]			
Experientiality	-0.011	0.042			
	[0.105]	[0.306]			
Risk Propensity	0.023	0.275			
	[0.068]	[0.192]			
Risk Perception	-0.002	-0.215			
	[0.047]	[0.172]			
Years Education	0.034	-0.071			
	[0.026]	[0.090]			
Years Work Experience	0.011†	0.004			
	[0.007]	[0.026]			
Years ICT Business Ownership	0.004	0.001			
	[0.007]	[0.027]			
Years Non-ICT Business Ownership	-0.006	-0.007			
	[0.024]	[0.086]			
No. of Non-ICT Businesses Owned	0.008	0.097			
	[0.080]	[0.307]			
Deliberate Practice	0.046†	-0.096			
	[0.024]	[0.071]			
Chi-Square		86.83***			

Notes: Coefficients are shown, with standard errors in parentheses;

X = Number of ICT Businesses Owned, M = Cognitively Versatile Strategy (Y/N) Overall, Y = Number of Opportunities Rated ≥ 4 Overall;

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed;

Table I14 Mediation Analysis Models for H_{3e} (cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 6) Overall

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
No. of ICT Businesses Owned	0.089* [0.037]	0.389** [0.124]	0.070 [0.041]	0.022	0.179
Versatile Strategy		0.785* [0.311]			
Rationality	-0.130 [0.099]	0.218 [0.234]			
Experientiality	-0.011 [0.105]	-0.012 [0.201]			
Risk Propensity	0.023 [0.068]	0.086 [0.151]			
Risk Perception	-0.002 [0.047]	-0.121 [0.104]			
Years Education	0.034 [0.026]	-0.055 [0.060]			
Years Work Experience	0.011† [0.007]	-0.006 [0.016]			
Years ICT Business Ownership	0.004 [0.007]	0.008 [0.014]			
Years Non-ICT Business Ownership	-0.006 [0.024]	0.025 [0.066]			
No. of Non-ICT Businesses Owned	0.008 [0.080]	0.146 [0.244]			
Deliberate Practice	0.046† [0.024]	-0.060 [0.040]			
Chi-Square		81.37***			

Notes: Coefficients are shown, with standard errors in parentheses;

X = Number of ICT Businesses Owned, M = Cognitively Versatile Strategy (Y/N) Overall, Y = Number of Opportunities Rated ≥ 6 Overall;

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†*p* < .10. **p* < .05. ***p* < .01. ****p* < .001, two-tailed;

Table I15 Mediation Analysis Models for H_{3d} (cognitive versatility mediates the relationship between experience and the number of opportunities identified) in the Multi-Touch Screen Task

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
No. of ICT Businesses Owned	0.085* [0.036]	0.242* [0.121]	0.040 [0.047]	-0.013	0.149
Versatile Strategy		0.464 [0.431]			
Rationality	0.068 [0.101]	0.227 [0.282]			
Experientiality	0.117 [0.087]	0.101 [0.242]			
Risk Propensity	0.050 [0.065]	0.168 [0.158]			
Risk Perception	0.024 [0.049]	-0.197 [0.124]			
Years Education	0.034 [0.022]	-0.064 [0.060]			
Years Work Experience	0.005 [0.008]	-0.003 [0.015]			
Years ICT Business Ownership	0.001 [0.008]	-0.009 [0.017]			
Years Non-ICT Business Ownership	-0.003 [0.019]	0.017 [0.064]			
No. of Non-ICT Businesses Owned	-0.046 [0.065]	-0.180 [0.219]			
Deliberate Practice	0.008 [0.018]	-0.041 [0.051]			
Chi-Square		44.58**			

Notes: Coefficients are shown, with standard errors in parentheses;

X = Number of ICT Businesses Owned, M = Cognitively Versatile Strategy (Y/N) in the Multi-Touch Screen Task, Y = Number of Opportunities Identified for the Multi-Touch Screen;

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed;

Table I16 Mediation Analysis Models for H_{3d} (cognitive versatility mediates the relationship between experience and the number of opportunities identified) in the 3D Imaging Task

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
No. of ICT Businesses Owned	0.090** [0.033]	0.054 [0.153]	0.138 [0.072]	0.053	0.320
Versatile Strategy		1.522* [0.652]			
Rationality	-0.068 [0.101]	-0.242 [0.447]			
Experientiality	-0.170 [0.113]	0.234 [0.294]			
Risk Propensity	0.074 [0.059]	0.034 [0.163]			
Risk Perception	-0.011 [0.043]	-0.197 [0.151]			
Years Education	0.006 [0.023]	0.088 [0.095]			
Years Work Experience	0.012* [0.006]	0.008 [0.024]			
Years ICT Business Ownership	0.014* [0.007]	-0.009 [0.020]			
Years Non-ICT Business Ownership	0.010 [0.025]	-0.021 [0.102]			
No. of Non-ICT Businesses Owned	-0.005 [0.065]	0.105 [0.396]			
Deliberate Practice	0.017 [0.022]	0.024 [0.061]			
Chi-Square		54.877***			

Notes: Coefficients are shown, with standard errors in parentheses;

X = Number of ICT Businesses Owned, M = Cognitively Versatile Strategy (Y/N) in the 3D Imaging Task, Y = Number of Opportunities Identified in the 3D Imaging Task;

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I17 Mediation Analysis Models for H_{3d} (cognitive versatility mediates the relationship between experience and the number of opportunities identified) in the Quick-Tap Task

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
No. of ICT Businesses Owned	0.088** [0.034]	0.117** [0.069]	0.034 [0.026]	0.003	0.092
Versatile Strategy		0.329 [0.245]			
Rationality	0.004 [0.101]	-0.028 [0.193]			
Experientiality	0.026 [0.116]	0.084 [0.167]			
Risk Propensity	0.007 [0.066]	0.045 [0.101]			
Risk Perception	-0.059 [0.048]	0.120 [0.124]			
Years Education	0.016 [0.026]	0.069 [0.047]			
Years Work Experience	0.009 [0.007]	0.024† [0.013]			
Years ICT Business Ownership	0.001 [0.007]	-0.009 [0.015]			
Years Non-ICT Business Ownership	-0.024 [0.027]	0.008 [0.037]			
No. of Non-ICT Businesses Owned	0.065 [0.077]	-0.055 [0.141]			
Deliberate Practice	0.020 [0.026]	0.017 [0.042]			
Chi-Square		50.89***			

Notes: Coefficients are shown, with standard errors in parentheses;

X = Number of ICT Businesses Owned, M = Cognitively Versatile Strategy (Y/N) in the Quick-Tap Task, Y = Number of Opportunities Identified in the Quick-Tap Task;

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I18 Mediation Analysis Models for H_{3e} (cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 4) in the Multi-Touch Screen Task

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
No. of ICT Businesses Owned	0.085* [0.036]	0.228† [0.117]	0.050 [0.049]	-0.003	0.160
Versatile Strategy		0.591 [0.420]			
Rationality	0.068 [0.101]	0.443† [0.253]			
Experientiality	0.117 [0.087]	0.120 [0.222]			
Risk Propensity	0.050 [0.065]	0.113 [0.147]			
Risk Perception	0.024 [0.049]	-0.212† [0.112]			
Years Education	0.034 [0.022]	-0.072 [0.057]			
Years Work Experience	0.005 [0.008]	-0.008 [0.014]			
Years ICT Business Ownership	0.001 [0.008]	-0.012 [0.017]			
Years Non-ICT Business Ownership	-0.003 [0.019]	0.013 [0.056]			
No. of Non-ICT Businesses Owned	-0.046 [0.065]	-0.101 [0.198]			
Deliberate Practice	0.008 [0.018]	-0.021 [0.051]			
Chi-Square		50.79***			

Notes: Coefficients are shown, with standard errors in parentheses;

X = Number of ICT Businesses Owned, M = Cognitively Versatile Strategy (Y/N) in the Multi-Touch Screen Task, Y = Number of Opportunities Rated ≥ 4 for the Multi-Touch Screen;

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I19 Mediation Analysis Models for H_{3e} (cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 4) in the 3D Imaging Task

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
No. of ICT Businesses Owned	0.090** [0.033]	0.111 [0.125]	0.109 [0.052]	0.048	0.242
Versatile Strategy		1.200** [0.421]			
Rationality	-0.068 [0.101]	-0.147 [0.301]			
Experientiality	-0.170 [0.113]	-0.049 [0.211]			
Risk Propensity	0.074 [0.059]	0.030 [0.115]			
Risk Perception	-0.011 [0.043]	-0.082 [0.108]			
Years Education	0.006 [0.023]	0.008 [0.065]			
Years Work Experience	0.012* [0.006]	-0.006 [0.017]			
Years ICT Business Ownership	0.014* [0.007]	0.000 [0.015]			
Years Non-ICT Business Ownership	0.010 [0.025]	-0.027 [0.074]			
No. of Non-ICT Businesses Owned	-0.005 [0.065]	0.219 [0.307]			
Deliberate Practice	0.017 [0.022]	-0.007 [0.041]			
Chi-Square		62.31***			

Notes: Coefficients are shown, with standard errors in parentheses;

X = Number of ICT Businesses Owned, M = Cognitively Versatile Strategy (Y/N) in the 3D Imaging Task, Y = Number of Opportunities Rated ≥ 4 in the 3D Imaging Task;

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed;

Table I20 Mediation Analysis Models for H_{3e} (cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 4) in the Quick-Tap Task

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
No. of ICT Businesses Owned	0.088** [0.034]	0.230** [0.084]	0.050 [0.030]	0.015	0.121
Versatile Strategy		0.564* [0.262]			
Rationality	0.004 [0.101]	0.042 [0.156]			
Experientiality	0.026 [0.116]	0.072 [0.151]			
Risk Propensity	0.007 [0.066]	0.049 [0.090]			
Risk Perception	-0.059 [0.048]	0.108 [0.087]			
Years Education	0.016 [0.026]	0.016 [0.035]			
Years Work Experience	0.009 [0.007]	0.015 [0.013]			
Years ICT Business Ownership	0.001 [0.007]	0.001 [0.013]			
Years Non-ICT Business Ownership	-0.024 [0.027]	-0.002 [0.040]			
No. of Non-ICT Businesses Owned	0.065 [0.077]	-0.010 [0.130]			
Deliberate Practice	0.020 [0.026]	-0.024 [0.031]			
Chi-Square		65.74***			

Notes: Coefficients are shown, with standard errors in parentheses;

X = Number of ICT Businesses Owned, M = Cognitively Versatile Strategy (Y/N) in the Quick-Tap Task, Y = Number of Opportunities Rated ≥ 4 in the Quick-Tap Task;

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed;

Table I21 Mediation Analysis Models for H_{3e} (cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 6) in the Multi-Touch Screen Task

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
No. of ICT Businesses Owned	0.085* [0.036]	0.121* [0.056]	0.048 [0.030]	0.014	0.119
Versatile Strategy		0.562** [0.208]			
Rationality	0.068 [0.101]	0.164 [0.121]			
Experientiality	0.117 [0.087]	0.010 [0.106]			
Risk Propensity	0.050 [0.065]	0.062 [0.109]			
Risk Perception	0.024 [0.049]	-0.099† [0.056]			
Years Education	0.034 [0.022]	-0.044 [0.035]			
Years Work Experience	0.005 [0.008]	-0.003 [0.006]			
Years ICT Business Ownership	0.001 [0.008]	-0.005 [0.008]			
Years Non-ICT Business Ownership	-0.003 [0.019]	0.018 [0.038]			
No. of Non-ICT Businesses Owned	-0.046 [0.065]	0.038 [0.144]			
Deliberate Practice	0.008 [0.018]	-0.004 [0.025]			
Chi-Square		67.413***			

Notes: Coefficients are shown, with standard errors in parentheses;

X = Number of ICT Businesses Owned, M = Cognitively Versatile Strategy (Y/N) in the Multi-Touch Screen Task, Y = Number of Opportunities Rated ≥ 4 for the Multi-Touch Screen;

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, two-tailed;

Table I22 Mediation Analysis Models for H_{3e} (cognitive versatility mediates the relationship between experience and the innovativeness of opportunities identified – rated ≥ 6) in the 3D Imaging Task

	Effect of X on M	Effect of X and M on Y	Indirect Effect of X on Y with Bootstrapped Estimates		
	coeff [SE]	coeff [SE]	coeff [SE]	Boot LLCI	Boot ULCI
No. of ICT Businesses Owned	0.090** [0.033]	0.123 [0.101]	0.050 [0.028]	0.016	0.116
Versatile Strategy		0.552* [0.233]			
Rationality	-0.068 [0.101]	-0.128 [0.158]			
Experientiality	-0.170 [0.113]	-0.011 [0.149]			
Risk Propensity	0.074 [0.059]	-0.033 [0.073]			
Risk Perception	-0.011 [0.043]	-0.083 [0.074]			
Years Education	0.006 [0.023]	0.001 [0.038]			
Years Work Experience	0.012* [0.006]	-0.011 [0.011]			
Years ICT Business Ownership	0.014* [0.007]	-0.002 [0.010]			
Years Non-ICT Business Ownership	0.010 [0.025]	-0.005 [0.048]			
No. of Non-ICT Businesses Owned	-0.005 [0.065]	0.134 [0.187]			
Deliberate Practice	0.017 [0.022]	-0.018 [0.025]			
Chi-Square		59.473***			

Notes: Coefficients are shown, with standard errors in parentheses;

X = Number of ICT Businesses Owned, M = Cognitively Versatile Strategy (Y/N) in the 3D Imaging Task, Y = Number of Opportunities Rated ≥ 6 in the 3D Imaging Task;

Number of Observations = 74; Bootstrap re-sampling = 5000;

Control Variables: Rationality, Experientiality, Risk Propensity, Risk Perception, Years Education, Years Work Experience, Years ICT Business Ownership, Years Non-ICT Business Ownership, Number of non-ICT Businesses Owned, and Deliberate Practice;

†p < .10. *p < .05. **p < .01. ***p < .001, two-tailed;