

# **The Role of Affect in Commercializing New Ideas**

by

**Gordon Kwesi Adomdza**

**A thesis  
presented to the University of Waterloo  
in fulfillment of the  
thesis requirement for the degree of  
Doctor of Philosophy  
in  
Management Sciences**

**Waterloo, Ontario, Canada, 2008  
©Gordon Kwesi Adomdza 2008**

## **Author's Declaration**

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

## **Abstract**

Psychological attachment to an entrepreneurial opportunity may motivate the entrepreneur to persevere but can also bias decisions made in the entrepreneurial process, especially on market entry. This thesis investigates how psychological attachment to an entrepreneur's idea influences decision making at the commercialization stage with special emphasis on control tendencies. Data collected from 106 fourth-year students from the Engineering Design Program at a top engineering-focused Canadian university revealed some interesting results. In the model estimated, the higher the subject's psychological attachment to the opportunity, the more control oriented the subject was. Interestingly, psychological attachment is a strong predictor of control tendency even when subjects' perceptions of projected returns (value) are statistically controlled in the analysis. Furthermore, psychological attachment correlates with proxy measures of the level of cognitive evaluation: the indication, affective constructs like psychological attachment elicit affect-laden evaluation of outcomes in a way that is divergent from the cognitive evaluation of commercialization situations.

Within a framework of financial decision making, even as subjects generally acknowledged outside investor expertise in a potential commercialization partnership, the main finding was that high levels of attachment are more likely to lead to control-oriented funding preferences over optimal financing preferences. Further, alternative research explanations for control tendency failed to hold, as individual personality-type factors were not significant in explaining the variability in control tendency. Therefore, control tendency may be dependent on attachment to the creative process as opposed to an individual's personality construct. The results provide insight into the role that affective constructs like psychological attachment and control tendency may play in important decision making in the entrepreneurship process.

## **Acknowledgements**

First and foremost, I thank the Almighty God for making this possible. I also want to thank my supervisors, Dr. Tom Astebro and Dr. Scott Jeffrey, and the other members of my dissertation committee for their valuable insight and advice. I am especially indebted to Dr. Astebro for supporting me academically and financially, as well as constantly challenging me to excel.

I am particularly grateful to my beautiful wife Ailsa for her patience and endurance. I also want to extend my appreciation to my office mate, Won No, for his support throughout this period.

Finally, I am thankful for all the constructive comments I received from various people throughout the dissertation period, which helped make this dissertation what it is today.

## **Dedication**

*To Ailsa and Lydia*

## Table of Contents

<i>Item</i>	<i>Page</i>
Chapter 1 .....	1
1.1 Introduction and Review of the Literature	1
1.1.1. Outside Party’s Concerns and Reactions	2
1.1.2. Developers’ Concerns and Reactions	4
1.1.3. Why Some Developers will be More Concerned than Others	6
1.1.4. Evidence of Developer Reactions to Concerns	8
1.1.5. Explaining the Empirical Evidence: The Affective Characteristics of PA and CT	10
1.1.6. Characteristics of Affect and Implications for Performance	11
1.1.7. The Objectives of this Study	12
1.1.8. Contributions	13
1.1.9. Other Areas of Research Application	14
Chapter 2 .....	16
2.1 Literature Review .....	16
2.1.1 Decision Making in Entrepreneurship	16
2.1.2. Empirical and Anecdotal Evidence of Psychological Attachment and Control in Entrepreneurship	26
2.1.3. Why Control from Attachment Can Be Detrimental To Venture Performance	35
Chapter 3 .....	39
3.1 Theory and Predictions.....	39
3.1.1 Psychological Attachment (PA)	39
3.1.2 Entrepreneurial Process-Generated Affect (Opportunity Recognition and Development)	49
3.1.3 Psychological Attachment vs. Cognitive Evaluation	59
3.1.4. Control Tendency and Psychological Attachment	65
3.1.5. Moderated Relationship between Psychological Attachment and Control	77
Chapter 4 .....	82
4.1 Methodology and Analysis.....	82
4.1.1. Domain of Study	82
4.1.2. Preliminary Work	82
4.1.3. Participant Population	93
4.1.4. Descriptive Analysis: Participant Population	96

<i>Item</i>	<i>Page</i>
4.1.4. Measures and Analysis: The Dimensions of Psychological Attachment	98
4.1.5. Measures and Analysis: Psychological Attachment and Cognitive Evaluation	111
4.1.6. Measures and Analysis: Psychological Attachment and Control Tendency	119
4.1.6. Measures and Analysis: Testing the Moderating Effect of Threats on the Relationship between Psychological Attachment and Control Tendency	135
Chapter 5.....	152
5.1 Control Tendency in Financing Decisions.....	152
5.1.1 Types of Financing.....	152
5.1.2 Literature Review: External Financing.....	153
5.1.3 Predictions.....	156
5.1.4 Measures and Analysis.....	157
Chapter 6.....	171
6.1 Discussion.....	171
6.2 Conclusion.....	175
6.3 Limitations.....	178
6.4 Contributions and Opportunities for Future Research.....	179
References.....	184
Appendices.....	197
Appendix 1: The Scale Development Process.....	197
Appendix 2: Codebooks.....	198
A. Pre-test of Questionnaire	198
B. Final Study: Part I	213
C. Final Study: Part 2 – Treatment Group	221
D. Final Study: Part 2 - Control Group	235
Appendix 3: Sample Interview Transcripts from Interviews With Subjects.....	248
Appendix 4: Information on Design Projects.....	252
Appendix 5 : Additional Statistical Results.....	255

## List of Tables

<i>Item</i>	<i>page</i>
Table 1: Descriptive Statistics of Industries Categorization for Projects.....	96
Table 2: Descriptive Statistics of Sources of Commercialization Knowledge.....	98
Table 3: Results for Principal Component Analysis on Affective Latent Items for PA.....	103
Table 4: Correlations between PA Measures.....	108
Table 5: Correlations between PA and Latent Items.....	109
Table 6: Descriptive Statistic for Severity and Likelihood of Commercialization Outcomes .....	114
Table 7: Descriptive Statistics for Control Tendency Measure.....	120
Table 8: Descriptive Statistics for Personality-Type Variables.....	124
Table 9: Hierarchical Regression Analysis of CT on Predictors .....	129
Table 10: Hierarchical Regression Analysis of CT on Predictors.....	134
Table 11: Descriptive Statistics for Affect-Type in Manipulation Check.....	139
Table 12: Descriptive Statistics for Fear in Manipulation Check .....	140
Table 13: Descriptive Statistics for Mood Changes Before and After the Manipulation .....	141
Table 14: ANOVA Tests For Differences in Mood Before and After the Manipulation .....	142
Table 15: Results For Paired Differences In Mood for Experimental Groups Before and After The Manipulation.....	143
Table 16: Descriptive Statistics of Mood Changes Before and After the Study.....	144
Table 17: Frequency Distribution for Mood Changes within the Treatment and Control Groups.....	144
Table 18: Frequency Distribution for Mood Changes Within the Treatment Group.....	145
Table 19: Descriptive Statistics of Subject’s Specific Feelings After the Study.....	146
Table 20: Hierarchical Regression Analysis for Testing Moderation of PA on CT .....	149
Table 21: Percentage Takes In Venture Capital and Angel Investor Financing Decision Contexts.....	158
Table 22: Venture Capital and Angel Investor Offers and Developers Takes .....	159
Table 23: Percentages of Subjects Choosing VC and Angel Offers.....	162
Table 24: Descriptive Statistics for Importance of Outside Financier Management Ability.....	169

## List of Figures

<i>Item</i>	<i>page</i>
Figure 1: Decision-Making: Dual, Cognitive and Affective Processes.....	21
Figure 2: Developing PA .....	40
Figure 3: Dimensions to PA.....	49
Figure 4: Psychological Attachment Vs. Cognitive Evaluation of The Microeconomic Environment.....	59
Figure 5: Differing Approaches To Perception Due To Divergence between Cognitive and Affective Evaluation of the Microeconomic Environment.....	63
Figure 6: The Effect of PA on Control Tendency .....	76
Figure 7: The Moderating Effect of Threat Perception on the Relationship between PA and CT.....	78
Figure 8: Relationship between PA, Objective and Subjective Evaluation of the Idea and Future Commercialization Environment.....	118
Figure 9: Interaction Between PA and Likelihood Of Loss (LL).....	151
Figure 10: Percentages of Subjects Choosing VC and Angel Offers Within High and Low PA Groups.....	164
Figure 11: Percentages of Subjects in High and Low PA Groups Choosing VC and Angel Offers within Rounds .....	166
Figure 12: Comparison of Subjects Share Preferences in the High and Low PA Groups With the Optimal Choice.....	167

# Chapter 1

## 1.1 Introduction and Review of the Literature

Commercialization of a new technology often involves relinquishing control of the technology to outside parties. In this thesis, an outside party is defined generally as an entity that provides resources (financial, production, logistic, etc.) towards the commercialization process. Relinquishing more control to an outside party, hereafter referred to as an “outsider”, implies choosing a strategy that reduces the technology developer’s involvement in decision making and increases the outsider’s involvement. Relinquishing less control implies choosing a strategy that increases the developer’s involvement and reduces the outsider’s involvement in the commercialization process. Based on their own interests, developers of technology and outsiders haggle over control at the point of commercialization. While the developer seeks to protect the technology from expropriation, the outsider seeks to protect her/his investment in the process. Therefore, each party’s perception of the other’s intentions, and uncertainty surrounding future behaviour, may play a role in how much control each party desires. This thesis attempts to investigate the issue of control from the developer’s point of view and discusses the dimensions, factors, mechanism of effects, and behavioural implications of the desire to control at the point of commercialization. More importantly, the thesis centres on the role of psychological attachment to one’s idea in shaping the desire to control. To proceed, the following identifies the background to the notion of control and the role of psychological attachment.

The background concerns market problems or issues with transactions at the point of commercialization; developer and outsider actions and reactions in anticipation to market problems; and reasons for such behaviour. To begin, I present the outsider’s concerns about

market problems and strategies they adopt to solve these problems. Next, I argue that the outsider's demands and strategies are logical given the uncertainty and unpredictability surrounding new technological ideas. However, given that developers often need outsider investment for successful commercialization, avoiding outsiders will lead to non-optimal commercialization decisions. Also, I introduce the notion and subsequent explanations as to why developers might choose to avoid outsider investment even if such investment is instrumental to success. Finally, I conclude this chapter by identifying some "real world" situations in which this research could be applied.

### **1.1.1. Outside Party's Concerns and Reactions**

Transactions at the point of commercialization involve costs, especially under conditions of risk and uncertainty. Williamson (1985) adopted the concept of transaction costs to describe the costs of interactions in an imperfect market situation where complete information is not available to all parties. Under such conditions of incomplete and asymmetric information, market problems of concern abound. Information asymmetry refers to the situation where the developer is believed to know more than the outsider (Jensen and Thursby, 2001). One such problem arising from information asymmetry is the "agency/principal-agent problem" to which outsiders react by wanting to control the technology when contracting with the developer. For instance, investors typically prefer to have control over a technology if they invest their funds (see evidence in venture capital literature Hart and Holmström, 1987, Hart, 1995, and Kaplan and Stromberg, 2003). Before elaborating on why outsiders want control when considering the agency problem, I will first provide a brief description of the principal-agent concept.

The agency problem occurs when the economic incentives of the outsider (principal) and developer (agent) are not costlessly aligned (Pratt and Zeckhauser, 1985). The principal-agent

theory, as it pertains to entrepreneurship, can be described as follows. The principal (an investor) provides resources to an agent (entrepreneur) to innovate on the principal's behalf. However, the principal cannot ensure that the agent uses the resources efficiently according to the agreement signed because of the high monetary costs and differences in economic incentives between the two. With that said, there are core reasons for the principal-agent problem. 1. The divergence of desires or goals of the principal and agent and the difficulty or cost the principal must incur to verify the agent's appropriate behaviour. 2. The problem of the principal and the agent preferring different actions for risk sharing when they have different risk preferences (Eisenhardt, 1989). Consequently, in anticipation of the principal-agent (agency) problem, the outsider desires to control the technology in attempt to seek alignment between his or her economic incentives and the economic incentives of the developer. The long-term aim is to reduce agency costs (Jensen and Meckling, 1976) or loss in the relationship.

The outsider's conviction in the need for control stems from the underlying belief that the developer knows more about the technology (information asymmetry). This belief is strengthened when considering the fact that the development of a new technology involves the investment of developer knowledge and skills and, therefore, information asymmetry between the developer and the outsider may be high. Thus, control is needed to reduce any information asymmetry. Such control is seen in the two main approaches to reducing information asymmetry and combating agency problems. The approaches are as follows: design an optimal contract (Jensen and Meckling, 1976) through pre-contract screening, due diligence and contract writing; use the incomplete contracts approach which concentrates on the post-contract allocation of control (Hart, 1995). Alternatively, the outsider (principal) can extend a simple control structure to include complex incentive contracting techniques that motivate the developer (agent) to take

actions preferable to the principal. Such complex techniques may include ex post punishments and rewards to align incentives. The incomplete approach may be common in the commercialization of new technologies due to the uncertainty and unpredictability associated with the future of the technologies involved. Under such circumstances, it's not possible to specify the legal consequences of every possible state of the world; hence the contract is "incomplete" (Hart, 1995).

Consequently, considering the above-mentioned agency problems in contracting within risky and uncertain domains, such as in technology development, it is logical to expect outsiders who invest resources to require control for the purposes of safeguarding their investment. However, relinquishing control to outsiders may not be an easy task for developers, especially those who are heavily and psychologically invested in the technology or the development process. For developers wielding maximum control until the point of commercialization, the experience of relinquishing control at that point may feel like losing "their baby" (I will return to this point shortly). In the next section, I discuss the market problems from the developer's perspective and identify factors that make developers more worried about "loosing their baby". This discussion is important since, in the agency theory domain, the culprit is the "agent" and the main objective is to get the agent to "behave" in the interest of the principal, with little consideration for how the agent might act in anticipation of the principal's strategies. My interest is in the notion that possible reactions might include the developer "selecting out" of essential outsider agreements needed for successful commercialization.

### **1.1.2. Developers' Concerns and Reactions**

Developers may be more concerned about market problems at the point of commercialization because commercialization entails exposure of the technology to the target

market, opportunistic outsiders and potential competitors. Typical problems of concern derive from the issues of appropriability, expropriation and opportunism (Williamson, 1985); paradox of disclosure (Arrow, 1962, 1963; Anton and Yao, 1994); information asymmetry (Jensen and Thursby, 2001); and disproportionate power of channel members (e.g., manufacturers and distributors), among others. The following are brief explanations of the non-self-explanatory concepts in the list. The explanations are constructed to suit the entrepreneurship domain from multiple sources and dictionary definitions and, thus, references are not necessarily cited. Appropriability is the ability to extract rents from the technology and is characterized by formal intellectual property rights such as patents, or informal mechanisms such as secrecy. Expropriation is the ability to extract rents from the technology belonging to another party in exchange for little or no compensation without regard to the original owner's wishes. Opportunism is the propensity for people to act in self interest, "with guile" (Williamson, 1985), not be entirely honest and truthful about their intentions, or attempt to take advantage of unforeseen circumstances that gives them the chance to exploit another party. The paradox of disclosure occurs when the entrepreneur risks disclosing information about the opportunity before a binding contract is signed. Since appropriability is more central to the goal of achieving returns to the technology, the following discussion of developer response to these market problems employs "appropriability" for illustrations.

How do developers respond to these concerns? The extent to which the above-mentioned developer concerns can materialize depends on the level of control that a developer grants to the outsider. If the perception is that the concerns are high, rampant or persistent, developers will likely desist from sharing control. There is empirical evidence suggesting that founders avoid sharing control with outsiders when outsider control threatens ownership, even if the potential

for an increase in performance is evident (Cressy and Olofsson, 1997; Winborg and Landström, 2001; Müller, 2007) – discussed later. Thus, a strong desire to appropriate returns from the technology demands more control than less. According to the viewpoint of the developer, the agency problem reinforces this position. The developer's perception that the principal's economic goals are likely to diverge from his or her perception is likely to increase weariness toward potential contracts due to the prevalence of concerns for appropriability. This weariness motivates a desire in the developer to control the technology. In effect, on perceiving the market problems, the developer seeks control to safeguard appropriability since the extent of appropriability determines the level of returns from the technology.

However, the main question of interest here is “why would some developers who perceive market problems, want control and desire to safeguard appropriability more than others?” I propose that the level of psychological investment in the technology or in the technology's development process impacts the developer's level of sensitivity towards the microeconomic environment and, therefore, the issue of appropriability. The following provides support for this argument.

### **1.1.3. Why Some Developers will be More Concerned than Others**

I argue that affective experiences during technology development can culminate in a possessive sensation (I call this “psychological attachment” [PA]) which goes on to bias decision making through an excessive want of control (Control Tendency [CT]) as a reaction to the perceptions of market problems in the microeconomic environment. PA is characterized as an affectional tie that a developer feels towards the technology. I define CT as the willingness to intentionally produce desired outcomes and prevent undesired outcomes (Skinner, Chapman, and Baltes, 1988). I concentrate on the affective components of these two constructs in studying

possible influences on making decisions (reasons provided later in this chapter). The following argues for PA as an affective construct operating in the technology development process.

An important belief in this study is that attachment will emanate from the affective experiences in a typical technology development process. Until recently, the role of “affect” in entrepreneurship has not been considered. Developing a pioneering framework for studying affect in entrepreneurship, Baron (2008) identifies various areas of the entrepreneurial process where affect can play a role. The author characterizes affect as emotions and feelings, and notes that affect is likely to influence cognition and behaviour in entrepreneurial environments due to the unpredictability and rapid nature of change in that domain. Baron (2008) also notes that affect may play a role in entrepreneurial creativity. In fact, research in the creativity literature points to affect-related constructs such as intrinsic drive (Amabile, 1983) and flow – optimal experience (Csikszentmihalyi, 1990, 1996 and 1997).

In addition, Baron (1998) notes that since entrepreneurs have a deep commitment to their opportunities, they are more likely than other people to experience intense emotions, more frequently, in relation to their work. In effect, the literature suggests a strong presence of affect in technology development and consequently, a higher level of concern over outsider control for the most affect-invested developers. In essence, developers that are more psychologically-invested than others are more likely to have greater concern about the market problems identified above and, also, are more likely to take steps to reduce outsider control in contracts with the aim of ensuring high levels of appropriability. Next, I note empirical evidence of developers’ reactions to these concerns and also note reasons why this evidence is interesting.

#### **1.1.4. Evidence of Developer Reactions to Concerns**

Before proceeding, the following provides the normative expectations for behaviour at the point of commercialization. Contrasting these expectations with the evidence of developers' reactions shows why the evidence is interesting and worth studying.

At the point of commercialization, the developer(s)' behaviour is based on the creation of new ventures on new technology; however, this is not necessarily a defining condition for entrepreneurship (Shane and Venkataraman, 2000). As well, the developer is not required to engage in all parts of the entrepreneurial process (Venkataraman, 1997 and Shane and Venkataraman, 2000, Eckhardt and Shane, 2003). Hence, technology developers are expected to choose the most efficient strategy at commercialization even if it limits their control and personal involvement in the market process. This view is supported by the argument that, technology developers do not often possess the financial resources and complementary assets necessary to achieve a successful commercialization (Fontes and Coombs, 2001; Gans and Stern, 2003; Teece, 1986). As a result, developers normally need to depend on outsiders for investment in order to achieve successful commercialization and ensure performance.

For developers who need outside investment, the task is to relinquish some of the ultimate control held from the time of idea recognition and also prepare for a limited involvement in the market process. These tasks are onerous for developers who have high psychological investment. Therefore, considering the risks and uncertainty surrounding new technology, one expects the typical technology developer to be more susceptible to outside investors or partners. However, as noted previously, outside investment comes with control conditions that will be most protested by developers who are highly-attached. Hence, reactions to the perception of outsider control may range from hesitation to outright avoidance or refusal to

elicit outside investment in the commercialization process. The following are some empirical evidence to that effect.

While existing empirical evidence is more common to venture financing (Cressy and Olofsson, 1997; Winborg and Landström, 2001; Müller, 2007), it is insightful for general commercialization decision making. For instance, Müller (2007) noticed that founders who experience a loss of control were reluctant to increase the size of equity, were prepared to pay higher interest rates for additional loans in order to maintain control and, as a result, experienced smaller growth. Winborg and Landström (2001) found owner financing to be the main method of financing in new firms. Cressy and Olofsson (1997) found that entrepreneurs averse to losing control of the opportunity were mindful that relinquishing some control would improve performance. The concept of relinquishing control for success is not limited to venture financing. In the area of commercialization strategy, Gans and Stern (2003) argue that, through cooperation, start-ups can avoid duplicative investment thereby avoiding sunken investment in complementary assets necessary for commercialization.

Essentially, except for special cases where the developer controls financial resources, complementary assets, tight intellectual property and or enjoys inalienable human capital, it is generally counter-intuitive to seek control over the technology during commercialization. Further, the resistance to relinquishing control to qualified outside parties seems to go beyond cognitive reasoning and connotes affective influences. If the developer needs to relinquish control to gain access to essential resources but does not, the developer is likely to defy his or her own cognitive reasoning, and rather listen to visceral voices that, for instance, trumpet the future pain of loss of control. This point takes us back to how psychological attachment and control

tendency as affective constructs might help explain some of these findings. The following discusses the “affectiveness” of PA and CT.

#### **1.1.5. Explaining the Empirical Evidence: The Affective Characteristics of PA and CT**

Affect has been shown to play a role in risky decision making and various aspects of human judgment (Lowenstein, Weber, Hsee, Welch, 2001) – reviewed in later sections. This section looks at how affective the construct of CT is. I focus on CT since the connection between PA and affect does not need further exposition when you consider the central theme in the definition of PA as the “affectional tie” between the developer and the technology.

Having emotionally invested in the technology, the perception of outsider control in light of appropriability and opportunism concerns is enough to evoke a developer’s control tendency. Experts who research the concept of control argue that perceived or subjective control is a stronger predictor of functioning than actual or objective control (Skinner, 1996). Thus, an individual’s perceived control, or conviction that control is available, is enough to mobilize action and modulate arousal (Averill, 1973) as well as influence affective states and behaviour (Skinner, 1996).

Hence, the point to note here is that CT could emanate from affective processes and may or may not have any cognitive or logical basis. Also note that by adopting the Shane and Venkataraman (2000) position that opportunities could be exploited without the developer’s complete involvement and control, the thesis narrowly characterizes CT as the developer’s urge to take charge of affairs at commercialization. Further, in concentrating on the affective components, the thesis links CT to PA and developer perceptions of control or loss of control in the microeconomic environment. If PA and CT possess strong affective components, the mechanisms can explain some of the empirical findings. Especially, the mechanism might fit the observation that

developers or founders accurately perceive the need for developer involvement but choose to ignore it. Such mental processes can easily be described from the characteristics of affect (in terms of PA and CT) and the relationship between affect and cognition. The following characterizes affect and draws implications for venture performance if PA and CT can be described as affective constructs.

#### **1.1.6. Characteristics of Affect and Implications for Performance**

I start by reviewing the current status of research on affect and relate the empirical findings to the behavioural expectations for PA and CT. Zajonc (1998) identifies affective processes as those evaluative sensations that address the “go/no-go” questions (that lead to approach/avoidance behavior), while cognitive processes are those that answer the true/false questions. Further, there are key characteristics of affective processes in relation to cognitive processes. First, affect is primary and often occurs below the cognitive radar (Bechara, Damasio, Damasio, and Lee, 1999). Second, affect plays an informational role and guides cognitive reasoning (e.g., the somatic marker hypothesis - Damasio, 1994; affect-as-information hypothesis - Clore, 1992; affect heuristic theories - Slovic, Layman, Kraus, Flynn, Chalmers and Gesell, 1991). Third, in decisions under risk and uncertainty, empirical evidence shows that affective processes diverge from cognitive processes and, when they do, affective processes often exert a dominating influence on behavior (Lowenstein et. al., 2001, Wilson and Arvai, 2006) leading to errors in judgment (Kahneman and Ritov, 1994; Kahneman, Ritov, and Schkade, 1999; Kahneman, Schkade, and Sunstein, 1998; Gneezy and Potters, 1997). For instance, considering specific affective states such as fear, Lerner and Keltner (2000, 2001) find that fearful people made more pessimistic judgments about the likelihood of adverse events and, in addition, they made risk-averse choices.

Essentially, affect and affect-laden constructs are instrumental in decision making and can steer the process towards inefficiency especially in decisions involving risk and uncertainty. In other words, if highly invested developers develop PA, it will aid in moving the technology from conception through development. However, at the point of commercialization (i.e., when issues of control creep in), excessive attachment might evoke the desire to control the process and the technology, when relinquishing control would ensure higher efficiency. As shown above, such victory for affect (in terms of PA and control) over cognition (in terms of a more accurate evaluation) spells inefficiency for commercialization decisions and strategies. Thus, one can advance this argument toward explaining why entrepreneurs shun outsider investment even when they realize that such investment will improve performance (Cressy and Olofsson, 1997; Müller, 2007). As noted earlier, those decision cases seem to initially involve an accurate cognitive and objective evaluation which is then discarded in the decision process.

#### **1.1.7. The Objectives of this Study**

As can be discerned from the foregoing this thesis studies developer CT at the point of commercialization. This study has five main objectives. The first is to identify the dimensions of PA. The second is to determine if PA leads to a decrease in cognitive evaluation of the microeconomic environment. The third is to verify if PA leads to CT. The fourth is to identify the moderators and, possibly, the mediators of the relationship between PA and CT. The fifth is to assess the relationship between PA in a hypothetical commercialization decision context where developers encounter outsiders and make decisions on how much control to share.

In order to fulfill these objectives, an experimental survey process was employed. The main challenges in this research design were to gain access to respondents who started developing similar technologies within the same timeframe, and obtain measures of PA and CT.

To minimize the problems posed by these challenges, the study employed a group of respondents tasked to develop engineering design projects within the same technology stream and with the same start and end dates. PA is elicited after a period of development, and respondents are presented with various hypothetical decision scenarios where their CT and other measures are captured.

### **1.1.8. Contributions**

The study presents various contributions to the literature in entrepreneurship. The results of the study provide insight into the adverse effect of affect-laden concepts in entrepreneurship decision making, thereby contributing to a burgeoning literature on the role of affect in entrepreneurship. By presenting the viewpoint of affective biases, the study complements research on the role of cognitive biases such as overconfidence (Camerer and Lovallo, 1999) and overoptimism (Arabshabani, de Meza, Maloney, and Pearson, 2000) in entrepreneurial decision making, research that sometimes lacks consensus. For instance, Lowe and Ziedonis (2006) found no effects for overoptimism in the decision to start a firm for entrepreneurs commercializing university technology. The authors found that entrepreneurs continue unsuccessful development efforts for longer periods of time than established firms, and economic returns for many are realized after the start-up has been acquired by an established firm. By speculation, one can relate what appears to be unfruitful persistence to the adverse effects of PA and CT. Thus, the results in this thesis question the extent to which affect influences sub-optimal decisions to self-commercialize.

Further, the study contributes to the venture performance literature by suggesting a nonlinear relationship between affect and performance – affect is instrumental in venture development, but could prevent venture goals from being attained. The effects of affective

constructs such as PA and CT may be fleeting, but have the potential to impact decisions with dire consequences in extemporaneous decision situations as found in entrepreneurship (Baron, 2008).

#### **1.1.9. Other Areas of Research Application**

The concepts could be applied to study a variety of phenomena in entrepreneurship. One such area is risk perception in the case of over-entry into markets. For example, CT may motivate self-commercialization when market concerns “push” the developer to launch his/her own venture. However, self-commercialization to “safeguard” the opportunity denotes risk-aversion but could be more “risky” due to higher uncertainty. This behavioural pattern denotes a simultaneous existence of gambling and insurance. Employing the prospect theory framework (Khaneman and Tversky, 1979) or other relevant frameworks can, in this context, complement current research on the role of emotions in expected utility computations (Caplin and Leahy, 2001) in order to better explain risk seeking as well as risk aversion in entrepreneurship. Another application is the transfer of control from entrepreneur-managers to more professional hands during business re-structuring, mergers and acquisitions. Entrepreneur-managers’ resistance to the control transfer could stem from excessive attachment to the idea, technology or business. Other areas include the “not invented here” syndrome, where employees will only adopt systems that are initiated by them or within the company or react adversely to outsourcing by the firm, with implications for productivity. A specific application to new technology technicians, such as software coders, could unveil ways to manage ownership issues and improve performance. A final application that can be considered is the work of product champions in corporate venturing. The concepts of PA and CT may help in studying how product champions transition between

new products and also identify avenues to improve on transition as well as performance in the process.

Finally, there may be implications for government programs that support commercialization efforts, possibly supporting unnecessary or misguided entrepreneurial efforts in the economy. Implications for practitioners include strategies for reducing the biasing effect of attachment in decision-making, while implications for public policy include designing innovative financing schemes to ensure the positive effects of attachment and reduce the negative ones. In general, the study has implications for the role of affect in various areas of entrepreneurship such as: opportunity recognition and exploitation, risk perception, strategy formulation, social, and venture capital formation.

The rest of the thesis is structured as follows. Chapter 2 identifies relevant literature, detailing some of the literature previewed in the introduction; Chapter 3 concentrates on theory and predictions; Chapter 4 reports measures and results for the various main effects; Chapter 5 describes application settings where control preferences in financial decision making is considered; and Chapter 6 provides discussion and conclusions.

## Chapter 2

### 2.1 Literature Review

*“Again, if the affections in themselves were pliant and obedient to reason, it were true there should be no great use of persuasions and insinuations to the will, more than of naked proposition and proofs; but in regard of the continual mutinies and seditious of the affections—reason would become captive and servile, if eloquence of persuasions did not practise and win the imagination from the affections’ part, and contract a confederacy between the reason and imagination against the affections; for the affections themselves carry ever an appetite to good, as reason doth. The difference is that the affection beholdeth merely the present; reason beholdeth the future and sum of time. And, therefore, the present filling the imagination more, reason is commonly vanquished; but after that force of eloquence and persuasion hath made things future and remote appear as present, then upon the revolt of the imagination reason prevaieth”.*

*Francis Bacon (1561 – 1626)*<sup>1</sup>

This chapter provides a review of extant literature on judgment decision making, relating cognitive to affective influences in evaluation of outcomes and decision making. In addition, the chapter reviews issues of control and ownership in various areas in management and entrepreneurship, citing the different effects of control and ownership on interactions and relationships between agents and principals. The chapter then narrows in on control and PA in idea development and ends with implications for venture performance.

#### 2.1.1 Decision Making in Entrepreneurship

##### **Entrepreneurial Decision Making: Heuristics and Biases**

Current research on entrepreneurial decision making concentrates on entrepreneurial cognitions: how entrepreneurs think and process information for opportunity assessment and exploitation. The focus on cognitions stems primarily from research in the area of judgment decision making which shows that people might not be expected-utility maximizers as the expected utility theory postulates. The subjective expected-utility theory (SEU) developed by

---

<sup>1</sup>The Advancement of Learning (Second book, XVIII, 4) The Web edition published by the University of Adelaide Library, South Australia: <http://etext.library.adelaide.edu.au/b/bacon/francis/b12a/complete.html>

von Neumann and Morgenstern (1944/1947) and Savage (1954) is a model for “rational choice” derived from simple axioms of consistent preferences under risk and uncertainty. In the model, alternative decisions are based more on uncertain events rather than outcomes of well-understood gambles. The agent calculates SEU for each decision alternative, and subsequently chooses the alternative with the highest SEU. In terms of the underlying axioms, the independence axiom (where two alternative decisions can yield the same consequence) plays a crucial role since it allows the definition of conditional preferences. Although the model has enjoyed the status of an acceptable normative standard and a useful descriptive model for decision making, its axioms (especially the independence axiom) have been contested in laboratory experiments in which these axioms are violated (Allais, 1953; Ellsberg, 1961; Kahneman and Tversky, 1979).

Tests by Allais (1953) and Ellsberg (1961) displayed paradoxical behavior while Kahneman and Tversky (1979) showed that subjects resorted to predictable “heuristics and biases” that were not in line with the expected utility theory. Earlier in 1955, Hebert Simon introduced the idea of “bounded rationality” when he argued that utility theory reflects assumptions about human information processing that are beyond the scope of people’s cognitive abilities. The limits on knowledge and cognitive ability motivate individuals to choose the first alternative that meets identified minimal criteria. This process is termed by Simon as “satisficing”. It involves the use of cognitive shortcuts or heuristics rather than an elaborate SEU process that chooses an optimizing solution. However, satisficing, or to be more precise, the use of cognitive shortcuts, is not always an efficient strategy, especially when one considers risk and uncertainty about future outcomes. Consider an illustration from the realm of entrepreneurship.

In relation to entrepreneurship, the level of uncertainty and risk involved in the process sometimes propels entrepreneurs to resort to heuristics and biases in decision making, often

resulting in errors in their intuitive predictions and judgments. Kahneman and Tversky (1996) define judgmental heuristics as ‘a small number of distinctive mental operations’ while biases are described as cognitive errors made in decision making. Although the heuristics technique is often used in problem solving (such as entrepreneurship); it does not always guarantee a correct solution. Empirically, some individual-level and heuristic-laden factors able to introduce biases into entrepreneurial decision making, including: overconfidence (Camerer and Lovallo, 1999), overoptimism (Arabshabani, de Meza, Maloney, and Pearson, 2000; Astebro, Jeffrey and Adomdza, 2007), entrepreneurial self-efficacy (Krueger, 2000), entrepreneurial locus of control (Wijbenga and Witteloostuijn, 2007), among others. The following highlights the tenets of some of these cognitive biases (such as overconfidence and optimism) and also empirical evidence for their biasing role in decision making in general and, specifically, in the domain of entrepreneurship.

Overconfidence was first explained to result from lack of meta-knowledge. Thus, people are unaware of the limits of their knowledge when making forecasts (Oskamp, 1965). Many other sources of overconfidence have been identified. An example is the “availability bias” (Kahneman and Tversky, 1973) – being influenced by the mental availability of instances when constructing perceptions of likelihood. Availability leads to the systematic overestimation of the probability of events that are familiar, recent and/or easily imaginable. Another source is the “confirmation bias” (Koriat, Lichtenstein, and Fishhoff, 1980) – the retrieval and use of evidence that supports existing hypotheses or a set of beliefs. The individual tends to want to confirm existing beliefs and avoid disconfirming evidence.

In entrepreneurship, notable among studies on the overconfident bias is the work of Camerer and Lovallo (1999) who constructed a laboratory experiment in which subjects were

asked to choose the extent to which they would enter a market where payoffs depended on entrant skill. The authors found that experimental subjects displayed overconfidence as they were more likely to excessively enter markets when they thought that post-entry performance depended on their skills. Further, subjects neglected the skill levels of other entrants and in doing so, neglected their reference groups in making market entry decisions. Camerer and Lovo (1999) noted two reasons why firms would make biased entry decisions. First, firms are likely to be aware of their skill capacity but fail to appreciate the number of competing entities. Second, firms may accurately forecast the competition but overconfidently think that they will succeed while the competing firms will fail. Similarly, Cooper, Woo, and Dunkelberg (1988) asked nearly 3000 new business founders about their chances of success, and found that 81% of respondents thought their businesses had more than a 70% chance of succeeding.

In addition to overconfidence, optimism has been largely studied in entrepreneurial decision making with positive and negative effects on decisions. Scheier and Carver (1985) define optimism as “the favorability of a person’s generalized outcome expectancy” (p. 232). In other words, optimism is the general belief that good things are more likely to happen and bad things are less likely to happen. However, the construct is often operationalized as a positive outlook on future financial states in business research. It has been studied in many other domains with good evidence of robustness in effects (see Weinstein and Klein, 1995 for a review of these studies).

Moderate optimism might lead to rational financial decisions, but overoptimism may lead to bad financial decisions (Manju and Robinson, 2007). Landier and Thesmar (2004) used a dataset of French businesses to examine entrepreneurial optimism and its effect on capital structure and performance. They found that optimistic entrepreneurs prefer short-term over long-

term debt, and prefer inside rather than outside financing. Astebro, Jeffrey and Adomdza (2007) found that optimistic independent inventors continue to spend resources after receiving a negative expert evaluation. Further, Arabsheibani et al. (2000) found the self-employed to have a better financial outlook than employees, but had worse experiences. Crane and Crane (2007) surveyed extant entrepreneurship literature over a 25-year period and concluded that dispositional optimism predicts entrepreneurial success and appears to be a defining characteristic of entrepreneurs. These studies have provided insight not only in the way entrepreneurs make decisions, but in the general mechanisms for judgement decision making. The following provides a recount of some mechanisms unearthed over time in research in the area.

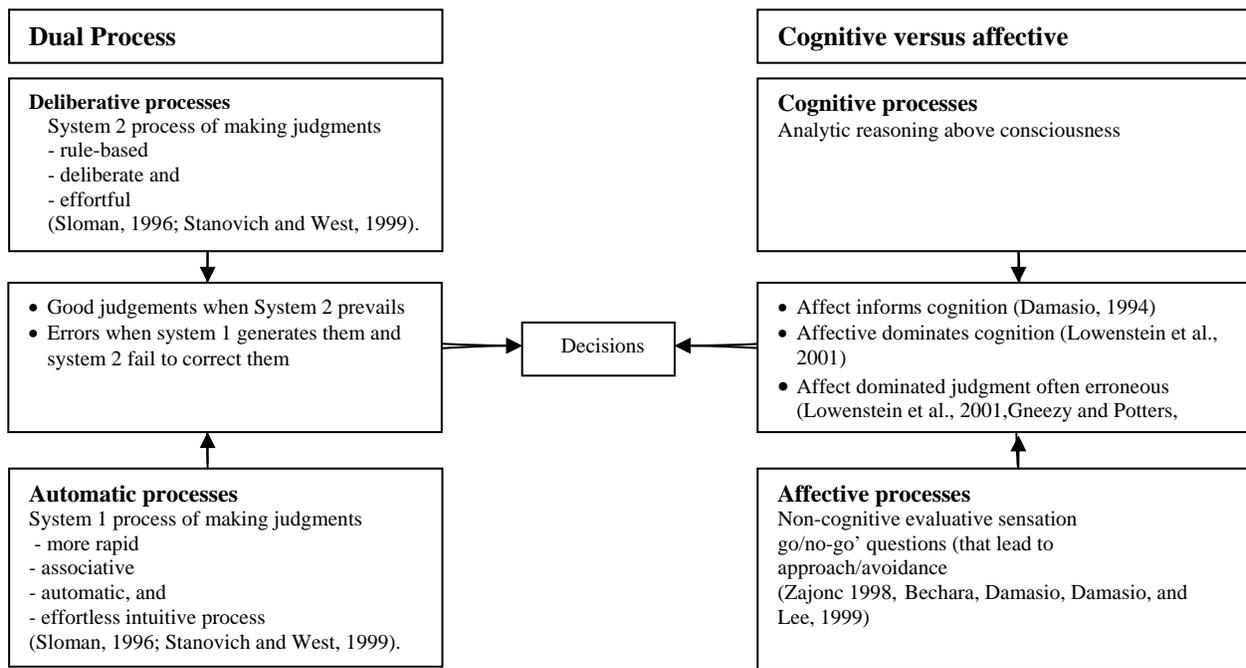
### **Mental Processes in Decision Making**

All in all, research on decision making, including the avalanche of studies on heuristics and biases in the mainstream literature, has provided some consensus on the processes through which the human mind operates in making decisions. The following presents the state of current research on the process of decision making as shown in Figure 1. Figure 1 presents a map of the psychological decision making literature and relevant progress made in outlining the process of human decision making. In doing that, Figure 1 compares the dual process system of decision making with the affective-cognitive systems, identifying the similarities and differences between the two. The basic assumption used in developing Figure 1 is that the processes outlined in the dual system mirrors the processes outlined in the cognitive-affective systems. The discussion of the right side will focus on the characteristics of affective and cognitive factors, differences in their effects on decision making, and how their characteristics influence the effects. The aim is to

show that affective processes are a powerful part of human decision making and then introduce PA as an affective construct with the potential to bias entrepreneurial decision making by way of unnecessary and inefficient control-seeking strategies during idea commercialization. Therefore, the discussion will briefly highlight the symmetric characteristics of the right (cognitive-affective) and the left (dual system) sides of Figure 1, and concentrate on the right (cognitive-affective) side of Figure 1.

**Figure 1**

**Decision-Making: Dual, Cognitive and Affective Processes**



It is widely agreed that decision making results from a dual process of information processing: “intuitive” and “analytical” (see Kunda, 2001 for a review). Notable among these theories is the dual process concepts of System 1 and System 2 which exhibit the interaction between intuitive and reflective judgments (Kahneman and Frederick, 2002). According to the model, System 1 involves a more rapid, associative, automatic and effortless intuitive process

while System 2 involves a rule-based, deliberate and effortful process of making judgments (Sloman, 1996; Stanovich and West, 1999). System 1 processes do not necessarily occur with awareness or consciousness and, therefore, may be out of cognitive reach. In the model, errors in the decision making process take effect when System 1 generates them and System 2 fails to correct them, as noted in the middle panel of the left side column in Figure 1.

Although the intuitive and reflective processes in the dual process model could be argued to operate purely on a cognitive basis, the distinction between intuitive and reflective is mirrored in the distinction between cognitive and affective processes (column on the right side of Figure 1). Zajonc (1998) identifies affective processes as those that address the ‘go/no-go’ questions (that lead to approach/avoidance behaviour) while cognitive processes are those that answer true/false questions. At this point, it should be noted that some researchers distinguish between “affect”, “feelings” and “emotions”. For instance, Masters (2000) noted such distinctions. He describes affect as an innately structured, non-cognitive evaluative sensation that may or may not register in consciousness. Feelings are described as affect made conscious, possessing an evaluative capacity that is not only physiologically based, but that is often also psychologically (and sometimes relationally) oriented. Finally, Masters (2000) describes emotion as psychosocially constructed and dramatized feeling. Although these distinctions are important and may influence conceptualization, the terms are used loosely in this thesis due to the interest in their behavioral outcome. Therefore, it is assumed that affective/feeling/emotional processes lead to approach/avoidance behaviour, meaning that there is no need to distinguish between them for the purposes of this study.

Going back to the idea that intuitive and reflective processes mirror cognitive and affective processes, it is important to note some characteristics about affective processes.

Affective responses are generally positive or negative (has valence) and may occur above the threshold of conscious awareness (knowing how you feel) or below it (reacting to a noise before you know what it is). Similar to System 1, affective processes are mostly automatic and unconscious as they often occur below the cognitive radar (Bechara et al., 1999). The question, therefore, is: “if affective processes can be automatic and unconscious, what effect do they have on cognitive processing or on decision making?”

I start with evidence from the judgment decision making literature and neuroscience and go on to briefly review the conclusions on how affect influences cognition. Theories have been developed to support the claim that analytic (cognitive) reasoning cannot be effective unless it is guided by affective processes (e.g.. the somatic marker hypothesis - Damasio, 1994; affect-as-information hypothesis - Clore, 1992; affect heuristic theories - Slovic, Layman, Kraus, Flynn, Chalmers and Gesell, 1991). Neuroscience studies show that cognitive processes are controlled by the cerebral cortex (or the higher brain) while affective processes are controlled by the amygdala (the lower brain). Conducting studies within this domain, Damasio (1994) argues that events and stimuli get tagged affectionately and these tags (somatic markers) are evoked when similar stimuli are encountered. Damasio (1994) found evidence for his theory when he observed that patients who have suffered prefrontal brain damage (leading to the uncoupling of their cognitive processes from their affective senses) were, in some cases, not able to make good decisions although they were capable of logical analyses. Studies in the domain of judgment decision making by Clore (1992), such as affect-as-information hypothesis model, hypothesizes the direct effect of feelings on judgment. In terms of social judgment, this is exemplified in how judgments of others are influenced by the positive and negative of liking and disliking.

From the foregoing, there are two main effects through which affect influences decision or cognition. First, affect can be evoked without intervention from cognition and second, the influence of cognition on decisions is mediated, to an extent, by affective processes. In the mediation process, affect can have a positive impact when it plays an informational role and aids cognitive decision making as Damasio pointed out. However, beyond the informational role, affective processes are likely to evoke negative consequences on decisions.

In effect, affective processes could be automatic and unconscious and their prevalence over cognitive processes could lead to errors in judgment and, therefore, failure in decision making. Much empirical evidence supports this claim. Empirical evidence shows that when affective processes diverge from cognitive processes, affective processes often exert a dominating influence on behaviour (Lowenstein et al., 2001; Wilson and Arvai, 2006) and thereby lead to errors in judgment in various domains (Kahneman and Ritov, 1994; Kahneman, Ritov, and Schkade, 1999; Kahneman, Schkade, and Sunstein, 1998; Gneezy and Potters, 1997; Benartzi and Thaler, 1995; Gneezy and Potters, 1997; Thaler, Tversky, Kahneman, and Schwartz, 1997). Further, illustrating with empirical evidence from work on specific affects such as fear and anxiety, researchers found evidence in line with cautious and risk-averse decision making (Lerner and Keltner, 2000, 2001). Fear, the response to imminent threat, discourages people from taking advantageous gambles (Gneezy and Potters, 1997). Lo, Repin and Steenbarger (2005) found that subjects whose emotional reaction to monetary gains and losses was more intense on both the positive and negative sides, exhibited significantly worse trading performance. There is also evidence from neuroscience research. Kenning, Mohr, Erk, Walter, and Plassmann (2006) used functional magnetic resonance imaging (fMRI) to investigate the neural mechanisms underlying *home-biased* financial decision making. One of their findings is a

correlation between activity within the amygdala-hippocampal regions of the brain, a region involved in negative emotional processing such as fear, and the investor's general risk aversion.

### **The Divergence between Emotional and Cognitive Processes**

A number of reasons have been identified for the divergence between emotional and cognitive processes. Lowenstein et al (2001) identify immediacy of risk and the manner of emotional responses to probabilities and outcome values as some factors responsible for the divergences. How individuals perceive risk and its immediacy determines, to a large extent, how they react to it. Essentially, individuals' personal risk preferences are driven at least in part by emotional reactions to risky choices (Hsee and Weber, 1997; Lowenstein et al., 2001). Elaborating on the mechanism by which negative emotions such as fear can affect risky decision making, it is important to note that the functional objective of fear centers on minimizing the potential for harm to oneself or something close in relationship to oneself. Lerner and Keltner (2000) argue that the specific impact of an emotion on cognitive appraisal shapes the willingness to take risks. Identifying characteristics of fear (in comparison with anger), the authors note that fear is associated with low certainty, high anticipated effort, low control, and medium responsibility. Also, fear produces a tendency to perceive negative events as unpredictable and under situational and not human control. So, in relation to the technology developer who is faced with commercialization, fear of outside encroachment and loss threatens existing control over the opportunity and, therefore, motivates risk-averse and control-oriented decision making.

Further, emotional responses to probabilities and outcome values in the perception of risk also determine how individuals react to risk. Technology entrepreneurs, for instance, may entertain basic worry about the possibility of the idea being stolen irrespective of the probability

that it may be secure enough. Such fear, as a response to imminent threat of loss, motivates escape and the search for safety (Frijda, 1986; Lazarus, 1991; Levenson, 1999; Öhman and Mineka, 2001). Thus the possibility of loss of the creative idea will evoke enough fear to cause a risk-averse action even if the probability of a loss is negligible. Lerner and Keltner (2000, 2001) found that fearful people made more pessimistic judgements about the likelihood of adverse events and also made risk-averse choices. Entrepreneurs who put undue weight on the possibility of adverse circumstances befalling the opportunity miss the chance to collaborate and partner in areas such as financing and technology development; areas that provide crucial support for a successful commercialization of an innovation.

In short, affective processes are important for efficient decision making under risk and uncertainty. However affective processes play an informational role serving as somatic markers for guiding decisions. Also, affective processes mediate the influence of cognitive processes on decisions, and when they dominate cognitive processes, there is the potential for inefficiency in the decision outcomes. Having established these notions, the discussion can turn to the role of affective processes in the domain of the entrepreneurial processes and implications for performance.

### **2.1.2. Empirical and Anecdotal Evidence of Psychological Attachment and Control in Entrepreneurship**

The above review discussed the decision-making literature and the role of affective and cognitive processes in risky decision making in uncertain decision scenarios, typical of the domain of entrepreneurship. The following provides an account of empirical evidence that suggests the role for PA and CT as affective constructs in entrepreneurial decision making. The account dwells on behaviour in different areas of management that exemplifies the notion of

possessiveness in how entrepreneurs deal with outside parties. To proceed, I start from research on cognitive biases in entrepreneurship (introduced earlier). The aim of this recapitulation is to argue that evidence of no effects reported for some cognitive biases suggests that affective biases could be considered.

### **Beyond Cognitive Biases: Affective Biases**

Although biases may stem from cognitive factors as earlier reviewed, the review of the affect literature also suggests that affective factors might play a far more significant role in decision making. The fact that many new ventures normally fail (Dunne, Roberts and Samuelson, 1988 and Cooper, Woo and Dunkelberg, 1988) implies that entrepreneurial decision making is often biased in judgment (Cooper, Woo and Dunkelberg, 1988; Busenitz and Lau, 1996, Barnes, 1984; Arabshabani, de Meza, Maloney and Pearson, 2000; Coelho, de Meza and Reyniers, 2004; Camerer and Lovallo, 1999; Forbes, 2005; Palich and Bagby, 1995; Åstebro, 2003; Åstebro, Jeffrey and Adomdza, 2007). I argue that it may be useful to consider affective biases in such decisions. One reason is that biases may not only emanate from cognitive thought processes but also from affective psychological states. As reviewed earlier, affective processes can dominate cognitive processes, thereby, biasing the decision-making process with a higher likelihood of inefficiency in outcomes. For illustration, let me turn to a study that suggests a lack of consensus on the role of cognitive biases while also suggesting a stronger role for affective biases (from factors such as psychological attachment and control tendency).

Consider Lowe and Ziedonis (2006) who found no effects for overoptimism in the decision to start a firm for entrepreneurs commercializing university technology. The authors find that entrepreneurs continue unsuccessful development efforts for longer periods of time than do established firms and also, that economic returns for many are realized after an established firm

has acquired the start-up. Thus, the authors question whether entrepreneurs are overoptimistic in continuing to develop products with limited chances for future success. From this illustration, it appears that another type of bias is influencing these entrepreneurs in their decision to persist – possibly, a bias that is affective and probably eludes consciousness.

Clearly, the lack of evidence for overoptimism is worrisome because it indicates that despite their seemingly excessive persistence, these entrepreneurs do not necessarily believe in the prospects of their ideas. As well, it may also imply that they are not overconfident in their abilities to ensure the ventures success, otherwise they would have scored high on optimism and most possibly be overoptimistic. On the other hand, evidence from the data shows that they persisted with little success, success was only realised when they relinquished control to an outside party. Although not implied in the discussion given by Lowe and Ziedonis (2006), there appear to be reasons to believe that these entrepreneurs were reluctant to allow outside involvement till it was absolutely necessary. The realization of positive financial returns for the opportunities upon transfer implies that the entrepreneurs' control over the ideas prevented the enactment of efficient strategies for commercialization. If these analogies hold, evidence will indicate a biasing influence from affective constructs such as desiring control over the opportunity, most likely due to attachment to the opportunity.

Similarly, Roberts (1990) studied the early years of technology-based firms and found lone founders to be slower to evolve from an engineering focus to product and market orientation. One can argue that according to intuitive logic, faster decision deliberations will emanate from lone founders compared to groups. However, on the contrary, we see lone founders being slower in adding value to their innovations. There appears to be stagnation and persistence at the development stage of the technology with reluctance to move to efficient commercialization.

Again by sheer speculation, one can envisage technology entrepreneurs who are too highly attached to the technology to organise market deployment in a more efficient and timely manner.

Another point of illustration is what is commonly referred to in the business press as “entrepreneurial disease” (Rubenson and Gupta, 1992). This notion is based on the idea that entrepreneurs have difficulty developing skills they need to transition into professional management. Thus, manager replacement becomes the efficient strategy as the firm grows. The business press is littered with founders and CEOs who do not possess the requisite human capital necessary to lead the firm forward, but who are reluctant to hand over control to more competent hands. Although there is no hard evidence of empirical research that links these behaviours to affective constructs such as psychological attachment and control tendency, the situations match the behavioural stipulations for these constructs.

### **Control over an Entrepreneurial Idea**

In addition to the anecdotal and implied sense of control found in the literature, there are a few empirical studies citing “control over an entrepreneurial idea” as a variable of interest. An example from the broader management area is that entrepreneurs strongly desire to control the activities of their organizations (Drucker, 1970; Gray and Ariss, 1985; Mintzberg, 1984) even though most of them lack managerial competence.

However, most of the studies on the topic have been done in the area of new venture financing. For instance, Müller (2007) did a study on the influence of the benefits of control on the capital structure and the growth of private companies for a sample of 8,964 UK companies with limited liability observed for up to five years. She notes that “[owners of private companies] want to remain in control because they obtain private benefits over and above the financial return

on their investment. In order to stay in control, they need to forego some growth opportunities, if the opportunities are too extensive to be realized with debt finance alone. This means that companies do not reach their growth potential and employ fewer people than would otherwise be the case". She found that founders who might experience a loss of control were reluctant to increase the size of equity, were prepared to pay higher interest rates for additional loans in order to maintain control and as a result they experienced smaller growth. Similar conclusions are drawn from other studies, which also show that entrepreneurs seem to prefer internal financing over external financing especially if it affects ownership (Winborg and Landström, 2001; Cressy, 1995; and Berggren, Olofsson and Silver, 2000). Cressy (1995) relates the phenomenon to "control aversion" where entrepreneurs are averse to losing control of the opportunity although, they are aware that relinquishing some control would improve performance (Cressy and Olofsson, 1997).

### **Post Market Entry Problems of Private Benefits and Control**

At the heart of appropriability are private benefits. One can argue that entrepreneurs who enjoy private benefits from their technologies are likely to feel that they have appropriated the returns to the technology to a large extent. This argument works on the assumption that private benefits are over and above "normal" returns to the entrepreneur. Although private benefits are not operationalized in this study, interest in them stems from the notion that psychological attachment may explain the notion that control-oriented entrepreneurs behave in a certain way due to their quest for private benefits. In other words, deep interest in private benefits might stem from attachment and can also lead to non-optimal decisions. Entrepreneurs may be in the "I deserve more" frame of mind even if "getting more" is unfair (or opportunistic) to the outsider.

Research in corporate finance provides empirical evidence that points to the agency problem of extraction of private benefits by shareholders from the firm when their voting rights far outweigh the cash flow rights (Bebchuk, Kraakman and Triantis, 2000; and Shleifer and Vishny, 1997). Recall the agency theory (Eisenhardt, 1989) where an agency relationship exists in which one party (the principal) delegates responsibilities to another (the agent). Problems such as: divergence of goals, cost of information and different risk preferences exist in these relationships.

Thus, private benefits are pursued by entrepreneur-managers (agents) who are entrusted with the management of funds provided by financiers (principals). A more exact description of the problem is given by evidence of controlling shareholders (entrepreneur-managers) extracting private benefits or profiting unfairly by deliberately choosing ineffective projects (e.g. see Berle and Means, 1932; Zingales, 1994; Dyck and Zingales, 2004; and Nenova, 2003). Dyck and Zingales (2004) show higher benefits of control in less-developed capital markets where there may not be high government protection for minority shareholders. In the US and UK, firms mostly respect the “one share-one vote” rule. However in areas or countries with a high concentration of entrepreneurs like in Canada, larger shareholders will have the advantage even when there is government regulations that protect minority shareholders.

Closely related to the private benefits problem is the desire for founders and entrepreneur-managers to remain at the helm of affairs even if relinquishing control might appear more prudent. Data provided by Dyck and Zingales (2004) show that for most of continental Europe and Asia, ownership is concentrated in the hands of individuals, families, governments or industrial groups and, therefore, the reluctance is evident. In Canada, ownership is concentrated in families with evidence in some of the major corporations such as Power Corp., Magna Corp.,

Bombardier Inc., Quebecor Inc. which are still controlled by their founders or their families (Ben-Amar and Andre, 2006). Ben-Amar and Andre (2006) reported a study that suggests that in spite of the legal protection offered by the Canadian Business Law, some reserachers find certain forms of expropriation in Canada (Attig, Fischer and Gadhoun, 2004 and Bozec and Laurin, 2004). In addition, Ben-Amar and Andre (2006) also report numerous research findings from around the world that note the decrease in firm value when there is a separation of ownership and voting rights as well as a decrease in firm performance (even though the evidence is mixed) when families consolidate their hold on the business through generations. Clearly, the concentration of ownership indicates the willingness of founders to remain at the helm of affairs when there is the possibility of greater potential for these firms to grow beyond their present capacity. A possible solution to this problem would be the relaxation of founder control of the firms.

In a quick summary, the incidence of private benefits indicates the willingness of agents to take advantage of their control positions and unfairly expropriate from agreements with principals. When such agents are entrepreneur-managers, their behaviour might be a reaction to a sense of entitlement to the technology, an attachment from conception or development that makes them think they deserve more than they are getting.

### **Market Entry Financing Issues**

Agency problems are not limited to after-market-entry interactions between entrepreneurs or managers and financiers. These problems guide interactions, decisions and relationships during financing of market-entry efforts. As briefly noted earlier, financiers encounter asymmetric information – when one party is believed to have better or more information than the other – in

their attempt to fund entrepreneurial ventures or opportunities. The problem is more profound when the non-human elements of such a contract can be more easily secured than the human elements especially when the entrepreneur's human capital is inalienable from the entrepreneurial opportunity.

In the venture capital financing literature, Van Osnabrugge (2000) reiterated two primary causes of agency problems: conflicts in alignment and verification of goals; and conflicts in risk sharing. The author identifies two approaches to combat agency problems. The first, aimed at decreasing asymmetric information, is the classical agency theory approach of designing an optimal contract between the principal and agent (Jensen and Meckling, 1976) through pre-investment screening and due diligence of the entrepreneur and idea. The second approach is the incomplete contracts theory which notes that because of transaction costs, bounded rationality, and asymmetric information, contracts are "incomplete" and the emphasis is on the post-contract allocation of control rather than the pre-contract screening and contract writing (Hart, 1995). There has been considerable work done on the structuring of post-contract allocation of control (Hart and Holmström, 1987; Hart, 1995; and Kaplan and Stromberg, 2003). Venture capitalists are typically concerned about monetary returns to safeguard their investments. Hence, to boost the entrepreneur's performance, venture capitalists typically enable the entrepreneur to obtain more control rights when company performance improves. It is often hoped that transfer of such rights may satisfy the entrepreneur's non-pecuniary motives and increase performance. However, any party's want to control is not solely dependent on that party's individual motive, but also in the level of trust existing or perceived to exist at that moment or in the future.

## **Control and Trust**

It is incomplete to discuss control and not mention “trust”. Dasgupta (1988) points out that trust between contracting parties is essential to overcome control problems that plague contract environments with severe agency risks and incomplete contracts. In extant research reports, control is viewed as relating to formal legal contractual agreements, while trust relates to psychological contracts. Also, the substitutability of trust and control has been discussed. Ring and Van de Ven (1994) contend that the two constructs are substitutes in interfirm cooperation, while Das and Teng (1998) argue that “a higher trust level does not automatically dictate a lowering of the control level, and vice versa.” (p. 496). At each development stage of a cooperative relationship, there is an optimum level of trust and control introduced to facilitate both the transaction and the long-term business success (Shepherd and Zacharakis, 2001). The implications are that trust and control play different roles in cooperative relationships. Control mechanisms include social controls, imposed on both parties externally, behavioural controls, based on agreements between both parties that establish rules around future behaviours, and output controls, designed to reward good and punish poor performance (Das and Teng, 1998). Controls can be introduced to coerce appropriate behaviour by the agent and build confidence. However, control can have a negative impact on outcomes, motivation of the innovator and innovation rates (Bromiley and Cummings, 1995; Dyer and Chu, 2003; Ring and Van de Ven, 1992; Teece, 1992). In this thesis, the concept of trust is not a major operational variable since discussions concentrate on the early stage of a potential relationship between a developer and an outsider. At that point, since the developer typically does not have a previous relationship with

the outsider for trust to have developed, we can only discuss the developer's dispositional trust when evaluating the outcomes of a possible relationship.

In summary, this section reviewed the literature on the issues of control from various perspectives. There is empirical evidence that point to the desire to control or cases which illustrate or suggest the desire to control in entrepreneurial endeavours. There is very little evidence in the empirical reports that the control instances emanate from a psychological attachment to one's creative idea. However, some of the cases of control denote some sort of attachment to the technology making it difficult for the developer (e.g. founders) to relinquish control, a strategy sometimes needed to improve performance. The following section discusses why control is detrimental to venture performance especially when emanating from attachment to the technology.

### **2.1.3. Why Control from Attachment Can Be Detrimental To Venture Performance**

The arguments in this section were briefly introduced in the introduction of this thesis. I provide more detailed discussion here. Entrepreneurs may need to control the entrepreneurial process, especially during opportunity recognition and development, as well as initial stages of venture creation to ensure the realization of set goals. Therefore, one will expect control to be instrumental to the continuity of the entrepreneurial process. For instance, the Schumpeterian model of entrepreneurship states that the work of the entrepreneur is done when a business is established (Schumpeter, 1934). Thus, the underlying theme of entrepreneurship is own-venture creation. However, Shane and Venkataraman (2000) argue that entrepreneurship consists of opportunity discovery and exploitation. The authors define entrepreneurship as "examination of how, by whom, and with what effects opportunities to create future goods and services are discovered, evaluated, and exploited" (p. 218). Thus, the creation of new ventures or ideas is not

necessarily a defining condition for entrepreneurship and, also the opportunity discoverer is not required to engage in all parts of the entrepreneurial process (Venkataraman, 1997 and Shane and Venkataraman, 2000; Eckhardt and Shane, 2003). Essentially, an entrepreneur does not need to establish a sole-venture on the idea but can cooperate with an outside party to commercialize or sell the idea outright. For instance, Gans and Stern (2002) note that cooperating with an outside party is particularly desirable when the degree of excludability is high and complementary assets belong to a third party. Generally, cooperating with third parties should bring as much benefit, if not more, as competing with existing ventures (Weick and Eakin, 2005).

In effect, if entrepreneurship is not defined by the entrepreneur's sole effort in venture creation, then the entrepreneur's control of the idea or the process is not paramount to successful innovation. Control is only of strategic importance if supported by available capacity (human, financial and complementary capital). Without such capacity, negotiations for financing, manufacturing and distribution contracts will involve some level of control trading since third parties typically require some control to reduce information asymmetry. This is evident in partnerships with manufacturers, R&D outfits and financiers, which often come with the redistribution of equity and control. In fact, entrepreneurial pedagogy stresses training students on how to "cooperate" with important outsiders like venture capitalists and other members of the value chain. Certainly, in these partnerships, the entrepreneur's control over the idea is acceptable if the entrepreneur's human capital is inalienable (cannot be surrendered) and the entrepreneur possesses some managerial ability.

However, given that most entrepreneurs lack the capacity or the managerial ability to solely develop a successful venture, it is logical to expect that most entrepreneurs will cooperate with

outsiders especially at the point of market entry or commercialization to ensure success. However, the empirical evidence chronicled above indicates otherwise. The evidence points to control behaviour deriving from some attachment to an innovation of one's creation and not from the position of available capacity or existing ability. This attachment seems to drive founders and entrepreneurs to choose inefficient strategies and to persist longer than is required in their entrepreneurial endeavours when relinquishing some control can increase performance to a greater extent. If such inefficient decisions and persistence can be explained by the desire to control due to attachment, then such a behavioural tendency is expected to be directed away from objective normative behaviour and lead to sub-optimal outcomes. Attachment-laden control will result in behaviour that is expected to be limiting since objectivity in evaluation is curtailed and cooperation with essential outsiders is discouraged. The reasons for these expectations have already been outlined above when the characteristics and differences between affective and cognitive factors were discussed, and psychological attachment and control were identified as affective constructs.

Consequently, the underlying theme in this thesis is that the desire to control (resulting from attachment) is likely to be detrimental to performance. Some major implications include resistance to feedback and rejection of base rates in decision making. Thus, highly-oriented entrepreneurs will be less likely to accept feedback from evaluation of their ideas (mostly if negative); less likely to pursue R&D with outsiders that they fear might change the core design of the innovation; more likely to disregard statistics on performance in the industry; and therefore, in addition to other reasons, resort to decisions that are narrow-minded and indifferent to important and available information. Given these implications, psychological attachment presents an interesting dimension to studying decision making especially at the point of

commercialization where the issue of control is prominent. Control preferences resulting from psychological attachment may explain additional variance in entrepreneurial decision making with implications for venture performance. Therefore, it is imperative to understand the constructs of control and psychological attachment, dimensions and effects. Chapter 3 provides the theoretical underpinnings of the constructs and the relationships between them.

## Chapter 3

### 3.1 Theory and Predictions

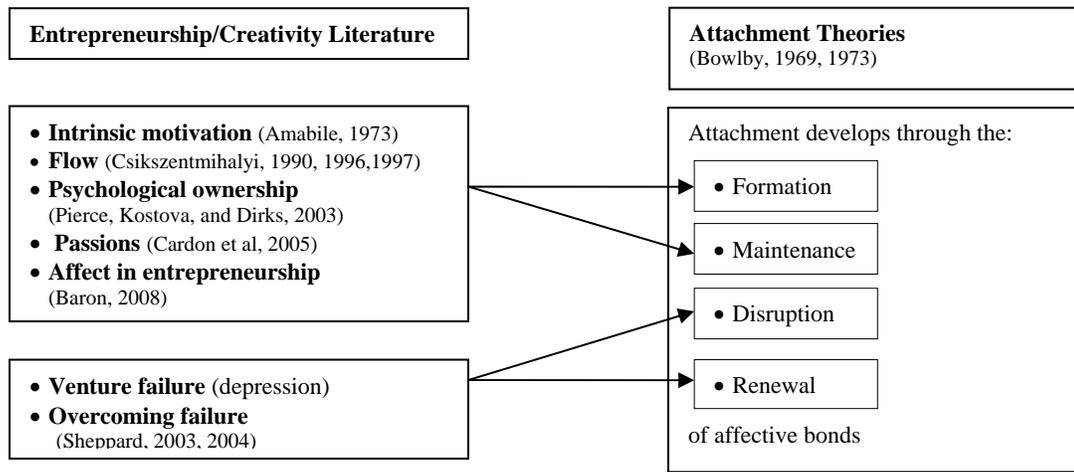
In the previous chapter I showed evidence of control tendency CT being an instrumental factor in commercialization of new technology. Also, I linked CT to psychological attachment (PA), when I argued that CT is most detrimental if it is based on subjective factors, such as attachment rather than objective factors such as inalienable human capital. In this chapter, I discuss the dimensions to PA, the relationships between PA and CT and the expected behavioural effects by way of hypotheses.

#### 3.1.1 Psychological Attachment (PA)

This section outlines the construct of PA, its tenets and its relationship with CT. The basic idea behind the construct is that the entrepreneurial process establishes a relationship between the developer and the opportunity. Figure 2 provides the conceptual view of the proposed relationship. In the right panel there is a set of steps identified in Bowlby's (1969, 1973) attachment theory. The right panel provides concepts identified in the entrepreneurship and creativity literature that relate to items in the steps from attachment theory. For instance, concepts such as intrinsic motivation relate to the formation and maintenance of an affective bond between the creator and the idea. The following sections discuss the constructs and relationships as they pertain to Figure 2.

**Figure 2**

**Developing Psychological Attachment**



The construct of “attachment” is inherently affect driven. Considering the tenets of attachment theories in psychology (Fairbairn, 1952; Bowlby, 1969, 1973), PA can be generally characterized as an affectional tie that forms based on interactions between “self” and “other” often accompanied by affective experiences, and constitutes affective states that can be major building blocks for decision making. Bowlby’s (1969, 1973) attachment theory provides a complete account of the normative and individual difference processes that generate emotions in close relationships. According to Bowlby, the attachment system plays the roles of protecting vulnerable individuals from potential threats and regulating subsequent negative affect. In his book “Attachment and Loss” Bowlby (1969) explains... “Many of the most intense emotions arise during the formation, the maintenance, the disruption, and the renewal of attachment relationships [as shown on the right side of Figure 2]. The formation of a bond is described as falling in love, maintaining a bond as loving someone, and losing a partner as grieving over someone.” In a parallel relation to the entrepreneurial process (technology especially), one can envisage entrepreneurs developing intense emotions when conceiving the opportunity (falling in love), developing an attachment to the opportunity (maintaining the bond as loving the

opportunity), developing sorrow or depression from failing in venture formation (losing the opportunity and grieving over it) (see Figure 2).

In addition, Bowlby notes that “[the] threat of loss arouses anxiety, and actual loss gives rise to sorrow, while each of these situations is likely to arouse anger”. Further, Bowlby (1973) postulated that an individual’s attachment system activates when the person perceives a threat thereby forcing her/him to protect themselves from that threat. In his example, a child’s attachment system is activated when he/she perceives threats in the environment and because of that he/she is motivated to seek protection from a caregiver. Bowlby says the unchallenged maintenance of this bond with the caregiver is “experienced as a source of security and the renewal of a bond as a source of joy”. He says “...because such emotions are usually a reflection of the state of a person’s affectional bonds, the psychology and psychopathology of emotion is found to be in large part the psychology and psychopathology of affectional bonds”.

Again, in relating to the entrepreneurial process, the entrepreneur develops an attachment to the idea and the perception of a threat of loss from the commercialization environment leads to a protective psychological posture. The emphasis is in guarding and maintaining the bond with the opportunity and then, the entrepreneur derives security from the maintenance of that bond. Further, Bowlby advocates the concept of “internal working models” which demonstrates the process through which children internalize their childhood attachment experiences with caregivers and rely on these internalized experiences when they form new personal relationships with outsiders. These models are the basis of current work in attachment that distinguishes between different styles of attachment (Hazan and Shaver, 1987; Mikilincer and Shaver, 2003).

In effect, one of the key characteristics of attachment theory is the developmental experience. The theory provides an explanation for the mechanisms at different stages of a

relationship: why an individual is attracted to a relationship; the appeal factor; and how the individual reacts to its dissolution. In relation to the entrepreneurial process, the attachment theory could provide a framework for studying the affective factors that: motivate an individual to be attracted to entrepreneurship; makes the entrepreneurial relationship with the opportunity appealing; and affective factors that explain reactions to disengagement from that entrepreneurial relationship (the dissolution of the relationship). In other words, the opportunity recognition, development and growth stages of the entrepreneurial process map onto the developmental paradigm noted by Bowlby within which an entrepreneur experiences the formation, maintenance, disruption and renewal of the affectional bond with the opportunity (see the mapping in Figure 2).

Also, entrepreneurs internalise their entrepreneurial experiences which influence their interactions with outsiders. The perception of a threat will kick in the attachment system that motivates the protection of that bond with the opportunity. However, these developmental experiences form an essential part of the affective experiences that entrepreneurs must encounter as they develop opportunities. The following provides empirical accounts of concepts that may apply to the various stages of the developmental process of formation, maintenance, disruption and renewal of the affectional bond with the opportunity.

Developer–opportunity interactions that indicate the formation and maintenance of affectional ties or psychological bonds as described in Bowlby’s work are noted in the creativity and entrepreneurship literatures and are characterized by concepts such as intrinsic drive (Ryan and Deci, 2000; Amabile, 1983); psychological ownership (Pierce, Kostova and Dirks, 2003), flow (Csikszentmihalyi, 1990, 1996 and 1997); passions (Baum and Locke, 2004; Branzei and Zietsma, 2004; Cardon et al., 2005); intense emotions from commitment to the opportunity

(Baron, 1998); and the role of affect in entrepreneurship (Baron, 2008). Although they don't directly argue for the effect of PA, these concepts provide evidence for affect-induced behaviour. For instance, Baron (2008) notes that affect is likely to influence cognition and behaviour in entrepreneurial environments due to the unpredictability and rapid nature of change. He also points out that affect may play a role in entrepreneurial creativity. The author specifically identifies opportunity recognition (corresponding to formation in attachment theory) and acquisition of essential resources (pertaining to the issue of control) as two areas where affect may play a role in entrepreneurship. Further, Baron (1998) notes that since entrepreneurs have a deep commitment to their opportunities, they are more likely than other people to experience intense emotions, more frequently, in relation to their work, and are more susceptible to *affect infusion* — when affective states elicited by one source or experience influences judgments about other, unrelated events (Forgas, 1995).

There are other concepts, such as entrepreneurs' grief over business failure (Shepherd, 2003, 2004), which illustrate the disruption of the affectional bond (business failure and loss leading possibly to depression) and renewal of the bond (getting over the loss and continuing to pursue the opportunity). For instance, Shepherd (2004) notes that the reasons entrepreneurs start their own businesses could highlight entrepreneurs' emotional attachment to their businesses. He advocates for pedagogical methods to help students in entrepreneurship manage emotions to avoid failure, learn from failure and improve their emotional intelligence. The following provides more illustrations of how some of the other identified concepts and processes might motivate PA to the opportunity.

Further, the concept of intrinsic motivation demonstrates a platform for the formation and maintenance of an affectional bond. For instance, many studies have shown that opportunity

development or creation is intrinsically motivating and rewarding (Deci, Koestner and Ryan, 2001; Rossman, 1931; Schumpeter, 1934; White, 1959; deCharms, 1968; Deci, 1975). For instance, White's (1959) effectance motivation theory suggests that individuals are motivated from the feeling of having an effect on their environment. deCharms' (1968) personal causation theory suggests that individuals get motivation from the feeling of being the initiators of their own actions. Amabile (1983) found that an individual's interest in an activity, rather than in external rewards, leads to a more creative performance. However, Deci's (1975) intrinsic motivation theory emerges as the most tested theory of motivation. It is defined as the doing of an activity for its inherent satisfactions rather than for some separable consequences (Ryan and Deci, 2000, p. 56). Deci's theory suggests that individuals' need for relatedness, competence and autonomy, individuals drive them to persist with tasks and report high interest and enjoyment. Intrinsic motivation then provides the mechanism through which the entrepreneur forges a closer bond with the opportunity; to form and maintain an affectional bond out of the reactions to successful problem solving and other positive experiences.

Another construct capable of providing an environment within which an affectional bond can be discussed is "psychological ownership". Psychological ownership is essentially the psychology of MINE. It is related to possessive tendencies (biological, social, situational or developmental) that establish the connection between self and targets of possession. Pierce, Kostova, and Dirks (2003) define the state of psychological ownership as 'that state where an individual feels as though the target of ownership or a piece of that target is *theirs*'. They identified the following features for the construct. The first feature is based on the concept of possession and relates to the sense of ownership which manifests itself in the meaning and emotion commonly associated with the expression MINE. The second feature they identify is the

relationship between the individual and the object. Here the object is experienced as having a close connection with the self or becomes part of the extended self. The third feature is a complex mix of cognitive-affective elements in which the individual is aware through intellectual perception. The affective component of interest here, according to Pierce et. al. (2003), ‘becomes apparent in the feelings that arise when others lay claim to objects for which one feels a sense of personal ownership’

In addition to the features, Pierce, Kostova and Dirks (2003) identify three routes to the emergence of the construct or *the state of psychological ownership*; controlling the ownership target (object); coming to know the target intimately; and investing the self into the target. Of particular interest is the process of investing the self into the target. It is easy to realize that the process of opportunity development is commensurate with investing the self into the idea. Pierce et. al. (2003) notes that ‘the most obvious and perhaps the most powerful means by which an individual invests him/herself into an object is to create it’. The authors mention writings of Locke (1691) who argued that we own our labour and ourselves, and therefore, are likely to feel that we own what we create, shape or produce. Along the same lines, Norton and Ariely (2005) show that people value goods more highly when they invest their own labour in creating them. They show that novices who make origami value their creations as highly as those made by experts, and individuals who make self-built Legos value it more highly than sets built by others. Thus, when creators endeavour to solve problems on their ideas and go through iterative rounds to develop a working prototype, they invest emotional energy into the process and the outcome (which is the idea).

Lastly, Pierce et al (2003) note that just like our words, our thoughts and emotions are representations of our self. Also, the authors note that ‘creation involves investing time, energy

and even one's values and identity'. Feelings of ownership in these circumstances are clearly not derived from legal possession, but from the feelings of the ownership target belonging to or being a part of the self as the creator conceives and develops the idea. Pierce et al (2003) indeed acknowledge that individuals may feel ownership for the products they create in vocations such as academia (through scholarly pursuits), entrepreneurship (through pursuing entrepreneurial opportunities), and politics (through the drafting of bills). In effect, effective reactions from interaction with the idea and resultant ownership are expected to lead to emotional attachment when the ownership target is felt to be threatened, as postulated by Bowlby (1969, 1973). The same way politicians are staunch defenders of bills they draft, entrepreneurs' PA will magnify in the face of perceptions of hostility on the market.

Going further, the concept of Flow is another construct that suggests the formation and maintenance of an affectional bond during the entrepreneurial process. Flow is the concept of optimal experience developed by Mihalyi Csikszentmihalyi (1990, 1996 and 1997). Csikszentmihalyi describes the feeling of having been able to create something new and original by focusing attention on a challenge. He notes the concept of 'Flow' which is a state of consciousness where an individual experiences feelings of deep enjoyment and of control and dominion. In this state, individuals are immersed in the present as they eradicate from their minds the impossibilities of the past and the uncertainties of the future. However, the state of Flow is a balance between psychological processes of differentiation and integration. The process of differentiation follows the notion of individuation put forth by Carl Jung (see Jung and Baynes, 1921). It is the process where the individual opens up to parts of him/herself beyond his/her ego. According to Jung, the individual needs to pay attention to dreams and question the assumptions of operant societal worldview rather than be blinded by the dominant norms and

assumptions. Therefore, differentiation is a break from the norm to realize dreams or attain new goals –in effect, is passion-laden. Integration, however, is bringing together information and experience into the process, and could be described as objectivity. Complexity is generated when differentiation interacts with integration. Having interviewed 91 people described as exceptional individuals, Csikszentmihalyi (1996) notes that some respondents describe the creative process a yin-yang alternation between the two extremes. With sufficient complexity to challenge and hold their attention, intrinsically motivated creators can easily achieve the optimal experience. The objectivity does not slow down the process of creation but lends credibility to the ideas conceived.

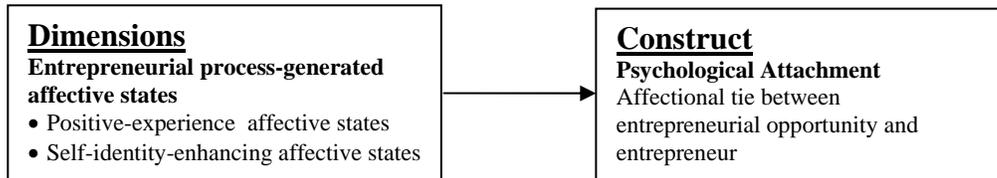
The concept Flow seems to imply that individuals are not inherently creative until they are intrinsically motivated by the complexities they face. Csikszentmihalyi (1996) notes that without passion individuals lose interest in a difficult task. Further, the state of consciousness could occur several times a day and might not give birth to novel ideas worth pursuing. However, the concept is appealing due to the importance of *drive* in the creation process, and also, due to the feelings of deep enjoyment, control and domination that accompany the Flow state. These are feelings at conception and at problem-solving points during development which are in line with Bowlby's (1969) formation and maintenance concepts when applied to the psychological bond between the idea and the entrepreneur.

Lastly, there are a number of other positive emotions identified in the literature which suggest an affectional bond between creator and idea. An example is "passion" in idea creation. Passion described by early philosophers such as Aristotle is what is now referred to as emotion. Bennett-Goleman (2001) describe passion as that gift of emotion that causes individuals to take a precise interest in and pay keen attention to something. Baron (1998) identified passion as being

associated with entrepreneurship. Also, Cardon, Zietsma, Saporito, Matherne and Davis (2005) argue for the consideration of emotion in entrepreneurship, compare entrepreneurial creation to parenthood, and identify factors such as passion, commitment and identification as drivers in entrepreneurship. As entrepreneurs conceive an idea and work on it, they are more likely to seek security in it and be protective of it. Further, working in the domain of relationship literature, Branzei and Zietsma (2004) provide a long list of qualitative evidence showing that founders speak with more passion about their business opportunities than non-founders. If the entrepreneurial process leads to passion, it is not difficult to see how the process will generate affectional ties between the entrepreneur and idea through passion.

In summary, attachment theory postulated by Bowlby (1969, 1973) can provide a framework for conceptualizing the formation, maintenance, disruption and renewal of the affectional bond between an entrepreneur/creator and an opportunity/idea. Concepts that illustrate the formation and development of this affectional tie are identified above. Among them are psychological ownership, intrinsic motivation, flow and passions. These factors are conceptualized to motivate an attachment to the opportunity which gets stronger when entrepreneurs perceive threats from the commercialization environment. Further, through the concept of internal working models these factors are expected to motivate entrepreneurs to internalize their affective experiences and evoke them during interactions with outsiders. Given these observations, the following identifies two dimensions of PA. The first dimension relates to the formation of the affective tie and is identified as the positive-experience affective states resulting from the entrepreneurial process. The second dimension relates to the maintenance of the affective tie and that is identified as affective states that enhance entrepreneurial self-identity (see Figure 3). Figure 3 shows a relationship between these two dimensions and PA.

**Figure 3**  
**Dimensions to Psychological Attachment**



### 3.1.2 Entrepreneurial Process-Generated Affect (Opportunity Recognition and Development)

#### Positive- and Negative-experience Affective States

Characterizing the entrepreneurial process (before commercialization) as comprising opportunity recognition and opportunity development, the following discusses the characterization of opportunity, opportunity recognition and development, and relates to the generation of affect in these two areas. I start with opportunity recognition, and provide a definition, review the literature on the issues of recognition process and what it entails. Then I discuss the role of affect in the process.

#### *Extant literature on the nature of opportunity and recognition of opportunities*

Opportunity recognition is defined as a process of perception, discovery and creation of new ideas (Singh, Hills, Hybels and Lumpkin, 1999). However, what characterizes an opportunity is subject to debate. The debate relates back to what defines entrepreneurship. A number of definitional paradigms can be identified (see Shane and Eckhardt, 2003). I review them because they focus on the role of the individual, and since affect emanates and resides in individuals, the paradigms provide insight into how affective states relate to the opportunity recognition process. One of these paradigms is the psychological-theories paradigm that suggests that there are a number of psychological traits possessed by the entrepreneur which allow him or her to undertake the task of entrepreneurship. There is also the Neoclassical equilibrium theories

paradigm which notes that markets are made up of maximizing agents and that there are no unnoticed business opportunities. Thus, only the people who choose to become entrepreneurs do so - not because the opportunities themselves haven't been noticed by anyone else. Then, there is the Austrian school paradigm which claims business opportunities arise because not everyone has the same amount of information and thus some are not equipped to "see" the opportunities. In essence two overarching paradigms emerge, one where entrepreneurship is a function of the individual and the other where it is a function of an enabling environment.

In the same fashion, the definition of an opportunity is also subject to debate; and this debate also has a bearing on the arguments for this thesis. Acs and Audretsch (2005) contend that a set of weakly held assumptions appear to dominate this debate leaving the fundamental nature of opportunity vague and unresolved. The debate is on whether "opportunity" is a subjective or an objective construct. Some researchers dwell on the subjectivity and the "socially-constructed" nature of opportunity arguing that these characteristics make it impossible to separate the opportunity from the individual. Others argue that an opportunity is an objective construct visible only to knowledgeable and attuned individuals. For instance, Shane and Venkataraman (2000) portray opportunities as objective phenomenon that may be discovered by entrepreneurs with unique cognitive abilities. However, Shane (2003) develops the idea of an individual-opportunity nexus which merges the traditional views of entrepreneurship offering a coherent and overarching conceptual framework that explains the different parts of the entrepreneurial process: the opportunities, the people who pursue them, the skills and strategies used to organize and exploit opportunities, and the environmental conditions favourable to them.

Mirroring the debate of entrepreneurship stemming from the individual or from the environment, there is also a debate as to whether "an opportunity" stems from the individual or is

independent of the individual. The view that is eventually adopted will determine the nature of the discussion of the role of affect in the opportunity recognition process. However, the role and traits of the individual can be seen to play a part in either approach. The following argues for the role of the individual irrespective of what approach is adopted, and what the implications are for the role of affect in the process.

***The individual in opportunity recognition*** Without arguing for an individual-centric process for dealing with opportunities, it is clear that the role of the individual cannot be relegated to the background. Even if opportunity recognition is episodic as the critics of the person-based view argue, when the episodes occur, it still takes an individual to realize the prospects of the opportunity and act on it. From that view point it could be argued that, irrespective of the characteristic of the opportunity, there is a certain level of personal judgement and decision making that must come from an individual for the opportunity to be exploited. For instance, Schwartz, Teach and Birch (2005) contend that opportunity recognition may follow a cognitive or a process approach. The cognitive approach is based on personal characteristics of entrepreneurs, scripts and mental models behind opportunity recognition, while the process approach emphasizes opportunity recognition as more of a manageable activity. In both approaches there will be the need for an individual mental (cognitive and affective) factor to move the process forward.

***First dimension: Positive affect in opportunity recognition and development*** Having argued that the individual (and, therefore, his or her affective experience) plays a role, in opportunity recognition and development, I proceed to argue for the role of affect in these processes. I start by making the case that since affect goes hand in hand with cognition, where cognition plays a role; affect plays a role as well. Thus, with a cognitive process at play, one will

expect an affective dimension to play an informative, supporting or reactionary role. Therefore, whether by a cognitive or process approach, the employment of a cognitive entrepreneurial capability (Baron, 2004, 2006a) that implies the recognition of opportunities is grounded in cognitive realizations with accompanying affective states (e.g., the 'Flow' concept of Csikszentmihalyi, 1996). Positive affective reactions to these cognitive realisations are expected to initiate an affectional tie to the idea as a natural response to the experiential experience. Baron (2008) identifies two ways in which affect influences opportunity recognition: through the influence on creativity and through the moderating effects of affect on the influence of other individual-level factors on opportunity recognition. Specifically, Baron (2008) notes that, in general, positive affect is more likely to facilitate creativity than negative affect and, thereby, enhance opportunity recognition. However, it should be noted that while Baron (2008) discusses affect that aids the creative process, the emphasis in this study is on affect that is a "by-product" of the creative process. In other words, the study dwells on the affective reactions to the events comprising the creative process.

For an illustration, let's revisit the concept of "Flow". Csikszentmihalyi (1996) associated the feeling of Flow with having to create something new and original by focusing attention on a challenge. As introduced above, "Flow" is a state of consciousness where an individual experiences feelings of deep enjoyment and of control and dominion. In a unique study of creativity, Csikszentmihalyi (1996) studied 100 individuals who had produced socially recognised creative works and were made up of scientists, artists, writers, educators, politicians and social activists, engineers, and religious leaders. He identified domain expertise as an instrumental factor in their excellence and creativity. This suggests that intrinsic motivation is a crucial aspect of creativity. Thus, creators possessing mastery in their skills will be intrinsically

motivated to endeavour in their areas of expertise. With the view that intrinsic motivation has affective components, it is not difficult to see that intrinsically motivated creators will experience positive affect from successful endeavours, and possibly negative affect, such as disappointments, from failure. These two cases will reinforce the creator's actions positively and negatively. One will expect that positive affect will correlate more with an affectional tie to the opportunity than negative affect (if at all).

The development stage will consist of similar mechanisms. Take the view that development is typically grounded in problem solving (see Brown and Eisenhardt, 1995). Then, for technology entrepreneurs developing product innovations, the development stage presents difficult tradeoffs in the areas of demand expectations, quality, design and fabrication in order to achieve goals such as the lowest manufacturing cost structure. Therefore, positive affective states resulting from successful recognition or discovery, as well as finding solutions to development problems (or to a previously difficult problem) are expected to increase attachment to the opportunity.

Further, creative problem solving has been identified to follow two different thinking processes: convergent or analytical, and lateral or associative (Guildford, 1967). While convergent reasoning produces one solution, divergent thinking produces multiple solutions thereby producing novel ideas and unusual responses to questions. Thus, divergent thinking cognitively leads in various directions some conventional and some original. Research in neuroscience supports these distinctions. For instance, the brain is found to function differently under the two types of thinking. Dacey and Lennon (1998) find the brain to be involved in a higher degree of neural complexity and, therefore a greater degree of neural connections under divergent thinking tasks than under analytical tasks. Functional MRI tests that contrasted insight

with analytical problem solving (devoid of insight) showed increased activity in the right hemisphere anterior superior temporal gyrus, an area of the brain noted for initial problem-solving efforts.

In addition, the existence of different thinking processes imply subjects can make connections across distantly related information and find connections that were not previously obvious (Jung-Beeman et. al., 2004; Bowden et. al., 2005). It is also known that observed Gamma bursts seen in these neuroscience studies activates emotions increasing the plasticity of the cortex and facilitating the formation of new associations in the thinking process. The divergent nature of thinking and the brain processes associated with creative thinking, suggest a high level of emotions from cognitive realizations when patterns are found or when discoveries are made. Divergence in thought suggests that discovery will be “unusual” and, therefore, evoke a high-level emotional reaction, in this case, positive emotions such as joy. The classic discovery story is told of Archimedes who rushed out of his bathtub onto the street, naked, and yelling “Eureka, Eureka” when he suddenly discovered his well-known principle of hydrostatics. Clearly, there was an intense outflow of emotions evoked by the discovery.

For entrepreneurs, such an experience is likely to initiate an affectional tie with the idea since the “affective discovery mode” might linger for a longer period. Empirically, there is also some correlation found between positive moods and creativity. In several studies conducted by Isen and colleagues, they found positive mood to positively affect creative problem solving than negative or neutral moods (Isen, 1990; Isen and Baron, 1991; Isen et. al., 1987). In relation to entrepreneurship, affect can shape thoughts during opportunity recognition (Baron, 2006b; Baron, 2008) and the recognition process, in turn, will reinforce the affective states. Likewise

depressed, sad and/or stressed people are less likely to conduct creative problem solving because the negative moods restrict attention and evoke stereotypic responses (Gazzaniga, 1988).

Further, I recount one of the processes of attachment theory (Bowlby, 1969, 1973): the formation of attachment – “falling in love”. The presence of affective states in creativity, whether emotions (such as joy, excitement) or drive states (such as intrinsic drives), suggest the likelihood of the actor falling in love with the creation. Referring to entrepreneurs as creative individuals, the argument can be made that positive affective states will garner attachment towards the entrepreneurial opportunity, while negative experiences, in contrast, will inhibit affectional ties to the opportunity. In this sense, the affective states in question relate to the equilibrium state the developer is in. So, during opportunity recognition and development, positive states refer to cases in which the problem (or key problem) is solved, while negative states refers to cases where the problem is not solved and, therefore, the creator is reacting negatively.

*H1a*: Positive affective states resulting from opportunity development process will be positively related to PA while negative affective states will be negatively related to PA<sup>2</sup>.

***Second dimension: Self- Identity- Enhancing Affective States*** As the entrepreneur identifies self with the opportunity the notion of the entrepreneurial role identity may begin to form. The entrepreneur may begin to envisage a burgeoning identity based on the idea and likely begin to develop possessive feelings. Using a related concept, Pierce, Kostova, and Dirks (2003) noted that the motivation for psychological ownership (of one’s creation) is partially grounded in

---

<sup>2</sup> Hypothesis *H1a* and *H1b* are what I refer to as validation hypotheses. Since hypotheses are not typically developed to investigate dimensionality, I developed these two hypotheses to assess the theoretical underpinnings of the two constructs as presented. I achieved this by correlating the dimensions with alternative measures of PA. A high correlation suggests a considerable level of validity.

self identity. The authors note that “the most obvious and perhaps the most powerful means by which an individual invests him/herself into an object is to create it” (pg 93). Through the reinforcing process of affect shaping opportunity and vice versa, entrepreneurs gain self understanding, express self identity to others, and become attached to the opportunity as they begin to view it as a natural extension of the self. Cardon et al. (2005) note that, entrepreneurial decisions sometimes stem from “emotions and deep identity connections between an entrepreneur and an idea or opportunity” (pg 24). As entrepreneurs begin to see the opportunity as an “extension of self”, they begin to develop a sustained commitment to the role-identity as they define themselves in terms of that role “I am going to be an entrepreneur”. Thus, the role identity will come to define the person, and to some degree, the role will merge with the person's self-definition (Turner 1978).

With roots in sociology, role identity relates to a person's individualized version of a social role. Role theory is based on the idea that people function within a society; and as a result there is communication of certain expectations regarding one's behaviour (Burke and Reitzes, 1991; Hoelter, 1983; Pilivain, and Callero 1991; Stryker 1980). Thus, a role becomes a set of individual and shared meanings (see Weigert, Teitge and Teitge 1986, for a comprehensive review of different views of identity theory).

Further, role identity has been shown to be a strong predictor of behaviour. For example, focusing on blood donors, Callero, Howard and Piliavin (1987) show that the extent to which an individual views himself or herself as a blood donor is more likely to sustain the behaviour of blood donation. When a role is sustained over time, it may become part of an individual's role identity (Reich, 2000). Thus, over time, the person becomes a “blood donor” as perceived by self and others. Role identity is also explained in symbols and positions. Stryker (1980) builds on

symbolic interactionism and connects symbols and positions to roles in social interaction. He notes that “In this usage, positions are symbols for the kinds of persons it is possible to be in society: rich man, poor man, thief, fool, teacher, sergeant, intellectual, rebel, president, and so on” (Stryker, 1980, p. 57). On symbols he adds, “Symbols enable people to predict their own and other’s behaviour and to anticipate the future course of interaction” (1980, p. 37). And on positions he notes that, “Like other symbolic categories, positions serve to cue behaviour and so act as predictors of the behaviour of persons who are placed into a category” (1980, p. 57). Thus, symbols and positions have certain behaviours attached to them and individuals use these roles to describe aspects of the self. Callero, Howard and Piliavin (1987) suggest that predictions of future behaviour can be made based on the extent an individual has merged a given role with his or her definition of self.

The identity literature provides some conceptualization of this role-person merger. Turner (1978) describes the role-person merger as the extent to which a role identity is integrated with a person’s overall self definition. A greater role-person merger implies a higher impact of role identity factors in the definition of self and consequently corresponds to a higher amount of time spent in the role. High role-person merger has been associated with self labeling as a person who performs the role (e.g., Burke and Reitzes, 1991; Piliavin and Callero, 1991; Stryker, 1980). The more an entrepreneur merges the self into the entrepreneurial role, the more he or she labels him or herself as an entrepreneur (or entrepreneurial). Research also shows that the choice of roles and the definition of self, is based on those roles develop over a period of time through role-related development stages. Kleine and Kleine (2000) outlined five stages of role-identity development for freely chosen, ordinary role identities (e.g., bridge player): role-identity presocialization, discovery, construction, maintenance and disposition. For instance, identity

discovery relates to the process of exploring a particular identity to determine the level of fit with the self, while identity construction refers to the individual choosing actively to devote time and energy to the pursuit of the identity. In relation, opportunity recognition is expected to motivate the entrepreneur towards entrepreneurial identity discovery while the process of problem solving through opportunity development might motivate the construction of an entrepreneurial identity through the experiences enjoyed. The crucial argument here is that entrepreneurs may need to necessarily develop some affectional tie to the opportunity in order to successfully discover and construct the entrepreneurial role identity.

Recent research in this area in entrepreneurship is beginning to discuss the role of entrepreneurial identity in the nascent process and effects on persistence and performance. For instance, employing role theory, George, Jain and Maltarich (2006) conceptualize the nascent process as a role identity transformation, and find, among other factors, perceived social and economic enablers to affect role identity adoption and opportunity commercialization. In general, attempts try to describe the entrepreneurial process in terms of identity dynamics as an alternative to the trait research in trying to understand the motivations to pursue entrepreneurial activity (Hoang and Gimeno, 2007, and Hytti, 2000). For example, Hytti (2000) argues for studying how the entrepreneurs define themselves as well as how other people define entrepreneurship and entrepreneurs according to their interactions in different circumstances.

Further, Hoang and Gimeno (2007) develop the concept of founder role identity and describe how centrality and complexity affect successful role transition. The authors explain founder centrality as how important the entrepreneurial identity is to the entrepreneur's self concept while complexity is explained as the depth and breadth of the entrepreneur's conception of the role. In relation to this study, developers with a high centrality are expected to view

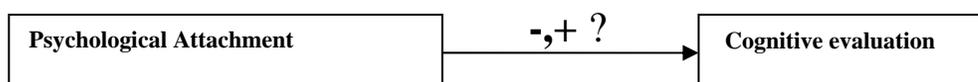
entrepreneurship favourably and, therefore, begin investing emotionally into the opportunity as they observe its prospects. Also, developers may endeavour to actualize whatever entrepreneurial role they conceptualize such that they will carry out entrepreneurial activities to various stages. Thus, some will only develop ideas to transfer to outsiders for commercialization while others will build new ventures on their ideas in accordance with their perceived entrepreneurial role identity.

On the whole, it is clear that an entrepreneurial identity might be an attraction for potential entrepreneurs, and this may also help explain entrepreneurial endeavours and persistence. However, since identity is constructed and not innate, the process might begin with opportunity identification but will be fostered through the development process. Positive experiences and celebrative affective states resulting from success in problem solving and other developmental achievements, may result in cognitive anticipation of a prospective entrepreneurial identity in the future. The affective reactions to this cognitive anticipation are expected to motivate a stronger bond between the opportunity and the developer, creating a PA.

*H1b*: Self-identity-enhancing affective states will be positively related to psychological attachment to the opportunity

### 3.1.3 Psychological Attachment vs. Cognitive Evaluation

**Figure 4**  
**Psychological Attachment vs. Cognitive Evaluation of the Microeconomic Environment**



Having argued that PA stems from affective conditions during opportunity recognition and development, it is important to discuss the differences in mechanisms between decision

processes governed by PA and those governed by cognitive evaluation, as indicated in Figure 4. Figure 4 shows that there is a relationship between PA and cognitive evaluation, the nature of which is discussed in this section. As briefly introduced earlier, affective processes are known to diverge from cognitive processes, and sometimes overshadow them, in judgment decision making (see Lowenstein et al., 2001 for a review). The authors note that “...other strands of literature in psychology most closely associated with the clinical literature suggest that [affect] often conflict with cognitive evaluations and can in some situations produce pathologies of decision making and behaviour” (p. 269). They cite examples such as anxiety and fear which make people react more strongly to outcomes they recognize as highly unlikely (such as airplane crashes) or not objectively terrible (such as public speaking), while reacting less strongly to negative outcomes that are more likely and probably more severe (such as car accidents).

The differences in mechanisms are also shown in related evidence which supports the notion that highly anxious individuals attend preferentially to threat-related stimuli and interpret ambiguous stimuli and situations as threatening (Eysenck, 1992 Derakshan and Eysenck, 1997; Eysenck, Mac-Leod and Matthews, 1987; Vasey, El-Hag and Daleiden, 1996). Further, studies by Wilson and Arvai (2006) show that despite expected gains in evaluability, affective responses to a stimulus may overwhelm analytic computations in decision making. These positions can be bolstered with the mood congruence theory. Baron (2008) suggests that entrepreneurs’ current moods may affect the information they store in memory and retrieve for later use. In relation, technology developers might envisage emotional reactions to adverse commercialization situations and the resulting mood may affect information storage, retrieval and use.

The differences in mechanisms for affective and cognitive processes are also seen in dual process models. Lowenstein et al., (2001) cite the work of Sloman (1996) who distinguished

between rule-based and associative processing. Similar to the System 2 – System 1 dual processes reviewed earlier, rule-based processing “is a relatively controlled form of processing that operates according to formal rules of logic and evidence and is mediated by conscious appraisal of information”, while “...associative processing is a more spontaneous form of processing that operates by principles of similarity and temporal contiguity” (p. 270). They argue that since associative processing is not mediated by conscious appraisal it is difficult to suppress its influence on judgments and decisions. Thus, in the case of divergence, the consequences can be dire mostly due to the negative influence of affective processes.

Lowenstein et al., (2001) also noted determinants of affective reactions that differ from cognitive evaluations. They argue that the divergences between affective and cognitive reactions occur for two reasons. Firstly, affective processes respond to probabilities and outcomes in a different manner from what is expected with cognitive evaluation. Secondly, there are situation-specific factors that have a minimum effect on cognitive evaluations: time-course of the decision, nonconsequentialist (not ‘if then’) aspects of the decision outcomes (e.g. vividness) and evolutionary preparedness for some reactions. The time-course of the decision refers to the temporal nature of affect, while vividness is concerned with individual differences in mental imagery in influencing affective responses. However, evolutionary preparedness relates to the idea that humans are preprogrammed to experience certain types of fears that are not cognitively dangerous but because evolution has prepared them for such experiences.

For an illustration of the divergence between affective and cognitive processes, consider the case of an entrepreneur of a low-technology household appliance, faced with a simple decision of choosing a type or size of distribution channel. A reasonable expectation is for the entrepreneur to choose a distributor that possesses maximum distribution capacities for a number

of reasons. A large distributor will ensure high volume and market share or reach, hence, the entrepreneur will experience higher economic returns and brand building or possibly quicker brand dominance. However, when the entrepreneur is highly attached to the idea, the pattern of decision making may deviate from this normative expectation, reflecting a divergence between affective and cognitive evaluation based on the reasons identified by Lowenstein et al. (2001).

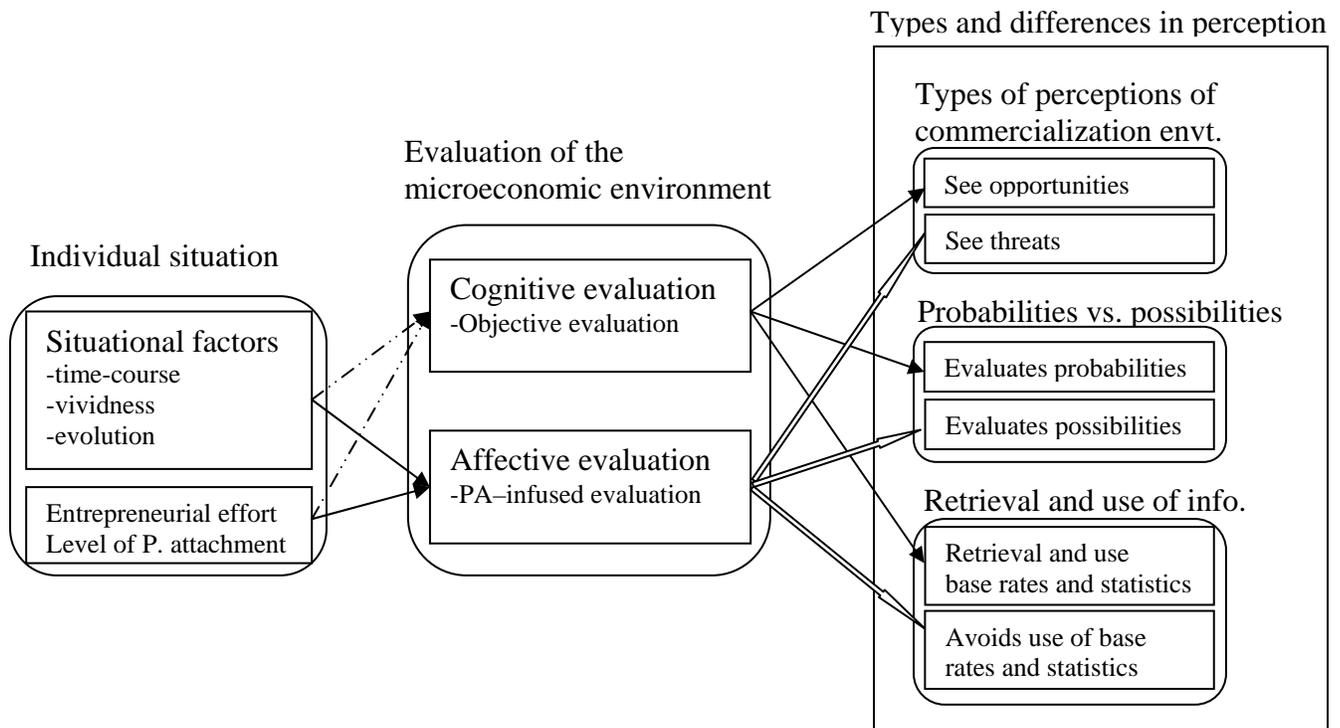
To see the reasons at play, assume the marketing/distribution channel the entrepreneur contacted demands more than 50% mark-up on the final price of the product, and the entrepreneur was aware of this information. First, in relation to the evaluation of probabilities and outcomes, as identified by Lowenstein et al. (2001), a highly-attached entrepreneur will begin considering all the possibilities of his or her profits being squeezed to the barest minimum (against the probability that it might not happen), as well as envisioning all the possible negative future outcomes. In terms of situational factors identified by Lowenstein et al. (2001), the proximity of the decision moment (at the point of commercialization) will bring these concerns to the fore (time-course). Likewise, the value of the mark-up will serve as a vivid signal of expropriation which might emanate from the entrepreneur's evolutionary make up. All these mechanisms can occur irrespective of the fact that operating costs and the complexity of channels of distribution require high mark-up fees.

In effect, the divergence between affective and cognitive processes will reflect in differences in PA-infused evaluations and cognitive evaluations of the commercialization environment as shown in Figure 5. Figure 5 relates the situational factors just reviewed and entrepreneurial effort to the differing cognitive and affective forms of evaluation, and further relates these forms of evaluation to types and differences in perception (shown in the right most panel). Although there are cognitive and affective influences throughout the decision-making

process, Figure 5 emphasizes on the affective influences on the process. Following Lowenstein et al. (2001), three areas were identified to illustrate the differences in perception from cognitive and affective points of view. The three areas are: the perception of the commercialization environment, the difference in perception as it relates to possibilities and probabilities, and the retrieval and use of information. Further illustrations are provided below.

**Figure 5**

**Differing Approaches to Perception Due To Divergence between Cognitive and Affective Evaluation of the Microeconomic Environment**



First, it is assumed that a strong affectional tie (a high level of PA) induces an affective evaluation of the microeconomic environment. Thus, as shown in Figure 5, PA-infused evaluation of the microeconomic environment will make developers envision threats and not opportunities in the microeconomic environment. As well, such developers will evaluate possibilities (from the threat) and not the probabilities of the “bright side” and may also avoid the use of base rates in their evaluations. To illustrate further, the commercialization stage, as noted

elsewhere, is characterized by exposure of the idea to potential stakeholders, an exposure that carries an element of risk due to the stakeholders' unknown and untested motives. The developer will naturally perceive threatening signals. As noted in Bowlby's (1969) attachment theory, the affectional tie increases when a threat is perceived.

Second, cognitive evaluation is based largely on the probability and desirability associated with the consequences, while affective evaluation is more sensitive to outcomes than to probabilities (Loewenstein et al., 2001). For example, emotional evaluations of strong positive or negative consequences of outcomes in uncertain or risky situations will be more sensitive to the possibility than the probability of outcomes. This pattern leads to an overweight of very small probabilities (Loewenstein et al., 2001). Thus developers will be psychologically affected by the possibilities of encroachment on property and appropriability rights even if property protection and alternative safeguards such as non-disclosure agreements and trade secrecy are available. Further, there is substantial research on the distinction between affective evaluation and cognitive evaluation relating to probabilities and possibilities. For instance, Rottenstreich and Hsee (2001) found that strong sensitivity to departure from impossibility and certainty (and also insensitivity to changes in probability), are more dramatic for affect-rich than for affect-poor outcomes.

Third, attachment will prevent the use of valuable information such as base rates in the face of perceived adverse outcomes, even if the developer acknowledges the value of such information. So, even if highly-attached developers realize the value of cooperation with a potential outsider and associated potential gains, they may fail to make use of this realization and place undue emphasis on the severity of a possible loss and less so on the probability of a positive outcome. Concentration on the negative possibilities decreases the salience of the

“positive” probabilities and reduces objective and cognitive evaluation of the microeconomic environment.

Therefore, considering the level of affective investment a developer pours into an opportunity, a high level of attachment is expected to magnify the possibilities of negative outcomes without full consideration of the probabilities of those outcomes. Hence, a high attachment to the opportunity is expected to lead to a lower level of cognitive evaluation of commercialization outcomes, most especially, when the possibility of loss is perceived.

*H2: Increases in psychological attachment decreases cognitive evaluation of outcomes for the opportunity.*

#### **3.1.4. Control Tendency and Psychological Attachment**

To discuss the concept of control, there is the need to first introduce the concept of commercialization options, the point where the issue of control in this study is argued to be most intense.

##### **3.1.4.1. Commercialization Options**

There is a variety of frameworks for categorizing options of commercialization. Gans and Stern (2003) note that key aspects of the commercialization environment motivate start-ups to choose between cooperative or competitive strategies. Others categorize options of commercialization into licensing or creation of new firms (Colyvas, Crow, Gelijns, Mazzoleni, Nelson, Rosenberg and Sampat, 2002; Shane, 2001; Shane 2002; and Neckar and Shane, 2003). Another type of categorization is provided by Pries and Guild (2004), who argue for substance over form and develop three categories, namely; create new business, partner with industry, or

sell. Yet, others look at more novel categorizations that depend on the type of technology involved (Nicolaou and Birley, 2003).

*Simplifying the options* Acknowledging the variety and the strategic implications of the various commercialization options, the simple bi-modal framework of “compete” or “cooperate” (Gans, Hsu and Stern, 2002 and Gans and Stern, 2003) is adopted in this paper for its simplicity and generalizability. This adoption is to orient the commercialization options to the Shane and Venkataraman (2000) notion of entrepreneurship where successful commercialization weighs heavily on collaboration with outside parties. The compete or cooperate framework is for evaluating start-up commercialization strategy and patterns of competitive interaction between start-ups and established firms. Gans and Stern (2003) contend that commercialization strategy for start-up innovators often presents a trade-off between establishing a novel value chain and competing against established firms, and leveraging an existing value chain and earning returns through cooperating with others. The following is a short elaboration on the two modes of commercialization and the modifications done to them to support the framework for this thesis.

Gans and Stern (2003) describe the option of competing as a situation where the start-up sets up a venture on the idea to compete with incumbents. Some factors that motivate firms to consider the competing option is the design of the technology (enabling trade secrecy – Pressman, 1988), pioneering nature of the invention, first mover advantage (Lieberman and Montgomery, 1988), and learning curves (Levin et al, 1987). However, Gans and Stern (2003) argue that without seeking cooperation, start-ups may lose the opportunity to earn returns as was the case of Robert Kearns who fought royalty payments for his intermittent windshield wiper for decades (Seabrook, 1994, as cited in Gans and Stern, 2003).

Conversely, the option of cooperating is where the start-up enters into agreements with other firms (Gans and Stern, 2003). There are many strategic options with cooperating. The authors identify licensing, acquisition of start-ups, joint ventures, strategic and educational alliances, milestone financing, among others. Essentially, cooperating is likely to make the start-up disclose technical information to the established firm, weakening its bargaining position (Gans and Stern, 2003). A possible solution is for the start-up to threaten pervasive disclosure which will increase its bargaining power and reduce the degree of expropriation (Anton and Yao, 1994, 1995). In addition, start-ups face problems of higher search costs for appropriate partners, unknown reputations of potential collaborators, differences in industry experience, among others. Even though obstacles in this option may be higher, cooperating has the advantages of allowing sellers of technology to soften downstream competition, avoiding duplicative investment, and enhancing complementary technology development (Gans and Stern, 2003).

*Commercialization options as pertains to this study* In moving from the frame of technology start-ups to technology entrepreneurs, a few adjustments need to be made to the Gans and Stern model. Competition will imply a number of options with the extreme being solely developing a venture on the idea while a less extreme option will entail subcontracting a part of the value chain, e.g. manufacturing or distribution. Cooperation will also include a number of options with extreme cooperation implying a complete sale of the idea and a less extreme option entailing partnering with outside parties in the areas of finance, manufacturing, R&D and distribution, among others. It should be noted that the options of “cooperating” and “competing” are not directly operationalized in this study. However, this characterisation forms the basis of the expectations for developers under different commercialization decision scenarios.

Cooperating implies sharing or relinquishing control for performance and competing implies restricting control sometimes at the cost of performance.

#### **3.1.4.2. Control At The Point of Commercialization**

At the point of commercialization, the technology entrepreneur has to decide on what commercialization strategy to employ. Choosing a roll-out strategy is always challenging and as Gans and Stern (2003) put it, start-ups typically lack the knowledge and expertise needed to find the appropriate markets for their idea and to translate their ideas into returns. However, many entrepreneurs and start-ups make these important decisions all the time. From the foregoing, we have seen that given knowledge constraints, uncertainty with the environment, and perceptions of outsider's motives as per agency theory, decisions emanate from a battle between cognitive and affective forces. Thus, in line with the conceptual issues developed in this study, the commercialization environment for a highly-attached entrepreneur naturally presents threats to the developer's control over the technology. Also, due to the affectional tie to the opportunity there is also a high sensitivity to these threats. Thus, the primary explanation for such high sensitivity to threats is the perception of fear of loss (of control) over the opportunity. For instance, fear will elicit appraisals of uncertainty and lack of individual control, two central determinants of risky judgments (Slovic, 1987). Therefore, due to such threats or fears, highly-attached entrepreneurs must perceive a high possibility of controlling their ideas in the future, to be openly receptive to partnership proposals from outsiders, while lowly-attached entrepreneurs may be relatively more receptive to such proposals. In line with this preface, the following discusses CT as a result of threat perception given a level of affectional tie (PA) to the idea.

### 3.1.4.3. The Construct of Control

Control generally refers to the extent to which an agent can intentionally produce desired outcomes and prevent undesired outcomes (Skinner, Chapman, and Baltes, 1988). Skinner (1996) developed a framework that classifies all constructs of control as objective, subjective or experienced and these labels refer to connections between ‘agents’ and ‘means’, ‘means’ and ‘ends’ and ‘agents’ and ‘ends’. Further, the framework compares constructs on whether they refer to future or past experiences and whether they have specific or general domains as their referents. According to Skinner (1996), the classical definitions of control hinges on the connections between agents and outcomes. Thus, entrepreneurs perceive control or lack of control depending on their perception of the commercialization environment or expected entrepreneurial outcomes.

This also implies that control does not need to be actual in order for it to be effective. Research provides support for perceived or subjective control as a stronger predictor of functioning than actual or objective control (Skinner, 1996). Therefore, an individual’s perceived control or conviction that control is available is enough to mobilize action and modulate arousal (Averill, 1973) as well as influence affective states and behaviour. Entrepreneurs are therefore expected to react to perceptions of control or lack of control in the commercialization environment. Accordingly, the concept of control hypothesized in this study concerns the desire to control the rights to the opportunity in reaction to the perception of threats from the commercialization environment. The control phenomenon is therefore a “drive” state premised on the affective connection between the entrepreneur and the opportunity.

*Similar control constructs* This concept of desire to control in the entrepreneurial experience shares certain characteristics with other constructs of control such as locus of control

(Rotter, 1966) and self-efficacy (Bandura, 1977). Locus of control is the individual's general expectancy of the outcome of an event as being within his or her personal control and understanding or beyond his or her personal control and understanding (Rotter 1966). Rotter developed the concept in studying individuals' perception about the underlying main causes of events in their lives. Rotter's view was that behavior was largely guided by "reinforcements" (rewards and punishments) and that through contingencies such as rewards and punishments, individuals come to hold beliefs about what causes their actions. These beliefs, in turn, guide the kinds of attitudes and behaviors people adopt.

Rotter (1966) differentiated between internal and external locus of control on his Rotter Internal-External Locus of Control Scale which measures generalized expectancies for internal versus external control of reinforcement. Internals (with internal locus of control) believe that their own actions determine the rewards that they obtain, while externals (with external locus of control) believe that rewards in life are generally outside of their control and their behavior has little effect. The scoring for the scale ranges from 0 to 13 and a low score indicates an internal control while a high score indicates external control. Many studies have found entrepreneurs to have more locus of control than others (e.g. Evans and Leighton, 1989; Brockhaus, 1980; Cromie and Johns 1983; Gilad 1982; van Praag, van Sluis and van Witteloostuijn, 2004). For example, van Praag, van Sluis and van Witteloostuijn (2004) studied interviews of 6,111 young US citizens over a two-decade period and show that entrepreneurs had higher mean locus of control score than employees. The authors note that having an internal locus of control positively relates to earnings while entrepreneurs realized a higher effect than employees.

Self-efficacy is also closely related to the control concept in this study. Self-efficacy is an individual's self-judgments of personal capabilities to initiate and successfully perform specified

tasks at designated levels, expend greater effort, and persevere in the face of adversity (Bandura, 1977; 1986). Self-efficacy beliefs influence the choices people make and actions they take. People tend to select tasks and activities in which they feel competent and confident and avoid those in which they do not. In that sense one expects the self-efficacious entrepreneur to envisage control over the rights to the entrepreneurial opportunity. Empirically, Krueger (2000) argues that the perception of entrepreneurial opportunities depends on an individual's perception that the situation is controllable and positive.

*How they differ* Clearly, there are overlaps between locus of control, self-efficacy and the concept of control as described in this study. For example, self-efficacy in the Bandura (1977) formulation is assessed as prospective and at an extremely specific behavioural level (Skinner, 1996) while locus of control is time-neutral and domain-specific. However, despite these overlaps, control as conceptualized in this study is unique to the opportunity creation context, connects past to future experiences with emphasis on control expectancies, refers to connections between agents (entrepreneurs) and ends (outcomes) and is related to perceptions of loss of control at the point of commercialization. In this sense, control in this study is more influenced by context rather than individual level factors such as the personality of the entrepreneur.

Theoretically, an entrepreneur who is affectively-invested in the process may become control-oriented even if he or she has low self-efficacy and an external locus of control. A low self-efficacy implies the entrepreneur doesn't believe in the strategic importance of his or her skills in ensuring performance while an external locus of control implies the entrepreneur believes performance is determined by external forces and is not under his or her control. In these cases, one expects a "rational" entrepreneur to favour cooperating with more capable

entities to ensure a successful commercialization. However, a high level of PA is expected to motivate non-cooperative behavior. At worst, a highly-attached entrepreneur may shelve the idea to prevent others from controlling the rights rather than expose it to the market.

#### **3.1.4.4. Reaction to the Perception of Control And The Role Of PA**

*The control response is characteristic of emotions* It has been established above that the perception of control or lack of control is enough to mobilize action. The perception of lack of control sets a coping mechanism into motion. Skinner (1996) identifies approach vs. avoidance as reactions to perceptions of opportunity and loss of control. The emotional/affective connection to control should be noted here. Frijda (1986) describes emotions as the change in action readiness through the appraisal of a situation. Thus, emotions carry a tendency for action. Similar to reactions to perceptions concerning control, Zajonc (1998) identifies emotional processes as those that address the ‘go/no-go’ questions (that lead to approach/avoidance behaviour), while cognitive processes are those that answer true/false questions. Thus, we see that behavioural reactions conceptualised for control and emotions are identical: approach vs. avoidance.

*Control as a coping strategy* Skinner (1996) identifies two coping strategies in response to threats and loss of control: primary control and relinquishment of control (Heckhausen and Schulz, 1995; Rothbaum Weisz, and Snyder, 1982). Primary control relates to the individual’s attempt to change the environment to fit his or her own desires and wishes while relinquishment of control relates to the voluntary yielding of control to another person (Burger, 1989). In general, when people perceive a high degree of control there is a general sense of action orientation where they exert more effort and are optimistic (Skinner, 1996). When people perceive less control, they withdraw, become fearful, pessimistic and distressed (Skinner, 1996).

In related literature in health psychology, positive affect elicits approach strategies while negative affect elicits avoidance strategies in dealing with stress (Carver, 2001). Further, across a number of domains, a number of theories illustrate the approach-avoidance behavioural tendency although most of these theories typically assume a conceptually cognitive paradigm. The theories include loss aversion (Kahneman and Tversky, 1979); risk aversion (Camerer, Loewenstein, and Rabin, 2004); regret aversion (Bell, 1982; Loomes, and Sugden, 1982, 1987); and protection motivation theory (Rogers, 1975, 1983; Boer and Seydel, 1996).

*Similar coping-strategy theories* The following are short descriptions of these theories. In each of the descriptions, one observes the notions of approach and avoidance in reaction to the level of risk and uncertainty perceived. In prospect theory<sup>3</sup>, Kahneman and Tversky (1979) describe loss aversion as the tendency for individuals to strongly prefer avoiding losses to acquiring gains. Much research evidence on this theory put the weight of losses at about twice that of gains in their psychological effects. Risk aversion could be described as the reluctance of an individual to accept a bargain with an uncertain payoff rather than another bargain with more certain, but possibly lower, expected payoff. Research in behavioral finance (see Camerer, Loewenstein and Rabin, 2004) considers risk as the degree of uncertainty associated with the return on an asset. Regret theory (Bell, 1982; Loomes and Sugden, 1982, 1987) says that individuals anticipate regret when they think of making a wrong choice and this anticipation is considered when making decisions. The fear of regret can therefore lead to risk-seeking in attempt to breakeven and risk aversion in a threat-coping fashion. The last is the protection motivation theory developed by Rogers (1975, 1983). Rogers (1975) first developed the theory

---

<sup>3</sup> A descriptive theory of risk taking in which individuals, due to diminishing sensitivity for absolute quantities, are both risk averse for gains and risk seeking in the domain of losses. An important metric is reference-dependency where changes in the reference point often lead to reversals of preference (Lichtenstein and Slovic, 1971; Tversky and Kahneman, 1991). Thus, evaluation and perception of the decision outcomes will depend on the initial wealth of the decision maker.

to explain fear appeals and extended it into a cognitive model for studying the effects of persuasive communication on behaviour (Rogers, 1983). The protection motivation theory describes adaptive and maladaptive coping with a health threat from two appraisal processes (Boer and Seydel, 1996). An individual resorts to a threat and a coping appraisal process leading to adaptive responses such as protecting oneself or maladaptive responses such as failing to protect oneself.

*Focusing on loss aversion theory* The loss aversion theory is closer and more appropriate to the mechanisms advocated for PA and CT in this study. Therefore, it better illustrates the approach-avoidance mechanism since decisions relate to the perception of threats (such as the threat of loss) in the commercialization environment. In effect, there is the need to elaborate a little on it. One implication of loss aversion is that individuals have a strong tendency to remain at the status quo, because the disadvantages of leaving it loom larger than the advantages. In experiments, Burmeister and Schade (2007) find that entrepreneurs are as affected by the status quo as students but less affected than bankers. Some studies show that fear or myopic loss aversion causes employees to forgo substantial financial gains by investing their retirement in safe bond or money market funds rather than in equities even though the long-term return of equities is often many times higher (Benartzi and Thaler, 1995; Gneezy and Potters, 1997; Thaler, Tversky, Kahneman and Schwartz, 1997).

In relation to this study, when entrepreneurs perceive loss of control, avoidance strategies will include preferring or choosing among commercialization strategies that preserve prior control (the status quo) and avoiding choices that reduce prior control. In addition to influencing the commercialization stage the control tendency also applies to the development stage of the opportunity where entrepreneurs may avoid outsiders who by virtue of their contribution may

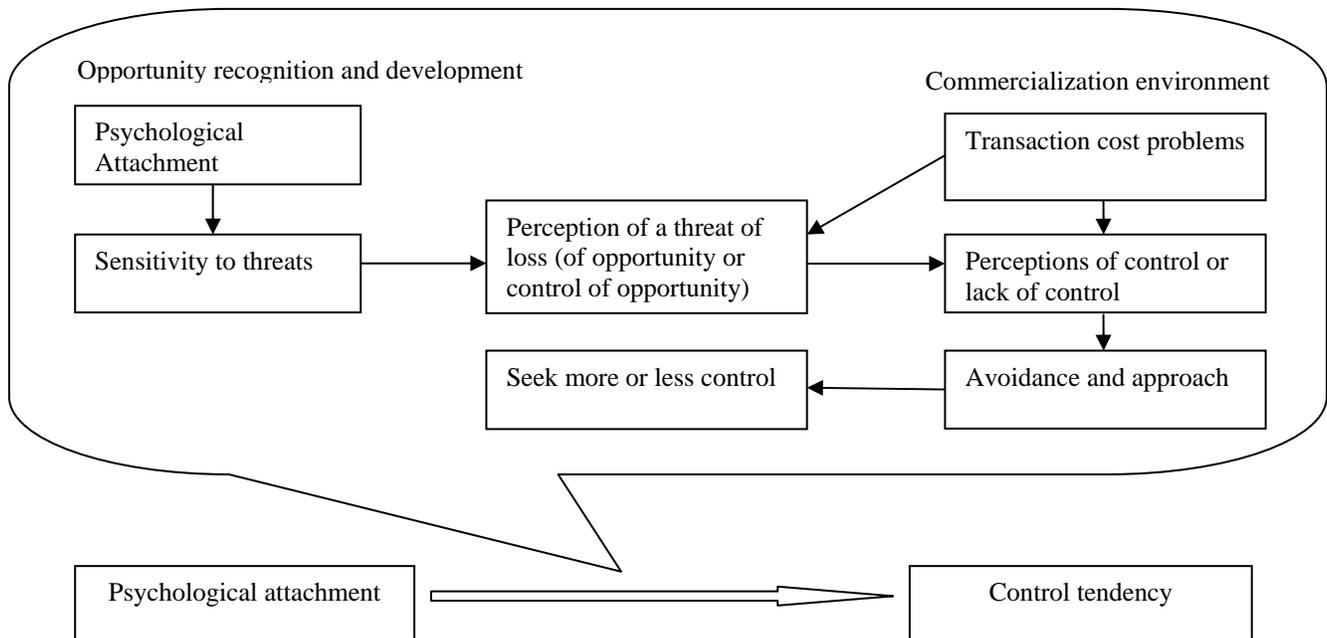
acquire part-ownership of the innovation. Such outsiders will include design or fabrication experts who propose significant changes to the design as well as financiers who contribute substantial development funds. Anecdotal evidence from personal interviews with Canadian inventors indicates that some will rather avoid such partners and delay the development process despite being aware of the potentially-adverse implications for the technology. However, most concede that due to current regrettable experiences; they will consider partnering or collaborating on their next project at an early stage.

Further, one relevant and related research area where the loss aversion theory is employed is the *endowment effect* phenomenon. The endowment effect concerns the increase in the value of a good and therefore resistance to exchange the good when it becomes a part of a person's endowment (Kahneman, Knetsch, and Thaler, 1990, 1991; Thaler, 1980). Several studies suggest that emotional attachment, through loss aversion, plays a role in the endowment effect (Ariely and Simonson, 2003; Carmon, Wertenbroch, and Zeelenberg, 2003; Dhar and Wertenbroch, 2000; Strahilevitz and Loewenstein, 1998; Ariely, Huber, and Wertenbroch, 2005). Following this view, the argument for the effect of PA on CT will be stronger in the entrepreneurship case than in the endowment effect case. I cite this evidence again: Norton and Ariely (2005) show that people value goods more highly when they invest their own labour in creating them. The authors show that novices who make origami value their creations as highly as those made by experts and, individuals who make self-built Legos value it more highly than sets built by others. Generally, an individual's reaction towards the good/object will be similar in both cases. However, in the entrepreneurship case, the good is not just endowed to the individual but is self-conceived and developed by the individual. In other words, if individuals are so unwilling to part with an endowed good, one will expect a higher level of unwillingness to "part"

with control over a created object, an object of ones labour and investment of self, as in the case of the entrepreneur.

In the forgoing, it was established that the perception of loss can influence a CT, leading to avoidance behaviour. I conclude the section with a summary of the mechanism through which PA will influence CT in the evaluation of the microeconomic environment, during commercialization attempts. I use Figure 6 to provide a graphic picture of this summary. Figure 6 provides the processes that developers will go through from the opportunity recognition and development stages to the commercialization stage and the affective mechanisms for the effect of PA leading to a CT.

**Figure 6**  
**The Effect of Psychological Attachment on Control Tendency**



Affective experiences during opportunity recognition and development contribute to an affectional tie between the entrepreneur and the opportunity. In line with attachment theory, the

PA is assumed to lead to a higher sensitivity to threats from the commercialization environment (shown in the left panel of Figure 6). The commercialization stage presents a very strategic point in the technology entrepreneurial process where important decisions need to be made about what market options to adopt. Due to the latent sensitivity to threats (middle panel of Figure 6), transaction costs, the issues with information asymmetry, etc, the developer is primed to sense a possible loss of control in future interactions with outsiders (as seen in right panel of Figure 6). The threat of loss and the complicity of agency problems initiate a coping mechanism which urges avoidance of strategies that relinquish control of the opportunity and reduce the affectional tie with the opportunity (right bottom panel of Figure 6). In other words, a threat of loss introduces a tendency to seek control. Thus, since the affectional tie encourages sensitivity to threats, an affectional tie (PA) will generally motivate a CT (middle bottom panel of Figure 6). However, the presence of an actual threat is expected to increase CT further.

*H3: As psychological attachment increases general control tendency increases*

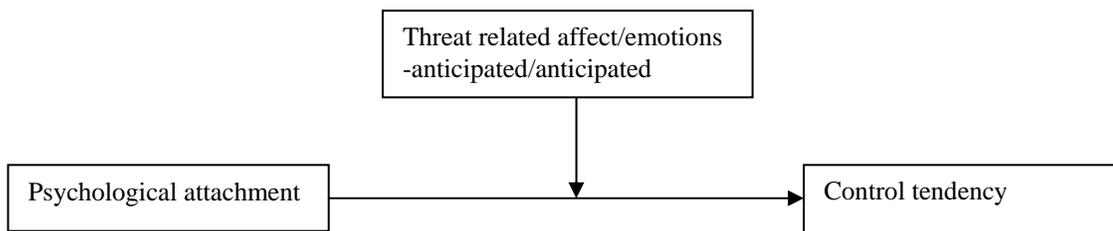
### **3.1.5. Moderated Relationship between Psychological Attachment and Control**

As already noted, the threat of loss is expected to influence the perception of future control or lack of control in the commercialization environment. The argument was that, issues of, and concerns about, transaction costs emanating from economic situations such as asymmetric information and perceptions of loss of control will provide threatening signals. In effect, threat is treated as a moderator of the relationship between PA and CT. When the perception of threat is high, a stronger relationship between PA and CT is expected. The following discusses the two main types of affective responses or emotional reactions to

perceived threats: anticipatory and anticipated responses (Loewenstein et al., 2001). The illustrations employ the specific-emotions approach<sup>4</sup> rather than the global positive-negative valence approach (Johnson and Tversky, 1983; Wright and Bower, 1992). Specific emotions have been shown to elicit specific appraisals (Lerner and Keltner, 2000, 2001; Tiedens and Linton, 2001) and are appropriate for this study since the concepts of PA and CT will elicit specific affective reactions such as fear and dread. Figure 7 presents an illustration of the moderating effects of anticipated and anticipatory emotions on the relationship between PA and CT.

**Figure 7**

**The Moderating Effect of Threat Perception on the Relationship between PA and CT**



**3.1.5.1. Moderating Effect of Anticipated Emotions on the Relationship between PA and CT**

Anticipated emotions are emotions that are not currently experienced but are expected to be experienced in the future. Research on emotion and rationality (Elster, 1996, 1998) as well as emotions and decisions under risk and uncertainty (Bell, 1982, 1985; Loomes and Sugden, 1982, 1987; Mellers et. al., 1997, 1999) employ this category of emotions. Essentially, people are seen as “consequentialist” in the manner in which they consider the future in making some decisions

<sup>4</sup> Studies on emotions in recent years argue for the importance of studying specific emotions (DeSteno, Petty, Wegener, and Rucker, 2000; Lerner and Keltner, 2000, 2001; Tiedens and Linton, 2001; Lerner, Gonzalez, Small, and Fischhoff, 2003). One example is the appraisal tendency theory (Lerner and Keltner, 2000). This approach moves away from past research, which modelled emotions in a global positive-negative valence paradigm (Johnson and Tversky, 1983; Isen and Patrick, 1983; Wright and Bower, 1992). For instance, Lerner and Keltner (2001) show that fear and anger influence judgments of risk in opposite ways. Thus, fearful individuals make pessimistic judgments about future events while angry individuals seem to make optimistic judgments.

in the present (Loewenstein, et. al., 2001). Typical emotions that are expected to be experienced considering the future outcomes of present decisions are disappointment or regret that may arise from counterfactual comparisons (Bell, 1982, 1985; Loomes and Sugden, 1982, 1987; Mellers, Schwartz, Ho and Ritov, 1997; Mellers, Schwartz and Ritov, 1999; Baron, 2000).

For instance, entrepreneurs making decisions within this framework may be reluctant to adopt a strategy of cooperating with an outsider, fearing expropriation or infringement on the rights to their idea. Such reluctance might result from perceived disappointment and regret in the future states considered. Thus, entrepreneurs may seek to control the situation to avert perceived undesirable outcomes. As noted by Skinner (1996), control tends to be considered in terms of its effectiveness in interactions with the environment. As a result, control outcomes have often been equated to changing the external world to fit the demands and wishes of the individual (Rothbaum et al., 1982) and also when dealing with the multiple consequences of the outcome.

*H4a:* Anticipated emotional reactions to perceived threats will positively moderate the relationship between psychological attachment and control tendency

### **3.1.5.2. Moderating Effect of Anticipatory Emotions on the Relationship between PA and CT**

Anticipatory emotions, however, are immediate visceral reactions and mood states such as fear, anxiety, worry and dread of uncertainties and risks. The “moment of truth” when the entrepreneur has to decide on a commercialization option, given perceptions of threat in the market environment, is likely to evoke emotions that will affect the choice made. Affective states enable individuals to seek mood-congruent information (Bower and Cohen, 1982; Blaney, 1986). As well, affective states influence the content of information retrieved, e.g. happy people report

higher probabilities on positive events (Wright and Bower, 1992) and affect the process of information retrieval, e.g. complexity reduction (Isen and Means, 1983). Baron (2008) cites similar work in his review of the role of affect in entrepreneurship.

Further, for entrepreneurs, anticipatory emotions will take input from memories from the development period. Difficult, exciting, and anxious experiences of self or others during problem solving and feasibility studies may stay in the entrepreneur's limbic system<sup>5</sup> and be evoked by perceptions of threat. Adverse experiences are expected to loom larger and stay longer than pleasant ones. For instance, Lowenstein et al (2001) note that fear responses could be evoked by crude or subliminal cues and fear conditioning may be permanent or last longer than other types of learning. Thus, in addition to pleasant memories, adverse circumstances resulting from persistence in the development of the opportunity such as divorce or bankruptcy may result in precautionary and self-protective behaviour (safeguarding the idea – the only consolation left). Studies have shown that individuals tend to develop precautionary and self-protective behaviour towards issues where they have previously had a personal experience that led to adverse consequences (Kunreuther, et al., 1978; Weinstein, 1989; Browne and Hoyt, 2000).

*H4b:* Anticipatory emotional reactions to perceived threats will positively moderate the relationship between psychological attachment and control tendency

This chapter introduced the constructs, outlined conceptual underpinnings and provided expected relationships between the constructs of psychological attachment, cognitive evaluation,

---

<sup>5</sup> The limbic system is a term for a set of brain structures including the hippocampus and amygdala that support a variety of functions including emotion, behaviour and long term memory  
[http://en.wikipedia.org/wiki/Limbic\\_system](http://en.wikipedia.org/wiki/Limbic_system) Accessed March, 20, 2008

and control tendency. The next chapter identifies methodological issues and statistical analyses of the theoretical positions and predictions outlined in Chapter 3.

## **Chapter 4**

### **4.1 Methodology and Analysis**

#### **4.1.1. Domain of Study**

There are a number of decision making areas in the commercialization or market entry domain where the behavioural effects of PA and CT can be studied. However, due to the nature of the constructs involved (such as attachment and control), there was the need to consider laboratory-type studies where the potential effects of alternative hypotheses could be minimized. Prior to describing the study population and the rationale for the sample choice, the following provides insight into preparation for conceptualization of the constructs identified.

#### **4.1.2. Preliminary Work**

A background study on CT included a study of responses to two sets of semi-structured interviews, one with 13 actual independent inventors and the other with a sample of subjects used for this study (post-study). The independent inventors were selected randomly from a pool of 1,776 independent Canadian inventors based on close proximity (driving distance of 150 kms) to the interviewer. The interviews were mainly unstructured, but with probing questions on the origins of the idea; development and financing; the inventor's personal situation and experiences; plans developed and actions taken; expectations for the invention; achievements, disappointments and failures, market outlook and future plans. On the question of what triggered the idea, the respondents recounted stories of conceiving the idea from recreational endeavours, house chores or professional experience. Most of the descriptions indicated 'Eureka' kinds of moments during the inventive process: the type of moments that can spur emotional attachment. Further to that, the interview transcripts also showed signs of the emotional attachment affecting

or playing a role in the decisions that inventors made. In the following accounts, I provide portions of transcripts on various issues in the commercialization process.

***Independent Inventor interviews*** The first issue deals with inventors' reservations about members of the value chain such as manufacturers and distributors. Almost all the respondents whose products were near or at the market stage expressed some reservations towards the distribution and marketing channels. One respondent, having pulled his product off the shelves due to dissatisfaction with returns, had this to say about his search for a new distributor: ".....so *I'm still in the process of finding that perfect relationship corporately*". The product in question was a simple household fixture with very little potential for long term market success. Without a patent and being very easy to copy, the product did not possess characteristics that afforded a pause in sales for any length of time. Hence the decision to pull it off the market and spend a considerable period of time searching for a new distributor was economically inefficient.

The second inventor commented on a similar situation. He had stocks of supplies for his product in storage at the time of the interview and marketing efforts had seized for a long time. This is what he has to say: "*Yes, there's that issue [not wanting to discuss with outsiders] again, and do I want to go through that?, because I would kick myself if I did do that and the product was then developed by somebody else, and I'd be left with nothing*". Asked if trying to get a distributor was not a better strategy than hoarding the pieces in storage, he responded "*I suppose, I don't want anyone else benefiting from it without me...but, I don't know, maybe I just don't trust people enough, I just, and maybe that's part of my problem, I have to get over that hurdle but, I don't know, I don't know what I am going to do*"

Another inventor made comments concerning intellectual property (IP) protection which is instrumental in discussions with outside parties. Normatively, IP protection is expected to

increase cooperation due to the IP strengthening the inventor's bargaining power. A patent on the idea should assure and encourage the inventor to be willing to engage a host of outsiders with the aim of finding an efficient commercialization strategy. However, the transcript from this inventor suggests otherwise: *".....you know, when you start an idea and you start a product and you're using...and you apply for intellectual property protection and you get patents granted in the United States and Canada and you get trademarks granted in United States and Canada, you're pretty close to the idea and you are pretty close to the product and you are very leery about who comes in to work with you and you want to protect it.... so was I over protective and missed out on some opportunities?, maybe, I don't know"*

One striking note to make of this inventor's comments is that he starts being "protective" after obtaining patents, not before. The implication is that IP protection reinforces that feeling of ownership and the claim over rights to the idea, evoking protective tendencies that are characteristic of PA. As noted above, a stronger bargaining position from IP protection was expected to make the inventor "open" to outsiders and not be overly protective. The respondent's partner continues: *"Well, probably we did because when you are trying to keep everything close to, close to yourself, you sometimes get a bit of a tunnel vision and you don't see that maybe there are...but again, it's the caution thing where you are being cautious, maybe a little too cautious, and probably, if you were...just in hindsight today...I think that we would look at bringing someone in, maybe to ease some of the financial burden, but again, it's got to be someone that you totally trust and is pretty much thinking...either they're thinking along the same lines as you and they are a partner as such, or they're just a silent partner and don't want anything to do with it"* The last parts of the response point to the need to consider level of trust in control and sharing decisions. The influence of trust was introduced and briefly discussed in the

literature review sections of this thesis and included as a control variable in the analysis section. However, since respondents are being asked to respond to hypothetical scenarios, disposition to trust and not actual trust was operationalized.

In another transcript, the inventor commented on his feelings towards commercialization efforts that may tarnish his personal image through a reduction in the quality of the product. Although logical and expected, his concerns indicate a level of connection he shares with the idea which I believe points to a possible attachment. When asked whether his want of control over the idea was responsible for his seemingly low tolerance for cooperation, the inventor had this to say: *“I would say, yes. And I’m [control-oriented]...and as years pass I get less and less concerned about it. Certainly at the beginning I had to control everything.....if I were to have it made in China I would be very concerned about product quality. Because I do look at it as its got my name written on it and I want it to work as I would expect it to work when a consumer picks it up, pumps it up and down in the tub, I expect it to work for them. So yeah, I take it very personally. That’s one of the reasons I don’t do any of the sales...I do very few sales calls. There has been some, where they want to speak to the guy who made it. And I have been a little bit involved in the whole Canadian Tire thing. But I typically leave all of that up to my wife and to my buddy [name omitted] because in the sales business there’s tons of rejection. And I hate it...because you are beating up on my baby“*. This response also shows the difficulty with which inventors take critical evaluation of their creations. It has the potential to determine their level of susceptibility to feedback from evaluators. If inventors tend to dismiss critical but useful evaluation feedback, because it stabs their ego, their ability to improve on their inventions will be limited. On another hand, the inventor’s response suggests that his control orientation decreased over the years. This is an interesting point that’s not discussed in this thesis.

In addition to aversion to manufacturers, distributors and potential imitators, inventors indicated reservations towards financiers taking control of their ideas. The perception of losing control is instrumental in this study in terms of the commercialization strategies that inventors adopt. In this example where the inventor talked about financing the commercialization effort, he had this to say; *“We’ve also looked at Venture Capital and different people like that. But to go into that level is an entrepreneurial step back because they basically want 3/4 of the company, right? So you kind of go, no I don’t really think I want to go there”*. There was a clear reluctance to consider venture capital (VC) funding due to reservations towards high VC equity stake conditions. In effect, the VC agent’s ability to raise the much needed funds for the company is entirely ignored. High attachment is capable of blurring the perception or even knowledge of an outsider’s potential to support commercialization goals.

Similarly, another inventor who was initially more accepting of VC financing reported disappointment with the process at the end. This inventor had spent about 20 years developing various improvements and applications of the idea. Rather than resisting cooperation, this inventor embraced cooperation and regretted doing so. *“In our attempts to get funding in Vancouver, people in Seattle became aware of this and they ended up funding,...they put in \$3million... we moved, shut down the operations in Guelph, moved it to Seattle and they took control of the whole thing. They eventually sold it for 20 million dollars and [the firm] is now going to commercialize it. But in the process I lost control and my net financial reward for this was \$170, 000. So the inventor did not get well rewarded at all. Fortunately this is only first of a series of technologies and I’m now working on the next ones with the hope that having done it once it should be easy to do it a second time. The Ontario Government is acutely aware of all the problems I had. They watched as I had to shut down the Guelph operation and had to move it*

*all to the west coast, and were unable to do anything to help. But it's being used in example now why government programs should be changed to try and encourage this type of thing happening in Ontario, rather than moving it"*

The inventor's decision to cooperate was influenced by the choices he had available at the time. Rather than hold on to control and risk bankruptcy, he decided to cooperate with potential financiers risking takeover of control from him. However, the loss of control initiated a set of events that created discontent: *"When you lose control, you have no bargaining power at all, and we lost control when the Americans put the money in..... there was no choice. It was either that or go bankrupt. If you go bankrupt, then they pick it all up for nothing. So, we just weren't in a strong bargaining position, we just could not raise the money and by the time we raised it, we were out of it. And a lot of these investment people, the venture capitalists, enjoy this messiness; it just increases their leverage. So they made their fantastic returns. Out of the \$20 million, the guy who put the \$3 million in, he got \$12 million. The guy they put in as CEO got \$2 million, so there's 14 of the 20 million gone right there. The US government took 2 million in taxes, so we're down to 4 million,... that is what we got out of the whole thing, the Canadian group and over those years we put in it, we put in about \$4 million so we got our money back, big deal!*

*..... No incentive at all, very frustrating. But, better to see technology go than to have it just fail. It's a nightmare, an absolute nightmare. The biggest frustration is the money people are only interested in one thing...making money. They don't give a damn about anything else. So they don't care that I can't carry on, they don't care about job creation, they don't care about anything, they just want to make their money. They get their 40% rate of return, bang!, that's what they want, and they are out of it and they're gone and they are on to the next deal. And the*

*government, if they are going to do anything about encouraging innovation and commercialization and have it stay here in Canada, they've got to address some of these problems head on. Up to now, they have not been able to address the problems that need to be addressed"*

Clearly, VCs want good return on investment and their actions may not necessarily constitute attempts to expropriate returns from inventors. Once a venture financing process goes through multiple stages, share dilution is expected to leave the inventor with low and unsatisfactory returns. However, of particular interest is being aware and perceiving this situation prior to closing financing deals. Accurately reading the VC capitalization sheet will show the extent of share dilution and associated returns at the end of the day. However, it is likely that the discontent will creep in at the end when the returns are compared with the investments. Nevertheless, the interesting point is that inventors who are able to predict their reaction or feeling at that end state might reconsider the decision to accept VC investment (see from the empirical evidence presented earlier). Therefore, although VC financing of some inventions is the most appropriate route to commercialization, the perception of VC "expropriative" tendencies may leave many inventors wanting to avoid them and explore sub-optimal financing avenues.

The last issue identified in the inventor interviews is the indication that some inventors do perceive their attachment to the idea or want of control over the rights to the idea as well as the possible negative consequences on decision making. For an illustration, this inventor noted that he was making efforts to emotionally disengage from the project: *"I am trying to remove myself from my idea because I know how dangerous it is to be possessive of it. I am ready to listen to people's views even if I won't act on them"*. The danger many inventors face is the ability to

realize their strong commitment to their ideas and its potentially negative effects on decision making, yet do nothing to counterbalance with objectivity. Realizing the attachment, this inventor perceives the potential to err in assessing commercialization options and therefore decides to remove self from the idea to allow a more effective evaluation of commercialization issues. His attitude points to a potential remedy for control-oriented behaviour being disengagement from the idea. This concept is not researched in this thesis.

***Study subject interviews*** The second set of interviews involved five (5) individuals from the pool of subjects used for this study. The subject pool is taken from a final year engineering design class in one of Canada's top technology-oriented universities – University of Waterloo. Subjects worked in groups of four or five to develop a novel idea with proven consumer need. The sample is described in more detail in the next section. However, the interviews were conducted after the study and interviewees were asked to respond to questions on the origins of the idea, experiences during the development process, instances of excitement and frustrations and their personal views on PA and CT; with respect to their own experiences and with respect to the experiences of others.

Most of the descriptions pointed to technological innovation. One respondent noted: *“The intent was to come up with a high-tech solution with some marketing potential”*. Respondents indicated that attachment was likely if the idea was something they were passionate about from the beginning rather than if it was suggested by someone else in their group. One respondent commented: *“Personally, I'm not too attached to the project. It wasn't the idea that I came up with...the one I was most excited about.”* Respondents indicated that they believed people could be attached to new ideas in which they invest. Sample responses were as follows. *“I think that people do, depending on their interest in the idea. If my group were still doing our 2nd idea*

*[which I was most interested in], I would have been more attached to it.” Another commented, “It depends on the motivation behind their development. There can conceivably be three in my opinion: something to pass the course, something to market, or something revolutionary... the last motive will definitely cause emotional attachment. I think any could apply to any group, depending on the idea they came up with in time for the proposal submission.”*

The respondents were also of the view that the projects may not involve the high level of investment expected of full-time technology developers so attachment might not be high. However, they indicated that they believed emotional investment in the idea may develop an attachment to the idea and there was the potential for this attachment to affect the decision making process with likely dire consequences. One respondent commented: *“I don't think it's beneficial to keep control for emotional reasons. It should depend on interest and potential revenue”*. Another commented: *“I'm not sure... My father is an entrepreneur, and I know how attachment limits marketing potential due to insistence on control and resistance to sharing. It will depend on how the majority of the group feels. If enough people want to participate in future development, we will keep control, otherwise, perhaps we should sell all of it”*. Clearly, although respondents wouldn't say they were highly attached to the idea (social desirability effect) they perceive the possibility of attachment to the project and also realise that attachment may have negative consequences on revenue generation. Two samples of these transcripts are provided in the Appendix 3. Together, these two sets of interview cases (independent inventors and subjects in this study) provide insight and anecdotal support for the concept of CT and PA at the commercialization stage while informing on elements that aided in the development of the experimental conditions for studying the phenomena.

*Secondary search effort* To complement the first-hand anecdotal evidence of attachment and control in idea and venture creation, a search was conducted on *Proquest* research database through the University of Waterloo library website. Keying in the words “invention” and “inventor” and indicating *multiple databases* as search source, Proquest provides pages of academic, business and regular articles (on empirical studies and business cases), as well as news items (on inventions and inventors). Empirical research publications often referred to cooperation with outsiders as a strategic approach to commercialization while business articles often cited idea developers’ want for control to attain pecuniary and non pecuniary gains even when they lacked the resources to do so. For the subjects in these stories, if by a stroke of luck, or extraordinary execution of strategy, they succeed, they were hailed as entrepreneurial heroes. Idea creation was also often described as a positively and negatively exciting process with stories depicting *Eureka* moments, emotional attachment, perceptions and exaggeration of threats, overcoming threats in various ways –many of the notions that have been expressed in theorizing PA and CT in this study.

There were stories on perseverance both at the individual and at the corporate level, perseverance which is likely to result from a certain level of attachment and be impacted by affective influences on behaviour. On the corporate level, the accounts were sometimes on “product champions” such as in the Sony Walkman and 3M’s Post It Note cases where the champions defied business analysts’ negative feedback and pressed on to push the ideas to market. In the case of the Sony Walkman, the perseverance of its product champion, Akio Morita, is well noted. He is reported to have said: “*I do not believe that any amount of market research could have told us that the Sony Walkman would be successful, not to say a sensational hit that would spawn many imitators*”. Clearly, the product was successful due to encouraging a

latent consumer need by providing people with an innovative product they hadn't known they needed. In the case of the Post It Note, there were accounts of perseverance on the part of Dr. Spence Silver, inventor of the adhesive, Arthur Fry, who discovered the Post It application, and Geoff Nicholson, the product champion in upper management (all of the 3M Company). Through their individual and collective perseverance they were able to chart a winning course through the corporate minefield despite the “doomed to fail” predictions they received in feedback. Fortunately in their case, the product was successful and is one of 3M's famous inventions.

Accounts of individual cases of perseverance, most strongly explainable by some type of attachment to the idea, were also available. There is the story of Thomas Edison, the inventor accredited with the invention of the light bulb, who is also noted for saying “*invention is 95% perspiration and 5% inspiration*”. Despite reports of rampant failure in developing inventions, Edison is widely regarded as a very accomplished and successful inventor. Others were not so lucky. One such account is the story of Robert Kearns who waged a protracted legal battle against auto manufacturers for hijacking his intermittent windshield wiper technology. After winning and losing some of the cases, his net winnings went to pay legal fees. His frustrations, the various reports noted, were because “*He had hoped not just to collect royalties but make the devices himself*”. One of the US district judges who presided over five of his trials was reported to have said “*His zeal got ahead of his judgment.*” Finally, there was the story of a Chicago man who shot and killed three people at a law firm in 2006. The Chicago Tribune reported that “*sources said they believed the shooter was a disgruntled former client of the attorney he had asked to see. Joe Jackson, 59, told police, before he was shot, that he had been cheated over a toilet he had invented for use in trucks*”. Although there may be other factors involved in the

shooter's behaviour, the story is an indication of how far some people will go to protect the fruit of their creative endeavours.

On the whole, the preliminary exercises provided insight into the creative process, concerns, issues, organisation, and management of the creative environment. Such insight was useful in helping identify appropriate and fitting concepts to investigate for this study. It was also useful in providing motivation for arguments and ideas on how to operationalize concepts theorised.

#### **4.1.3. Participant Population**

The participant population for the study is made up of students recruited from the area of engineering design. The rationale for recruiting from this population was to ensure that subjects were all at an equal level of creative endeavour and were developing products that had minimal technical variability. Specifically, the study sample was from the ECE 492A class of the University of Waterloo (UW) (see Appendix 4 for more details on design projects). Subjects were engaged in opportunity identification and development in a manner close, in process, to what actual technology entrepreneurs encounter. The project curriculum requires that students develop a novel design project following strict design rules. Project deliverables include a project specification, design block verification, a detailed design, prototype testing, prototype demonstration, and an experience report<sup>6</sup>. The projects are developed in groups of four or five and receive support in the areas of lab space, machine shop, educational discounts, student research funds and sponsorship in-cash and in-kind from companies such as Microsoft or through the university. The groups are also given direction on patenting and commercialization

---

<sup>6</sup> <http://ece.uwaterloo.ca/~ece492a/> accessed Nov 17, 2007

by firms associated with the program after development. At the time of the study, they had not received any such direction.

The subjects engage and develop their design projects in an environment with a high level of commercializable research productivity. The indication is that the quality of the projects is high and the commercialization of successful projects is encouraged, mostly due to the “creator owns it” intellectual property policy of the university. To gain an understanding of the technology environment of the university and the impact of its intellectual property, consider a report that was produced by PricewaterhouseCoopers (PwC) in 2001 from an effort to document and quantify the economic impact of UW on the economy of the Waterloo Region. Comparing with a 1999 Statistics Canada report, the PwC report indicates that UW accounts for over 22% of all spin-offs in Canada, generating over 100 of the 454 spin-offs from 84 universities across the country. The report indicates that when the definition of the transfer of technological resources is broadened to include the transfer of intellectual resources, 250 spin-off companies with some level of attribution to UW were identified. Essentially, UW boasts of a more than 25-year old legacy of spin-off companies including reputable companies such as Waterloo Maple, Open Text Corp. and Dalsa Inc.

The university also has the largest co-operative education enrolment of any university in the world, enrolling about 10,000 students across multiple faculties in the year 2000 (PricewaterhouseCoopers, 2001). Among prominent beneficiaries of this coop system are Microsoft, Google and RIM, makers of Blackberry (RIM is also located one block away from the university). In fact, the coop option is mandatory for the subject group and they are expected to complete a minimum of six (6) work terms (2 and a half years of work experience) throughout their undergrad studies. By the time of conducting this study, the subjects would have completed

a minimum of four (4) work terms and an average of five (5). The coop placements equip subjects with different skill-sets as they are exposed to engineering design tools in industry.

Further, the flexible intellectual property policy of UW, the spin-off track record of UW and the coop experience of the students has implications for the projects they develop. On such implication is that most projects will have a considerable commercialization value and some of the groups or developers will endeavour to develop ventures on their projects. Although there is no hard data on the number of projects attempting commercialization or leading to start-ups, the ratio is considered to be close to 50% if not more (personal conversation with program director). From this viewpoint it is not unreasonable to posit that the quality of some, if not a significant number, of these projects match the average quality of technology innovations developed by independent inventors or start-up project teams in industry. Hence the sample group provides significant benefits in terms of costs and access, etc, to studying the concept of attachment in technology entrepreneurship.

Further support for the relevance of the subject group emanates from the approach to the formation of the groups, which bears similarity to the structure of technology teams or start-up firms. Post-survey interviews revealed that most project groups are set up by individuals who had recognized an opportunity and needed “experts” to form a team to develop the idea. Thus, group members typically possessed complementary skills in the different areas of product engineering. However, the group efforts threaten biasing the subjects’ responses due to different kinds of group psychological effects or biases. To prevent or reduce these biases, survey questions elicited individual evaluations and subjects were instructed to concentrate on their individual perceptions and discard any group views they might hold. Subjects were also asked to provide an amount of money they are willing to pay (willingness to pay) the other team members

(excluding themselves) to acquire total ownership of the project technology. The procedure of thinking about the task and writing down the amount is expected to evoke a sense of ownership that will encourage individual judgement in the survey. In addition to these characteristics of the sample, the subject pool also theoretically ensures variance in the attachment measure since some students are normally actively involved and heavily emotionally invested in the project while others are not.

#### **4.1.4. Descriptive Analysis: Participant Population**

*Survey* Online surveys were sent to subjects twice with email reminders sent on a weekly basis for a period of three weeks. The first survey captured background and control factors and the second captured research measures identified for the study. The second survey was sent two weeks after the first ended. At the end of the second survey, of 248 contacts, 106 students responded culminating in a response rate of 43%. Out of the 106 responses, 89 students completed the surveys with 60 participating in the first and second while 29 participated only in the second. There were no significant differences between those who participated in both surveys and those who participated only in the second survey. Also, dividing the sample between ‘early’ and ‘late’ respondents, led to no significant differences between the groups.

*Descriptive statistics* The average age of subjects was 22 years, 83% were men and 17% women. The average number of hours spent on the project per week was 14 hours (Std. Dev.= 12). More projects (30) fell within the “hi-tech equipment” category (21%) than in any other category. This category was followed by household or general consumer products, then games or toys, sports or leisure, and security or safety products. See the distribution of projects in the various categories in the Table 1 below. Subjects were allowed to choose more than one category and therefore there are multiple choices for the categories.

**Table 1**

**Descriptive Statistics of Industries Categorization for Projects**

<b>Industries – categories</b>	<b>N</b>	<b>%</b>
Environmental or Energy	6	4
Automotive	10	7
Sports or Leisure	16	11
Games or toys	16	11
Medical or health	11	8
Tools	6	4
Household or general consumer products	23	16
High tech equipment	30	21
Security or safety	16	11
Industrial equipment	4	3
Other	8	5
Total	146	100

Participants generally ranked their knowledge of commercialization as low (Median=2, Std. Dev = 1) on a five-point Likert-type scale. The results are provided in Table 2 which shows percentages of subjects distributed among options of how much they knew about commercialization prior to the study. The question was “on a scale of 1 to 5, rank your knowledge of commercialization and attendant issues prior to this study. About 63% reported knowing “little” (2) and “very little” (1) with 20% being neutral (3) and 16% knowing “something” (4) and 1% knowing “everything” (5). For those who indicated knowing about commercialization, in the two latter cases, their knowledge was gained from the following sources: 26% read about it, 20% attended a talk or seminar where commercialization was discussed, 11% took a course in which commercialization was incorporated, 24% did personal research, 20% learned about the topic on the job while none of the subjects had a personal commercialization experience. Clearly, subjects did not know much about commercialization prior to the study. This will normally be the case for majority of technology developers who

develop new ideas, and attempt to commercialize while learning about commercialization at the same time.

**Table 2**

**Descriptive Statistics of Sources of Commercialization Knowledge**

<b>Source of Knowledge</b>	<b>%</b>
Reading about it	26
Seminar/public lecture	20
took a course	11
personal research	24
Previous experience from a job	20
Previous personal experience	0
<b>Total</b>	<b>100</b>

**4.1.4. Measures and Analysis: The Dimensions of Psychological Attachment**

**Measure: The Dimensions of Psychological Attachment**

*Hypothetical items* Since psychological attachment cannot be directly measured, it is expected that when the unobservable magnitude is measured with a scale of hypothetical items, the resulting measure will capture the true score of the construct (see Appendix 1 for scale development process). The strength and quantity of psychological attachment is believed to cause the hypothetical items to take on certain values (DeVellis, 1991). Each item then gives an indication of the strength of psychological attachment.

Therefore, hypothetical items were designed for the two dimensions identified in the theory section. Positive affective states and self-identity-enhancing affective states were the two dimensions of PA identified in the theory section. For the positive-experiences dimension, items included “I am experiencing a lot of exciting moments working on this project”, with an item on

negative experience, “I am personally experiencing a lot of frustrations working on this project”. The self-identity dimension comprised of items such as “The project reflects who I am” and its reverse written item “The project does not reflect who I am” (See Appendix 2 for study instrument).

Pre-tests led to the refinement and removal of some of the items and this process was based on inter-item correlations and interviews with a sample of pre-test respondents. The refined list of items was measured on a five-point Likert-type scale: subjects rated agreement from 1 (strongly disagree) to 5 (strongly agree). The latent items were randomly presented and mixed with filler items. For validation purposes, PA was also measured “directly” with the item “I feel emotionally attached to this idea” and a reverse coded version on a five point scale. However, due to the importance of the construct development process, there is the need to illustrate further, the mechanism behind the use of hypothetical items. To arrive at an efficient scale for the construct, there is the need to consider the issues of validity and reliability.

**Validity** Validity is considered a vital aspect of psychological tests (Anastasi and Urbina, 1997) and is instrumental in ensuring the value of the construct under study. Validity refers to the truthfulness of findings and if the measures used capture what was planned or what was expected to be measured. Cronbach (1971) describes validation as a process used by the test developer to collect evidence that supports the types of inferences to be made from the test scores. Crocker and Algina (1986) identified three types of validity: content, criterion-related and construct validity<sup>7</sup>. The other type of validity is face validity, which looks at an evaluation by the researcher or an external expert to examine the extent to which the survey instrument measures what was intended to be measured.

---

<sup>7</sup> Validity was reduced from four categories to three by the American Psychological Association (1954) with criterion-related validity developed from a combination of predictive and concurrent validity.

Elaborating on the various types of validity, content validity assesses whether the items in the inventory adequately represent psychological attachment or if inference could be drawn from test scores to a larger domain. Criterion-related validity encompasses predictive and concurrent validity and deals with the ability to draw inference about a test score to performance on a real behavioural variable that has practical importance. Construct validity is for drawing inference from a test score to performances that can be grouped under a particular psychological construct, such as PA. Construct validity is therefore the extent to which the items are tapping into the underlying theory or model of behaviour in conceptualising psychological attachment. Further, construct validity consists of convergent validity which deals with how well the items belong together or discriminant validity which deals with how well the items distinguish different respondents on the measures. Some researchers have argued that construct validity comprises both content and criterion-related validity (Shepperd, 1993; Anastasi, 1986). In this study, construct validity is the main type of validity investigated in measuring PA. To investigate the convergent and discriminant validity the affective items were taken through a factor analysis (Thurstone, 1931).

Reyment and Joreskog (1993) describe factor analysis as a generic term used to describe a number of methods aimed at analysing the interrelationship between a set of variables resulting in fewer hypothetical variables called factors<sup>8</sup>. This is based on the assumption that the observed

---

<sup>8</sup> DeVellis (1991) identifies three purposes for doing a factor analysis on a set of items. The first purpose is to help the investigator to determine how many latent variables underlie a set of items. The second purpose is to provide a means of explaining variation among relatively many original variables or items from a few newly created variables or the factors. The third purpose is to define the substantive content or meaning of the factors (i.e. latent variables) that account for the variation among a larger set of items. The substantive content or meaning of the latent variables could be defined by identifying groups of items that covary with one another.

or measured values are linear combinations of some underlying source variables or factors. There are two types of factor analysis: exploratory and confirmatory factor analysis<sup>9</sup>.

Exploratory factor analysis is appropriate for this study because the items developed need to be accessed in terms for their affinity to the dimensions that were theorised. The process of exploratory factor analysis initially involves analyzing the fit of the model after producing factor loadings. Factor loadings represent the relationship of a specific variable to a specific factor without the influence of other variables (Stevens, 1992). Since factors are latent aggregates of the observed variable, the factor name will depict the aggregate. In order to determine the factors underlying the variables, a variable reduction scheme is used (Gorsuch, 1983) resulting in a matrix of association which shows how the variables cluster together or are correlated with one another. Further, the factor loadings are determined through the process of rotation which indicates the simplest solution among a potentially infinite number of solutions that are equally compatible with the observed correlations (Kim and Mueller, 1978).

Rotation gives a more interpretable solution for the factor loadings. In this study, the principal axis factor method<sup>10</sup> is employed and among other methods, a scree plot of eigenvalues was evaluated to identify the number of factors to retain. There are several methods to determine how many factors to retain. The decision of the number of factors to be retained and the substantive meaning given to a factor are decisions that mainly stem from the researcher's intuition. According Gorsuch (1983), it's advisable to use a method that accounts for 70% of the total variance. A statistical measure of association is then used to analyse the variance and

---

<sup>9</sup> Exploratory factor analysis is a theory-generating study used to determine the number of existing factors and the pattern of their loadings (Stevens, 1992). Confirmatory factor analysis is a theory-confirming study with the measurement items based on theoretical or empirical foundation and the researcher's ability to specify the exact factor model in advance (Stevens, 1992).

<sup>10</sup> Principal components were extracted through a process which amounts a variance maximizing (varimax) rotation of the original variable space. This type of rotation is called variance maximizing because the criterion for the rotation is to maximize the variance of the factor, while minimizing the variance around the new variable (Afifi and Clark, 1990; Stevens, 1986).

covariance structures. The fit of the model depends on the level of convergent and discriminant validity.

### **Results: The Dimensions of Psychological Attachment**

*Factor analysis results* An exploratory factor analysis was conducted with Varimax rotation. The results reported in Table 3 contain factor loadings with Eigen values greater than one (Gorsuch, 1983). Without restricting the number of factors to compute, the process revealed two factor dimensions with the positive and self-identity affective states emerging as separate factors (Eigen values, 3.84 and 1.65). Judging from the structure of the loadings, there are indications of possible discriminant and convergent validity as the theoretical dimensions defined separate as well as group some latent items together. Discriminant validity was verified by determining for each latent variable the extent to which the average variance extracted by the latent variable's measures was larger than the latent variable's shared variance with any other latent variable (Fornell and Larcker, 1981). The items for positive affective states seem to load together and separate from the items identified for the self-identity affective states. In terms of the cumulative percentage explained, the two factor model registered a cumulative variance of 54%.

**Table 3**  
**Results for Principal Component Analysis on Affective Latent Items for PA**

Item	Two dimensions		
	Positive experiences	Self-identity-enhancing	Negative experience
I am experiencing a lot of exciting moments working on this design project	<b>0.81</b>	0.31	
Working through this project, I feel like a genius	<b>0.74</b>	0.05	
I have personally put a lot of work into this project	<b>0.56</b>	0.36	
The design of the project reflects how I think personally	<b>0.68</b>	0.23	
I see my personal ideas in every aspect of the project	<b>0.74</b>	-0.04	
The project reflects who I am	0.55	<b>0.58</b>	
The project does not reflect who I am (r-coded)	0.45	<b>0.68</b>	
The key concept for this project came from me	0.23	<b>0.74</b>	
The key concept of this project is from others in the group (r-coded)	-0.27	<b>0.86</b>	
I am personally experiencing a lot of frustrations working on this design project			<b>0.91*</b>
Eigen value	3.17	2.27	
Percentage of variance explained	31.72	22.70	
Cumulative percentage of variance explained	31.72	54.42	

*\*Reported only for comparison sake, not as a separate factor*

*NB: Values bold are those defining a factor (N, 60)*

Further, the negative affective item loaded on a separate dimension but since it is a single item, this loading is not analysed further than just to note that negative affect might relate negatively with PA as expected. In removing this negative item from the computation, the factor

loadings did not change much and the percentage variance improved (35% from 32% for positive affect and 25% from 23% for self-identity affect). The cumulative variance also improved (61% from 54%).

*Cross loading items* Table 3 also indicates the specific hypothetical items that loaded on the dimensions. One could see items such as “I am experiencing a lot of exciting moments working on this design project” making the strongest presence in that dimension. However, there appear to be cross-loading items. Some items loaded below 0.70 (although slightly above 0.50) for the identified primary factor and above 0.30 (in two cases) for the cross-loading factor. Further, some items that should intuitively fall in the self-identity dimension are seen loading under the positive experience dimension. An example is “working through this project, I feel like a genius” While the argument could be made that the subjects may be concentrating mainly on the positive experience of feeling like a genius, the argument can also be made that the subject maybe be responding to the self-identity-enhancing aspect of feeling like a genius. Another factor loading with relative ambiguity is the item “I see my personal ideas in every aspect of the project”. Intuitively a similar argument could be made about this item. The subject may be responding with elation from seeing their personal ideas in the project or from the self-identity-enhancing feeling from seeing their ideas in the project. Thus, there are some indications that some of the items identified for one dimension belong to another, and that some important items were left unidentified or that there is possibly just one dimension to psychological attachment. These possibilities are analysed by correlating the individual items with the average of the two-item measure of attachment administered (reported in Table 4). Before proceeding to that section it is important to briefly assess reliability in the measures identified.

**Reliability of the measure** Reliability assesses the element of consistency if the study is repeated several times. DeVellis (1991) defines scale reliability as the proportion of variance attributable to the true score of the latent variable; a definition shared by the various reliability methods<sup>11</sup>. One common type of reliability is internal consistency reliability<sup>12</sup>. DeVellis notes that internal consistency deals with the homogeneity of the items comprising the scale. This is based on the notion that the relationships among variables are logically connected to the relationships the items have with the latent variable. If the items of a scale have a strong relationship to their latent variable, they will have a strong relationship to each other. A scale is therefore internally consistent by the level to which the items are highly intercorrelated. Thus, high-item correlations imply the items are measuring the same thing which indicates a strong link between the items and the latent variable. A commonly used measure of internal consistency is Cronbach's (1951) coefficient alpha<sup>13</sup>,  $\alpha$  which denotes high internal consistency between items when  $\alpha$  is closer to one (1). The internal consistency for the items of the positive affective dimension (Mean=3.13, Std Dev=0.76) was quite high ( $\alpha =0.79$ ). The self-identity-enhancing items (Mean=2.95, Std Dev=0.87) also recorded a high reliability ( $\alpha =0.75$ ). The average of the total set of items (hereafter referred to as the multiple-item measure) recorded an even higher internal consistency ( $\alpha =0.82$ ). This composite measure was computed as the average of all the individual items employed in the factor analysis (without the negative affective item)

---

<sup>11</sup> There are different methods for measuring reliability (see Nunnally, 1978 and Crocker and Algina, 1986). Some methods identified are test-retest, multiple forms, inter-rater and split-half methods. The test-retest method administers the test instrument to the same study population at different points in time and reports a reliability coefficient computed from a correlation coefficient between the two scores of the population. The multiple forms method which is also known as parallel forms is the technique of mixing up the questions in the test instrument and presenting to the same study population twice. The split-half reliability, is estimated by analyzing half of the test instrument and comparing the results with the overall analysis on the full instrument. One example of this method is the Cronbach (1951) alpha

<sup>12</sup> Internal consistency is the convergent validity rule of unidimensionality while external consistency is the discriminant validity rule of unidimensionality.

<sup>13</sup> Alternative measures include composite factor reliability and average variance extracted. The composite factor reliability assesses whether there is a sufficient relationship between the scale items and their respective constructs. The average variance extracted measures the amount of variance that is captured by the factor as opposed to the variance due to error.

(Mean=3.10, Std Dev=0.68). Summing across the facets of a latent construct seems conceptually appropriate since the composite of the dimensions should relate to a diverse range of affective instances better than does one any one component dimension. Thus, the composite measure will contain more important information than any lower level information obtained (see Carver, 1989). Further, as noted in the previous paragraph, a two-item measure of PA (Mean=3.43, Std Dev=0.85) was also computed. Since only two items, this measure recorded a low internal consistency ( $\alpha = 0.30$ ). The following provides further analysis on validation.

***Validity of the PA measure: The concept*** Further to the indications in the factor analysis of the possibility of achieving convergent and discriminant validity for the PA measure (in terms of the dimensions); additional analysis is conducted to investigate the issue of validity. An appropriate procedure is to collect data from independent samples and use these samples as validation samples to test for invariance of the factor structures across the calibration and the validation samples (Cudeck and Browne, 1983). However, due to the unavailability of validation samples, an “in-sample” test of validation was conducted. This involved testing the correlation between the multiple PA items used in the factor analysis and a two-item measure of PA (noted earlier). The multiple items were elicited in the first round and the two-item measure was administered three weeks after the first round of the survey. Since the two item measure asked specifically whether the respondent felt attached to the technology, it is believed that correlating with the multiple items will provide an avenue for investigations according to the basic objective of validity; which is the extent to which the survey instrument measures what was intended to be measured. The procedure also provides the analysis for the validation hypotheses *H1a* (Positive affective states resulting from opportunity development process will be positively related to PA

while negative affective states will be negatively related to PA) and *H1b* (Self-identity-enhancing affective states will be positively related to PA to the opportunity).

The analyses were conducted on two levels. On the first level, the dimensions from the factor analysis, the two-item PA measure and the multiple-item PA measure are correlated to test the validation hypotheses *H1a* and *H1b*. The second level of analyses correlated the items in the multiple-item measure individually with the two-item measure, to learn about the pattern of correlations the individual items bring to a PA measure. This procedure is deemed important since the factor analysis recorded near cross-loading items. It is believed that some insight into why the near cross-loading happened could be gathered from this exercise.

***Validity of the PA measure: The analyses, Level 1*** Correlations were computed between the two-item PA measure and the factor scores of the two dimensions, to investigate support for hypotheses *H1a* and *H1b*. The results are presented in Table 4. The results show a significant relationship ( $r = 0.49, p < 0.01$ )<sup>14</sup> between the two-item PA and the factor scores of the positive affective states. Hence *H1a* is supported partially (this procedure couldn't test the relationship for the negative affective states. It is operationalized in the next section). Also, there was a positive relationship between the two-item PA measure and the self-identity factor score ( $r = 0.34, p < 0.01$ )<sup>15</sup>. Hence *H1b* is supported. There was also a high positive relationship between the two-item PA measure and the composite of the multiple-item PA measure ( $r = 0.60, p < 0.01$ ).

---

<sup>14</sup> A correlation was also computed between the two-item PA and the average of the actual scores of the positive affective states ( $r = 0.60, p < 0.01$ )

<sup>15</sup> A correlation was also computed between the two-item PA and the average of the actual scores of the self-efficacy affective states ( $r = 0.43, p < 0.01$ )

**Table 4**  
**Correlations between PA Measures**

<b>PA measures</b>	<b>Mean</b>	<b>SD</b>	<b>PA (two-item)</b>	<b>PA (multiple-item)</b>
PA (two-item)	3.42	0.85		
PA(multiple-item)	3.10	0.68	0.60**	
Factor scores for positive affective states dimension	0.06	0.96	0.49**	0.76**
Factor scores for self-identity-enhancing states dimension	-0.00	0.96	0.34**	0.64**

(*N*, 60, 91), \*\**p* < 0.01, \**p* < 0.05

**Validity of measure: The analyses, Level 2** The second set of analyses is to assesses the individual correlations between the individual attachment items and the two-item measure. The correlation matrix provided in Table 5 shows that almost all the items were correlated with the two-item measure of PA with significant correlation coefficients ranging from 0.30 to 0.67. However negative affect was not correlated with the two-item PA measure and therefore *H1a* was only partially supported.

**Table 5**  
**Correlations between Psychological Attachment and Latent Items**

Items	Mean	SD	1	2	3	4	5	6	7	8	8	10
1 PA (two-item measure)	3.43	0.85										
2 I am experiencing a lot of exciting moments working on this design project	3.67	1.08	0.42**									
3 Working through this project, I feel like a genius	2.43	1.17	0.32*	0.52**								
4 I have personally put a lot of work into this project	3.50	1.03	0.66**	0.51**	0.28*							
5 The design of the project reflects how I think personally	3.00	1.01	0.42**	0.43**	0.42**	0.29*						
6 I see my personal ideas in every aspect of the project	3.07	0.97	0.40**	0.47**	0.41**	0.47**	0.43**					
7 The project reflects who I am	3.00	1.07	0.30*	0.47**	0.48**	0.28*	0.61**	0.23				
8 The project does not reflect who I am (r-coded)	3.27	1.12	0.46**	0.48**	0.35**	0.44**	0.39**	0.25	0.63**			
9 The key concept for this project came from me	2.70	1.28	0.31*	0.26*	0.22	0.41**	0.29*	0.21	0.46**	0.38**		
10 The key concept of this project is from others in the group (r-coded)	2.93	1.13	0.23	-0.06	-0.13	0.20	-0.03	-0.12	0.22	0.46**	0.45**	
11 I am personally experiencing a lot of frustrations working on this design project	2.90	1.15	0.06	-0.08	0.08	-0.03	0.06	0.16	0.15	-0.16	0.04	-0.10

(N, 60)

\*\* $p < 0.01$

\* $p < 0.05$

Upon further scrutiny, it was interesting to discover that the most correlated item in the list is “I have personally put a lot of work into this project” ( $r= 0.66, p<0.01$ ). This item was positively correlated with the item “the key concept for this project comes from me” ( $r= 0.41, p<0.01$ ) (which is also weakly correlated with PA). This finding is surprising given those who initiated the idea were also expected to be the ones more attached to it. However, judging from the weak correlations between these items, it appears conception of a new idea does not directly increase PA.

Further, one can realize that there is no significant correlation between “the key concept for this project came from me” and “Working through this project, I feel like a genius” ( $r= 0.22, p>0.10$ ). The indication is that those who conceived the idea are not necessarily the subjects who “worked hard” on the idea. This was expected considering that most groups started with the “leader” assembling fellow “technician” colleagues to develop his or her conception (learned from post-survey conversations). It is therefore not surprising that when subjects conceived the idea, they were not necessarily attached to it. However, what is interesting is the notion that idea conception and development might affect PA in different ways. There are real world implications for this notion. The following are a few of such implications.

This notion of different effects for the two dimensions could be considered in the scope of corporate venturing where the project scientist conceiving an idea may not necessarily be the technician working on it, generating positive affective states and therefore being attached to the project. An illustration could be made of the 3M Post It Note case, where although Spence Silver was the one who discovered the adhesive, it was Arthur Fry who is more noted for championing the product. Comparing to the scenario above, one can argue that Fry invested a lot more psychologically in the product’s applications than Silver, hence Fry would be more likely to be attached (if he was) to the Post it Note than Silver.

Another area of application is the distinction in attachment between entrepreneur-managers and investor-managers. Will both have the same level of attachment to the idea? Is the process of attachment different for each group or is it the same? I propose that given the evidence from above it is possible that investor-managers might become as attached as entrepreneur-managers so long as they spend a considerable amount of emotion, time, money and experience affect working on the project. The result shows that one does not necessarily need to conceive the idea to be attached to it. The implication being that, investor-managers are capable of developing the level of attachment that can have consequences on decision making at the point of commercialization. So the development process is crucial for the growth and sustenance of PA.

In sum, given the results above –findings of the different effects of idea conception and development on attachment— the main implication for this study is that conceiving an idea does not necessarily guarantee PA. Working through the development phase and psychologically investing in problem solving, etc., is more likely to lead to attachment to the idea. This finding will be explored in future research. Further, PA might be a multidimensional construct as there was some distinctive difference in the loadings for the two dimensions put forth by this study.

#### **4.1.5. Measures and Analysis: Psychological Attachment and Cognitive Evaluation**

In the theory section, it was proposed that due to the differences in cognitive and affective processes, PA as an affective construct was likely to instigate an affective evaluation of the microeconomic environment. It was theorized that such an evaluation will limit the use of cognition and therefore through a number of processes, high PA will reduce cognitive evaluation of the microeconomic environment. One mechanism identified that could result in this reduction

of cognitive evaluation is the individual emphasizing more on possibilities than on probabilities. The following presents the operationalization of the level cognitive evaluation.

***Measures: Subjects' cognitive evaluation*** To approximate subjects' cognitive evaluation, an expected value-based model was adopted. A good cognitive model giving full consideration to probabilities can be evaluated within the subjective expected utility (SEU) paradigm (Savage, 1954). The paradigm combines the decision-maker's perceived utility function and a subjective probability to obtain the expected value of the utility. SEU dwells on strong assumptions such as completeness or independence which have been vigorously challenged in behavioural decision research. Subjects for experiments on SEU displayed predictable "biases" and "heuristics" (Kahneman and Tversky 1979) leading to many modifications of SEU in behavioural decision research (see Wakker, 2006 for annotated reference review). However, I resort to simple expected value (EV) calculations to operationalize the construct of cognitive evaluation. The following describes the process designed to obtain subjects' subjective values and probabilities for this computation.

***Measures: Subjects' rating of outcomes and probabilities*** Subjects' ratings of severity and probability for identified adverse future commercialization outcomes and pleasureability of favourable outcomes were collected in the areas of intellectual property, financial management and product development. The outcomes are chosen to represent possible outcomes in a commercialization partnership with an outsider. Hypothetical items were developed on these outcomes for subjects to evaluate. To illustrate, the hypothetical item based on IP presented a future possibility of the idea being stolen (by a potential partner). There is also the possibility of imitation by a potential partner in the form of the partner leveraging the technology in outside private products. The third item presented the possibility of hidden clauses in contracts signed with potential partners. The final item was based on level of success achieved with a potential

commercialization partnership with the outsider. The severity or pleasureability of these future outcomes was scored on a Likert-type 5-point scale. Subjects were given a prelude concerning an unfamiliar outsider who was described as being able to successfully help them commercialize as well as cheat them in the process. Subjects were then asked to generate probability judgements and place a mark on a 10-point scale to determine their perceived probability of the outcomes occurring.

Table 6 reports the descriptive statistics of subjects' judgements on the severity/pleasureability and likelihood of the commercialization outcomes just reviewed. For each outcome, there are two columns. The first column reports that scores of severity/pleasureability and the second reports the likelihood. I report on some of the results. Responding to the possibility of an adverse IP outcome (first set of columns), a majority indicated on a five-point scale that it would be "extremely painful"(1) "if the potential partner forcibly took over their idea" (62%, Median=1, St. Dev.= 0.68). In terms of probabilities, most participants believed (on a 10-points scale) that there is a 50-50 chance that the potential partner would "forcibly take over ownership of their idea" (Median=5, St. Dev = 2.04). For pleasurable outcomes, most students indicated that it will be "extremely pleasurable" if the partner assisted in achieving the level of expected success (77%, Median=5, St. Dev=0.52). However, they only perceived a just above-average likelihood (on a 10-points scale) that the potential partner will assist in that manner (Median=6.50, St. Dev =1.73). These results are interesting because although the subjects were presented with a hypothetical situation, they indicated some affect as they noted the pleasureability of a successful partnership while doubting the outsider's credibility in such a partnership.

**Table 6**  
**Descriptive Statistic for Severity and Likelihood of Commercialization Outcomes**

	Forcible takeover of ownership by partner		Imitation by partner		Hidden clauses in contract		Private success with partner	
	Severe (1) Pleasurable (5)	Likelihood (1 – 10)	Severe (1) Pleasurable (5)	Likelihood (1 – 10)	Severe (1) Pleasurable (5)	Likelihood (1 – 10)	Severe (1) Pleasurable (5)	Likelihood (1 – 10)
Mean	1.47	5.28	1.57	5.65	1.97	6.33	4.73	6.13
Median	1.00	5.00	1.00	6.00	2.00	7.00	5.00	6.50
Mode	1.00	5.00	1.00	5.00	2.00	8.00	5.00	7.00
Std. Dev	0.68	2.04	0.81	2.18	0.69	2.30	0.52	1.73
N	60	60	60	60	60	60	60	60

**Measures: Computing EV** The concept of expected value (EV) stems from the basic idea that the value of an option is an additive function of the value of outcomes that are supported by the option's attributes. In computations, there is the assumption of an explicit set of options and that each option in the set has identifiable potential outcomes. Each outcome holds the subject's perceived value with a perceived probability of that option. The computation of EV comprises summarizing the value of each option as the sum of the values of its potential outcomes, each discounted by or multiplied by the probability of the outcome occurring. The product sum is known as the option's expected value.

Subjects' EV calculations of the commercialization outcome were computed as a summation of their rankings of severity (and pleasureability) multiplied by the probability of the outcomes presented. The formula for the computation is given as follows:

$$EV = \sum_{i=1}^4 x_i p_i \text{ where } x \text{ denotes the ratings of the commercialisation outcomes}$$

presented and the  $p$  denotes the probabilities of those outcomes occurring.  $i$  represents the outcomes: 1. forcible takeover of ownership, 2. imitation by partner, 3. hidden clauses in a contract, 4. private success with partner.

*Measures: EV – Subjects’ cognitive evaluation* As noted above, the underlying assumption for EV-type models (SEU type models and other modifications) is that the rational decision-maker maximises some kind of expectation by evaluating beliefs or probabilities and the values or utilities of possible outcomes. Given this view, employing the expected value calculations in assessing entrepreneurial outcomes denotes consideration for the probabilities of the outcomes and hence an appreciable level of objectivity in judgement. Further, a cognitive process involves a conscious analysis of a situation, resorting to base rates and past information that informs the decision-maker’s intuitive judgement on the value of the option and the likelihood of its occurrence.

The use of EV to tap into cognitive evaluation is in line with the arguments for the mechanism by which affect-based constructs like PA influences evaluation of the micro-economic environment. As argued in the theory section, PA is expected to affect perceptions of the environment, the evaluation of possibilities and probabilities and the retrieval and use of information from the micro-economic environment. Subjects are expected to weight the values of the negative outcomes high and positive outcomes low when they are highly attached to the opportunity. This is because they tend to place a high value on the idea as a result of the attachment. Likewise highly-attached subjects are expected to report high probabilities for negative outcomes more than for the positive outcomes. In essence the EV variable is used in this study to represent the level of cognitive processing the subject employs. A decrease in the EV variable is assumed to signify a decrease in cognitive engagement possibly due to the differences in evaluation within the cognitive and affective paradigms and consequently, an influence of an affective evaluation process over the cognitive evaluation process. The EV variable therefore represents the level of cognitive evaluation in this study. It was found to have a mean of 2.95 and a standard deviation of 1.21.

*Measures: Discrepancy measure – Difference between assumed objective and subjective evaluations* Deviation from an assumed normative cognitive decision frame is what underlies research in decision biases. To further study this hypothesised deviation, a discrepancy measure, computed as the difference between an assumed objective evaluation and subjective evaluation of the micro-economic environment, was developed. The objective factor was represented by the subject's estimation of the project's value. Subjects were asked to indicate the amount they will pay the rest of the group (excluding themselves) to obtain sole ownership of the project. The average subjective value offered was \$3,322.57 CDN (Mean= \$3,323, Median=\$500, Std Dev=\$9,046, maximum \$60,000, Skewness=4.63) (see distribution in Appendix 5.2). The values were concentrated on the lower end of the scale, below \$10,000 with a median of \$500, a 25<sup>th</sup> percentile of \$100 and a 75<sup>th</sup> percentile of \$1,275. The log of this dollar amount was used to represent the value of the project in the analyses of the results. Taking logarithms of the variable transformed the probability distribution to approximate the Normal distribution (see distribution in Appendix 5.1), effectively reducing the excessive variance (Mean= \$2.76, Std Dev=\$0.83).

The discrepancy measure was therefore the log of the project value minus the subjective expected value described above (Mean= -0.13, Std Dev=1.378). A high value for this discrepancy measure indicates a wider deviation from the normative and therefore the cognitive and implies a higher level of bias. Likewise a small value for the measure indicates a higher level of congruence in the supposed objective and subjective measures and therefore a lower level of bias. One should however note that the supposed objective value has a level of subjectivity in its elicitation. This is the case because the project value was taken from subjects' subjective estimates rather than obtained from actual market sources. However, the project value is assumed to be a good proxy for an objective value of the project and may have merit because it

indicates the subject's attempt to estimate of the objective value of the project. Hence the discrepancy measure provides the opportunity to compare the subject's objective and subjective estimates of the project and outcomes and also the comparison provides insight into the subject's realizations (in objective terms) and preferences (actionable preferences influenced by a subjective evaluation).

**Results: PA and cognitive evaluation (H2)** H2 predicts a decrease in the level of cognitive evaluation when PA increases. In support of H2, there was a significant negative correlation between PA and the level of cognitive evaluation ( $r = -0.26$   $p < 0.05$ )<sup>16</sup>, a positive significant relationship between the log of project value (objective measure) and PA ( $r = 0.37$   $p < 0.01$ ), and a significant positive relationship between PA and the discrepancy measure (difference between log of project value and the level of cognitive evaluation) ( $r = 0.48$   $p < 0.01$ ). These relationships are shown in Figure 8.

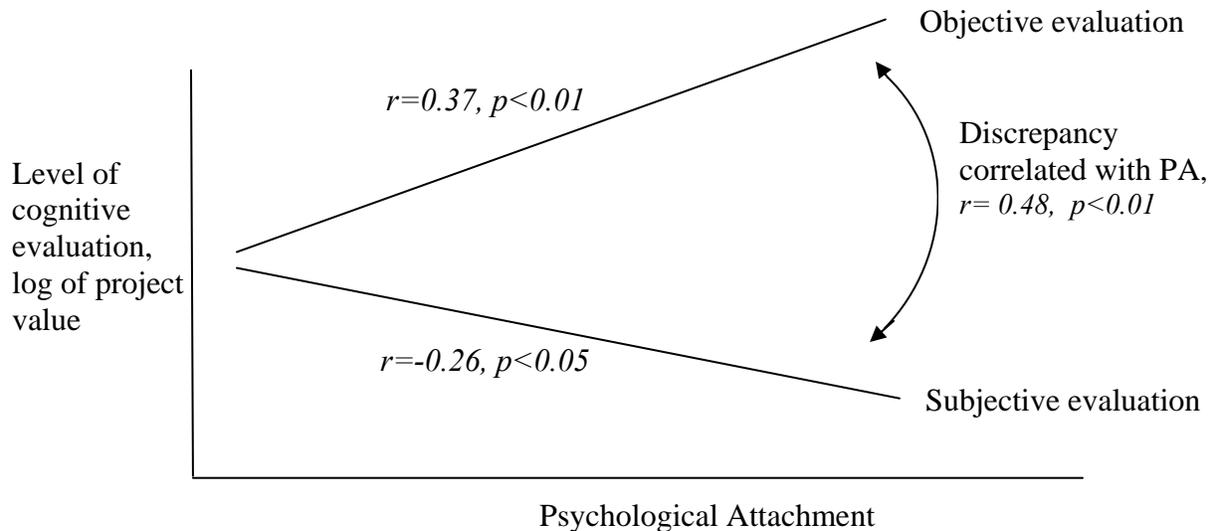
It appears high attachment prevented subjects from employing cognitive mental processes to enable them effectively incorporate objective valuation of future outcomes and probabilities associated with these outcomes. Hence, when subjects' PA increased, their level of cognitive evaluation of the future outcomes decreased, widening the difference between that evaluation and their estimation of project value. While the subjective expected value computation and the discrepancy measure may not reflect the level of cognitive evaluation, these measures provide insight into how subjects weight value and expectancy in evaluating the micro-economic environment. Irrespective of alternative explanations, the relationship between the measures and PA suggests a divergence in effects between PA as an affective construct and cognitive-type measures such as the expected value measure, computed here.

---

<sup>16</sup> The PA measure used here is the composite multiple-item measure of PA which averages the actual scores of those affective items. However, the relationship was stronger when the two-item PA measure was correlated with the level of cognitive evaluation ( $r = -0.37$   $p < 0.01$ )

Further, in considering the individual dimensions of PA, the positive affective states was negatively correlated ( $r= -0.25, p<0.05$ ) with level of cognitive evaluation while positively correlated with the discrepancy measure ( $r= 0.48, p<0.01$ ). The self-identity affective states was also negatively correlated ( $r= -0.25, p<0.05$ ) with level of cognitive evaluation while positively correlated with the discrepancy measure ( $r= 0.34, p<0.05$ ). The main implications of these results are that PA seems to engage its affective components to cripple objective analysis of the commercialization environment when entrepreneurs are faced with market entry. The affective components seem to engage according to the level of attachment to the idea. Thus, as attachment increases the value placed on the idea, the level of threat perceived increases and cognitive evaluation is inhibited.

**Figure 8**  
**Relationship between Psychological Attachment, Objective and Subjective Evaluation of the Idea and Future Commercialization Environment**



*NB:* All correlation are with the PA measure. The level of cognitive evaluation denotes subjective evaluation and the log of project value denotes objective evaluation.

#### 4.1.6. Measures and Analysis: Psychological Attachment and Control Tendency

*Measures: Control tendency* Control tendency was measured by presenting subjects with six items (three reverse scaled) on three areas of control identified to be of concern to the entrepreneur: the right to the intellectual property of the opportunity, the right to influence decisions involving the opportunity, the right to the returns on the opportunity. Similar measures defined within these categories have been used in research on psychological ownership in the organizational setting (Pierce, Rubinfeld and Morgan, 1991) and property rights (Furubotn and Pejovich, 1974)<sup>17</sup>. For the set-up of the measures, subjects were introduced to a hypothetical potential commercialization partner and provided with the costs and benefits of developing a business relationship with the partner. Since commercialization decisions are decisions made under risk and uncertainty, an element of uncertainty is also introduced into the introductory statement. Subjects are told that they do not know anything about the company they are going to partner with and as such do not have any idea of how a business relationship may turn out. Pre-tests led to the refinement of the items. (See Appendix 2 for study instrument).

Instructions required subjects to rate on a five-point scale the extent to which they will want their decisions to prevail in the three areas and the extent to which they are comfortable allowing a fictitious potential partner to make overriding decisions on the commercialization effort. Table 7 provides descriptive statistics on the items used in this measure. When asked if they will “want to be the sole owner” of their projects, subjects response was strong (Mean=3.72, Std. Dev=0.93). The responses were also strong for questions on the extent of willingness to

---

<sup>17</sup> These three rights were adapted from the characterization of rights in ownership culture (Pierce, Rubinfeld and Morgan, 1991) and from the property and control rights literature (Furubotn and Pejovich, 1974; Williamson, 1991; Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995; Aghion and Tirole, 1994). Pierce, Rubinfeld and Morgan (1991) define ownership culture around certain rights associated with owning a business and from which employees can derive psychological ownership: the right to information about the status of the business, the right to exercise influence over the business and the right to some share of the financial value of the business. In the property rights literature, three types of property rights are identified: the right of use, the right of changing forms and structure of the product and the right to reap profits from the product (Furubotn and Pejovich, 1974; Williamson, 1991).

maintain the right to make overriding manufacturing and distribution decisions (Mean= 3.54, Std. Dev=0.93). Responses were also strong on the question of the extent to which subjects will prefer to be the key decision-maker in how money is spent on the project (Mean=3.65, Std Dev=0.85). On the question of the extent to which subjects are willing to allow the outsider to be the sole owner of the project, the response was low (Mean 1.58, Std. Dev=0.82). The response was not comparatively low for subjects when asked about allowing the outsider to control manufacturing and distribution (Mean=2.40, Std. Dev=0.95). Subjects were also not comfortable with allowing the outsider to make decisions on how financial disbursements are made (Mean=2.29, Std. Dev=0.97).

**Table 7**  
**Descriptive Statistics for Control Tendency Measure**

	Want to be sole owner	Main decision-maker on manufacturing and distribution	Main financial manager	Allow outsider sole ownership	Allow outsider to decide on manufacturing and distribution	Allow outsider to manage finances
Mean	3.72	3.54	3.65	1.58	2.40	2.29
Median	4.00	4.00	4.00	1.00	2.00	2.00
Std. Dev	0.93	0.93	0.85	0.82	0.95	0.97
Min	1	1	1	1	1	1
Max	5	5	5	5	5	5

Factor analysis supported the unidimensionality of the control tendency scale at an Eigen value of 2.186. The items in the scale also recorded a reasonably high inter-item reliability (Cronbach alpha,  $\alpha=0.64$ ). Reversing the scores for items based on outsider control, an average control tendency was computed. The average control tendency was quite high (Mean= 3.77, Std. Dev= 0.54). The distribution the control tendency average is skewed towards the left (Skewness= - 0.757) with the median and the mode falling into the range of values that define a high control

tendency (See Appendix 5.1). Given these analyses, one can conclude that on average, subjects were relatively control-oriented when dealing with hypothetical outsiders.

*Measures: Statistical control variables – Personality-type variables* To better argue for significant effects of PA, there is the need to statistically control for conceptually similar but personality-type factors. These factors are chosen from a purely conceptual point of view. Thus, the personality controls have the capacity to influence CT in a similar manner to how PA will affect CT. Hence evidence of their insignificance in a statistical effect on CT lends support for the robustness of PA in influencing CT. Most of the items were taken from Dr. Goldberg's International Personality Items Pool (IPIP), which is "a scientific collaboratory for the development of advanced measures of personality traits and other Individual differences" ([www.ipip.ori.org](http://www.ipip.ori.org)).

The first is Emotion-Based Decision Making (EBDM) (Barchard, 2001). CT could result from an individual disposition to make decisions by emotions. Therefore this measure is a good statistical control for testing PA. EBDM is one of seven components of Emotional Intelligence IPIP (EI-IPIP) developed by Barchard (2001). EBDM is the tendency to make important life decisions based upon emotions, rather than using logic. The construct is a 10-item measure with 5 positively-keyed and 5 negatively-keyed items. Barchard modelled the scale on the TEIS (Tett's Emotional Intelligence Scale) Flexible Planning subscale. TEIS (Tett, Wang, Fisher et, 1997; Tett, Wang, Gribler, Martinez, 1997) is a multi-dimensional measure of emotional intelligence which gives scores for twelve separate subscales and an infrequency scale. Some items of the emotion-based decision making scale are "I rarely, consider my feelings when

making decisions” and “I plan my life based on how I feel”. The items as tested in this study produced a Cronbach alpha of 0.82 (9 items)<sup>18</sup>.

The second is Risk-taking propensity. This measure is important because low-risk-taking developers might be control-oriented due to their perception of the risk of losing the idea on the market. Therefore, it becomes a good statistical control for testing the effects of PA. The Risk-taking construct is also taken from the Jackson Personality Inventory (JPI-R). The construct assesses the propensity to take risks in general risk domains across a variety of situations related to health, finance and goal attainment. The scale taken from the IPIP database is a 10-item measure with 6 positively-keyed and 4 negatively-keyed items. Some items of the risk-taking scale are “I seek danger” and “I would never make a high risk investment”. Reliability test when the measure was administered in this study produced a Cronbach alpha of 0.82 (10 items)<sup>19</sup>.

Another factor measured is Machiavellianism (IPIP, 2001). Machiavellianism is an ideal statistical control due to the similarities between the construct and CT with respect to control. Therefore CT might be a result of the Machiavellian disposition in developers. The Machiavellianism scale is also taken from IPIP and was modelled on the Social Astuteness aspect of the Jackson Personality Inventory - JPI-R (Jackson et al, 1972, Jackson, 1994). Christie and Geis (1970) developed the construct of Machiavellianism on the basis of the sixteenth century works of Niccolo Machiavelli. The trait of Machiavellianism refers to an orientation in which individuals think that manipulating others is an underlying strategy of social influence. Individuals with a high level of this trait have a powerful need to hold leadership positions, influence others, and they usually dominate relations with other people. The scale taken from the IPIP database is a 6-item measure with 3 positively-keyed and 3 negatively-keyed

---

<sup>18</sup> Cronbach alpha for the scale from tests conducted by Barchard (2001) is 0.73

<sup>19</sup> The scale is reported by IPIP (2001) to have a Cronbach alpha of 0.78

items. Some items of the Machiavellianism scale are “I have a natural talent for influencing people” and “I lack the talent for influencing people”. A reliability test for the measure in this study, revealed a Cronbach alpha 0.82 (6 items)<sup>20</sup>.

The final personality-type construct measured is Need for control (Siegrist, 1996, 2002). CT could result from the innate disposition of having the need to control. Hence statistically controlling for need for control in testing the effects of PA provides insight into the characteristics of PA. The need for control construct is a subscale of the Effort-Reward-Imbalance model (Siegrist, 1996, 2002) which is based on social reciprocity where an employee invests efforts and expects rewards. Illustrating further, where there is an imbalance, employees with excessive work-related overcommitment underestimate the external demands and overestimate their own coping resources, without realising their contribution to the imbalance. Need for control is described by need for approval, competitiveness, disproportionate irritability, and inability to withdraw from work. The construct is closely related to aspects of the type A behaviour pattern that reflect an exorbitant ambition in combination with the need for approval and esteem. Examples of the items on this scale include “Work rarely let me go, its still on my mind when I go to bed” (effort) and “my job promotion prospects are poor” (reward). Items were personally received from Dr. Siegrist through email. References to “office work” in the original questionnaire were replaced with “group work” to fit the school work environment. Reliability test when administered to the sample in this study produced an alpha of 0.76<sup>21</sup> (6 items).

Table 8 provides the descriptive statistics for the above-outlined personality-type variables. Machiavellianism scored highest among the variables (Mean=3.21, Std Dev=0.75).

---

<sup>20</sup> The scale is reported by IPIP (2001) to have a Cronbach alpha of 0.79

<sup>21</sup> There was no available record of Cronbach alpha for the scale used but the alpha computed in this study was relatively high.

Risk-taking propensity was also high among subjects (Mean=3.12, Std Dev=0.66). Emotion-based decision making (Mean=2.55, Std Dev=0.58) and need for control (Mean=2.30, Std Dev=0.63) recorded low averages. In essence, subjects had higher levels of Machiavellianism and risk-taking while having lower propensities to make decisions based on emotions or need for control. These results have significant implications for this study. If subjects have lower propensities to make decisions based on emotions and on the need for control, then any evidence of control tendency arising from PA suggests that the effects originate from their experiences with the project (context driven) rather than their innate psychological dispositions.

**Table 8**  
**Descriptive Statistics for Personality-Type Variables**

<b>Personality-type variables</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
Emotion-based decision making	1	4	2.55	0.58
Risk-taking	1	4	3.12	0.66
Machiavellianism	1	5	3.21	0.75
Need for Control	1	4	2.30	0.63

(N, 92)

*Measures: Statistical control variables – other variables* Another control variable considered was project value. As already reported above, subjects were asked to indicate the amount they will pay the rest of the group (excluding themselves) to obtain sole ownership of the project. The average subjective value offered was \$3,322.57 CDN and the log of this dollar amount was used to represent the value of the project in analyses. (the variable is described in the measures section for *H2*).

Yet another variable considered is trust. The social capital literature describes trust as a subjective belief about the likelihood that a potential partner will act honestly (see Dasgupta, 2003). Some also draw a connection between trust and control. For example, Das and Teng (1998) identify trust and control as two alternative sources in developing confidence in partner

cooperation and suggest that trust level will facilitate the deployment of control mechanisms. In this study, since the subjects have no prior experience with the potential third-party, an attempt was made to capture dispositional trust (Rotter, 1980) towards the outsider, rather than employing a multidimensional view of trust (Rousseau Sitkin, Burt, and Camerer, 1998). Rotter (1980) defines dispositional trust as "a generalised expectancy held by an individual that the word, promise, oral or written statement of another individual or group can be relied upon."

In effect, the subject's trusting disposition towards a potential partner was measured by eliciting the likelihood that "the potential partner will write hidden clauses that limited the subject's rights in the contract" (on a 10 points scale). There seemed to be a general dispositional distrust for the potential partner (Mean=6.46, Median=7, St. Dev= 2.30) (See distribution in Appendix 5.3). In other words, subjects expressed a considerable level of distrust towards hypothetical outsiders with the view that such hidden clauses had the potential to restrict their rights to the project.

The next control variable considered is perceived likelihood of expected success from a potential collaboration. Simply put, entrepreneurial reward orientation could be shaped by pecuniary or non-pecuniary motives. Either way, the entrepreneur will build this motive into goals and expectations for the future outcomes concerning the opportunity. To capture the likelihood of such expectations in possible outside-party collaboration, subjects were asked to rate on a 10 point scale, the probability that the potential partner will play a positive role in realising an expected level of success. The responses show the perception that "the potential partner will help achieve the level of success expected" (Mean=6.13, Median=6, St. Dev= 1.84) (see distribution in Appendix 5.4).

The final control variables considered are the perceived severity of a future loss of the opportunity and the likelihood of a future loss of the opportunity. Subjects might perceive the

consequences of a future loss of the project and therefore be less willing to give up control to outside party. This mechanism might occur outside of a PA to the idea. In effect, it is advisable to include this variable as a statistical control in studying the effect of this perception on CT. The severity variable was elicited by asking subjects to rank on a 5-point scale, how severe they think it will be if a third party “forcibly takes over ownership of the project idea”. As partly reported earlier, responses to this question was high in severity (low on the scale) (Mean=1.52, Median=1, Std Dev=0.80). Subjects largely felt that the impact on them, if they lost their idea on the market, will be devastating.

***Results: Correlational analysis – PA, CT and statistical controls*** Prior to analyzing the effect of PA on CT, correlations was computed for PA, CT and the identified statistical control variables. The variables in this correlation procedure included: PA; personality-type constructs; project value; level of cognitive evaluation; dispositional trust, the likelihood of personal gain from third-party partnership; and perceived severity of a future loss of the opportunity. CT was significantly and positively correlated with PA ( $r = 0.29, p < 0.01$ ), albeit weakly. Further, the correlational relationships between the personality-type control variables and control tendency were examined. Among the personality variables, the only correlation reported was a positive correlation between PA and Machiavellianism ( $r = 0.29, p < 0.05$ ). This implies that subjects who believe they can influence or manipulate their social interactions might be more attached to their opportunity, probably because they also believe they can influence the outcomes through the development and commercialization processes. Given that the average score for Machiavellianism was higher (Mean=3.20), it was not surprising that it was the only personality factor to be statistically significant in the correlations.

Other correlations of interest that were not hypothesised are provided as follows. There was a positive relationship between Machiavellianism and risk-taking ( $r = 0.36, p < 0.01$ ) while

risk-taking was negatively correlated with need for control ( $r = -0.35, p < 0.01$ ). Intuitively subjects who felt they could manipulate others were also likely to take risks while those with need for control were less likely to take risks. Further, positive affective states were also positively correlated with need for control ( $r = 0.34, p < 0.01$ ) and positively with estimates of the project value ( $r = 0.40, p < 0.01$ ). Subjects who experienced a lot of positive affective states during development were likely to also have a need for control and these subjects were also likely to rate the value of the project high. PA was also positively correlated with project value estimates ( $r = 0.37, p < 0.01$ ). The more attached the subject is, the more likely they were to raise the value of their project. The average measure of attachment was positively correlated with the likelihood of achieving expected success with an outsider ( $r = 0.27, p < 0.05$ ) while increasing the perceived severity of a future loss ( $r = 0.27, p < 0.05$ ).

***Results: Hierarchical modeling analysis – PA and CT with statistical controls*** To test  $H3$ — as PA increases CT increases — the CT measure was modeled hierarchically (Raudenbush and Bryk, 2002) on factors identified in the previous section (see Table 9 below). Hierarchical linear models take into account the dependence between observations. Also, tests for identified hypotheses can be done at different levels making it possible to assess the amount of variation at each level. Table 9 provides the tests of models entered into the statistical software hierarchically. The models with the single unit labels (e.g. Model 1) are the initial models to which the subsequent models in the decimal unit labels (e.g. Model 1.1) are compared. Model 1 predictors consisted of the personality-type variables. The results show that Machiavellianism was weakly significantly related to CT ( $p = 0.90$ ). The implication is that when subjects believed that they were capable of manipulating outsiders, they were more control-oriented. Model 1.1 introduced the estimated project value, the level of cognitive evaluation and the multiple-item composite measure of PA into Model 1. Although none of the predictors were significantly

correlated with CT, the weak effects of Machiavellianism disappeared (also none of the model statistics was significant). The correlations computed earlier indicated a correlation between Machiavellianism and PA ( $r= 0.23, p<0.05$ ) and this could have caused the disappearance of the effects for Machiavellianism.

**Table 9**  
**Hierarchical Regression Analysis of CT on Predictors**

<b>Predictors</b>	<b>Model 1</b>	<b>Model 1.1</b>	<b>Model 2</b>	<b>Model 2.1</b>	<b>Model 3</b>	<b>Model 3.1</b>
Constant	4.09** (0.60)	3.82** (0.62)	4.35** (0.59)	3.97** (0.61)	3.97** (0.60)	3.65** (0.82)
Emotion-Based decision making	-0.20 (0.13)	-0.17 (0.13)	-0.21 (0.13)	-0.18 (0.13)	-0.18 (0.13)	-0.14 (0.12)
Risk-taking	-0.13 (0.11)	-0.18 (0.11)	-0.05 (0.11)	-0.14 (0.11)	-0.14 (0.11)	-0.08 (0.10)
Machiavellianism	0.16† (0.09)	0.13 (0.09)				
Need for control	0.06 (0.12)	-0.04 (0.14)	0.07 (0.12)	-0.05 (0.14)	-0.05 (0.13)	-0.17 (0.13)
Estimated project value (log)		0.03 (0.09)		0.04 (0.09)	0.03 (0.09)	0.05 (0.08)
Level of cognitive evaluation		-0.01 (0.07)		-0.00 (0.07)		
PA composite multiple-item		0.20 (0.13)		0.24† (0.13)	0.24* (0.12)	0.28* (0.12)
Trusting disposition						-0.05 (0.03)
Likelihood of achieving expected level of successes with outside partnership						-0.07† (0.04)
Perceived severity of future loss of opportunity						0.18† (0.11)
Likelihood of future loss of opportunity						0.00 (0.04)
$R^2$	0.14	0.21	0.09	0.18	0.21	0.37
$R^2$ adjusted	0.07	0.10	0.04	0.08	0.11	0.24
$R^2$ change		0.07		0.09		0.16
$F$	2.05	1.81	1.67	1.78	2.15†	2.69*
$F$ change		1.42		1.81		2.41*
( $N$ , 56)	** $p < 0.01$	* $p < 0.05$		† $p < 0.10$		

Model 2 excluded Machiavellianism as a predictor. The predictors of Model 1.1 (without Machiavellianism) were repeated for Model 2.1. As expected we observe a positive and

significant coefficient for PA ( $\beta = 0.24$ ,  $p = 0.06$ ), hence *H2* which predicted a positive relationship between PA and CT was supported. Thus, controlling for the personality-type variables (without Machiavellianism), PA was significant in explaining variability in CT. However, what is more striking about Model 2.1 is that there are interesting implications for the lack of significant effects found for the statistical control variables. There were no effects found for emotion-based decision making: implying that subjects were not control oriented because they were emotionally aroused in perceiving all the possible adverse conditions associated with losing IP, managerial, R&D and financing rights to the idea. Further, subjects were not control oriented because they were risk seeking or had a need for control as innate dispositions.

More interestingly, there were no effects found for estimated project value. It was believed that since the question for this measure asked subjects to indicate their *willingness to pay*, this value was what they placed on the project. Therefore, if the project value was high it indicated that subjects viewed the project favourably and will consequently have a desire to control the rights due to their perceptions of favourable returns. A rational model would indicate that a project valued highly will predict a high level of CT. Therefore the lack of effects for project variable lends strength to the effect of PA on CT, controlling for project value, among others. There were relatively large values recorded for changes in the coefficient of determination,  $R^2$ <sup>22</sup>, and the *F* values<sup>23</sup> although not significant (see bottom panel of Table 9)

For Model 3, the level of cognitive evaluation was removed to enable the inclusion of other correlates that form a part of the computation of the level of cognitive evaluation. The correlates are: the trusting disposition; likelihood of achieving expected level of success with outside partnership; perceived severity of a future loss of the opportunity; and the likelihood of a

---

<sup>22</sup>  $R^2$  – The coefficient of determination is the proportion of variability in a data set that is accounted for by the statistical model

<sup>23</sup> The *F* test is calculated generally as  $F = (\text{between-group variability}) / (\text{within-group variability})$ .

future loss of the opportunity. Unlike Model 2.1, Model 3, with the removal of level of cognitive evaluation, registered a significant  $F$  value ( $p < 0.10$ ) and a slightly higher  $R^2$ , meaning the model with the excluded variable performs better in predicting CT. This result is insightful because, aside from the potential statistical explanations, it suggests that without cognitive evaluation, subjects' CT is better explained by PA. In terms of the effect of PA on CT, PA improved in significance (from  $p = 0.06$  to  $p = 0.04$ ) comparing Model 2.1 to Model 3 and the standard errors also decreased slightly.

Model 3.1 included the variables for which the level of cognitive evaluation was removed from Model 3. The model seemed to improve over Model 3 with a significant  $F$  change ( $F = 2.41$ ,  $p < 0.05$ ) and a sizeable in  $R^2$  change (0.16). PA increased in significance in Model 3.1 ( $\beta = 0.28$ ,  $p = 0.03$ ) over Model 3 ( $\beta = 0.24$ ,  $p = 0.04$ ) in explaining variability in CT. Of the four correlates added to Model 3.1, two were weakly significant. The likelihood of achieving expected level of successes with outside partnership was weakly significant ( $\beta = -0.07$ ,  $p = 0.07$ ). This result implied that when subjects' viewed outsider assistance favourably in achieving expected level of success, their CT decreased. This finding is also very interesting because it implies that controlling for PA, the perception of a successful outsider partnership motivates control sharing. A further implication is that if this perception is strong, the effects of PA might be overcome and CT will decrease enough for an increase in performance. The other correlate that was weakly significant is the perceived severity of a future loss of the opportunity ( $\beta = 0.18$ ,  $p = 0.098$ ). Although the significance of this variable is very weak, the result suggests the intensity of the perception of adverse commercialisation outcomes may explain additional variance in CT, controlling for PA.

Finally, for validation purposes, the two-item PA measure was introduced into the models to replace the multiple-item PA measure. The Model 1.1 results for the two-item PA

measure revealed a similar trend to the composite measure ( $\beta = 0.13, p = 0.14$ ). Also, the results were similar when entered into the following models: Model 2.1 which excluded Machiavellianism ( $\beta = 0.16, p = 0.06$ ), Model 3 ( $\beta = 0.17, p = 0.04$ ) and into Model 3.1 ( $\beta = 0.19, p = 0.03$ ). Likewise, the results were similar in Model 3.1 for the additional correlates: the likelihood of achieving expected level of success with outside partnership ( $\beta = -0.07, p = 0.06$ ) and the perceived severity of a future loss of the opportunity ( $\beta = 0.20, p = 0.07$ ) – a slight improvement in the latter. Also, the model statistics were similar. Thus, the similarity in effects may be explained by the high correlation between the two-item and multiple-item measures of PA. Further, the multiple-item measure very well captures the essence of PA in explaining CT by virtue of the fact that the two-item measure asked subjects the extent to which they were attached to the idea.

Further to testing the effects of PA (using the multiple-item measure), it is important to examine individually the effect of the PA dimensions on CT. To that end, the factor scores of the positive affective states and the self-identity affective states (dimensions) were introduced into Models 2, 2.1, 3 and 3, run above, in replacement of the multiple-item measure. The results are reported in Table 10 below. The models are renamed in continuation of the previous set run (hence are from 4 to 5.1). The models also exclude Machiavellianism which correlates with PA. Model 4.1 (converted Model 2.1), shows that the positive affective states dimension was significant in explaining variability in CT ( $\beta = 0.20, p = 0.03$ ), while the self-identity dimension was not ( $\beta = 0.05, p = 0.54$ )<sup>24</sup>. These results present a very interesting take on the dimensions of PA. Although the results are not surprising, judging from the correlations between the dimensions and CT, it is worth speculating on. The lack of effect for the self-identity dimension

---

<sup>24</sup> The pattern of effects is confirmed, but did not improve, when the factor scores are replaced by averages of the actual scores of the two dimensions. The positive affective states dimension was weakly significant ( $\beta = 0.22, p = 0.08$ ), while the self-identity dimension was not ( $\beta = 0.04, p = 0.67$ )

implies that experiencing what is termed in this study as self-identity-enhancing affective states, does not automatically lead to CT. This is an intuitively reasonable conclusion since enhanced self-identity should not necessarily drive CT. The reason being that enhancing self-identity relates to personal association with the idea and this association can be upheld even when control is shared or relinquished. Developers can christen technologies according to their preferences when partnering with outsiders and obtain both the financial resources from improved business as well as the name-association with the technology.

The pattern of effects for the dimensions is repeated in Model 5 and Model 5.1. Models 5 and 5.1 exclude both Machiavellianism and level of cognitive evaluation as was the case in Models 3 and 3.1. There was a significant effect reported in Model 5 for the positive affective states ( $\beta = 0.19, p = 0.02$ ) and no effect for self-identity affective states ( $\beta = 0.04, p = 0.54$ ). Model 5.1 results also report a significant effect for the positive affective states ( $\beta = 0.19, p = 0.02$ ) and no effect for self-identity affective states ( $\beta = 0.08, p = 0.30$ ). However, unlike in Model 3.1 when significant but weak effects were recorded for the likelihood of achieving expected level of success with outside partnership and the perceived severity of a future loss of the opportunity, Model 5.1 only recorded an effect for the likelihood of achieving expected level of success with outside partnership ( $\beta = -0.07, p = 0.07$ ). The effects for the perceived severity of a future loss of the opportunity disappeared ( $\beta = 0.18, p = 0.11$ ) and this is not surprising since the effect was very weak in Model 3.1. However the pattern of the model statistics reported was also very similar to those of the other set of models with significant differences in statistics, showing improvements in the hierarchical models.

**Table 10**  
**Hierarchical Regression Analysis of CT on Predictors**

<b>Predictors</b>	<b>Model 4</b>	<b>Model 4.1</b>	<b>Model 5</b>	<b>Model 5.1</b>
Constant	4.35** (0.59)	4.82** (0.64)	4.81** (0.63)	4.55** (0.10)
Emotion-Based decision making	-0.21 (0.13)	-0.19 (0.13)	-0.19 (0.13)	-0.15 (0.12)
Risk-taking	-0.05 (0.11)	-0.13 (0.11)	-0.13 (0.11)	-0.08 (0.10)
Need for control	0.07 (0.12)	-0.08 (0.14)	-0.07 (0.13)	-0.18 (0.13)
Estimated project value (log)		0.02 (0.09)	0.02 (0.09)	0.04 (0.08)
Level of cognitive evaluation		0.01 (0.07)		
Trusting disposition				-0.05 (0.03)
Likelihood of achieving expected level of successes with outside partnership				-0.07† (0.11)
Perceived severity of future loss of opportunity				0.18 (0.11)
Likelihood of future loss of opportunity				0.00 (0.04)
Positive affective states – factor scores		0.20* (0.09)	0.19* (0.08)	0.19* (0.08)
Self- identity enhancing affective states – factor scores		0.05 (0.07)	0.04 (0.07)	0.08 (0.07)
$R^2$	0.09	0.21	0.20	0.38
$R^2$ adjusted	0.04	0.09	0.11	0.24
$R^2$ change		0.12		0.18
$F$	1.67	1.76	2.09†	2.75*
$F$ change		1.75		3.17*
( <i>N</i> , 56)	** $p < 0.01$	* $p < 0.05$	† $p < 0.10$	

In summary, one can conclude from the analyses that there is strong support for the influence of PA on CT, while statistically controlling for essential correlates. The key previously-hypothesised evidence in this section is the positive effect of PA on CT. Other

unhypothesized evidence include: the lack of effect of estimated project value, the weak positive effect of Machiavellianism, the negative effect of success expectations with outsider on CT, and the very weak positive effect perceived severity of loss of the opportunity on CT. The results also suggest that if PA is multidimensional, then there is the possibility of differing dimensional effect on CT. Finally, personality-type factors such as Emotion-Based Decision-Making, Risk-Taking and Need for Control were not significantly correlated with control tendency.

#### **4.1.6. Measures and Analysis: Testing the Moderating Effect of Threats on the Relationship between Psychological Attachment and Control Tendency**

##### **4.1.6.1. Introduction**

As noted earlier, commercialization presents a situation where an analysis of the micro-economic environment is necessary in order to chart an efficient commercialization strategy. Results from data analysis in the previous session have shown that subjects perceive a high level of severity for adverse conditions concerning their projects. In the theory section, I noted the threat of loss is expected to influence the perception of future control or lack of control in the commercialization environment. The underlying argument was that the perception of loss of control will provide threatening signals that will influence the relationship between PA and CT. Essentially the notion of threat should be treated as a moderator of the relationship between PA and CT. The argument for the hypotheses, when the perception of threats is high, was a stronger relationship between PA and CT. I also introduced the main types of affective responses or emotional reactions to perceived threats: anticipatory and anticipated responses (Loewenstein et al., 2001). The hypotheses developed were *H4a* (Anticipated emotional reactions to perceived

threats will positively moderate the relationship between PA and CT) and *H4b* (Anticipatory emotional reactions to perceived threats will positively moderate the relationship between PA and CT). In this section I test hypotheses *H4b*, focusing on an experimental procedure aimed at inducing threat and assessing its impact on the relationship between PA and CT. I concentrate on anticipatory affect: affective states of the now.

#### **4.1.6.2. Experimental Design**

To study the effect of anticipatory affect on the relationship between PA and CT, I employed a quasi-experimental paradigm (Cook and Campbell, 1979). Quasi-experimental design is useful in applied research settings where real-life constraints restrict complete control over the research setting. Since subjects develop PA outside of the experimental process, the quasi-experimental paradigm provides a better framework for studying its effects. Classic experimental designs (Campbell and Stanley, 1963) are characterized by the ability to randomize subjects into treatment and control groups and thereby control the variables that are not explicitly included in the study. Quasi-experimental designs however, have to control for confounding variables explicitly through statistical techniques and are therefore sometimes labeled as correlational designs. Further, certain alternative hypotheses for instance, history effects, are allowed to prevail: a choice of relevance and external validity over control and internal validity.

#### **4.1.6.3. Experimental Manipulation**

After PA was measured, subjects were randomly assigned to two experimental groups. As noted above, the purpose of this experimental effort was to investigate the effect of anticipatory emotions such as fear on the relationship between PA and CT. There are various forms and causes of fear; personal fear, social fear, fears of physical danger, etc. Generally, fear

can be described as functional defense behaviour with survival advantages for the individual. Fear could be learned (e.g. Pavlovian classical conditioning) or be evolutionary (e.g. fear of snakes). Fear in this context refers to the personal fear of loss in a commercialization situation. It should be noted that since subjects consider potential dangers (such as theft of their creative idea in the future); there is the potential for fear to be mixed with anxiety at the point of commercialization<sup>25</sup>. Lerner and Keltner (2000, 2001) find that fearful people made more pessimistic judgments about the likelihood of adverse events and also made risk-averse choices. The authors argue that the specific impact of an emotion on cognitive appraisal shapes the willingness to take risks. Thus, fear is associated with low certainty, high anticipated effort, low control, and medium responsibility.

The pathways of fear have been studied extensively through functional neuroimaging and neuropsychological studies which relate the fear system to the amygdala<sup>26</sup> (LeDoux, 1996, 1998, see Zald, 2003 for a review). Other methods include physiological measures such as heart rate, skin conductance, and facial electromyography. Studies typically use threatening stimuli such as pictures (threatening or fearful faces), sounds and also masked stimuli (unconscious processing) for fear inducements (Zald, 2003). Lang, Bradley and Cuthbert (1999) develop a set of normative emotional stimuli for experimental investigations of emotion and attention. Findings have shown these stimuli to be effective. For instance, within the same framework, Cuthbert, Lang, Strauss, Drobles, Patrick, and Bradley (2003) assessed psychophysiological responses to fear memory imagery and found participants to be significantly more reactive (in physiology and report of affect) to fear than neutral cues.

---

<sup>25</sup> Animal models conceptualize anxiety as a response to potential danger while fear is a response to present danger (Catherall, 2003)

<sup>26</sup> The amygdala is a sub-cortical nuclear group of neurons located deep within the brain in humans and other animals. It is regarded as the "heart and soul" of the fear system.

***First Treatment*** It was believed that inducing ambient fear will create the environment for subjects to perceive the fear of loss when presented with potential commercialization partners. A pre-test of the first treatment used fearful pictures from the International Affective Picture System (IAPS)<sup>27</sup> pool (Lang et al., 1999) as a better alternative to other stimuli such as sound. The IAPS database is a large set of standardized, emotionally-evocative, internationally accessible, color photographs that includes contents across a wide range of semantic categories. With regards to the database, emotions are defined as a coincidence of values on three strategic dimensions: affective valence (ranging from pleasant to unpleasant), arousal (ranging from calm to excited) and dominance or control. The database comes in CD-ROM format and includes over 900 pictures which were assembled from studies in which 12 sets of 60 pictures each, varying on the dimensions identified, were rated in the course of 10 years (prior to 1999). Further, Mikels et al. (2005) provide an image set from the IAPS which they find to be effective in eliciting different discrete emotions, such as fear, more than others. Such a set avoids contamination of the targeted emotions by other related emotions.

In this study, only pictures depicting threat-evoking emotions with negative valence (such as snakes, tornadoes, gun threats), according to the data in Lang et al. (1999), were chosen for the inducements. Subjects are first screened to ensure that they were willing to view negatively-valenced graphic images. They were first shown four representative images excluded from the experiment and only those who are willing to participate were employed for the experiment. Subjects who refused were not included in the control group even though they were allowed to finish the experimental process. Willing subjects viewed each image after which

---

<sup>27</sup> Lang, Bradley and Cuthbert (1999) report on The International Affective Picture System (IAPS), the International Affective Digitized Sound system (IADS), the Affective Lexicon of English Words (ANEW), as well as other collections of affective stimuli, developed and distributed by the NIMH Center for Emotion and Attention (CSEA) at the University of Florida in order to provide standardized materials that are available to researchers in the study of emotion and attention.

irrelevant rating cards were provided for them to fill. In summary, subjects were taken through the procedure with sample pictures before they begun and they went through the rest of the pictures at their own pace. The control group was shown a set of neutral-to-scenic pictures. The results for this pre-test are given below.

***First Treatment Results:***

Manipulation check asked subjects to rate the degree to which they felt the following emotions when they saw the pictures. The results are noted in Tables 11. The table provides descriptive statistics of subjects’ responses to the affective states experienced when they saw the pictures. By the averages, subjects felt less fear and anger than disgust and sadness. Clearly the manipulation did not have the desired impact on the subjects. The upper 95% bound for fear is 2.37, which is below “neutral” score.

**Table 11**  
**Descriptive Statistics for Affect-Type in Manipulation Check**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
Fear	13	1	4	2.15	1.345
Disgust	13	1	5	2.92	1.656
Sadness	13	1	5	2.92	1.382
Anger	13	1	4	1.77	1.092

In further analysing just the fear factor, Table 12 was developed to show the frequency distribution for the variable. The table provides the distribution for the scores from the various facets of the 5-point scale. The tables shows that slightly more than half of the subjects (54%) chose “not at all” when asked the extent to which they felt fear when they viewed the pictures, while about 23% of subjects chose “somewhat”. Only 23% of the subjects felt fear to “a considerable amount” while none felt fear by “a great amount”.

**Table 12**  
**Descriptive Statistics for Fear in Manipulation Check**

<b>Fear</b>	<b>Frequency</b>	<b>%</b>
Not at all	7	53.8
Somewhat	3	23.1
A considerable amount	3	23.1
A great amount	0	
Total	13	100

In sum, with respect to the first treatment, albeit the small sample size, the results showed that the fear manipulation using the IAPS pictures was not effective. In effect, the manipulation was changed from picture-induced fear to a recall-induced fear of loss, presented in the second treatment, reported below.

**Second Treatment** The poor pre-test results confirmed the view that it is almost impossible to use fear inducing manipulations in such samples without evoking large demand effects. Therefore, theoretically, following methods adopted from social psychology and judgement decision making literature (e.g. loss aversion etc), a manipulation was designed to directly evoke a sense of loss. Subjects in the treatment group were asked to describe a loss of a personal possession in the past – in detail: providing details of the process of the loss, its effect on them and if they expect that such a loss can occur again in the future. Similar methods can be found in Keltner, Ellsworth and Edwards (1993) where subjects were asked to recollect events that make them feel what they felt then (when the event happened). The self-report methodology is also commonly used to elicit affective states (e.g. Smith and Ellsworth, 1985; Lerner and Keltner, 2001). There is also generally, a tradition of studying the carryover effects of emotions on economic decision making (see Lerner, Small and Loewenstein, 2004). The control group, on

the other hand, was asked to write about a recent realization they had or something interesting that they recently observed.

**Second Treatment Results** Manipulation checks revealed no significant differences between the control and treatment groups. Results are presented in Table 13 and Table 14. Table 13 provides descriptive statistics for the treatment and control groups before and after the study. Before and after the study, subjects were asked to indicate on a five-point Likert-type scale their affective state with the question “how do you feel?” A score below three (3) indicated that the subject was in a bad mood and a score above three (3) means the subject is in a good mood. Table 13 shows that in general, subjects were very slightly above neutral (3) (into the “good mood” range, - Mean=3.39, Std. Dev=1.07) at the beginning of the study, compared to the end of the study (Mean=3.30, Std. Dev=0.97). The difference is very small and any differences could have been due to experimental fatigue rather the effects of the manipulation.

**Table 13**  
**Descriptive Statistics for Mood Changes before and After the Manipulation**

Mood tests		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
Before Study	Treatment	50	3.52	1.04	0.15	3.23	3.81
	Control	45	3.24	1.09	0.16	2.92	3.57
	Total	95	3.39	1.07	0.11	3.17	3.61
After Study	Treatment	49	3.33	0.97	0.14	3.05	3.60
	Control	43	3.28	0.98	0.15	2.98	3.58
	Total	92	3.30	0.97	0.10	3.10	3.51

Further, still observing from Table 13, we see that the results for the treatment and control groups also show that the mean mood for the treatment group seems to be slightly lower after the study (Mean=3.33, Std. Dev=0.97) than before the study (Mean=3.52, Std. Dev=1).

Meanwhile the mean mood for the control group was just slightly higher (0.06 points) after the study (Mean=3.28, Std. Dev=0.98) than before the study (Mean=3.24, Std. Dev=1.1). One will expect both groups to express a lower mean mood after the study, at least due to experimental fatigue, but the mood of the control group seem to have improved (very slightly) while that of the treatment group declined. Following this lead, ANOVA<sup>28</sup> tests were conducted to check for statistical differences between these mood scores. The results shown in Table 14 indicate that the mood changes between and within groups were not statistically significant.

**Table 14**  
**ANOVA Tests for Differences in Mood Before and After the Manipulation**

Mood tests		Sum of Squares	Df	Mean Square	F	Sig.
Before Study	Between Groups	1.80	1	1.79	1.60	0.21
	Within Groups	104.79	93	1.13		
	Total	106.59	94			
After Study	Between Groups	0.05	1	0.05	0.05	0.82
	Within Groups	85.43	90	0.95		
	Total	85.48	91			

However, a paired-sample T test, which tests if the difference between two variables, within group, is different from zero, suggested dissimilar results. Table 15 presents results that suggest the mean difference in mood for the treatment group before and after the study was statistically significant ( $p=0.019$ ) from zero and insignificant ( $p=0.623$ ) for the control group.

<sup>28</sup> This was a one way ANOVA test which is a technique used to compare means of two or more samples or groups (based on the F-distribution)

**Table 15**  
**Results for Paired Differences in Mood for Experimental Groups Before and After the Manipulation**

Mood		Mean	Std. Deviation	Paired Differences Std. Error Mean	95% Confidence Interval of the Difference		T	df	Sig. (2-tailed)
					Lower	Upper			
Treatment group	Before Study - After Study	0.18	0.53	0.08	0.03	0.34	2.44	48	0.02
Control group	Before Study - After Study	0.05	0.62	0.09	-0.14	0.24	0.50	42	0.62

Delving deeper into the change in mood, subjects were also asked to indicate “the extent to which their mood had changed since they started the study” and “the extent to which their mood was affected by remembering the loss they suffered”. These questions were scored on a 5-point Likert-type scale. The descriptive statistics for these two questions are provided in Table 16. Given the neutral point as 3, both questions scored a mean of less than 3 – indicating “little” change, if any. However, the means were lower for the treatment group (Mean=1.73) than the control group (Mean=2.91) especially on the question of the extent to which mood is affected by narration. The treatment group indicated that there was very little change in their mood during the study while the control group indicated more change than the treatment group. This difference is possibly due the differences in the manipulation tasks.

**Table 16**  
**Descriptive Statistics of Mood Changes Before and After The Study**

	Extent of mood change since study begun			Extent to which mood is affected by narration of loss suffered		
	All	Treatment group	Control group	All	Treatment group	Control group
Mean	2.91	2.88	2.95	2.28	1.73	2.91
Median	3.00	3.00	3.00	2.00	1	3.00
Std. Deviation	0.48	0.48	0.48	1.25	1.02	1.21
Minimum	2	2	2	1	1	1
Maximum	4	4	4	5	4	5
N	92	49	43	92	49	43

Further, frequency distributions of the two questions were also computed and the results reported in Table 17 and Table 18. About 76% of the subjects indicated that there was no change in their mood in the course of the study. About 16% indicated their moods changed for the worst while about 8% indicated that their mood changed for the better. There were no differences in the pattern of the categories within which the treatment and control groups indicated the extent to which their moods changed during the study. Most subjects in the treatment and control groups expressed no change (around 76%) in their mood.

**Table 17**  
**Frequency Distribution for Mood Changes Within the Treatment and Control Groups**

Extent of mood change since study begun	All		Treatment group		Control group	
	Frequency	%	Frequency	%	Frequency	%
Change for the worst	15	16.3	9	18.4	6	14.0
No change	70	76.1	37	75.5	33	76.7
Change for the better	7	7.6	3	6.1	4	9.3
Total	92	100.0	49	100.0	43	100

Frequency distributions for the question of the extent to which subject’s mood changed by the narration of the loss suffered (for the treatment group) and the realization (for the control group) however showed slight differences between the treatment and the control groups. Results are presented in Table 18. Compared to the total –all subjects— (41%), more subjects (60%) in the treatment group, in proportion, indicated that their mood change was to a” small extent” than those in the control group (21%). Likewise in comparison to the total –all subjects— (16%), fewer subjects (8%) in the treatment group, in proportion, indicated that their mood change was to a “considerable extent” than those in the control group (26%).

**Table 18**  
**Frequency Distribution for Mood Changes Within the Treatment Group**

Extent of mood affected by narration of loss suffered	All		Treatment Group		Control group	
	Frequency	%	Frequency	%	Frequency	%
To a small extent	38	41.3	29	59.2	9	20.9
To a slight extent	11	12.0	8	16.3	3	7.0
Somewhat	25	27.2	8	16.3	17	39.5
To considerable extent	15	16.3	4	8.2	11	25.6
To a large extent	3	3.3			3	7.0
Total	92	100	49	100	43	100

To gain further understanding of what subjects felt, if at all, subjects were asked to tick among a number of affective states that they were in after going through the treatment exercise. The options were: happiness, anger, excitement, fear sadness and nothing. Table 19 gives the actual numbers of subjects indicating what they felt in the total, treatment and control groups. Intuitively, fewer subjects in the treatment group (2) indicated happiness than in the control group (14). This finding supports and explains evidence in the last two tables where the control

group had noted more change in mood than the treatment group. The result is expected since the control group was asked to write about an event that gave them a realisation they felt was “interesting” while the treatment group was asked to recollect and note down a loss of a personal property that was “dear to them”. This also explains why many more in the treatment group (15) reported sadness than in the control group (3). However, with the affective state of interest – fear— the number of subjects reporting this state (2) was less than in the control group (4). Clearly, the concept of fear of loss did not explicitly connect with incidental fear. There is also the possibility of social desirability effects here, as subjects in the treatment group might sense that the loss narration was designed to make them feel fearful and therefore made a conscious effort to not report that affective state.

**Table 19**  
**Descriptive Statistics of Subject’s Specific Feelings after the Study**

<b>What subject felt after the manipulation</b>	<b>All</b>	<b>Treatment group</b>	<b>Control group</b>
Happiness	16	2	14
Anger	8	6	2
Excitement	7	1	6
Fear	6	2	4
Sadness	18	15	3
Nothing	58	30	28
<b>Total</b>	<b>113</b>	<b>56</b>	<b>57</b>

*NB: Subjects had the option of choosing more than one emotion therefore the total number of responses is greater than the number of subjects*

In effect, hypothesis *H4b* on the moderating effect of anticipatory emotional reactions on the relationship between attachment and control orientation is not supported. However, it should be noted that, under the circumstances, lack of support for this hypothesis is due in part to failure of the manipulation or treatment employed. A better designed manipulation might unearth the

effects expected. Although the accepted test for differences between and within groups for the various measures (ANOVA) yielded no significant results, various descriptive statistics suggested differences might exist between the groups. To ensure that any “hidden” differences did not exist to affect the results in other tests, a dummy variable was created for the experimental groups for further analysis (1=treatment group, 0=control group). For illustration, this dummy variable was included in a regression of CT on its correlates. The coefficient for the dummy variable was not significant ( $\beta = 0.22, p=0.11$ ). But, there was a very weak significance for estimated project value ( $\beta = 0.14, p=0.09$ ). However, due to the weakness of the significance, this result is not explored further. With slimmer chances of testing for moderation, while maintaining that some sort of moderation of the relationship between PA and CT takes place, I turned to the data to identify variables that could be used as moderators to test for possible effects.

***Additional moderation tests: identified moderator*** One of the variables employed in the cognitive evaluation computation (also included as a correlate in testing for effects on CT) is conceptually close to the indication of threat perception from the microeconomic environment. As previously reviewed and reported, subjects were asked to indicate the likelihood of loss of the opportunity (the IP) in future market attempts. To briefly recap, subjects were asked to assume a commercialization decision scenario where they choose a partner, an outsider, to assist in the process. They were told that they know little about this outsider but the relationship can be successful or unsuccessful. Among other questions, subjects are specifically asked “How likely is it that the company (the partner) forcibly takes over ownership of the project idea?” The question was scored on a 10-point scale. As previously reported, the distribution of subjects’ responses were almost Normally distributed (Mean=5.28, Median=5, Std. Dev=2.04). About

half, 46%, of the subjects, noted that the chances of losing the project to the outsider were more than 50% (see Appendix 5.7 for the distribution). This variable was therefore considered for moderation analyses. Other variables eliciting likelihood were not considered appropriate to include in computing a composite moderation variable. These other variables asked about the likelihood of the project being imitated or the outsider including hidden clauses in a contract with the subject. These perspectives do not directly and necessarily lead to a loss of the idea and therefore were excluded in the moderation test.

***Additional moderation tests: Results*** Hierarchical multiple regression is employed in the analysis since the predictor (PA) and the moderator are measured on the continuous scale (Aguinis, 1995). To proceed, the predictor and moderator variables were standardized to avoid multicollinearity (high correlations) between the interaction term and the predictor and moderator variables (Aiken and West, 1991, Cohen et al., 2003). Standardizing also enables easier computation of standard deviations around the mean in plotting the moderator effects. After standardizing, the interaction term was created by computing the product of the standardized predictor and moderator variables (PA and likelihood of loss – LL).

To test for interactions in the hierarchical regression process, the variables were added in steps as was done in testing the effects of PA on CT earlier (Aiken and West, 1991, Cohen et al., 2003). The first step involved testing the main effects of the predictor and moderator variables and the second step involved adding the interaction term (Aiken and West, 1991, Cohen et al., 2003, Judd et al., 1991). The next activities involve interpreting the effects of the predictor and the moderator variables; testing the significance of the moderator effect and plotting the significant moderator effect.

For completeness, the three variants of the predictor were considered: the multiple-item PA, the positive affective dimension of PA and the two-item PA measure. Regression tests with

the multiple-item PA variable failed to identify any significant effects for the moderator. The moderator variable was not statistically significant ( $\beta = 0.07, p=0.28$ ) on the second step as described above. The  $F$  change was also not significant ( $F=1.17, p=0.28$ ). The positive affective states dimension was also tested and reported no significance for the moderator coefficient ( $\beta = 0.09, p=0.25$ ) and the  $F$  change ( $F=1.33, p=0.25$ ). However, when the two-item PA was considered, there were some significant observations recorded. These results are shown in Table 20 below.

**Table 20**  
**Hierarchical Regression Analysis for Testing Moderation of PA on CT**

<b>Predictors</b>	<b>Model 1</b>	<b>Model 2</b>
Constant	3.82** (0.06)	3.85** (0.06)
PA (two-item)	0.17* (0.06)	0.18** (0.06)
Likelihood of loss (LL)	0.03 (0.07)	0.02 (0.06)
Interaction term (PA x LL)		0.11† (0.06)
$R^2$	0.11	0.17
$R^2$ adjusted	0.08	0.12
$R^2$ change		0.06
$F$	3.52*	3.68*
$F$ change		3.67†

( $N, 60$ ), \*\*  $p < 0.01$ , \*  $p < 0.05$ , †  $p < 0.10$

Model 1 tests the main effects of PA and likelihood of loss. The results show that PA was statistically significant ( $\beta = 0.17, p=0.01$ ) while the likelihood of loss (LL) was not ( $\beta = 0.03, p=0.71$ ). Model 2 is the addition of the interaction term to Model 1. The results show that while PA improved in significance ( $\beta = 0.18, p=0.006$ ), likelihood of loss remained not significant and the interaction term was weakly significant ( $\beta = 0.11, p=0.06$ ). The Model statistics also showed

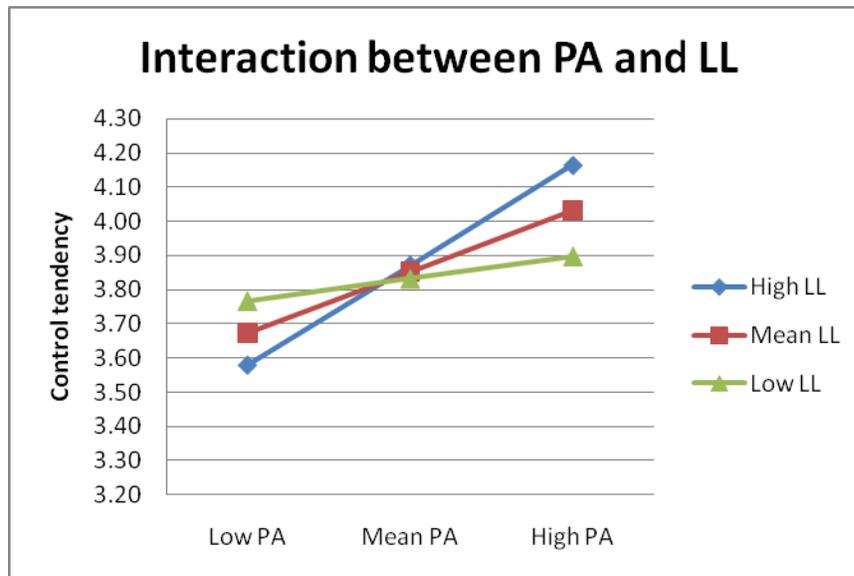
a small increase in  $R^2$  (0.06) moving from Model 1 to Model 2. This means that the interaction between PA and LL explained an additional 6% of the variance in CT scores over and above the 11% explained by the first order effects of PA and LL alone. The  $F$  change was also significant ( $F=3.67, p=0.06$ ). The indications are that they may be evidence of moderation between PA and CT when the two-item PA measure is used<sup>29</sup>. The lack of effects from the multiple-item and positive affective states dimensions is difficult to explain: except to speculate that the two-item measure used more direct questions on attachment although the potential for social desirability bias on the part of subjects in answering the question cannot be ruled out.

Since some significance was found for the interaction term, a moderation plot was developed to assess the results further. A common procedure recommended by Cohen et al., (2003) is to choose the groups at the mean and at low (1 standard deviation from the mean) and high (1 standard deviation from the mean) values of the continuous variable. Figure 9 shows the interaction plot developed with predicted values that are calculated by multiplying the unstandardized regression coefficients for each variable by the appropriate value (-1, 1) for each variable in the regression equation.

---

<sup>29</sup> To check the effects of controlling for the other correlates used earlier in testing CT (Table 9), the following procedure was followed. Correlates were entered in the first step of the regression equation, followed by the predictor variable, moderator variable, and interaction term in the last step. In evaluating the last step, there was no significance recorded for the moderator variable ( $\beta = 0.07, p=0.31$ ) and the  $F$  change ( $F=1.06, p=0.31$ ).

**Figure 9 Interaction between Psychological Attachment (PA) and Likelihood of Loss (LL)**



High LL      3.58      3.87      4.17  
 Mean LL      3.67      3.85      4.03  
 Low LL      3.77      3.83      3.90  
 (N,56), Solid triangles- low LL, solid squares – mean LL and solid diamonds – high LL

The plot shows some interaction between PA and LL in predicting CT. The differences in groups, in terms of control tendency, were larger in the high PA than in the low PA condition. Subjects with a highest level of CT (CT=4.17) were those who perceived a high likelihood of loss with high PA. This was higher compared to subjects who perceived a low likelihood of loss with high PA (CT=3.90). Subjects perceiving high and low likelihood of loss with mean PA were similar in their CT scores (CT=3.87, CT=3.83 respectively) and subjects perceiving high and low likelihood of loss with low PA did not differ as much (CT=3.58, CT=3.77 respectively) as those with high PA, in their CT scores. Essentially, given high PA, when there is a high likelihood of loss perceived, CT is also high. The results indicate the potential for investigating the moderation of PA on CT in further studies.

## **Chapter 5**

There are a number of decision making areas in venture commercialization where control tendency can be studied. One interesting area is entrepreneurial financing where entrepreneurs seem to prefer control in financing decisions. This preference sometimes implies choosing internal financing over external financing when ownership is at stake. This chapter discusses PA and control in terms of preferences for external financing.

### **5.1 Control Tendency in Financing Decisions**

#### **5.1.1 Types of Financing**

Choosing the appropriate financing package has tremendous implications for the performance of the new venture. The implications are more pronounced from the viewpoint of the entrepreneurial equity gap – shortage of financing availability (various sources). There is much debate about whether the equity gap results from insufficient supply of funds or from the prevalence of market problems such as information asymmetry, agency costs and moral hazard problems (Hillier and Ibrahim, 1993) (see the introduction to this thesis for discussion). However, it is clear that in any commercialization partnership or contract, such market problems will impact on most of the conditions governing the financial offers as well as perceptions guiding acceptance of these offers. Both financiers and entrepreneurs react to these problems in unique ways. Their individual reactions, however, depend on the type of venture financing pursued.

There are two types of financing strategies for venturing: internal and external financing. Internal financing involves producing funds from business operations or through close personal

relationships with no financing conditions and therefore avoiding most transaction costs. External financing is simply raising money through debt or equity. Intuitively, there is no reason to doubt that an equity gap exists, entrepreneurs and start-ups are credit constrained, and therefore often need to resort to external financing. However, the transaction costs involved in external financing coerces some to avoid that route even if such avoidance is costly. Some entrepreneurs will avoid external finance to retain control even if performance suffers as a result.

### **5.1.2 Literature Review: External Financing**

For the sake of illustration, I recount some of the literature reviewed in the introduction and literature review sections of this thesis. I recap the literature on venture capitalist financing and introduce the literature on angel financing to compare and contrast with venture capital financing. As previously noted, there is evidence to suggest that entrepreneurs prefer internal financing over external financing especially if it affects ownership (Winborg and Landström, 2001; Cressy, 1995; and Berggren, Olofsson, and Silver, 2000). Cressy (1995) relates the phenomenon to control aversion where entrepreneurs are averse to losing control of the opportunity, although aware that relinquishing some control would improve performance (Cressy and Olofsson, 1997). Müller (2007) argues that founders tend to remain in control and forego some growth opportunities, if the opportunities are too extensive to be realized with debt finance alone. These founders are content paying higher interest rates for additional loans in order to maintain control. The implication is that their firms are limited in their growth potential.

However, as prefaced in the introduction to this thesis, in being control-oriented, entrepreneurs are simply reacting to financier strategies that attempt to wrestle control from entrepreneurs in the bid to safeguard investments. The notion of financiers seeking control is well studied in the venture financing literature with respect to agency problems — when the

economic incentives of the financier (principal) and entrepreneur (agent) are not costlessly aligned (Pratt and Zeckhauser, 1985). To combat agency problems, the financier can either; design an optimal contract (Jensen and Meckling, 1976) through pre-investment screening and due diligence; or use the incomplete contracts approach which concentrates on the post-contract allocation of control rather than the pre-contract screening and contract writing (Hart, 1995).

*Venture capitalists* Financiers such as venture capitalists (VCs) often resort to either principal-agent or incomplete contracts or both approaches to combating agency problems. Especially in the incomplete contracting paradigm, entrepreneurs and venture capitalists (VCs) are known to wrestle over control rights due to conflicting objectives (Hart and Holmström, 1987, Hart, 1995, and Kaplan and Stromberg, 2003). A VC is a person or entity that provides financing for new, growing or struggling businesses from a venture fund (a pooled investment vehicle that invests third party capital in ventures too risky for the standard capital markets or bank loans)(various sources). In VC financing, control rights are allocated such that the VCs obtain full control if the company performs poorly (Kaplan and Stromberg, 2003). But to boost the entrepreneur's performance, VCs typically give up some of their control and liquidation rights, enabling the entrepreneur to obtain more control rights, when company performance improves. However, since VCs need to reduce information asymmetry to provide sufficient funds, agency costs increase and their control over the opportunity also increases. They typically need to assert considerable control over the opportunity to safeguard their investment of effort and money as well as ensure high performance. Nevertheless, we have seen from the foregoing that entrepreneurs' perception of conditions for financing might be affected by their level of attachment to the opportunity. Initial control terms in a contract might prevent some from accessing these opportunities.

*Angel investors* Another group of external financiers that are somehow different from VCs are Angel investors (Angels). Angels are “private individuals using their own money directly in unquoted companies in which they have no family connection” (Mason and Harrison, 1996). Angels dominate early stage entrepreneurial investment - making 30 – 40 times as many deals as VCs, and risking about the same amount of dollars - \$23.1 bn (Center for Venture Research, 2005) compared to \$23.0 bn (Moneytree, 2006). Angels invest their own money at the high-risk stage of a venture's existence (Freear, Sohl and Wetzel, 2002) which is often a catalyst for subsequent VC investment (Shepherd and Zacharakis, 2001).

There are differences in Angel and VC financing, although there are basic similarities in their financing conditions. For example, Zacharakis and Meyer, (2000) suggests four main categories on which VCs base their decision: entrepreneur/team capabilities, product/service attractiveness, market/competitive conditions, and potential returns if the venture is successful. However, Angels do not necessarily use these categories. Feeney, Haines and Riding, (1999) note that although Angels view management ability as important, they tend to concentrate on the growth potential of the opportunity and how reliable and capable the entrepreneur is in ensuring that growth potential. Hence, the Angel is more likely to value the entrepreneur's role in the business more than the VC, leading to differences in their contract preference. Van Osnabrugge (2000) suggests that VCs may prefer the principal-agent approach partly to demonstrate responsible conduct in competing for fund provider's money (Van Osnabrugge, 2000) and partly to signal competence and reliability in the VC marketplace (Sapienza et al. 1996). Similarly, Fiet (1995) suggests that VC's are more concerned about market risks or those risks due to uncertain market conditions that affect the size of the growth and accessibility of the market. In contrast, Van Osnabrugge (2000) suggests that Angels may prefer the contracts incompleteness approach.

Angels are also concerned with agency risks but they will tend to place more emphasis on the “fit” with the entrepreneur as an important ingredient in combating divergence in interests.

### **5.1.3 Predictions**

*Preference for Angel vs. VC financing given a level of PA* From the foregoing, the indications are that, generally, entrepreneurs at the early stage of development may prefer Angel investment to VC investment. Angel investment is more associated with early stage financing and serves to prepare the opportunity for larger VC financing (Shepherd and Zacharakis, 2001). Also, entrepreneurs and technology developers might prefer Angel investors due to the connotation of the label “Angel”. They might view an Angel investor more like a “helper” than a profit-hungry investor (often associated with VCs in the business press). Entrepreneurs may also prefer Angel investors because of the more “informal” approach they bring to due diligence and contractual deliberations, compared to the VC.

However, it should be noted that both VCs and Angels employ control strategies to minimise investment risk. According to the literature just reviewed, the VC typically demands a high level of decision making control –while the Angel typically seeks to participate in the venture with the entrepreneur – in order to enhance the value of the business and also mitigate the risks. These forms of control limit the entrepreneurs’ independence, autonomy and rights over his or her creation. Hence highly attachment entrepreneurs, not willing to share control with financiers, will be weary of accepting external financing of any kind (as seen in the empirical evidence presented above).

In effect, high levels of PA may increase CT as entrepreneurs perceive avenues for opportunism on the part of potential financiers. Opportunistic possibilities arising from informational asymmetries are quite pervasive during commercialization (Williamson 1979,

1985). As such, although VCs possess high matching abilities and are capable of matching entrepreneurs to essential financial resources; and BAs provide flexible finance terms and invest industry experience alongside funds; a high level of attachment is likely to increase developers' preference for control even if they cognitively realise that relinquishing some control would improve performance.

*H4:* High levels of psychological attachment are more likely to lead to strong control preferences in making financing choices, than low levels of attachment.

#### **5.1.4 Measures and Analysis**

*Measures: Control preferences in financing decision* Subjects were provided with generic information about commercialization, its definition and one-sentence description of a venture capitalist (VC) and an Angel investor. They were then provided with pairs of offers from a VC and an Angel with a share structure designed such that an optimal set of offers and takes could be easily determined. Table 21 presents the percentage shares of equity that financiers expect to take in six rounds of paired financing (VC paired with Angel). The first row indicates the rounds or deals presented to subjects. The second row provides the VC's equity demanded, in percentages, for \$4m investment into the company in each round presented to subjects. The third row provides the Angel investor's equity demand for a \$2.5m investment in the company for each round listed. It could be observed that the VC's equity stake demanded decreased from 55% in the first round to 50% in the 6<sup>th</sup> round, in unitary decreases over the period. The Angel's shares demanded increased from 45% in the first round to 50% in the 6<sup>th</sup> round. Also, the Angel's offer is just a little more than half (62.5%) the offer presented by the VC.

**Table 21**  
**Percentage Takes In Venture Capital and Angel Investor Financing Decision Contexts**

Rounds	1	2	3	4	5	6
VC offers \$4m, takes shares %	55	54	53	52	51	50
Angel offers \$2.5m, takes shares %	45	46	47	48	49	50

Further, subjects were told that in partnering to commercialize, whichever party held more than 50% shares effected decisions on product development, finance, sales etc (See Appendix 2 for questionnaire). In each round, subjects were required to pick one option, the VC's offer or the Angel's offer. For instance, in the first round subjects choose between Option A: A VC offer of \$4m with a 55% VC equity stake and Option B: An Angel offer of \$2.5m with a 45% Angel equity stake. The six pairs were presented individually on separate pages with alternating positions for the options in each subsequent pair presented. The design takes motivation from the notions of loss aversion and the violations of first-order stochastic dominance in the work of Kahneman and Tversky (1979)<sup>30</sup>. On each round it was optimal to pick the VC's offer over the Angel's offer. Table 22 provides calculations that reveal the optimal choice in each round.

<sup>30</sup> In prospect theory, loss aversion refers to the tendency for people to strongly prefer avoiding losses than acquiring gains. Some studies suggest that losses are twice as psychologically powerful as gains. First order stochastic dominance - The original version of prospect theory showed violations of first-order stochastic dominance (a situation where one lottery - a probability distribution over outcomes - can be ranked as superior to another. It is based on preferences regarding outcomes - e.g., if each outcome is expressed as a number, i.e. gain or utility, a higher value is preferred).

**Table 22**  
**Venture Capital and Angel Investor Offers and Developers Takes**

<b>Venture capitalist</b>							
<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>
<b>Deal</b>	<b>Offer</b>	<b>Takes</b>	<b>Pre-money value</b>	<b>Total valuation</b>	<b>Developer's share</b>	<b>Developer's value</b>	
1	4	0.55	3.27	7.27	0.45	3.27	
2	4	0.54	3.41	7.41	0.46	3.41	
3	4	0.53	3.55	7.55	0.47	3.55	
4	4	0.52	3.69	7.69	0.48	3.69	
5	4	0.51	3.84	7.84	0.49	3.84	
6	4	0.5	4.00	8.00	0.50	4.00	

<b>Angel investor</b>							
<b>Deal</b>	<b>Offer</b>	<b>Takes</b>	<b>Pre-money value</b>	<b>Total valuation</b>	<b>Developer's share</b>	<b>Developer's value</b>	<b>Deal value difference: VC - Angel</b>
1	2.5	0.45	3.06	5.56	0.55	3.06	0.21
2	2.5	0.46	2.93	5.43	0.54	2.93	0.48
3	2.5	0.47	2.82	5.32	0.53	2.82	0.73
4	2.5	0.48	2.71	5.21	0.52	2.71	0.98
5	2.5	0.49	2.60	5.10	0.51	2.60	1.24
6	2.5	0.5	2.5	5	0.5	2.5	1.50

Column A is the list of rounds or deals presented to subjects (as shown Table 21). Column B represents the offers from the potential financiers: VCs offer \$4m and Angels offer \$2.5m. Column C provides the percentage of equity takes that the financiers demanded. E.g. For the first deal VCs requested 55% equity in the business when they offered \$4m as was shown in Table 21. Column D presents a calculation of pre-money valuation, which is the value of the business before investment. Investors use the pre-money valuation to determine the amount of equity to demand for the amount invested. In this example for Column D, it is calculated as *offer x (1-% take) / % take*. For example, for the first round, the Angel offered \$2.5m and demanded 45% equity. Using the formula, the pre-money valuation is calculated as  $2.5 \times (1-0.45) / 0.45 = 3.06$ .

Hence, the pre-money valuation when the Angel offered \$2.5m and demanded 45% equity is \$3.06m. This implies the total valuation of the company is  $\$2.5m + \$3.06m = \$5.56m$ . Note that for the \$5.56m total valuation, the 55% equity stake accruing to the developer amounts to \$3.06 – the pre-money value. Having identified the total valuation and pre-money valuation, the investor evaluates the investment against the economic environment. For instance, in this example, the Angel has to determine that the business is worth \$5.56m before committing the \$2.5m for the 45% stake. Otherwise, the Angel can proceed to update the investment amount, the shares demanded or both.

Column E in Table 22 provides the total valuation of the company (offer added to the pre-money valuation) given the offer and percentage equity stakes. Column F showcases the percentages of developer equity stakes as shown in Table 21 above. Column G indicates developers' stake in the company in million dollar amounts (which also equals the pre-money valuation as shown in the example above).

To determine the optimal offer, compare Column G for the financiers and developers across the rounds or deals. One can observe that for every deal the value of the developer's stake in the company is higher from the VC offer than from the Angel's offer. Column H provides the difference between developer values for the VC and Angel for each deal. E.g. for the first deal, the difference,  $\$3.27 - \$3.06$ , equals \$0.21m. The deal value in Column H is positive for each deal and increases throughout the deals from \$0.22m to \$1.50.

Essentially, subjects employing a cognitive model in their evaluations are expected to be close in judgement to realising the VC option as optimal in all deals<sup>31</sup>. In effect, the hypothesis

---

<sup>31</sup> Note that even without the pre-money valuation calculations, the percent structure of stakes and offers, provides subjects with enough information to realise the optimal offers provided by the VC. Since the VC offers \$4m and the Angel, \$2.5, simple calculations quickly reveal the optimal offer in each paired deal. For example, adopting the developer's percent stakes for illustration, the highest amount a developer obtains in equity within the VC offers is

tested with this design thrives on the notion that when PA is high and therefore the evaluation process is affect-biased, subjects are likely to concentrate on how much control they are relinquishing to the VC rather than the optimal offers the VC presents. It should be stressed that the information presented to subjects was limited to the financiers' percentage takes of equity and offers (see Appendix 2 for questionnaire). In effect, subjects were expected to make choices more according to what they feel about control and the consequences of choosing the various options.

***Results: Control tendency in financing decisions*** The hypothesis of interest here is *H5* (High levels of PA are more likely to lead to strong control preferences in making financing choices, than low levels of PA). The multiple and two-item PA measures provided a similar pattern of choices. The results from the use of the multiple-item PA are reported here, in the main text, and those of the two-item PA measure are placed in Appendix 6. Table 23 provides the proportions of subjects picking among offers in the high PA and low PA groups, computed from a median split of the PA responses.

---

\$2.2 (45% of the \$4m offer in the first deal, when the VC demanded 55% equity), while the lowest is \$2m (50% of the \$4m offer, with VC demand of 50%). Conversely, the highest amount in the Angel offers for the developer is \$1.38m (55% of the \$2.5m Angel offer, when the Angel demands 45% equity), while the lowest is \$1.25m (50% of the \$2.5m Angel offer). Clearly, simple proportions show that the VC offers are optimal in all deal rounds. Hence, subjects are not expected to necessarily compute the pre-money valuation calculations to make the expected (normative) choices.

**Table 23**  
**Percentages of Subjects Choosing VC and Angel Offers**

A	Rounds of offers		1		2		3		4		5		6	
			VC	Angel	VC	Angel								
B	High PA	% of subject choices	15	85	15	85	15	85	18	82	24	76	97	3
C			<i>a.8</i>	<i>b.47</i>	<i>a.8</i>	<i>b.47</i>	<i>a.8</i>	<i>b.47</i>	<i>a.10</i>	<i>b.45</i>	<i>a.13</i>	<i>b.42</i>	<i>a.53</i>	<i>b.2</i>
D	Low PA	% of subject choices	56	44	63	37	59	41	59	41	63	37	97	3
E			<i>c.25</i>	<i>d.20</i>	<i>c.28</i>	<i>d.17</i>	<i>c.27</i>	<i>d.18</i>	<i>c.27</i>	<i>d.18</i>	<i>c.28</i>	<i>d.17</i>	<i>c.43</i>	<i>d.2</i>
F	<i>F</i>		12.89**		18.68**		15.57**		12.72**		10.45**		0.02	
G	VC (offer \$4m), takes %		55		54		53		52		51		50	
H	Angel (offer \$2.5m), takes %		45		46		47		48		49		50	

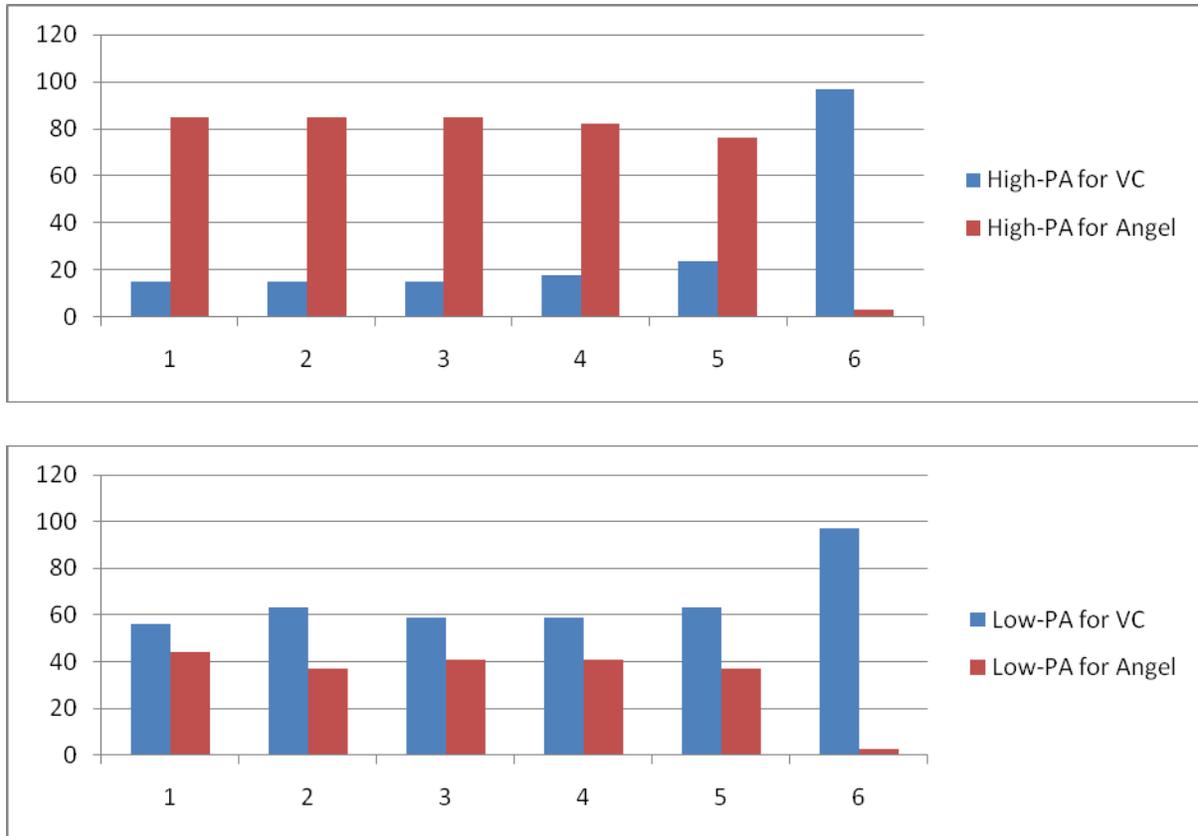
(*N*, 59), \*\*  $p < 0.01$ , \*  $p < 0.05$ , †  $p < 0.10$

Note: The cells denoted as *a*, *b*, *c* and *d*, indicate the percentages of subjects choosing within each round (deals) and sums up to 100%.

Using the alphabetical letter labels in the leftmost column and the numbers in the top row (which denote the rounds/deals); I describe the cells in Table 23. The columns corresponding to the rounds, 1,2,3..6, present the percentages of subjects preferring VC and Angel offers in each round. Rows B and D, report these preferences within the high and low PA groups respectively. For example, cell 1B (column, row), reports that in the first round of deals, subjects in the high PA group preferred the Angel's offer (85%) over the VC's offer (15%). Also computed is the distribution of subjects within each round on their preferences for VC and Angel offers in the high and low PA groups. These are reported in the C and E rows and labelled *a*, *b* in the C row and *c*, *d* in the E row for VC and Angel preferences respectively. *a*,*b*,*c*, and *d* sum up to 100%. For instance, for the first round of deals, cell 1C reports *a*=8% (high PA subjects who preferred the VC's offer) and *b*=47% (high PA subjects who preferred the Angel's offer); while the cell 1E reports *c*=25% (low PA subjects who preferred the VC's offer) and *d*=20% (low PA subjects

who preferred the Angel's offer). So, the highest percentage of offers in the first round was from high PAs who preferred the Angel's offer. These percentages add up to 100% for the subjects' responses in the first round. The percentages across and within rounds are developed into charts that provide a pictorial view of the distribution of subject responses (See Figures 11, and 12 below). Row F contains ANOVA results testing the differences between and within the high PA and low PA groups and the VC and Angel groups. Row's G and H provide the VC and Angel equity demands (in percentages) for their investment. This is included in the table for comparison sake. Rows B and D are developed into a pictorial presentation as shown in Figure 10 below (with row B on top and row D at the bottom of the diagram).

**Figure 10**  
**Percentages of Subjects Choosing VC and Angel Offers within High and Low Psychological Attachment Groups**



*F* 12.89\*\* 18.68\*\* 15.57\*\* 12.72\*\* 10.45\*\* 0.02

VC (\$4m) takes %	55	54	53	52	51	50
Angel (\$2.5m) takes %	45	46	47	48	49	50

(*N*, 59), \*\*  $p < 0.01$ , \*  $p < 0.05$ , †  $p < 0.10$

The results in Table 23 and Figure 10 indicate that, except for the last round, subjects within the high PA group strongly and consistently preferred the Angel’s options, over the VC’s options (see Row B in Table 23 and the top part of Figure 10). The Angel offered more control to subjects (see row H) while the VC offered less control (see row G). These preference styles go

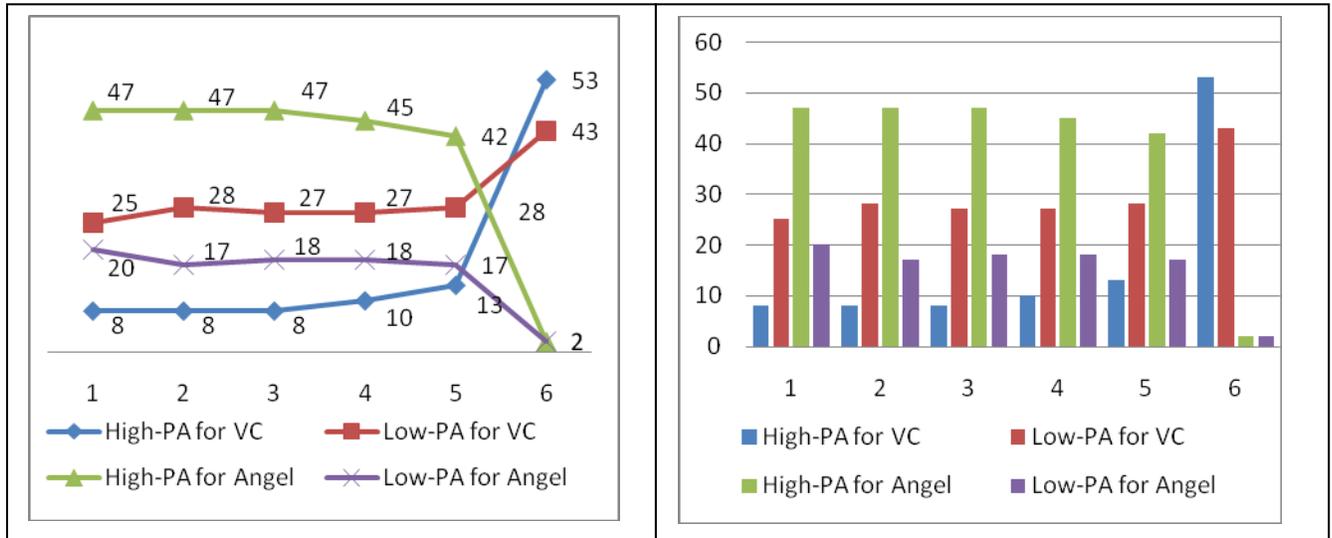
against the conventional economic wisdom that subjects should choose the VC offers because they are economically optimal. However, subjects within the low PA group had a choice pattern closer to the optimal set of choices as low PA subjects consistently preferred the VC's offers (see Figure 12– to be discussed). Despite the differences in their preference styles, subjects in the high and low PA groups unanimously voted for the VC offer in the last round where the financiers demanded 50% of equity with the VC providing \$4m investment and the Angel, a \$2.5m investment. Further, there were remarkable statistical differences between and within group for the first five rounds of deals but no significant difference for the last group of deals (see *F* values in row F of Table 23).

To probe these results further, Figure 11 was developed to study distribution of preferences within each round of deals (see Rows C and E in Table 23). Figure 11 plots the percentages of subjects in the high and low PA groups preferring the VC and Angel offers within the rounds, thereby presenting a more integrated view of how the sum of a 100 percentage points is distributed among the groups in each round. The plot on the left (a) shows that from the first to the fifth round, the largest group in each round of deals was the high PA group who preferred the Angel's offers. The next largest group was the low PA group who preferred the VC offers. The two smaller groups were the low PA groups that preferred the Angel offers and these groups were slightly larger than the high PA group that preferred the VC offers. The striking feature of the plot is that the largest group preferring the VC offers in the last round of equal share offers was the high PA group who had consistently preferred the Angel offers in the previous rounds. Although, the low attachment group comparatively voted more for the VC in the previous rounds, the high PA group oversubscribed to the VC position by 10% points (53% over 43%).

**Figure 11**  
**Percentages of Subjects in High and Low Psychological Attachment Groups Choosing VC and Angel Offers within Rounds**

(a)

(b)

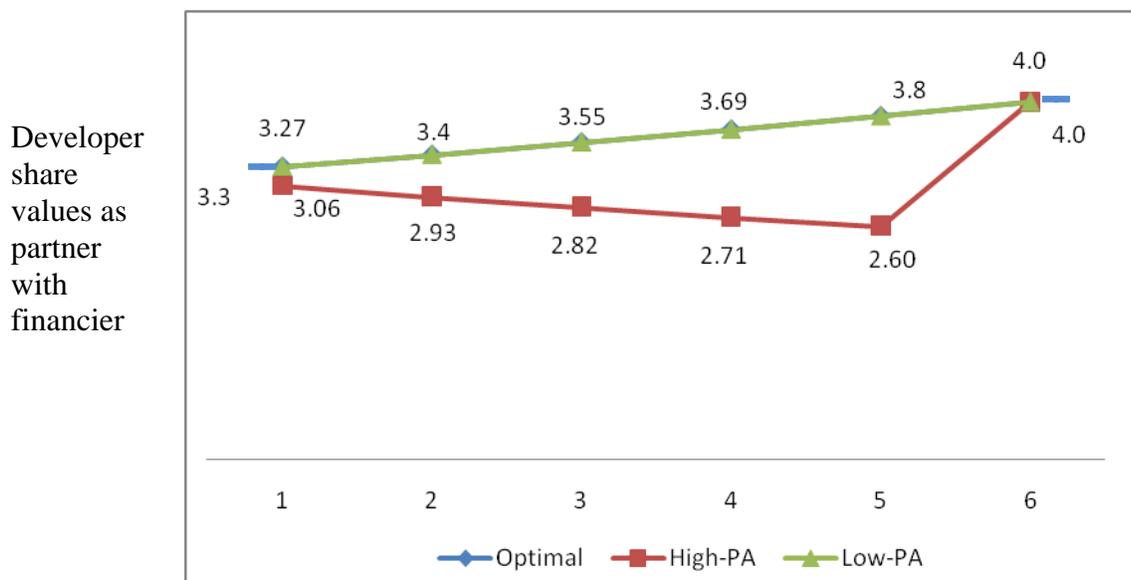


(N,56); Solid triangles- High PA choosing Angel offer; solid squares – Low PA choosing VC offer; stars - Low PA choosing Angel offer; and solid diamonds – High PA choosing VC offer,

Finally, Figure 12 was developed to model the deviation from the optimal choice across the 6 rounds of deals. For each round, the highest percentage of subjects preferring the VC or the Angel was recorded and the corresponding developer equity share value noted. For instance, if for the first round the majority preference was for the Angel, a value of \$3.06 corresponding to the developer’s equity share value (when the Angel invests \$2.5m and demands a 45% stake) was recorded. Figure 12 then plots the identified developer’s equity share values for the high and low PA groups, alongside the optimal developer share values (which are the developer values when accepting the VC offers). The plot shows that for each round, the low PA group preferred the optimal choice (lines coincide). However, the high PA group deviated away from the optimal choices till the last round when shares were of equal proportion. Nevertheless, it is striking to observe that developer share value for the high PA group consistently decreased in deviation from the optimal, spanning a range of \$0.22m to \$1.24m in the first to fifth rounds. By

consistently choosing the Angel offers, the high PA group lost share value in two ways: 1. Share value foregone by not choosing the VC offer which recorded an increasing share value for the developer, 2. Share value reduction due to share dilution as the Angel's equity share demands increased over the period. More strikingly, for marginal control in the fifth round where the VC demanded 51% and the Angel, 49%, high PA subjects preferred to forego \$1.24m value and choose the Angel's offer –in order to gain marginal control.

**Figure 12**  
**Comparison of Subjects Share Preferences in the High And Low Psychological Attachment Groups with the Optimal Choice**



(N,56), Solid triangles- Low PA choice, solid squares – High PA choice, and solid diamonds – optimal choice. Note that the optimal and low PA choice are identical (coincide)

VC (\$4m) takes %	55	54	53	52	51	50
Angel (\$2.5m) takes %	45	46	47	48	49	50

Consequently, the results show that despite the VC's optimal offers, subjects in the high PA group forego economic intuition and prefer the non-optimal alternative - Angel's offers. However, the VC's equity stake was higher (above 50% in the first five rounds) than the

subject's stake but the Angel's equity stake was lower (below 50%) than the subject's equity stake. Hence, to avoid the optimal offers of the VC implies that subjects were concerned about VC control. This claim is substantiated by the results from the sixth round of deals where subjects in the high PA group changed course and subscribed to the VC's offer because both financiers demanded 50% equity stake and the VC offered 60% more investment than the Angel. Clearly, high PA subjects suddenly regained their economic wisdom when they encountered the sixth round where the equity allocations put them at equal footing with the financier.

Therefore, given the correlation between PA and CT in previous analysis, evidence of the high PA group preferring the Angel offers suggests that: 1. High PA can lead to the desire to control in venture financing<sup>32</sup> and 2. High PA can lead to disregard for rational intuition in venture financing decisions and consequently lead to inefficient financing strategies. As noted a few times already, Müller (2007) found founders to limit the growth potential of their firms by being content with paying higher interest rates for additional loans in order to maintain control. Given the results, *H5* which predicted a control-orientation for high PA subjects in financing decision preferences is strongly supported.

***Financier's ability*** To check for possible alternative explanations, such as low credence for VC/Angel ability, subjects were later asked to indicate on a 5-point Likert scale the importance of the VC or the Angel's management ability in ensuring the success of the commercialization effort<sup>33</sup>. Results are presented in Table 24 which shows the responses to

---

<sup>32</sup> Note that in the instructions, subjects were told that whichever party has more than 50% equity holds sway in decision making

<sup>33</sup> The question asked subjects to indicate the importance of the VC or the Angel without separating the two. The question could have asked subjects to allocate marks of importance to the two financiers and then correlated with PA in analysis. However, while probably unwise, the VC and Angel were lumped together for fear of comparing VCs and Angels. Note that the labels "VC" and "Angel" were employed for description purposes and do not denote differences in VC and Angel equity demands. In reality, both VCs and Angels may demand more than 50% stake in the business in order to control decision-making. Therefore the labels could have been "Financier 1" and "Financier

subjects' perceived importance within the ordinal points in the Likert scale. The responses are for all subjects, high PA, and low PA groups using the multiple-item measure of PA.

**Table 24**  
**Descriptive Statistics for Importance of Outside Financier Management Ability**

<b>Importance of VC/Angel management ability</b>	<b>All %</b>	<b>High PA %</b>	<b>Low PA %</b>
Not important	1	0	4
Neutral	5	3	7
Important	36	33	37
Very important	58	64	52
N	89	33	27

A majority of subjects (58%) rated the VC or the Angel's management ability on the upper end of the scale as "very important" and 36% rated the financiers ability as "important" (Mean= 5.42, Median= 5, Std. Dev= 0.64). Thus, 94% of all subjects (97% for the high PA group and 89% for the low PA group) thought the VC or the Angel's ability was important in securing commercialization success. Since the question could not separate the VC and Angel in eliciting responses to the importance question (see footnote), interpretation of the results will involve some speculation.

First, we have seen that the high PA group overwhelmingly preferred the Angel offers in the first five rounds, but suddenly switched (overwhelmingly) to the VC offer in the sixth round. This shows that subjects did not make choices between a "VC" and an "Angel" but between two potential financiers and also considered the level of control they were willing to relinquish to these financiers. Second, given the level of importance subjects ascribe to the financier's ability, it was counter intuitive that majority (see Figure 12) will prefer the Angel's offer when the

---

2" and the results are expected to be the same as those found using the labels "VC" and "Angel". In effect the question was aimed at eliciting the level of importance subjects assign to financiers, in general.

Angel's equity share demand was lower than the VC's, in the first five rounds. The worst culprit was the high PA group who ascribed more importance to the financiers' ability (97%) than the low PA group did (89%). Yet, this group preferred to hold control over decision making in a potential partnership deal with their preferred financier.

One will expect that if subjects view the financier's ability to be important, they should not strive to take over control of decision making from the financier (especially given the background of these subjects). In effect, the results support evidence cited earlier that entrepreneurs prefer control in financing decisions even when aware of positive effects on performance. For instance, to repeat for illustration purposes, Cressy (1995) coins the term "control aversion" to describe situations where entrepreneurs are averse to losing control of the opportunity, although aware that relinquishing some control would improve performance (Cressy and Olofsson, 1997).

In closing, high levels of psychological attachment seem to increase developers' desire to control as they likely overweight concerns over opportunism on the part of potential financiers. More importantly, subjects are willing to forego optimal financial offers for marginal control over their ideas. In addition to foregoing optimal offers, subjects also fail to incorporate their stated beliefs that the potential financiers possess the resources (ability) to aid in commercialization. These conclusions are derived from observations that highly-attached subjects indicated belief in the ability of the VC/Angel but preferred to control decision making even if this position was secured with marginal control over the idea and at the cost of foregoing optimal financial resources.

## Chapter 6

### 6.1 Discussion

The findings in this study support the underlying theory in this paper that psychological attachment influences the perception of outcomes and therefore control preferences. Among the key findings are the following. There is a positive effect of psychological attachment on control tendency, controlling for personality factors and other statistical control factors such as the subjective value of the developer's project. As a proxy for how developers value their projects and therefore the returns they expect from pursuing it, no statistical significance for the effect of estimated project value indicates the strength of psychological attachment in explaining control tendency.

The results also highlight the possible differences between entrepreneurs' cognitive and affective evaluations of the commercialization environment, given a level of attachment to the opportunity. In this study, subjects' level of attachment was negatively correlated with their level of cognitive evaluation employed in evaluating the microeconomic environment. Further, as psychological attachment increased, the discrepancy between the proxy variables for objective and subjective evaluations of the project and its outcomes, increased. Thus, affect-based constructs such as attachment may cause entrepreneurs to overweight the possibility of losses, inadequately weight probabilities of gains and lower their subjective expected value of future commercialization outcomes even as the objective valuation increased. While subjects in this study did not necessarily possess base rate information on the probabilities of the outcomes presented to them, the pattern of correlations between these variables provide insight into affective mechanisms governing entrepreneurial decision making at the commercialization stage.

The concepts were taken to a financing application context where subjects were confronted with hypothetical financing options. The main finding was that high levels of attachment are more likely to lead to control-oriented funding preferences than low levels of attachment. Also, preferring control let subjects to forego optimal financing options. These findings are very interesting due to the potential for economically bad choices as some researchers have pointed out. For instance, as noted several times already, Cressy (1995) argues that entrepreneurs are averse to losing control. Further, Cressy and Olofsson (1997), working with Swedish data, argue that this aversion can persist even if entrepreneurs are aware that relinquishing some control would improve performance.

As expected, high levels of attachment will increase the desire to control as entrepreneurs become concerned with market issues and agency problems. Such a desire for control may be especially strong for technology developers when they overweight the fears of opportunism on the part of potential financiers. It should however be noted that depending on the level of equity already invested, the developer might be indifferent to the contractual conditions and accept any *satisficing* arrangement. In effect, attachment effects may be reduced in cases where external funds are instrumental to the continual development of the technology. Landström and Winborg (1995) find that when the firm experiences financial difficulties, the attitude towards external financiers changes and tends to be more positive. However, in cases where the development costs are low and attachment is high, one can envisage entrepreneurs avoiding necessary external funding due to preference for control. Interestingly, such situations describe the cases of millions of independent inventors who strive to either fill the shelves of hardware stores with new creations or to develop new ventures on these ideas.

Considering other findings, personality-type factors such as Emotion-Based Decision-Making, Machiavellianism, Risk-Taking and Need for Control were not significantly correlated

with control tendency. Machiavellianism was however weakly correlated with both psychological attachment and control tendency. In an attempt to interpret this finding, one can assert that when subjects felt they were capable of manipulating others, they were more attached to their creative ideas and also desired to control the rights to their ideas. However, the effects of Machiavellianism did not hold when other correlates were controlled for.

Nevertheless, the lack of effects for these personality-type factors is important because the implication is that control tendency, as conceptualized in this study, is not an individual level personality-type construct and also differentiates from control-type personality dispositions like Need for Control. Thus, the implication for the field of entrepreneurship is that, irrespective of entrepreneurs' psychological or attitudinal dispositions, as effort is exerted in the creative process and attachment increases, a control orientation develops. In effect, control tendency, as described here, is essentially context-driven and depends on the relationship between the opportunity and its developer.

In terms of construct of psychological attachment, an attempt was made to study its dimensionality. Two theoretically-identified dimensions emerged, lending some statistical credibility to the notion that the construct may have a multidimensional scale. Positive affective states and self-identity-enhancing affective states seem to hold as two possible dimensions (among potential others not operationalized here). Results from testing the effects of the dimensions, individually, on control tendency, reported significant coefficients for the positive affective states but not for the self-identity-enhancing states. The indications are that, albeit the measurement errors in eliciting the latter, affective states that enhance self identity do not necessarily lead to control tendency. This result is intuitive because, an entrepreneur who highly identifies with the technology does not necessarily need to control the rights to the opportunity to reach his or her commercialization goals. In effect, the investigation of dimensionality for the

construct achieved one objective – determining the extent to which positive affective states determine psychological attachment. However, it also indicated that there is the need to further investigate the issue of dimensionality to determine other possible dimensions of the construct.

All in all, the issue is not whether it is rational for entrepreneurs to be attached to their ideas or to be control-oriented, but rather, the consequences excessive attachment and control present to the decision maker. As affect-based constructs, the effects of attachment and control tendency may be fleeting but are instrumental in entrepreneurial decision making because of the potential for unalterable rash decisions with grave economic consequences. For example, a control tendency in making decisions involving rapidly developing technologies can be extremely counter-productive and inefficient. Also, the spontaneity with which entrepreneurs react to their environment affords a fertile ground for affect-based constructs to play a part in their decisions. Baron (2008) notes that affect is likely to influence cognition and behaviour in entrepreneurial environments due to the unpredictability and rapid nature of change.

It may then be reasonable to suggest that the negative effects of psychological attachment and control tendency in response to signals from the microeconomic environment may play a role in rampant over-entry into markets and subsequent business failure. The reason is psychological attachment and control tendency promote self-commercialization and dissuades essential cooperation with outside parties. Thus, in cases where cooperation provides better prospects, entrepreneurs may over-enter or fail. Thus, this work on affective biases may go a long way to complement current research on cognitive biases in understanding entrepreneurial decision making and entrepreneurial failure.

For practitioners, the issue of interest is how to reduce the effects of psychological attachment. Although not tested in this study, methods to reduce attachment and therefore its consequences may include: educating entrepreneurs and promoting disengagement from the

opportunity, either through reduced interactions or deliberate psychological depersonalisation in the decision making process. Another issue is when to promote disengagement since psychological attachment may be needed to motivate the entrepreneur to persevere during the initial problem solving stages of the development process. Essentially, ways of de-biasing the decision-making process of highly-attached entrepreneurs will increase efficiency and performance. Further, from the regression results in this study, it appears assuring entrepreneurs of their expected personal gains will decrease their desire to control. Therefore, contracts that identify and assure entrepreneurs of their specific reward expectations may facilitate the transfer of control to outside parties, reduce information asymmetry and possibly increase performance.

There may also be the need for more efficient government intervention in safeguarding the intellectual property of smaller entrepreneurs as well as more efficient financing schemes. Entrepreneurs will be hesitant to collaborate with outside parties if highly attached to the opportunity and without the necessary safeguards and funds. This implies missed opportunities, inefficient capital formation, and the risk of stifling innovation. Therefore, public policy schemes aimed at ensuring the positive effects of psychological attachment and reducing its negative effects will be socially desirable.

## **6.2 Conclusion**

This thesis investigated the role psychological attachment to an entrepreneur's opportunity plays in decision making at the commercialization stage. Essentially, the thesis explored the dimensionality of psychological attachment; the relationship between psychological attachment as an affective construct and cognitive evaluation of the microeconomic

environment; the relationship between psychological attachment and control tendency; and the effects of psychological attachment on control preferences within a financing context.

Entrepreneurs, especially in technology, are noted for opportunistically taking an extemporized approach to strategy planning and implementation, considering potential revenue opportunities as they present themselves, rather than having a long term focus (Gans and Stern, 2003; Bhide, 2000). The implication is that affect-based constructs such as psychological attachment and control tendency cannot be ignored. This is especially so when these constructs have the potential to influence decisions, in major ways, given the extent of unpredictability in the entrepreneurial environment (Baron, 2008). The argument for the role of such constructs is more compelling considering transactions costs and market problems in designing a partnership contract with outside parties at the point of commercialization. Agency theory suggests the need to preserve control as a leverage point for coercing partners to put up mutually beneficial behaviour. For outside parties, it implies putting measures in place to control the rights to the opportunity. For the entrepreneur, it implies safeguarding the rights to the opportunity to avert or minimise opportunism and expropriation. A high level of psychological attachment will motivate the entrepreneur to avoid such outside parties or if they are unavoidable, resist elements of the partnership that threaten attachment to the idea.

The entrepreneur's resistance and hesitation to partner is still expected even if the outside party is in the position to contribute much needed resources to the commercialization effort and even if the entrepreneur cognitively realises the outsider's position. However, since psychological attachment is affect-based, the chances that the entrepreneur's fears are unnecessarily heightened are rather high. Likewise, the chances that the entrepreneur's evaluation of the micro-economic environment is biased are also high. Hence, a high level of attachment leads to biased perceptions and inefficient strategies. So, although attachment to the

opportunity might motivate the entrepreneur to persevere and also signal value to investors, attachment can also prevent the entrepreneur from effectively evaluating commercialization outcomes, choosing efficient market entry strategies and performing well.

Data collected from 106 fourth-year engineering design students from a top engineering-focused Canadian university, provided some interesting results. In the model estimated, the higher subjects' psychological attachment was to the opportunity the more control oriented they were. Subjects' perceived project value was statistically insignificant as a statistical control variable. The implication being that psychological attachment is a strong predictor of control tendency even when subjects' perceptions of projected returns (value) are controlled for. Also, perceived likelihood of achieving success through outside party assistance correlated negatively with control tendency. From correlational analysis, when subjects' psychological attachment increased, their level of cognitive evaluation of the microeconomic environment decreased even if they previously rated the project high. The indication is that, as an affect-laden construct, psychological attachment can lead to a decrease in objective, logical and cognitive evaluation of commercialization outcomes.

Further, alternative explanations for control tendency failed to hold as individual personality-type factors such as Emotion-Based Decision Making, Machiavellianism, Risk-Taking and Need for Control were not significant in explaining variability in control tendency. Control tendency may therefore be context-dependent, on attachment through a creative process, and not an individual level personality construct. Finally, analysis within a framework of financial decision making showed that although subjects rated the financier's management skills as highly critical for performance, they strongly preferred to control the rights to decision making on the project and thereby forfeit optimal financial offers. The results therefore provide insight into the role psychological attachment may play in forming behavioural tendencies during

important decision making stages of the entrepreneurship process. The results also provide insight into the implications of attachment- and control-oriented decision preferences for performance on the market, with particular emphasis on the role of affect in these preferences.

### **6.3 Limitations**

There are a number of limitations to this study. Fundamentally, this study is exploratory and will benefit from a well grounded empirical exercise involving actual entrepreneurs. Although the student sample used share characteristics with technology developers, they are not full-fledged entrepreneurs and therefore generalizability of the results under certain conditions might be limited. Further, the need to measure psychological attachment required sampling to be done in a group that had spent sometime developing entrepreneurial ideas. However, the development process could not be captured adequately and therefore certain history effects might exist in the results. It is a big challenge to secure access to a sample that develop new technology in a similar technological area or industry and are on the same stage of the development process. Therefore, there might be the need to control some aspects of the process to be able to collect data for analyses. However, an actual entrepreneur sample may be more conducive. Further, a study capturing the opportunity recognition as well as the development aspects of the process may provide a better understanding of the creative process and psychological attachment to the idea.

Lastly, the decision preferences measured were not actual decisions. Due to the circumstances of the sample, such as the opportunity being a school design project with stringent intellectual property safeguards to protect students ideas, it was not possible to observe and measure actual decisions. Thus, although intentions and tendencies to act may well predict actual

decisions and behaviour, the effects studied may be more appropriately unearthed if actual decisions are measurable.

#### **6.4 Contributions and Opportunities for Future Research**

However, in contributing to the research on the role of affect in entrepreneurship the study raises empirical questions that need further research. One such question is what role does psychological attachment play in commercialization strategy formulation in consideration of the intellectual property position and complementary asset needs of the venture? Since, this question forms a crucial part of the commercialization process, I devote a few paragraphs to it and then present short paragraphs on two other areas of future research.

*Formulating commercialization strategies* Innovation or the commercialization of new ideas is likely to require lateral, vertical and horizontal linkages. Successful commercialization, especially for entrepreneurs or start-ups, often needs to involve access to complementary assets that are not available within the organisation. In other words, without the necessary resources in-house, start-ups have little choice but to partner in restrictive contracts with outside parties to be able to successfully enter their target market. However, in these contracts the most important concern for the parties involved is appropriability – the ability to extract rents from the opportunity. Appropriability is most effectively ensured through formal and informal intellectual property (the degree of excludability). Hence, to realise fair appropriability terms, a commercialization strategy should find a good balance between issues of complementary assets and intellectual property protection (Teece 1986; Gans, Hsu and Stern, 2002; Gans and Stern, 2003; Arora and Ceccagnoli, 2006 and Hsu, 2006).

A high level of IP protection implies a high degree of excludability of parties with bad intentions. Therefore, when the degree of excludability increases the entrepreneur is expected to

gain confidence in the intellectual property protection and be willing to share information on the technology. This should be the case because entrepreneurs will be able to legally enforce their control over the rights to the opportunity and also command a stronger bargaining power. However, due to the perceived possibility of a loss of control over the idea and of expropriation in a contract, highly-attached entrepreneurs may rather want tighter control than loose control. This view is further supported by the fact that strong excludability signals value to the entrepreneur and therefore the desire to control the rights to the opportunity further increases as the perceived value increases. Hence with high excludability, the highly-attached entrepreneur may desire more control when expected to desire less.

In terms of complementary assets, cooperating with firms that own complementary assets seems to be an efficient strategy (Teece, 1986, Gans and Stern, 2003). Gans and Stern (2003) note that through cooperation, start-ups can avoid duplicative investment and thereby avoid sunken investment in complementary assets necessary for commercialization. However, Gans and Stern (2003) also note that firms with complementary assets are more likely to imitate the innovator. Entrepreneurs and start-ups typically do not have the knowledge, expertise and tact in choosing contracts that have proper safeguards to avert opportunism. Even when a seemingly appropriate outside party is located, there are still risks of opportunism present in the relationship. A common example is the “hold up” problem (Williamson, 1985; Levin, Klevorick, Nelson, and Winter, 1987). In a hold up situation, the partner firm might demand more of the quasi-rents of the joint effort. How will a highly-attached developer react to such situations? Due to the glaring power imbalance, the developer will be hesitant to sign any contract with the partnering firm if the terms are considered threatening to the rights to the idea. In other words, the perception of a possible future loss might retard a highly-attached developer’s progress in signing a contract even if the actual potential advantages loom large.

However, in reality, control preferences might be short-lived in conditions characterized by high excludability with complementary assets belonging to an outside party. As noted by Gans and Stern (2003), these market conditions provide the perfect opportunity to cooperate with outside parties to ensure a successful commercialization. So, considering that complementary assets often belong outside the start-up (Teece, 1986), entrepreneurs may have little choice but to partner with outside parties. However, there are possible cases where strong influence from psychological attachment and control preferences might motivate some developers to establish otherwise available complementary assets. That is, building manufacturing or distribution facilities when such facilities exist elsewhere and cooperating is the most efficient strategy. Examples are cases where failing start-ups refuse to outsource capabilities when it's more cost-effective to do so.

In effect, although developers are expected to heed to the requirements of the microeconomic environment when faced with commercialization challenges, a strong influence from psychological attachment and control, especially when decision making is on an ad-hoc basis, can spell dire consequences. Future research can aim to unearth effects of psychological attachment and control on commercialization strategies; to develop own venture, license, sell or pursue other options.

***Other research interests*** The issue of risk perception is another potential area for further research. The results in this study suggest risk perception may be guided by shifting reference points. Thus, control tendency may motivate self-commercialization as a result of the “push” situation where affect-led perceptions of loss of the opportunity drive the entrepreneurs to develop their own venture. However, self-commercialization to “safeguard” the opportunity denotes risk-aversion but could be more “risky” due to higher uncertainty. This scenario implies a simultaneous existence of gambling and insurance. Future studies could employ the prospect

theory framework (Khaneman and Tversky, 1979) or other frameworks that study the role of emotions in expected utility models (Caplin and Leahy, 2001) to better explain risk-seeking as well as risk-aversion in entrepreneurship.

Lastly, this study is in line with recent research attention on the role of affect in opportunity recognition (Baron, 1998, 2006b, 2008). Research in this area may also consider psychological “by-products” of the entrepreneurship process such as psychological attachment and its effects. A thorough scale development process to empirically test and validate antecedents and dimensionality of psychological attachment will provide a useful measure for further studies. Further, there is the need to identify potential mediators and moderators impacting the relationship between psychological attachment and control tendency. For instance, it will be interesting to investigate the moderating effects of psychological attachment (as an affective construct) on the relationship between micro-level factors (such as optimism and self-efficacy) and new venture performance. Baron (2008) urges researchers to investigate the mediating role of affect in the relationship between individual-level (or micro-level) variables and macro-level variables. There is great research potential for affect and affective constructs.

Below is a list of possible future issues or questions to study, related to the concepts unearthed here.

#### **Areas of Application for Research on Control Orientation and Psychological Ownership**

1. The role of control tendency in the transfer of management oversight from owner-managers to more qualified personnel
2. The role of control tendency in the transfer of responsibilities from CEO's at any point in time
3. The role of psychological ownership in how effective employed engineers are in preparing complete manuals on their inventions to prevent others from “reinventing the wheel”
4. The role of psychological ownership in the effectiveness of transitioning between products for product champions
5. The extent to which psychological ownership can help explain the Not Invented Here or the Invented Here syndromes
6. The effect of control tendency on the performance of employed inventors as compared to

independents

7. The role of psychological ownership on the performance or turnover of employees whose creative solutions are subverted.
8. The effect of control tendency on tenured researchers of academic faculty and their willingness to collaborate
9. The effect of control tendency on the choice of commercialization options in tight and loose appropriability regimes (Teece, 1986, 1998), across countries, cultures, regions etc.
10. The role of control tendency in different licensing agreements
11. The effect of control tendency on complete vs. incomplete contracts
12. The effect of control tendency on performance of agents considering different allocation mix for control rights in venture capital contracts
13. The role of control tendency in the commercialisation decisions of VC-backed vs. non-VC-backed technology. Are non-VC-backed developers missing market opportunities simply because of threat-related emotional reactions towards the VC structure?
14. The role of subjective probability estimates in the development of the control tendency

## References

- Acs Z. and D. Audretsch, D. (2005) *Handbook of Entrepreneurship Research* Springer Verlag, New York.
- Afifi, A. A. and Clark, V. (1990) *Computer-Aided Multivariate Analysis* New York, NY: Van Nostrand Reinhold.
- Aghion, P. and Tirole, J. (1994) On the management of innovation. *Quarterly Journal of Economics*, 109:1185-1207.
- Aguinis, H. (1995). Statistical power problems with moderated multiple regression in management research. *Journal of Management*, 21, 1141–1158.
- Aiken, L. S. and West, S. G (1991), *Multiple Regression: Testing and Interpreting Interactions*, Newbury Park, CA: SAGE Publications.
- Allais, M. (1953) Le comportement de l'homme rationnel devant le risque: critique des postulats et axiomes de l'école Américaine, *Econometrica* 21, 503–46.
- Amabile, T. M. (1983) *The social psychology of creativity*. New York, Springer-Verlag.
- Anastasi, A., and Urbina S. (1997). *Psychological testing* (7<sup>th</sup> ed). New York: McMillian.
- Anastasi, A. (1986). Evolving concepts of test validation. *Annual Review of Psychology*, 37:1-15
- Anton, J.J. and Yao, D. (1994). Expropriation and inventions: Appropriable rents in the absence of property rights *American Economic Review* 84: (1):190-209
- Anton, J.J. and D. Yao (1995), Start-ups, Spin-offs, and Internal Projects, *Journal of Law Economics and Organization*, 11: 362-378.
- Arabshabani, G.D., de Meza, D., Maloney, R.J and Pearson, B. (2000) And a vision appeared unto them of a great profit: evidence of self- deception among the self-employed. *Economic Letters* 67: 35–41.
- Ariely, D. and Simonson, I. (2003). Buying, bidding, playing, or competing? Value assessment and decision dynamics in online auctions, *Journal of Consumer Psychology*, 13: 113-123
- Ariely, D. Huber, J. and Wertenbroch, K. (2005). When do losses loom larger than gains? *Journal of Marketing Research* 42: 134-38
- Arora, A. and Ceccagnoli, M. (2006) Patent protection, complementary assets and firms: incentives for technology licensing. *Management Science*, 52:293–308
- Arrow, K. J. (1962) Economic welfare and the allocation of resources for invention. In Richard R. Nelson (ed.), *The Rate and Direction of Inventive Activity: Economic and Social Factors*, National Bureau of Economic Research, Conference Series, p. 609-625 Princeton: Princeton University Press.
- Arrow, K. J. (1963). Uncertainty and the welfare economics of medical care. *American Economic Review*. 53 (5): 941-973.
- Åstebro, T. (2003) The return to independent invention: evidence of unrealistic optimism, risk seeking or skewness loving? *Economic Journal*, 113(484):226-239.
- Åstebro, T., Jeffrey, S. A., and Adomdza, G. 2007. Inventor Perseverance after being told to quit: The role of cognitive biases. *Journal of Behavioural Decision Making* 20(3): 253-272
- Attig N., Fong W-M., Gadhoum Y., and Lang L. (2004) *Effects of Large Shareholding on Information Asymmetry and Stock Liquidity*, Working Paper, Chinese University of Hong Kong.
- Averill, J. R. (1973) Personal control over aversion stimuli and its relationship to stress *Psychological Bulletin* 80: 286 – 303.
- Bandura, A. (1977) *Social learning theory*. Englewood Cliffs, NJ: Prentice-Hall
- Bandura, A. (1986) *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, New Jersey: Prentice-Hall.
- Barchard, K. A. (2001) *Emotional and social intelligence: Examining its place in the nomological network*. Unpublished doctoral dissertation, University of British Columbia, Canada
- Barnes, J. H., Jr. (1984) Cognitive biases and their impact on strategic planning. *Strategic Management Journal* 5:129-137.
- Baron, R. A. (1998) Cognitive mechanisms in entrepreneurship: why and when entrepreneurs think differently than other people. *Journal of Business Venturing* 13: 275–294.

- Baron, R.A. (2000) Counterfactual thinking and venture formation: the potential effects of thinking about what might have been. *Journal of Business Venturing*, 15(1):79-92.
- Baron, R. A. (2004) The cognitive perspective: a valuable tool for answering entrepreneurship's basic "why" questions" *Journal of Business Venturing*, 19(2):221-239
- Baron, R.A. (2006a) *Opportunity recognition as pattern recognition: How entrepreneurs "connect the dots" to identify new business opportunities*. *Academy of Management Perspectives*, 20 (1): 104-119.
- Baron, R. A. (2006b) *Affect and entrepreneurial cognition: how feelings shape thought during the entrepreneurial process*. Paper presented at the annual meeting of Academy of Management, Atlanta, Georgia. Aug 11-16, 2006. <http://meetings.aomonline.org/2006>
- Baum, J. R., and Locke, E. A. (2004) The Relationship of Entrepreneurial Traits, Skills, and Motivation to Subsequent Venture Growth, *Journal of Applied Psychology*, 89(4), 587-598
- Bebchuk, L., Kraakman, R., Triantis, G., (2000). Stock Pyramids, Cross-Ownership, and Dual Class Equity: The Creation and Agency Costs of Separating Control From Cash Flow Rights. In: R. Morck, eds., *Concentrated Corporate Ownership*. Chicago: University of Chicago Press
- Bechara, A., Damasio, H., Damasio, A.R., Lee, G.P., (1999) Different contributions of the human amygdala and ventromedial prefrontal cortex to decision-making. *Journal of Neuroscience*. 19 (13), 5473–5481.
- Bell, D.E. (1982). Regret in decision making under uncertainty. *Operations Research*, 30: 961–981.
- Bell, D. E. (1985). Disappointment in decision making under uncertainty. *Operations Research*, 33: 1-27.
- Ben-Amar, W. and André, P., (2006) Separation of Ownership from Control and Acquiring Firm Performance: The Case of Family Ownership in Canada *Journal of Business Finance and Accounting*, 33(3-4): 517-543
- Benartzi, S., and Thaler, R. H. (1995) Myopic Loss Aversion and the Equity Premium Puzzle, *Quarterly Journal of Economics* 110: 73-92.
- Bennett-Goleman, T. (2001) *Emotional alchemy: how the mind can heal the heart*. New York: Harmony Books
- Berggren, B., Olofsson, C. and Silver, L., (2000) Control aversion and the search for external financing in Swedish SMEs. *Small Business Economics*, 15 (3): 233-242.
- Berle, A. and Means, G. (1932). *The Modern corporation and private property*. New York: Macmillan.
- Bhide, A (2000). *The origin and evolution of new businesses*, New York (NY): Oxford University Press
- Blaney, P.H., (1986). Affect and memory: a review. *Psychological Bulletin*. 99: 229–246.
- Boer, H., and Seydel, E.R. (1996) Protection motivation theory. In M. Connor and P. Norman (Eds.) *Predicting Health Behaviour*. Buckingham: Open University Press.
- Bower, G. H., and Cohen, P. R. (1982). Emotional influences in memory and thinking: Data and theory. In M. S. Clark and S. T. Fiske (Eds.), *Affect and cognition*. The 17th Annual Carnegie Symposium on Cognition (pp. 291-331). Hillsdale, NJ: Erlbaum.
- Bowden, E. M., Jung-Beeman, M., Fleck, J. and Kounios, J. (2005) New approaches to demystifying insight. *Trends in Cognitive Sciences*, 9, 322-328.
- Bowlby, J. (1969) *Attachment and loss*, Vol. 1: *Attachment*. New York: Basic Books.
- Bowlby, J. (1973). *Attachment and loss: Vol.2, Separation*. New York: Basic.
- Bozec, Y. and C. Laurin (2004) Concentration des droits de propriété, distribution des droits de vote and performance opérationnelle des sociétés: une étude canadienne *Finance Contrôle Stratégie* 7(2): 123-164
- Branzei, O., and Zietsma, C. (2004) Temporary cognitions of entrepreneurial love: dancing with the opportunity. In W.D. Bygrave, C.G. Brush, P.Davidsson, J. Fiet, P.G. Green, R.T. Harrison, M. Lerner, G.D. Meyer, J. Sohl, A. Zacharakis (Eds), *Frontiers of Entrepreneurship Research*, Wellesley, MA, 620-633.
- Brockhaus, R. H. (1980). Risk taking propensity of entrepreneurs. *Academy of Management Journal*.

23(3), 509-520

- Bromiley, P. and Cummings, L.L. (1995) Transaction costs in organizations with trust. In R. Bies, B. Sheppard, and R. Lewicki (eds.), *Research on negotiations in organizations*, vol. 5. Greenwich CT: JAI press, 219-247
- Brown, S. L., and Eisenhardt, K. M. (1995) Product Development: Past Research, Present Findings, and Future Directions *Academy of Management Review* (20): 343-379.
- Browne, M. J., and Hoyt, R. E. (2000). The demand for flood insurance: empirical evidence. *Journal of Risk and Uncertainty*, 20: 271-289.
- Burger, J. M. (1989) Negative reactions to increases in perceived personal control. *Journal of Personality and Social Psychology* 52:246 -256
- Burke, P. J. and Reitzes, D. C. (1991) An identity theory approach to commitment. *Social Psychology Quarterly*, 54(3): 239-251.
- Burmeister, K. and Schade, C. (2007) Are entrepreneurs' decisions more biased? An experimental investigation of the susceptibility to status quo bias *Journal of Business Venturing* 22: 340– 362
- Busenitz, L. W., and Lau, C. M. (1996) A cross-cultural cognitive model of new venture creation. *Entrepreneurship: Theory and Practice*, 20(4): 25-39
- Callero, P. L., Howard, J. A., and Piliavin, J. A. (1987). Helping behavior as role behaviour: Disclosing social structure and history in the analysis of prosocial action. *Social Psychology Quarterly*, 50(3): 247-256.
- Camerer, C. and Lovallo, D. (1999) Overconfidence and excess entry: an experimental approach *American Economic Review* 89: 306-318.
- Camerer, C.F. Loewenstein, G. and Rabin, M. (2004) Behavioural economics: past, present, future. In: Camerer, Loewenstein, and Rabin (eds.): *Advances in Behavioral Economics*. Chapter 1: 3-51. Princeton, N.J: Princeton Univ. Press
- Campbell, D. T. and Stanley, J. C. (1963) *Experimental and quasi-experimental designs for research*. Chicago: Rand McNally
- Caplin, A. and Leahy, J. (2001) Psychological expected theory and anticipatory feelings. *Quarterly Journal of Economics* 116(1): 55-80.
- Cardon, M., Zietsma, C., Saparito, P., Matherne, B. and Davis, C. (2005) A tale of passion: new insights into entrepreneurship from a parenthood metaphor. *Journal of Business Venturing*, 20(1): 23-45.
- Carmon, Z., Wertenbroch, K. and Zeelenberg, M. (2003) Option attachment: When deliberating makes choosing feel like losing. *Journal of Consumer Research*, 30:15-29.
- Carver, C. S. (2001). Affect and the functional bases of behavior: On the dimensional structure of affective experience. *Personality and Social Psychology Review*, 5: 345–356.
- Catherall, D. R. (2003) How fear differs from anxiety *Traumatology*, 9 (2): 76-92
- Center for Venture Research (2005) Whittemore School of Business and Economics at the University of New Hampshire, <http://www.unh.edu/cvr/>
- Christie, R. and Geis, F. (1970) *Studies in machiavellianism* New York: Academic Press
- Clore, G. L. (1992) Cognitive phenomenology: Feelings and the construction of judgment. In L. L. Martin and A. Tesser (Eds.), *The construction of social judgments* pp. 133-163. Hillsdale, NJ: Erlbaum.
- Coelho, M., de Meza, D. and Reyniers, D. (2004) Irrational exuberance, entrepreneurial finance, and public policy. *International Tax and Public Finance* 11: 391–417.
- Cohen, J., Cohen, P., West, S. G., and Aiken, L. S. (2003). Applied multiple regression/correlation analysis for the behavioral sciences, Third Edition. Mahwah, NJ: Earlbaum.
- Colyvas, J., Crow, M., Gelijns, A., Mazzoleni, R., Nelson, R. R., Rosenberg, N., and Sampat, B. N. (2002) How do university inventions get into practice? *Management Science*, 48(1):61-72.
- Cook, T. D. and Campbell, D. T. (1979) *Quasi-experimentation: design and analysis issues for field settings*. Boston: Houghton-Mifflin.
- Cooper, A. C., Woo, C. Y., and Dunkelberg, W. C. (1988) Entrepreneurs' perceived chances for success. *Journal of Business Venturing*, 3: 97-108.

- Crane F. G. and Crane, E. C (2007) Dispositional Optimism and Entrepreneurial Success The *Psychologist-Manager Journal*, 10(1):13 - 25
- Cressy, R. (1995) Business Borrowing and Control: A Theory of Entrepreneurial Types, *Small Business Economics* 7(3):291–300.
- Cressy, R. and Olofsson, C., (1997), The financial conditions for Swedish SMEs: Survey and research agenda. *Small Business Economics*, 9: 179-192
- Crocker, L. and Algina, J. (1986) *Introduction to Classical and Modern Test Theory*. New York: Holt, Rinehart and Winston
- Cromie, S., and Johns, S. (1983) Irish entrepreneurs: Some personal characteristics. *Journal of Organizational Behavior* 4 317-324
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297-334.
- Cronbach, L.J. (1971). Test validation. In R.L. Thorndike (Ed.), *Educational measurement* (2<sup>nd</sup> ed., pp. 443-507). Washington, DC: American Council on Education.
- Csikszentmihalyi, M. (1990) *Flow: the psychology of optimal experience*. New York: Harper and Row.
- Csikszentmihalyi, M. (1996) *Creativity: Flow and the psychology of discovery and invention*. New York: HarperCollins Publishers, Inc.
- Csikszentmihalyi, M. (1997) *The evolving self: a psychology for the third millennium*. Cambridge: Cambridge University Press
- Cudeck, R., and Browne, M. W. (1983). Cross-validation of covariance structures. *Multivariate Behavioral Research*, 18(4), 147-167.
- Cuthbert, B. N., Lang, P. J., Strauss, C., Drobles, D., Patrick, C. J. and Bradley, M. M. (2003) The psychophysiology of anxiety disorder: Fear memory imagery *Psychophysiology*, 40 (3): 407–422.
- Dacey, John S. and Kathleen H. Lennon. (1998) *Understanding Creativity: The Interplay of Biological, Social and Psychological Factors*. San Francisco: Jossey-Bass.
- Damasio, A.R. (1994) *Descartes' error: emotion, reason, and the human brain*. New York: .G.P. Putnam's Sons.
- Das, T.K., and Teng, B.S. (1998) Between trust and control: Developing confidence in partner cooperation in alliances. *Academy of Management Review* 23(3): 491-512
- Dasgupta, P., (1988) Trust as a commodity in D. Gambetta (ed), *Trust: Making and Breaking Cooperative Relations*, Oxford: Basil Blackwell: 49-72
- Dasgupta, P. (2003). Social capital and economic performance: Analytics. In E. Ostrom and T. K. Ahn (Eds.), *Foundations of Social Capital. Critical Studies in Economic Institutions*, vol. 2. pp. 309–39. Cheltenham: Edward Elgar.
- deCharms, R (1968) *Personal causation: the internal affective determinants of behaviour*. New York: Academic Press
- Deci, E. L. 1975. *Intrinsic motivation*. New York: Plenum.
- Deci, E., Koestner, R., and Ryan, R. (2001) Extrinsic Rewards and Intrinsic Motivation in Education: Reconsidered Once Again. *Review of Educational Research* 71 (1): 1-27
- Derakshan, N., and Eysenck, M. W. (1997). Interpretive biases for one's own behaviour and physiology in high-trait-anxious individuals and repressors. *Journal of Personality and Social Psychology*, 73: 816-825.
- DeSteno, D., Petty, R.E., Wegener, D.T., and Rucker, D.D. (2000). Beyond valence in the perception of likelihood: the role of emotion specificity. *Journal of Personality and Social Psychology*, 78: 397-416.
- DeVellis, R. F. (1991). *Scale development: Theory and applications*. Newbury Park, CA: Sage.
- Dhar, R. and Wertenbroch, K. (2000). Consumer choice between hedonic and utilitarian goods. *Journal of Marketing Research*, 37: 60-71
- Drucker, P.K. (1970) Entrepreneurship in the business Enterprise. *Journal of Business Policy* 1 (1): 3 – 12.

- Dunne, T., Roberts, M. J. and Samuelson, L. (1988) Patterns of Firm Entry and Exit in U.S. Manufacturing Industries. *Rand Journal of Economics* 19 (4):495-515.
- Dyck, A. and Zingales, L. (2004) Private benefits of control: an international comparison. *Journal of Finance*, 59(2):537-600.
- Dyer, J. H. and Chu, W. (2003) The Role of Trustworthiness in Reducing Transaction Costs and Improving Performance: Empirical Evidence from the United States, Japan, and Korea. *Organization Science* 14(1): 57-68.
- Eckhardt, J., S. Shane (2003) Opportunities and Entrepreneurship. *Journal of Management*. 29 333-349
- Eisenhardt, K.M. (1989) Building theories from case study research. *Academy of Management Review* 16 (3), 620-627
- Ellsberg, D. (1961) Risk, Ambiguity, and the Savage Axioms *Quarterly Journal of Economics* 75: 643-669.
- Elster, J.(1996) Rationality and the Emotions *The Economic Journal* 106: 1386-1397
- Elster, J. (1998) Emotions and Economic Theory *Journal of Economic Literature* XXXVI, 47-74
- Evans, D. S. and Leighton, L. S. (1989) Some Empirical Aspects of Entrepreneurship, *American Economic Review*, 79:3, 519-535
- Eysenck, M. W. (1992) *Anxiety: the cognitive perspective*. Hove, England: Erlbaum.
- Eysenck, M. W., MacLeod, C., and Matthews, A. (1987) Cognitive functioning and anxiety. *Psychological Research*, 49: 189-195.
- Fairbairn, W. R. D. (1952) *An object-relations theory of the personality*. New York: Basic Books.
- Feeney, L. G.H. Haines, and Riding, A.L. (1999) Private investors' investment criteria: insights from qualitative data. *Venture Capital* 1 (2): 121-145
- Fiet J.O. (1995) Risk avoidance strategies in venture capital markets. *Journal of Management Studies*, 32 (4): 551-574.
- Fontes, M. and Coombs, R. (2001) Contribution of New Technology-Based Firms to the Strengthening of Technological Capabilities in Intermediate Economies. *Research Policy* 30: 79–97.
- Forbes, D. P. (2005) Are some entrepreneurs more overconfident than others? *Journal of Business Venturing*. 20 (5): 623-640
- Forgas, J. P. (1995) Mood and judgment: The affect infusion model. *Psychological Bulletin*, 117, 39–66.
- Fornell C.D., and Larcker F. (1981) Evaluating structural equation models with unobservable variables and measurement errors. *Journal of Marketing Research*; 18: 39-50.
- Freear, J., Sohl, J. E. and Wetzel, W. (2002) Angles on angels: financing technology-based ventures – a historical perspective *Venture Capital*, 4 (4): 275-287
- Frijda, N. (1986) *The emotions*. Cambridge: Cambridge University Press.
- Furubotn, E. G. and Pejovich, S. (1974) *The economics of property rights*. Cambridge, MA: Ballinger
- Gans, J. S. and Stern, S. (2003) The product market and the market for ideas: commercialization strategies for technology entrepreneurs. *Research Policy* 32: (2) 333 – 350
- Gans, J.S., Hsu, D. and Stern, S. (2002) When does start-up innovation spur the gale of creative destruction? *RAND Journal of Economics*, 33 (4):.571-586.
- Gazzaniga, M.S. (1988) Transcript of interview from The infinite voyage: Fires of the mind, a production of WQED/Pittsburg and The National Academy of Sciences. Kent, OH: PTV Publications.
- George, G., Jain, S. and Maltarich, M. A. (2005) Academics or Entrepreneurs? Entrepreneurial Identity and Invention Disclosure Behavior of University Scientists Available at SSRN: <http://ssrn.com/abstract=799277> accessed Oct 14, 2007
- Gilad, B. (1982) On encouraging entrepreneurship: An interdisciplinary analysis, *Journal of Behavioural Economics* 11(1):132-163
- Gneezy, U. and Potters, J. (1997) An experiment on risk taking and evaluation periods, *Quarterly Journal of Economics*, 112: 631-645

- Gorsuch, R.L. (1983) *Factor analysis* (2nd ed.). Hillsdale, NJ: Erlbaum.
- Gray, B. and Ariss, S. 1985. Politics and change across organizational life cycles. *Academy of Management Review*, 10 (6): 707-723.
- Grossman, S. J. and Hart, O. D. (1986) The costs and benefits of ownership: a theory of vertical and lateral integration. *Journal of Political Economy* 94(4):691–719.
- Guilford, J.P. (1967) *The Nature of Human Intelligence*. New York: McGraw-Hill
- Hart, O. and Holmström, B. (1987) The theory of contracts. In Truman F. Bewley. (ed) *Advances in Economic Theory*. Fifth World Congress. Cambridge: Cambridge University Press
- Hart, O. and Moore, J. (1990) Property rights and the nature of the firm. *Journal of Political Economy*, 98(6): 1119-1158.
- Hart, O. 1995. *Firms, contracts, and financial structure*. Oxford: Clarendon Press.
- Hazen, C. and Shaver, P. (1987) Romantic love conceptualized as an attachment process. *Journal of Personality and Social Psychology*, 52: 511-524.
- Heckhausen, J., and Schulz, R. (1995). A life-span theory of control. *Psychological Review*. 102, 284-304
- Hillier, B. and Ibrahim M.B. (1993). Asymmetric information and models of credit rationing. *Bulletin of Economic Research* 45(4): 271-304.
- Hoang, H. T. and Gimeno, J. (2007) Becoming a Founder: How Founder Role-Identity Affects Entrepreneurial Transitions and Persistence in Founding. INSEAD Business School Research Paper No. 2007/46/EFE/ST Available at SSRN: <http://ssrn.com/abstract=1021739>
- Hoelter, J. W. (1983) The Effects of Role Evaluation and Commitment on Identity Salience *Social Psychology Quarterly*, 46: 140-147.
- Hsee, C. K., and Weber, E. U. (1997) A fundamental prediction error: Self—other discrepancies in risk preference. *Journal of Experimental Psychology: General*, 126: 45-53.
- Hsu, D. (2006) Venture capitalists and cooperative start-up commercialization strategy. *Management Science*, 52: 204-219
- Hytti, U. (2000) The concept of identity and its relevance for entrepreneurship research A paper presented at the RENT XIV Conference in Prague, Czech Republic, November 23-24, 2000. Published in RENT XIV Research and Entrepreneurship and Small Business Proceedings (EIASM and ECSB)
- IPIP (2001) International Personality Item Pool: A Scientific Collaboratory for the Development of Advanced Measures of Personality Traits and Other Individual Differences (<http://ipip.ori.org/>). Internet Web Site Accessed June 30, 2007
- Isen, A. M. (1990) The Influence of Positive and Negative Affect on Cognitive Organization: Some Implications for Development. In *Psychological and Biological Approaches to Emotion*. N.L. Stein, B. Leventhal, T. Trabasso (eds.). Hillsdale, NJ: Erlbaum.
- Isen, A. M., and Baron, R. (1991) Positive Affect as a Factor in Organizational Behavior. In *Research in Organizational Behavior*. L.L. Cummings and B.M. Staw (eds.). Greenwich, CT: JAI Press.
- Isen, A. M., and Means, B. (1983). The influence of positive affect on decision-making strategy. *Social Cognition*, 2: 18-31
- Isen, A. M., and Patrick, R. (1983) The effect of positive feelings on risk taking: When the chips are down. *Organizational Behaviour and Human Decision Processes*, 31: 194–202.
- Isen, A. M., Kimberley A. Daubman, and Gary P Nowicki. (1987) Positive Affect Facilitates Creative Problem Solving. *Journal of Personality and Social Psychology* 52(6):1122-1131
- Jackson, D., Hournay, L., and Vidmar, N. (1972) A four-dimensional interpretation of risk taking. *Journal of Personality*, 40: 483-501.
- Jackson, D. N. (1994). *Jackson personality inventory-revised manual*. Port Huron, MI: Sigma Assessment Systems
- Jensen, M.C., and W.H. Meckling, (1976), Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure. *Journal of Financial Economics*, 3: (4): 305-360.
- Jensen, R., and Thursby, M. (2001) Proofs and Prototypes for Sale: The Licensing of University

- Inventions. *American Economic Review*, 91 (1): 240-259.
- Johnson, E. J., and Tversky, A. (1983) Affect, generalization, and the perception of risk. *Journal of Personality and Social Psychology*, 45: 20-31.
- Judd, C. M., Smith, E. R. and Kidder, L. H. (1991) *Research methods in social relations* (6th ed.). Fort Worth, TX: Holt, Rinehart and Winston
- Jung, C. G., and Baynes, H. G. (1921). *Psychological Types, or, The Psychology of Individuation*. London: Kegan Paul Trench Trubner.
- M. Jung-Beeman, E.M. Bowden, J. Haberman, J.L. Frymiare, S. Arambel-Liu, R. Greenblatt, P.J. Reber, J. Kounios, (2004) Neural Activity When People Solve Verbal Problems with Insight. *PLoS Biol* 2(4): e111,
- Kahneman, D., and Ritov, I. 1994. Determinants of stated willingness to pay for public goods: a study in the headline method. *Journal of Risk and Uncertainty*, 9: 5-38.
- Kahneman, D. and Tversky, A. (1973) On the psychology of prediction. *Psychological Review*, 80: 237-251
- Kahneman, D., and Tversky, A. (1979) Prospect theory: an analysis of decision under risk. *Econometrica*, 47: 263-291.
- Kahneman, D., and Tversky, A. (1996) On the reality of cognitive illusions: A reply to Gigerenzer's critique. *Psychological Review*, 103:582-591.
- Kahneman, D. and Shane F. (2002) Representativeness Revisited: Attribute Substitution in Intuitive Judgment, in *Heuristics and Biases: The Psychology of Intuitive Judgment*, eds. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, New York, NY: Cambridge University Press, 48 – 81.
- Kahneman, D., Knetsch, J.K., and Thaler, R.H. (1990) Experimental tests of the endowment effect and the Coase Theorem. *Journal of Political Economy*. 98(6):1325-1348.
- Kahneman, D., Knetsch, J.K., and Thaler, R.H. (1991) Anomalies: the endowment effect, loss aversion, and status quo bias. *Journal of Economic Perspectives*, 5(1):193–206.
- Kahneman, D., Ritov, I., and Schkade, D. (1999) Economic preferences or attitude expressions? An analysis of dollar responses to public issues. *Journal of Risk and Uncertainty*, 19: 203-237.
- Kahneman, D., Schkade, D. A., and Sunstein, C. R. (1998) Shared outrage and erratic awards: the psychology of punitive damages. *Journal of Risk and Uncertainty*, 16: 49-86.
- Kaplan, S. and Stromberg, P. (2003) Financial contracting theory meets the real world: an empirical analysis of venture capital contracts. *Review of Economic Studies*, 70(2): 281-315
- Keltner, D., Ellsworth, P. C., and Edwards, K. (1993). Beyond simple pessimism: Effects of sadness and anger on social perception. *Journal of Personality and Social Psychology*, 64: 740-752
- Kenning, P., Mohr, P., Erk, S., Walter, H. and Plassmann, H. (2006) The role of fear in home-biased decision making: First insights from neuroeconomics. MPRA Paper 1076, University Library of Munich, Germany, revised 18 Nov 2006. [http://mpra.ub.uni-muenchen.de/1076/01/MPRA\\_paper\\_1076.pdf](http://mpra.ub.uni-muenchen.de/1076/01/MPRA_paper_1076.pdf)
- Kim, J O and Mueller, C W (1978) *Factor analysis: statistical methods and practical issues*. *Quantitative Applications in the Social Sciences Series*, No. 14. Thousand Oaks, CA: Sage Publication.
- Kleine, R. E., III and Kleine, S. S. (2000) Consumption and Self-Schema Changes Throughout the Identity Project Life Cycle, in *Advances in Consumer Research*, Vol 27, eds. Robert J. Meyer and Stephen Hoch, Provo, UT: Association for Consumer Research, 279-285.
- Koriat, A., Lichtenstein, S. and Fischhoff, B. (1980) Reasons for Confidence, *Journal of Experimental Psychology: Human Learning and Memory* 6: 107-118.
- Krueger, N. (2000) The cognitive infrastructure of opportunity emergence, *Entrepreneurship Theory and Practice*, 24(3), 5-23
- Kunda, Z. (2001) The case for motivated reasoning. *Psychological Bulletin*, 108(3): 480-498.
- Kunreuther, H., Ginsburg, R., Miller, L., Sagi, P., Slovic, P., Borkan, B., and Katz, N. (1978) *Disaster insurance protection: public policy lessons*. New York: Wiley.
- Landier, A. and Thesmar, D. (2004) *Financial contracting with optimistic entrepreneurs: theory and evidence*. Mimeo, New York University and HEC, Paris.

- Landström, H. and Winborg, J. (1995) Small business managers' attitudes towards and use of external financial sources. In W.D. Bygrave et al. (eds.). *Frontiers of Entrepreneurship Research* (pp 172-186). Center for Entrepreneurial Studies. Babson College.
- Lang, P.J., Bradley, M.M., and Cuthbert, B.N., (1999) International affective picture system (IAPS): instruction manual and affective ratings. *Technical Report A-4*, The Center for Research in Psychophysiology, University of Florida.
- Lang, P.J., Bradley, M.M., and Cuthbert, B.N. (1999). *International Affective Picture System (IAPS): Technical manual and affective ratings*. Gainesville, FL: Center for Research in Psychophysiology.
- Lazarus, R. S. (1991) *Emotion and adaptation*. New York: Oxford University Press.
- LeDoux, J. (1996) *The emotional brain*. New York: Simon and Schuster.
- LeDoux, J. (1998) Fear and the brain: where have we been, and where are we going? *Biological Psychiatry*, 44 (12): 1229-1238.
- Lerner, J. S. and Keltner, D. (2000) Beyond valence: toward a model of emotion-specific influences on judgment and choice. *Cognition and Emotion*, 14: 473-494.
- Lerner, J.S., and Keltner, D. (2001) Fear, anger, and risk. *Journal of Personality and Social Psychology*, 81: 146-159.
- Lerner, J.S., Gonzalez, R.M., Small, D.A. and Fischhoff, B. (2003) Effects of fear and anger on perceived risks of terrorism. *Psychological Science*, 14: 144-150.
- Lerner J.S., Small D.A., and Loewenstein G. (2004) Heart strings and purse strings: carryover effects of emotions on economic decisions. *Psychological Science*, 15(5): 337-341
- Levenson, R. W. (1999) The intrapersonal functions of emotion. Special issue: Functional accounts of emotion, *Cognition and Emotion*. 13: 481-504.
- Levin, R. C., Klevorick, A. K., Nelson, R. R. and Winter, S. G. (1987) Appropriating the Returns from Industrial Research and Development. *Brookings Papers on Economic Activity* 3 : 783- 831
- Lichtenstein, S. and Slovic, P. (1971) Reversals of Preference Between Bids and Choices in Gambling Situations, *Journal of Experimental Psychology*, 89: 46-55.
- Lieberman, M. B. and Montgomery, D. B. (1988) First-mover advantages. *Strategic Management Journal*, 9: 41-58.
- Lo, A. W., Repin, D. V., and Steenbarger, B. N. (2005). Fear and greed in financial markets: A clinical study of day-traders. *American Economic Review*, 95(2): 352-359
- Locke, J. (1691) Some Considerations on the consequences of the Lowering of Interest and the Raising of the Value of Money Rod Hay's Archive for the History of Economic Thought, McMaster University, Canada <http://socserv2.socsci.mcmaster.ca/~econ/ugcm/3113/index.html>
- Loewenstein, G. (1996) Out of control: visceral influences on behaviour *Organizational Behaviour and Human Decision Processes* 65(3): 272-292
- Loewenstein, G. F., Weber, E.U., Hsee, C. K., and Welch, E. S. (2001) Risk as feelings. *Psychological Bulletin*, 127(2): 267-286.
- Loomes, G. and Sugden, R. (1982) Regret theory: an alternative theory of rational choice under uncertainty. *Economic Journal* 92: 805-24.
- Loomes, G. and Sugden, R. (1987) Some implications of a more general form of regret theory. *Journal of Economic Theory* 41: 270-87
- Lowe, R.A. and Ziedonis, A.A. (2006) Over-optimism and the performance of entrepreneurial firms, *Management Science*, 52 (2): 173-186
- Puri, Manju and Robinson, David T. (2007) Optimism and Economic Choice. *Journal of Financial Economics* 86(1): 71-99
- Mason, C.M. and R.T. Harrison (1996), Informal venture capital: a study of the investment process and post-investment experience, *Entrepreneurship and Regional Development*, 8 (2):105-126
- Masters, R. A. (2000). Compassionate Wrath: Transpersonal Approaches to Anger. *The Journal of Transpersonal Psychology*, 32(1): 31-51
- Mellers, B. A., Schwartz, A., Ho, K., and Ritov, I. (1997) Decision affect theory: emotional reactions to the outcomes of risky options. *Psychological Science*, 8: 423-429.

- Mellers, B., Schwartz, A., and Ritov, I. (1999) Emotion-based choice. *Journal of Experimental Psychology: General*, 128: 332-345.
- Mikels, J. A., Fredrickson, B., Larkin, G. R., Lindberg, C. M., Maglio, S. J., and Reuter-Lorenz, P. A. (2005) Emotional category data on images from the International Affective Picture System *Behaviour Research Methods*, 37(4): 626-630.
- Mikulincer, M., and Shaver, P. R. (2003). The attachment behavioral system in adulthood: Activation, psychodynamics, and interpersonal processes. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 35). New York: Academic Press.
- Mintzberg, H. (1984) Power and organization life cycles. *Academy of Management Review*, 9(2): 207-224.
- Moneytree Report (2006) Downloaded from “www.pwcmoneytree.com” on 10 Jan. 2008.
- Müller, E. (2007) Benefits of control, capital Structure and company growth, *Applied Economics*, forthcoming
- Nenova, T. (2003) The value of corporate voting rights and control: a cross-country analysis. *Journal of Financial Economics*, 68: 325-351.
- Nerkar, A., and Shane, S. (2003) When do start-ups that exploit patented academic knowledge survive? *International Journal of Industrial Organization*, 21:1391-1410.
- Nicolaou, N., and Birley, S. (2003) Academic networks in a trichotomous categorisation of university spinouts. *Journal of Business Venturing*, 18: 333-359.
- Norton, M. I. and Ariely, D. (2005) The “IKEA effect”: Why Labor Leads to Love” Society for Judgment and Decision Making Annual Conference 26th Anniversary Edition Sheraton Centre, Toronto Canada, November 11-14, 2005 Master Schedule page 8 <http://www.sjdm.org/programs/2005-program.pdf>.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
- Öehman, A., and Mineka, S. (2001) Fears, phobias, and preparedness: Toward an evolved module of fear and fear learning. *Psychological Review*, 108: 483–522.
- Oskamp, S. (1965). Overconfidence in case-study judgments. *Journal of consulting psychology*, 29, 261–265.
- Palich, L. E., and Bagby, D. R. (1995) Using cognitive theory to explain entrepreneurial risk taking: Challenging conventional wisdom. *Journal of Business Venturing*, 10:425-438.
- Pierce, J. L., Kostova, T and Dirks, K.T. (2003) The state of psychological ownership integrating and extending a century of research. *Review of General Psychology*, 7(1): 84-107.
- Pierce, J. L., Rubenfeld, S. A., and Morgan, S. (1991) Employee ownership: a conceptual model of process and effects. *Academy of Management Review*, 1:121 – 144.
- Pilavin, J. A. and Callero, P. L. (1991) *Giving blood: The development of an altruistic identity*. Baltimore: Johns Hopkins University Press
- Pratt, J. and Zeckhauser, R. J. (1985) *Principals and agents: The structure of business*, Cambridge, MA: Harvard Business School Press.
- Pressman, D. (1988). *Patent Yourself*. Second Edition. Nolo Press. California
- PricewaterhouseCoopers (2001) Regional Economic Benefits Study (documenting and quantifying the economic impact of University of Waterloo on the Waterloo Region. Information and Public Affairs, University of Waterloo
- Pries, F and Guild, P (2004) *Analyzing the commercialization of university research: a proposed categorization scheme*. Institute Innovation Research, University of Waterloo <http://www.iir.uwaterloo.ca/WorkingPaperSeries.html>
- Raudenbush, S.W. and Bryk, A. S. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods* (2nd ed.). London: Sage.
- Reich, W. A. (2000). Identify structure, narrative accounts, and commitment to a volunteer role. *The Journal of Psychology*, 134(4), 422-434
- Reyment, R. and Jöreskog, K.G., (1993) *Applied Factor Analysis in the Natural Sciences*, Cambridge University Press

- Ring, P.S. and A.H. Van de Ven (1992) Structuring cooperative relationships between organizations, *Strategic Management Journal*, 13: 483-498
- Ring, P.S. and A.H. Van de Ven (1994) Developmental processes in cooperative interorganizational relationships, *Academy of Management Review*, 19: 90-118
- Roberts, E. B (1990) Evolving toward product and Market orientation: The early years of technology-based firms. *Journal Production and Innovation Management* 7:274-287
- Rogers, R. W. (1975) A protection motivation theory of fear appeals and attitude change. *Journal of Psychology*, 91: 93-114.
- Rogers, R.W. (1983) Cognitive and physiological processes in fear appeals and attitude change: a revised theory of protection motivation. In J. Cacioppo and R. Petty (Eds.), *Social Psychophysiology*. New York: Guilford Press.
- Rossmann, J. (1931) *The psychology of the inventor*. Washington DC: Inventor's Publishing.
- Rothbaum, F., Weisz, J. R., and Snyder, S. S. (1982). Changing the world and changing the self: a two-process model of perceived control. *Journal of personality and social psychology*, 42(1), 5-37.
- Rottenstreich, Y., and Hsee, C.K. (2001). Money, kisses, and electric shocks: On the affective psychology of risk. *Psychological Science*, 12:185–190.
- Rotter, J. (1966) Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied*, 80: 1-28.
- Rotter, J. B. (1980). Interpersonal trust, trustworthiness, and gullibility. *American Psychologist*, 35, 1-7.
- Rousseau, Denise M., and Judi McLean Parks (1993) The Contracts of Individuals and organizations, in Larry L. Cummings and Barry M. Staw (Eds.), *Research in Organizational Behavior*, Vol. 15, Greenwich: JAI Press, 1-47.
- Rubenson, G. C. and Gupta, A. K. (1992) Replacing the Founder: Exploding the Myth of the Entrepreneur's Disease, *Business Horizons* 53 – 57
- Ryan, R. M., and Deci, E. L. (2000) Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemporary Educational Psychology*, 25: 54- 67
- Sapienza, H. J., Manigart, S., and Vermeir, W. (1996) Venture capitalist governance and value added in four countries. *Journal of Business Venturing*, 11: 439-469.
- Savage, L. J. (1954). *The foundations of statistics*. Dover.
- Scheier, M. F., and Carver, C. S. (1985). Optimism, coping and health: Assessment and implications of generalized outcome expectancies. *Health Psychology*, 4, 219-247
- Schumpeter, J. A. 1934. *The theory of economic development*. New York: Oxford University Press.
- Schwartz, R.G., Teach, R.D., Birch, N.J. (2005) A longitudinal study of entrepreneurial firms opportunity recognition and product development strategies. *International Journal of Entrepreneurial Behaviour and Research*, 11(4): 315-329.
- Seabrook, J. (1994) *The Flash of Genius*, The New Yorker, Jan 11, pp. 38-52.
- Shane, S. (2001) Technological opportunities and new firm creation. *Management Science*, 47(2):205-220.
- Shane, S. (2002) Selling university technology: patterns from MIT. *Management Science* 48(1): 122-137.
- Shane, S. (2003) *A General Theory of Entrepreneurship. The individual-opportunity Nexus*. Massachusetts: Edward Elgar Publishing, Inc
- Shane, S. and Venkataraman, S. (2000) The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25: 217-226
- Shane, S., and Eckhardt, J. (2003). The individual-opportunity nexus. In Z. J. Acs and D. B. Audretsch (Eds.), *Handbook of Entrepreneurship Research* (pp. 161-194). Dordrecht, NL: Kluwer
- Shepherd, D.A., and Zacharakis, A. (2001) The venture capitalist-entrepreneur relationship. *Venture Capital- An International Journal of Entrepreneurial Finance*, 3 (2): 129-149.
- Shepherd, D. A. (2003) Learning from business failure: Propositions about the grief recovery process for the self-employed. *Academy of Management Review*, 28:318–329.
- Shepherd, D. A. (2004) Educating entrepreneurship students about emotion and learning from failure *Academy of Management Learning and Education*, 3(3):274–287.

- Shleifer, A. and R. Vishny (1997) A Survey of Corporate Governance, *Journal of Finance*, 52:737-82
- Siegrist, J. (1996) Adverse health effects of high-effort/low-reward conditions. *Journal Occupational Health Psychological* 1(1): 27-41
- Siegrist, J. (2002) Effort-reward Imbalance at Work and Health. In P. Perrewe, and D. Ganster (Eds.), *Research in Occupational Stress and Well Being* (pp. 261-291). New York: JAI Elsevier.
- Simon, M., Houghton, S. M. and Lumpkin, G. T. (2001) Making lemonade out of lemons: the role of strategy in managing misperceived start-ups. *Academy of Management Annual Best Papers Proceedings*, Washington, DC, 2001.
- Singh, R., Hills, G, Hybels, R and Lumpkin (1999) Opportunity recognition through social network characteristics in entrepreneurship. Paper presented at the 1999 Babson College on Entrepreneurship Research, Columbia. SC
- Skinner, E. A. (1996) A guide to constructs of control. *Journal of Personality and Social Psychology*, 71: 549 - 570.
- Skinner, E. A., Chapman, M., and Baltes, P. B . (1988) Control, means-ends, and agency beliefs: A new conceptualization and its measurement during childhood. *Journal of Personality and Social Psychology* 54: 117-133
- Slooman, S. A. (1996) The empirical case for two systems of reasoning. *Psychological Bulletin*, 119(1), 3-22.
- Slovic, P. (1987) Perception of risk. *Science* 236: 280–285.
- Slovic, P., Layman, M., Kraus, N., Flynn, J., Chalmers, J., and Gesell, G. (1991) Perceived risk, stigma, and potential economic impacts of a high-level nuclear waste repository in Nevada. *Risk Analysis*, 11: 683- 696.
- Smith, C. A. and Ellsworth, P. C. (1985) Patterns of cognitive appraisal in emotion. *Journal of Personality and Social Psychology*, 48: 813-838
- Stanovich K.E, and West R.F. (1999) Discrepancies between normative and descriptive models of decision making and the understanding/acceptance principle. *Cognitive. Psychology*. 38: 349–85
- Stevens, J. (1986) *Applied Multivariate Statistics for the Social Sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Stevens, J.P. (1992) *Applied Multivariate Statistics for the Social Sciences* (2nd edition). Hillsdale, NJ: Erlbaum.
- Strahilevitz, M. A., and Loewenstein, G. F. (1998) The effect of ownership history on the valuation of objects, *Journal of Consumer Research*, 25: 276-289.
- Stryker, S. (1980) Symbolic interactionism: A social structural version. Menlo Park, CA: The Benjamin/Cummings Publishing Company.
- Teece, D. J. (1986) Profiting from technological innovation: implications for integration, collaboration, licensing and public policy. *Research Policy* 15: 285-305
- Teece, D. J. (1998) Capturing value from knowledge assets. *California Management Review*, 40(3): 55-79.
- Teece, D.J. (1992) Competition, Cooperation and Innovation: Organisational Arrangements for Regimes of Rapid Technological Progress, *Journal of Economic Behaviour and Organization*, 18: 1–25
- Tett, R., Wang, A., Gribler, J. and Martinez, A. (1997) Development of Self-report measures of emotional intelligence. Paper presented at the 1997 Annual Convention of the Southern Psychological Association, Atlanta, GA
- Thaler, R. H. (1980) Toward a positive theory of consumer choice. *Journal of Economic Behavior and Organization*, 1(1):39-60.
- Thaler, R., Tversky, A., Kahneman, D. and Schwartz, A. (1997) The Effect of Myopia and Loss Aversion on Risk Taking: An Experimental Test, *Quarterly Journal of Economics*, CXII: 647–661.
- Thurstone, L.L. (1931). Measurement of social attitudes. *Journal of Abnormal and Social Psychology*, (26), 249-269
- Tiedens, L.Z., and Linton, S. (2001) Judgment under emotional certainty and uncertainty: the effects of specific emotions on information processing. *Journal of Personality and Social Psychology*, 81:

973-988.

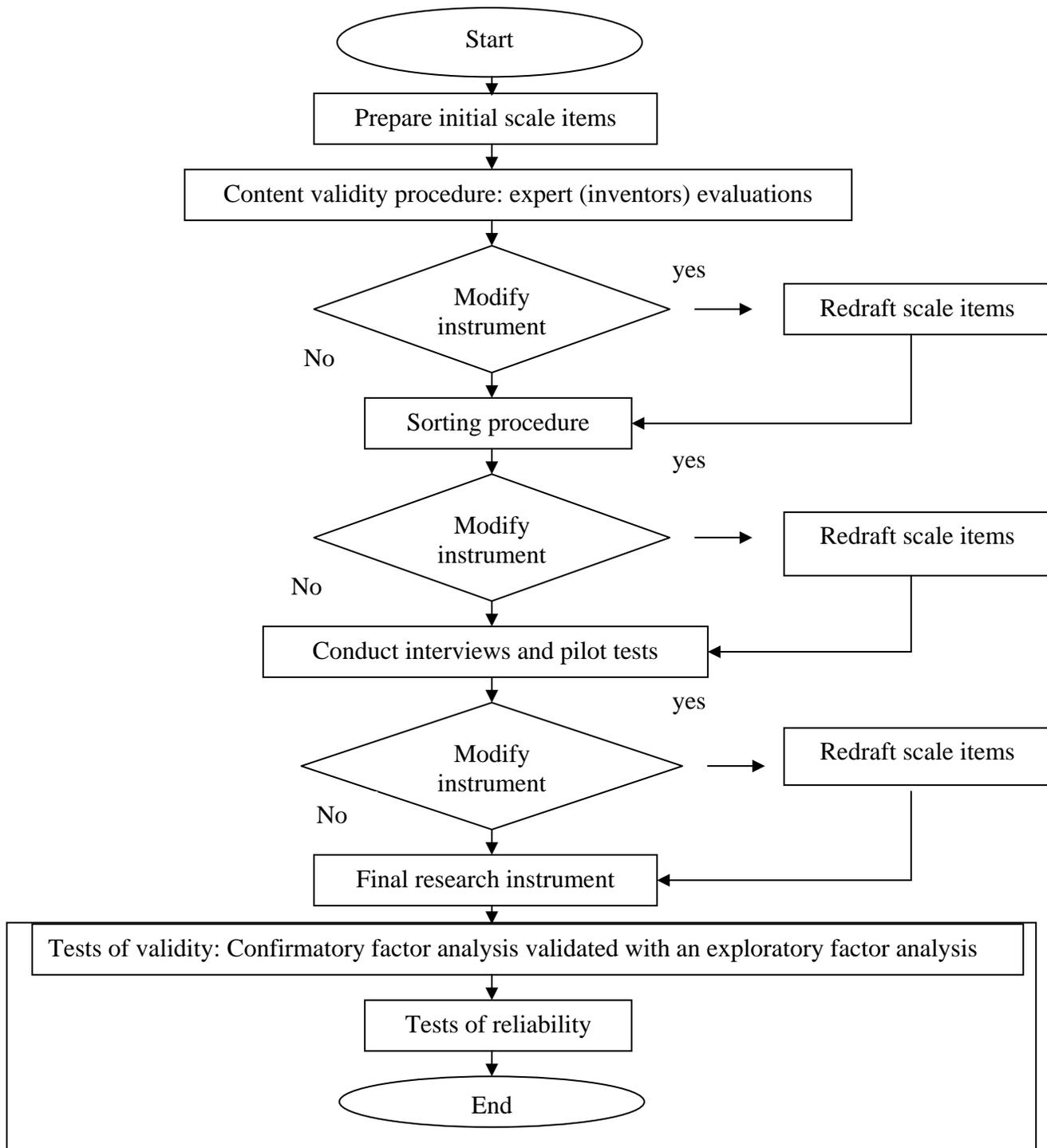
- Turner, R. H. (1978) The role and the person, *American Journal of Sociology*, 84:1-23.
- Tversky A. and D. Kahneman (1991) Loss aversion in riskless choice: A reference dependent model, *Quarterly Journal of Economics* 106: 1039-1061.
- Van Osnabrugge, M. (2000) A comparison of business angel and venture capitalist investment procedures: An agency theory-based analysis. *Venture Capital*, 2 (2): 91-10.
- van Praag, M., van der Sluis, J. and van Witteloostuijn, A. (2004) The Impact of the Locus of Control Personality Trait on the Earnings of Employees vis-à-vis Entrepreneurs. Tinbergen Institute Discussion Paper Ii 2004-130/3 [<http://www.tinbergen.nl> (March,2005)]
- Vasey, M. W., El-Hag, N., and Daleiden, E. L. (1996) Anxiety and the processing of emotionally threatening stimuli: distinctive patterns of selective attention among high- and low-test-anxious children *Child Development*, 67:1173-1185.
- Venkataraman, S. (1997) The distinctive domain of entrepreneurship research. In J. A. Katz (Ed.), *Advances in Entrepreneurship Research: Firm Emergence and Growth*. Vol. 119-138. Greenwich, CON: JAI Press.
- von Neumann, J. and Morgenstern, O. (1944) *The Theory of Games and Economic Behaviour*, Princeton University Press.
- Von Neumann, J. and Morgenstern, O. (1947). *Theory of games and economic behaviour*, 2nd ed. Princeton, NJ: Princeton University Press.
- Wakker, P. (2006). Annotated References on Decisions and Uncertainty. Web site: <http://www1.fee.uva.nl/creed/wakker/refs/rfrncs.htm>.
- Weick, C. W. and Eakin, C. F. (2005) Independent inventors and innovation: an empirical study. *The International Journal of Entrepreneurship and Innovation*, 6 (1): 5-15
- Weigert, A. J., Teitge, J. S. and Teitge, D. W. (1986), *Society and Identity: Toward a Sociological Psychology*, New York, NY: Cambridge University Press
- Weinstein, N. D., and Klein, W. M. (1995) Resistance of personal risk perceptions to debiasing interventions. *Health Psychology*, 14, 132-140.
- Weinstein, N. D. (1989) Effects of personal experience on self-protective behaviour. *Psychological Bulletin*, 105: 31-50.
- White, R.W. (1959) Motivation reconsidered: the concept of competence. *Psychological Review*, 66: 297–333
- Wijbenga, F.H. and van Witteloostuijn, A. (2007) Entrepreneurial locus of control and competitive strategies – The moderating effect of environmental dynamism. *Journal of Economic Psychology* 28(5): 566-589
- Williamson, O.E. (1979) Transaction cost economics: the governance of contractual relations. *Journal of Law and Economics*, 22: 233-261.
- Williamson, O.E. (1985) *The economic institutions of capitalism*. New York: The Free Press.
- Williamson, O. E. (1991) Comparative economic organization: the analysis of discrete structural alternatives. *Administrative Science Quarterly* 36: 269-296
- Wilson, R. S and Arvai, J.L (2006) When less is more: how affect influences preferences when comparing low and high-risk options. *Journal of Risk Research* 9(2): 165-178
- Winborg, J. and Landström, H. (2001) Financial Bootstrapping in Small Business – Examining small business manager’s resource acquisitions behaviours *Journal of Business Venturing* 16(3): 235 – 254
- Wright, W.F. and Bower, G.H. (1992) Mood effects on subjective probability assessment. *Organizational Behaviour and Human Decision Processes*, 52: 276-291.
- Zacharakis, A. L., and Meyer, G. D. (2000) The potential of actuarial decision models: Can they improve the venture capital investment decision? *Journal of Business Venturing*, 15 (4): 323-346.
- Zajonc, R. B. (1998) Emotions, In D. Gilbert, S. Fiske and G. Lindzey (Ed) *The Handbook of Social Psychology* pp. 591-632 New York: Oxford University Press.
- Zald, D.H. (2003) The human amygdala and the emotional evaluation of sensory stimuli. *Brain Research*

*Reviews* 41 (1): 88–123.

Zingales, L. (1994) The value of the voting right: a study of the Milan Stock Exchange experience. *Review of Financial Studies* 7:125-148.

## Appendices

### Appendix 1: The Scale Development Process



## Appendix 2: Codebooks

### A. Pre-test of questionnaire

This test involved the first attempt to measure psychological attachment using the psychological ownership measure. The measure for psychological ownership is adapted from Dyne and Pierce's (2004) measure of the construct in the organisation (Seven items with Cronbach's coefficient alpha, 0.87, 0.90, and 0.93 for three samples). Below is a tentative scale for measuring the construct in this study (Four items – items referring to OUR in terms of the organisation where deleted from the Dyne and Pierce (2004) scale).

#### Psychological Ownership

Instructions: Think about the car, bike or gadget you own, and the experiences and feelings associated with the statement 'THIS IS MY CAR!' The following questions deal with the 'sense of ownership' that you feel for the object (product) in front of you. Indicate the degree to which you personally agree or disagree with the following statements on a scale of 1 (disagree) to 5 (agree).

#### Item

1. This is MY \_\_\_\_\_ (object, product)
2. I feel a very high degree of personal ownership for this \_\_\_\_\_ (object, product)
3. I sense that this is MY \_\_\_\_\_ (object, product)
4. It is hard for me to think about this \_\_\_\_\_ (object, product) as MINE. (reversed)

The items are consistent with the core meaning of psychological ownership and uses possessive vocabulary such as reflected in everyday associations with property and possessions, such as "That idea was MINE," (Dyne and Pierce, 2004).

Due to the failure of this scale to capture the construct, hypothetical items were written to theoretically get to the construct.

Also included in the pre-test were threat-inducing pictures to introduce the threat manipulation. The pictures are not included due to space constraints.

Other items tested were the items for the control tendency measure, the items for venture capitalist/Angel investor studies, control preferences in commercialization strategy making and other control variables.

## INTRODUCTION

In this research study, we are interested in learning how you feel about certain decisions concerning a 3rd or 4th year engineering design project of your choice from your project design class. You will be asked to choose a design project not developed by your group but by another group. You will be answering questions mainly involving how you feel about decision options on getting this project out to the target market.

### Confidentiality

Information you provide will be anonymous and will be held in the strictest confidence. All responses will be aggregated and reported as groups of responses so that no individual can be identified.

### Instructions

This questionnaire is designed to elicit your views and feelings towards the questions and scenarios presented to you. Try to be as truthful as you can. There are no right or wrong answers so don't try to guess what you think the answer to a question is expected to be. We are simply looking for your views, feelings or beliefs. Feel free to add comments at the end of the study about the questions or your responses. . The questionnaire takes approximately 45 minutes to complete, some have finished in 40 minutes, and some have finished in 1 hour.

If we can assist you in any way, or if you have any questions or comments, please contact the researcher.

Gordon Adomdza  
Department of Management Sciences, University of Waterloo  
200 University Avenue West  
Waterloo, Ontario, N2L 3G1  
(519) 888 4567 x33422 (office)  
(519) 880 9055 (home)

## Web-based Survey

### Preliminary questions

2. If you work in a group, rank the contribution of team members to this design project so far, including yours, in order of the highest contributor (1) to the lowest contributor (5). Contribution is in terms of the amount of creative and work effort.

Using initials of first and last names, please rank team members below. For you write "me".  
Don't write your name!

1	<input type="text"/>
2	<input type="text"/>
3	<input type="text"/>
4	<input type="text"/>
5	<input type="text"/>

3. Now, imagine that you have cheques for a bank account from which you can draw money to buy out your group members' ownership stake in this project. In the space below the sample cheque leaf, write out the maximum amount you are willing to pay your group members (excluding you).

✖

Amount: \$

## YOUR DESIGN PROJECT EXPERIENCE

**Instructions:** Think about the design project you just described. Think of feelings associated with the statement **THIS IS MY DESIGN PROJECT!**

4. The following questions deal with the sense of ownership that you personally feel for this design project.

Indicate the degree to which you personally agree or disagree with the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree). Please click on a button for each statement on the scale below

		1	2	3	4	5	
<input type="checkbox"/>	This is MY design project!	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
<input type="checkbox"/>	I sense that this design project is MY invention	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
<input type="checkbox"/>	I feel a very high degree of personal ownership for this design project	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
<input type="checkbox"/>	It is hard for me to think about this design project as MINE.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

## PICTURE VIEWING

5. To aid analyses of the questions you just answered, we will like you to view some pictures and answer some questions on them. Researchers do this to anchor responses when they ask people about their feelings so as to get cleaner measures. As such, to be able to anchor your responses and conduct better analyses we present you with some pictures which represent different scenes, some of which may occur in life.

These pictures may contain scenes of trauma and violence such as animals or weapons. Although these pictures have been used in many previous studies some people may find them distressing and might prefer not to see them.

For the next few minutes, you will be viewing different pictures on your screen. After viewing, you be asked to answer some questions about the pictures.

Before we start, we would like you to look at a sample of nine (9) representative images so that you can determine if you want to participate in the viewing or not.

## PICTURE VIEWING

8. After seeing these samples, if you still want to do this part of the study, read and sign the informed consent form provided.

## PICTURE VIEWING

### 9. Consent

If you signed the consent form, click the "Yes, show me the pictures" button to start viewing. You are in control of this process. How quickly you view the pictures is up to you

If you did not sign the consent form, click the "No thanks" button to continue with the rest of the studies.

## PICTURE DESCRIPTION

10. Having viewed the pictures, please indicate the extent to which you agree or disagree with the following statements about the pictures you just saw.

Please click on a button for each statement on the scale below

		1	2	3	4	5		
<input type="checkbox"/>	The pictures are all from the last decade	Strongly Disagree	<input type="radio"/>	Strongly Agree				
<input type="checkbox"/>	The pictures were taken from the internet	Strongly Disagree	<input type="radio"/>	Strongly Agree				
<input type="checkbox"/>	Every picture had a unique theme	Strongly Disagree	<input type="radio"/>	Strongly Agree				
<input type="checkbox"/>	The scenes in the pictures are identical	Strongly Disagree	<input type="radio"/>	Strongly Agree				
<input type="checkbox"/>	The pictures are of real and actual scenes	Strongly Disagree	<input type="radio"/>	Strongly Agree				

## COMMERCIALIZATION

Now, let's proceed with the rest of the study.

Please read this information about commercialization carefully.

Consider the commercialization of the design project you have just been endowed with. Commercialization is the business of selling your design project for money. You can self-commercialize or do it with a partner.

Either way, when successful, commercialization can give you tangible benefits like money and intangible benefits like fame or recognition.

However, when unsuccessful, you can have bad experiences: the project may be stolen, imitated or just exploited by your partner or someone else. Sometimes others will make money at your expense or become famous for something that you created.

NB: In the following exercise, you will be answering questions on commercialization scenarios. We know that your project may not be ready for commercialization. We just want you to answer the questions assuming your project is ready for the market.

## COMMERCIALIZATION

**Instructions:** Now, consider all the rights to your new design project: the right to legally own the project, the right to make manufacturing and distribution decisions and the right to benefits from the project. Think of the effort you spent on the design project and your entitlement to these rights.

11. Assume that after an exhausting search for the "perfect partner" for commercialization, you identified the company, Commercialization Agencies Limited (CAL). CAL has partnered with many idea creators in successfully commercializing their ideas. However, as is the case with such companies, there are a few unsubstantiated instances in which the company has been accused of cheating.

Clearly, you have little information about how a business relationship with CAL might turn out but you can indicate what you think about certain issues in doing business with the company.

Imagine you are about to partner with CAL. Indicate the extent to which you agree or disagree with the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree). Please click on a button for each statement on the scale below.

NB: Remember this is about the chosen design project that you now 'own.'

**In a commercialization relationship with CAL.....**

		1	2	3	4	5		
<input type="checkbox"/>	I want to be the sole owner of my design project	Strongly Disagree	<input type="radio"/>	Strongly Agree				
<input type="checkbox"/>	I desire to be the main decision-maker on how the project is manufactured and distributed	Strongly Disagree	<input type="radio"/>	Strongly Agree				
<input type="checkbox"/>	I desire to have control over how money is spent on the project	Strongly Disagree	<input type="radio"/>	Strongly Agree				
<input type="checkbox"/>	I am happy to allow CAL to be the sole owner of my project	Strongly Disagree	<input type="radio"/>	Strongly Agree				
<input type="checkbox"/>	I am happy to allow CAL the right to make manufacturing and distribution decisions for my project	Strongly Disagree	<input type="radio"/>	Strongly Agree				
<input type="checkbox"/>	I have no problem with allowing CAL to have control over how money will be spent on the project	Strongly Disagree	<input type="radio"/>	Strongly Agree				

## FUND RAISING

### Venture Capital Funding Exercise

In the following exercise your aim is to raise funding for the commercialization of this design project. Two funding options will be presented to you in each round of decision-making. The options are provided by a Venture Capitalist (VC) and an Angel Investor (angel) who are individuals or entities that provide capital for business start-ups.

Up until the time you commercialize a design idea you have total control over such things as: ownership, management decisions and the tangible and intangible benefits from the design project.

However, when you enter into a contract to form a company with another party such as a VC or an angel investor, control over your design idea depends on how many shares you retain in the company. More shares mean more control. Under the terms of the contract, whoever has more than 50% of the shares has ultimate power over the design idea. For instance, if you have 49% of the shares and the VC has 51% of the shares, the VC can decide against implementing some of your ideas. Some future decisions you may or may not be able to make will involve product modifications, pricing, entering new markets, developing related products, etc.

## FUND RAISING

**Instructions:** Now, consider all the rights to your design project: the right to legally own the project, the right to make manufacturing and distribution decisions and the right to benefits from the project. Think of the effort you spent on the design project and your entitlement to these rights.

12. Assume that a VC and an Angel present to you options to choose from. The first pair unveils the following details:

#### VC Option 1

- You get \$4 million.
- The VC takes **55%** of the shares, you get the rest.

#### Angel Option 1

- You get \$2.5 million.
- The Angel takes **45%** of the shares, you get the rest.

Which option will you choose? Please click on ONE button.

VC option 1:

OR

Angel option 1:

## FUND RAISING

13. Assume that the VC and Angel present to you another pair of options to choose from.

### Angel Option 2

- You get \$2.5 million.
- The Angel takes 44% of the shares, you get the rest.

### VC Option 2

- You get \$4 million.
- The VC takes 54% of the shares, you get the rest.

Which option will you choose? Please click on ONE button.

Angel option 2:

OR

VC option 2:

## FUND RAISING

14. The third pair of options is as follows:

### VC Option 3

- You get \$4 million.
- The VC takes 53% of the shares, you get the rest.

### Angel Option 3

- You get \$2.5 million.
- The Angel takes 47% of the shares, you get the rest.

Which option will you choose? Please click on ONE button.

VC option 3:

OR

Angel option 3:

## FUND RAISING

15. The fourth pair of options is as follows:

### Angel Option 4

- You get \$2.5 million.
- The Angel takes 48% of the shares, you get the rest.

### VC Option 4

- You get \$4 million.
- The VC takes 52% of the shares, you get the rest.

Which option will you choose? Please click on ONE button.

Angel option 4:

OR

VC option 4:

## FUND RAISING

16. The fifth pair of options is as follows:

### VC Option 5

- You get \$4 million.
- The VC takes **51%** of the shares, you get the rest.

### Angel Option 5

- You get \$2.5 million.
- The Angel takes **47%** of the shares, you get the rest.

Which option will you choose? Please click on ONE button.

VC option 5:

OR

Angel option 5:

## FUND RAISING

17. The last pair of options is as follows:

### Angel Option 6

- You get \$2.5 million.
- The Angel takes **50%** of the shares, you get the rest.

### VC Option 6

- You get \$4 million.
- The VC takes **50%** of the shares, you get the rest.

Which option will you choose? Please click on ONE button.

Angel option 6:

OR

VC option 6:

## DECISIONS

### The VC/angel and your decisions

18. This question is about how important you think decisions, made by you, the VC, or the angel, are in ensuring the success of the company you set up together.

When you sign a contract with the VC or angel to what extent do you think YOUR personal decisions are critical for the success of the company?

Please click on a button on the scale below

	1	2	3	4	5	
Not critical at all	<input type="radio"/>	Highly critical				

19. To what extent do you think the VC's or Angel's decisions are critical for the success of the company?

Please click on a button on the scale below

	1	2	3	4	5	
Not critical at all	<input type="radio"/>	Highly critical				

## IMPORTANCE OF ASSETS AND PATENTS

### *High excludability and the importance of third-party complementary assets*

**Instructions:** Think of how important an existing company's manufacturing and distribution capabilities are for a successful commercialization of this project. Such a company can be a potential partner as well as a potential competitor. This is how we describe importance of these assets.

**Important:** You will have to contract with an existing company to provide manufacturing and distribution services

**Not Important:** You can raise funding, manufacture and distribute the project yourself.

20. Using these descriptions for the importance of these assets we want you to tell us the extent to which you feel an existing company's capabilities are important to you in commercializing this project.

Please click on a button on the scale below

	1	2	3	4	5	
Not at all important	<input type="radio"/>	Very important				

**Instructions:** Assume that you want to commercialize this project. You have a patent, which means you can legally prevent others from producing or selling the project, and you have been approached by a company that has manufacturing and distribution capabilities for your project. Think of how much control you feel you should give this potential partner. (For 50% control or lower you make the decisions in the commercialization of your project; for 50% or higher, the company makes the decisions)

21. How much control do you FEEL you should give this potential partner?

I will give the potential partner..... Please click ONE button below

- less than 25% control
- between 26% and 50% control
- between 51% and 75% control
- between 76% and 100% control

22. Now, assume that you DO NOT have a patent on this project idea (you cannot legally protect the idea). How much control do you FEEL you should give this potential partner?

I will give the potential partner..... Please click ONE button below

- less than 25% control
- between 26% and 50% control
- between 51% and 75% control
- between 76% and 100% control

## EXPERIENCE WITH COMMERCIALIZATION

23. On the scale of 1 to 5 below rank your knowledge of the commercialization process and attendant issues prior to this study

Please click on a button on the scale below

	1	2	3	4	5	
I knew little	<input type="radio"/>	I knew everything				

24. If you had some knowledge about commercialization prior to this study, how did you learn about it?

Please check all that apply.

- from reading about it
- seminar/talk/public lecture
- took a course
- personal research
- worked on a project for a company or someone else (coop job, business friend)
- worked on commercializing my own project (either design project or another project)

## GROUP WORK EXPERIENCE

26. Listed below are various statements generally or typically relating to you and group work for school. Please use the following scale to click on a button stating the extent to which you personally agree or disagree with the statements

NB: These statements relate to how you do group work at school

		1	2	3	4	
<input type="checkbox"/> I get easily overwhelmed by time pressures of group work	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
<input type="checkbox"/> As soon as I get up in the morning I start thinking about group work assignments.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
<input type="checkbox"/> When I get home, I can easily relax and 'switch off' group work assignments.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
<input type="checkbox"/> People in my group say I sacrifice too much for group work.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
<input type="checkbox"/> Group work rarely lets me go. It is still on my mind when I go to bed.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
<input type="checkbox"/> If I postpone something that I was supposed to do today I'll have trouble sleeping at night.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

## PERSONALITY

25. Listed below are various statements generally or typically relating to you. Please use the following scale to click on a button stating the extent to which you think the statement is a very accurate or inaccurate description of you.

		1	2	3	4	5		
<input type="checkbox"/>	I listen to my feelings when making important decisions.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I enjoy being reckless.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I base my goals in life on inspiration, rather than logic.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I plan my life based on how I feel.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I find it easy to manipulate others.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I take risks.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I believe emotions give direction to life.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I listen to my heart rather than my brain.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I would never go hang-gliding or bungee-jumping	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I plan my life logically.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I would never make a high risk investment.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I believe important decisions should be based on logical reasoning.	Very inaccurate	<input type="radio"/>	Very accurate				

<input type="checkbox"/>	I seek adventure.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I find it difficult to manipulate others.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I am willing to try anything once.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I lack the talent for influencing people.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I know how to get around the rules.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I can talk others into doing things.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I make decisions based on facts, not feelings.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I have a natural talent for influencing people.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I stick to the rules.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I avoid dangerous situations.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I listen to my brain rather than my heart.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I hate being the center of attention.	Very inaccurate	<input type="radio"/>	Very accurate				
<input type="checkbox"/>	I seek danger.	Very inaccurate	<input type="radio"/>	Very accurate				

27. Are you .....?

Male  Female

28. What is your age?

years

29. What year are you in?

30. What faculty are you in?

31. What department are you in?

### Picture Viewing Revisited

32. With respect to the pictures you viewed earlier, rank the degree to which you felt each of following emotions.

		1	2	3	4	5		
<input type="checkbox"/>	Fear	Not at all	<input type="radio"/>	A great amount				
<input type="checkbox"/>	Disgust	Not at all	<input type="radio"/>	A great amount				
<input type="checkbox"/>	Sadness	Not at all	<input type="radio"/>	A great amount				
<input type="checkbox"/>	Anger	Not at all	<input type="radio"/>	A great amount				

### Comments

If there is anything else you would like to tell us about your feelings, beliefs, and ideas in this study, please use the space provided below.

### Study Results

If you want a summarized report on this study in the future, please enter your email address below.

## MOOD LIFTING PICTURES

/ PAGE

Were you adversely affected by the fearful pictures screened earlier and want to see some mood lifting pictures?

## CONTROL ORIENTATION SURVEY

### Thank you for your participation in control orientation survey.

We appreciate your participation in our study, and thank you for spending the time helping us with our research. After the first set of questions, you were told that there is a picture viewing section which researchers typically use to anchor responses when they ask people about their feelings. However, the study was more complicated than we explained to you at that point. We could not give you complete information about the study at that time because it may have influenced your behaviour during the rest of the study in a way that would make investigations of the research question invalid. We apologize for the omissions, and hope that you understand the need for it once the purpose of the study has been fully explained to you.

We were interested in how emotional reactions unrelated to an economic decision affect choice of options in economic situations. Research shows that unrelated moods or emotions can affect decisions that have nothing to do with how people felt at the time. One group (the treatment group) received fearful pictures while another group (the control group) received neutral pictures. We did this to see differences in the two groups on the effect of the pictures on the decisions made on the economic scenarios presented to you after the viewing. Although we are mainly interested in how the negative pictures affected the treatment group, we couldn't provide pictures for only that group. We needed to provide the neutral pictures to the control group for experimental reasons. Specifically, we wanted to eliminate the Hawthorne effect explanation for the changes in behaviour observed in the treatment group. The Hawthorne effect in this setting will be the behaviour change as a result of viewing pictures. Since we provided neutral pictures to the control group, we can relate differences in behaviour between the two groups to the type of picture viewed.

We also wanted to study how emotions evoked from viewing the pictures sensitized you to some of the cautionary notes that were included in the economic scenarios, given your level of attachment to the project idea. To summarise our research questions and hypotheses, we were studying how negative emotions can affect your commercialization decisions. We expect to find the treatment group to desire more control over the project idea and consequently make sub-optimal commercialization choices.

The reason why we needed to withhold some information from you was because the part of the study on viewing the pictures was not consistent with the other questions and tasks. If you realised this, your responses would have been impacted since you were likely to think that we brought that stage in for a purpose. This would have affected the validity of the results. We apologize for this, but we hope you can understand why it was necessary. As you can see, we would not have been able to investigate this research question if we just gave you the pictures to view with no reason.

Because the study involves some aspects that you're not told about before starting, it's very important that you not discuss your experiences with any other students who potentially could be in this study until after the end of the term. If people come into the study knowing about our specific predictions, as you can imagine, it would influence their results, and the data we collect would be not be useable. Also, since you will be given a copy of this feedback to take home with you, please do not make this available to other students. If you do not keep the feedback, please dispose of it rather than leaving it somewhere that other students might read it.

Because some elements of the study are different from what was originally explained, we have another consent form for you to read and sign if you are willing to allow us to use the information that you have provided. This form is a record that the purpose of the study has been explained to you, and that you are willing to allow your information to be included in the study.

We hope you understand the need for withholding some information from you in this study. However, if you later want to discuss this further, or you think of some other questions, please do not hesitate to contact Gordon Adomdza and Scott Jeffrey.

If you suffer from adverse effects from viewing the pictures now or in the future and you will like to seek professional counselling, please contact Lorraine Nesbitt at Counselling Services at the University of Waterloo, NH 2080, phone: 519-888-4567, Ext. 33528 or by email [lnesbitt@uwaterloo.ca](mailto:lnesbitt@uwaterloo.ca). Also please feel free to contact Dr. Susan Sykes, the Director of the Office of Research Ethics at 519-888-4567, Ext. 36005, if you have concerns or comments resulting from your participation.

As part of the compensation for this study, you have the chance to enter into a draw for an Ipod Nano. If you want to participate in this study, you can write your email address on a piece of paper, fold it and drop it in the draw urn at CPH 4361. On May 15th 2007, a draw will be held and the winner will be contacted by email. The prize will be kept till the end of the year after which it will be withdrawn. The winner will be given five email notices concerning the claiming of the prize.

We really appreciate your participation, and hope that this has been an interesting experience for you.

- During the debriefing session, I learned that it was necessary for the researchers to disguise the real purpose of some parts of this study. I realize that this was necessary since having full information about the actual purpose of that part of the study might have influenced the way in which I responded to the tasks and this would have invalidated the results. Thus, to ensure that this did not happen, some of the details about the purpose of those parts of the study initially were not provided (or were provided in a manner that slightly misrepresented the real purpose of those parts of the study). However, I have now received a complete verbal and written explanation as to the actual purpose of the study and have had an opportunity to ask any questions about this and to receive acceptable answers to my questions.

I have been asked to give permission for the researchers to use my data (or information I provided) in their study, and agree to this request. I am aware that I may withdraw this consent by notifying the Principal Investigator of this decision.

I am also aware that I may contact the Office of Research Ethics at 888-4567 Ext. 36005 if I have any concerns or comments resulting from my involvement in this study.

## CONTROL ORIENTATION SURVEY

Thank you for your submission.

## B. Final Study: Part I

This codebook outlines the questions for the first part of the final study. The first part was mainly to measure psychological attachment and compare with a later measure for differences. Also, statistical control variables were measured in this part to avoid demand effects in the next part.

**WEB-BASED SURVEY**

# Login

**INFORMATION LETTER FOR CONTROL ORIENTATION SURVEY**

Title of Research : Control Orientation: The Role of Affect in Commercializing New Ideas

Investigator : Gordon Adomdza  
University of Waterloo, Department of Management Sciences  
(519) 888-4567 Ext. 33422 [gkadomdz@engmail.uwaterloo.ca](mailto:gkadomdz@engmail.uwaterloo.ca)

**The page cannot be found**  
The page you are looking for might have been removed, had its name changed, or is temporarily unavailable.

Please try the following:

- Make sure that the Web site address displayed in the address bar of your browser is spelled and formatted correctly.
- If you reached this page by clicking a link, contact the Web site administrator to alert them that the link is incorrectly formatted.
- Click the [Back](#) button to try another link.

HTTP Error 404: File or directory not found.

[Continue](#)

## INTRODUCTION

In this research study, we are interested in learning about how you feel regarding this term's design project.

**Confidentiality**

Information you provide will be anonymous and will be held in the strictest confidence. All responses will be aggregated and reported as groups of responses so that no individual can be identified.

**Instructions**

This questionnaire is designed to elicit your views and feelings towards the questions and scenarios presented to you. Try to be as truthful as you can. There are no right or wrong answers so don't try to guess what you think the answer to a question is expected to be. We are simply looking for your views, feelings or beliefs. Feel free to add comments at the end of the study about the questions or your responses. . The questionnaire takes approximately 10 minutes to complete.

If we can assist you in any way, or if you have any questions or comments, please contact the researcher.

Gordon Adomdza  
Department of Management Sciences, University of Waterloo  
200 University Avenue West  
Waterloo, Ontario, N2L 3G1  
(519) 888 4567 x33422 (office)  
(519) 880 9055 (home)

[Next](#)

## Web-based Survey

### Preliminary questions

Before we begin

1. Please click on ONE button below

- 1.1  I work in a group on this design project. Please answer Question 2
- 1.2  I work alone on this design project. Please go to Question 3

Next

## Web-based Survey

### Preliminary questions

2. If you work in a group, rank the contribution of team members to this design project so far, including yours, in order of the highest contributor (1) to the lowest contributor (5). Contribution is in terms of the amount of creative and work effort.

Using initials of first and last names, please rank team members below. For you write "me".  
Don't write your name!

- 2.1 1
- 2 2
- 3 3
- 4 4
- 2.5 5

3. Now, imagine that you have cheques for a bank account from which you can draw money to buy out your group members' ownership stake in this project. In the space below the sample cheque leaf, write out the maximum amount you are willing to pay your group members (excluding you).



Amount: \$

Next

## YOUR DESIGN PROJECT EXPERIENCE

The following statements deal with your experiences and emotions relating to the building of this design project.

4. Indicate the degree to which you personally agree or disagree with the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree). Please click on a button for each statement on the scale below.

		1	2	3	4	5	
4.1	<input checked="" type="radio"/> I am experiencing a lot of exciting moments working on this design project.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.2	<input checked="" type="radio"/> I am feeling emotionally attached to this design project.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.3	<input checked="" type="radio"/> I am learning a lot in this design project.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.4	<input checked="" type="radio"/> I feel responsible for the success of this project.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.5	<input checked="" type="radio"/> The key concept of this project is from others in the group.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.6	<input checked="" type="radio"/> This project reflects who I am.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.7	<input checked="" type="radio"/> I am personally experiencing a lot of frustrations working on this design project.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.8	<input checked="" type="radio"/> The design of the project reflects how I think personally.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.9	<input checked="" type="radio"/> This is the biggest design project I have been involved.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.10	<input checked="" type="radio"/> The key concept of this project is came from me.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.11	<input checked="" type="radio"/> I don't feel any attachment to this design project.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.12	<input checked="" type="radio"/> Working through this project, I felt like a genius.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.13	<input checked="" type="radio"/> I see my personal ideas in every aspect of the project.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.14	<input checked="" type="radio"/> I have personally put a lot of work into this project.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.15	<input checked="" type="radio"/> This project does not reflect who I am.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
4.16	<input checked="" type="radio"/> I feel this project's success depends on others in the group, not me.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

5. Which of the following industries would you say your prototype applies to? Mark all that apply.

- 5.1  Environmental or Energy
- 5.2  Automotive
- 5.3  Sports or Leisure
- 5.4  Toys or Games
- 5.5  Medical or Health
- 5.6  Tools
- 5.7  Household or General Consumer Products
- 5.8  High Tech Equipment
- 5.9  Security or Safety
- 5.10  Industrial Equipment
- 5.11  Other (Please name)

6. The following question is on how much time, on average, you spend on this project? In the space below, please indicate how many hours, in your estimation, you spend on the project per week.

I spend  hours per week.

Next

## SEVERITY

**Instructions:** Assume that you have been approached by a company that may help you successfully commercialize your project and may also cheat you in the process. Without further information, indicate how severe the following outcomes of a business relationship might be.

7. Please click on a button for each statement on the scale below.  
NB: Remember we want your personal views.

		-6	-3	0	3	6		
7.1	<ul style="list-style-type: none"> <li>The company forcibly takes over the ownership of your project idea</li> </ul>	Extremely painful	<input type="radio"/>	Extremely pleasurable				
	<ul style="list-style-type: none"> <li>The company secretly imitates your project idea in one of their new products</li> </ul>	Extremely painful	<input type="radio"/>	Extremely pleasurable				
	<ul style="list-style-type: none"> <li>The contract you signed with the company contains hidden clauses that limit you</li> </ul>	Extremely painful	<input type="radio"/>	Extremely pleasurable				
7.4	<ul style="list-style-type: none"> <li>The company helps you achieve the level of success you wanted.</li> </ul>	Extremely painful	<input type="radio"/>	Extremely pleasurable				

Next

## LIKELIHOOD

**Instructions:** Next, assume that you have been approached by a company that may help you successfully commercialize your project and may also cheat you in the process. Without further information, indicate how likely you feel the following outcomes of a business relationship might be.

8. Please click on a button for each statement on the scale below

		1	2	3	4	5	6	7	8	9	10		
8.1	<ul style="list-style-type: none"> <li>How likely is it that the company forcibly takes over the ownership of the project idea?</li> </ul>	Not at all	<input type="radio"/>	Very likely									
	<ul style="list-style-type: none"> <li>How likely is it that the company secretly imitates your project idea in one of their new products?</li> </ul>	Not at all	<input type="radio"/>	Very likely									
	<ul style="list-style-type: none"> <li>How likely is it that the contract you signed with the company contains hidden clauses that limit you?</li> </ul>	Not at all	<input type="radio"/>	Very likely									
8.4	<ul style="list-style-type: none"> <li>How likely is it that the company helps you achieve the level of success you wanted?</li> </ul>	Not at all	<input type="radio"/>	Very likely									

Next

## CHOICE

9. Assume that you are faced with a company that may help you successfully commercialize your project and may also cheat you in the process.

Without further information, how certain are you that you will consider partnering with this company?

Please click on a button on the scale below

	1	2	3	4	5	
Not at all certain	<input type="radio"/>	Extremely certain				
	9.1				9.5	Next

## PERSONALITY

10. Listed below are various statements generally or typically relating to you. Please use the following scale to click on a button stating the extent to which you think the statement is a very accurate or inaccurate description of you.

		1	2	3	4	5				
10.1	<input type="radio"/> I listen to my feelings when making important decisions.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.2	<input type="radio"/> I enjoy being reckless.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.3	<input type="radio"/> I base my goals in life on inspiration, rather than logic.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.4	<input type="radio"/> I plan my life based on how I feel.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.5	<input type="radio"/> I find it easy to manipulate others.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.6	<input type="radio"/> I take risks.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.7	<input type="radio"/> I believe emotions give direction to life.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.8	<input type="radio"/> I listen to my heart rather than my brain.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.9	<input type="radio"/> I would never go hang-gliding or bungee-jumping	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.10	<input type="radio"/> I plan my life logically.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.11	<input type="radio"/> I would never make a high risk investment.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.12	<input type="radio"/> I believe important decisions should be based on logical reasoning.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.13	<input type="radio"/> I seek adventure.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.14	<input type="radio"/> I find it difficult to manipulate others.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.15	<input type="radio"/> I am willing to try anything once.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.16	<input type="radio"/> I lack the talent for influencing people.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.17	<input type="radio"/> I know how to get around the rules.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.18	<input type="radio"/> I can talk others into doing things.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.19	<input type="radio"/> I make decisions based on facts, not feelings.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.20	<input type="radio"/> I have a natural talent for influencing people.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.21	<input type="radio"/> I stick to the rules.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.22	<input type="radio"/> I avoid dangerous situations.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.23	<input type="radio"/> I listen to my brain rather than my heart.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.24	<input type="radio"/> I hate being the center of attention.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				
10.25	<input type="radio"/> I seek danger.	Very inaccurate	◀	<input type="radio"/>	▶	Very accurate				

[Next](#)

## GROUP WORK EXPERIENCE

11. Listed below are various statements generally or typically relating to you and group work for school. Please use the following scale to click on a button stating the extent to which you personally agree or disagree with the statements

NB: These statements relate to how you do group work at school

		1	2	3	4	
11.1	<input type="radio"/> I get easily overwhelmed by time pressures of group work	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
11.2	<input type="radio"/> As soon as I get up in the morning I start thinking about group work assignments.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
11.3	<input type="radio"/> When I get home, I can easily relax and 'switch off' group work assignments.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
11.4	<input type="radio"/> People in my group say I sacrifice too much for group work.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
11.5	<input type="radio"/> Group work rarely lets me go, it is still on my mind when I go to bed.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree
11.6	<input type="radio"/> If I postpone something that I was supposed to do today I'll have trouble sleeping at night.	Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Next

## BACKGROUND INFORMATION

12. Are you .....?

12.1  Male  Female 12.2

13. What is your age?

years

14. What year are you in?

15. What faculty are you in?

16. What department are you in?

### Comments

If there is anything else you would like to tell us about your feelings, beliefs, and ideas in this study, please use the space provided below.

### Study Results

If you want a summarized report on this study in the future, please enter your email address below.

Next



DEPARTMENT OF  
MANAGEMENT SCIENCES

# SURVEY MANAGEMENT TOOL Web-based Survey

## CONTROL ORIENTATION SURVEY

Thank you for your submission.

Please be reminded that this is the first part of the questionnaire.

You will be contacted at the end of July to fill the second part.

## C. Final Study: Part 2 – Treatment group

The treatment group was asked to recount a personal possession they lost and answer questions of how it felt

WEB-BASED SURVEYLogin

**INFORMATION LETTER FOR CONTROL ORIENTATION SURVEY**

Title of Research :	Control Orientation: The Role of Affect in Commercializing New Ideas
Investigator :	Gordon Adomdza University of Waterloo, Department of Management Sciences (519) 888-4567 Ext. 33422 <a href="mailto:gkadomdz@engmail.uwaterloo.ca">gkadomdz@engmail.uwaterloo.ca</a>

**Welcome back!**

Welcome back to the second phase of the Control Orientation survey.

If you didn't do the first phase, you can still complete the survey subject to slight changes in remuneration. Remember that we want your personal views, not that of your group.

We know your project idea may not be ready for market, but please answer the questions as if it was ready for market. Some questions (just a few) are repeated from Phase 1. Please bear with us. We want to capture any changes in your project since you filled the last survey.

If you need to read the information letter again see below.

This study is being conducted by Gordon Adomdza as part of his Ph.D. dissertation under the supervision of Dr. Scott Jeffrey (UW, Management Sciences) and Dr. Tom Åstebro (UT, Rotman School of Business). We are conducting research on how idea creators or inventors choose among commercialization options. There has been a lot of research into how inventors make decisions when it comes to putting their invention on the market, however, many questions remain. Since you are an idea creator by virtue of your participation in creating your engineering design project, we are inviting you to participate in this study.

If you agree to participate in this study, you will be asked to complete two (2) questionnaires in two (2) time periods. The first questionnaire, which you need to complete within the next two (2) weeks asks general questions about your project idea (for example, how you enjoy the creative process) and your perceptions on some hypothetical economic scenarios (for example, the extent to which certain events will happen). The second questionnaire will be sent to you at the end of July and it will ask for your judgments on economic scenarios (for example, what funding options you will choose for commercializing the design project).

By participating, you will be contributing towards helping the research community to better understand how scientific ideas such as yours could be made successful on the market. You will also learn about commercializing new ideas such as your design project. Further, you will receive \$20 at the end of the second questionnaire and a chance to win an Ipod Nano!

Participation in this study is voluntary, and will take approximately 10 minutes of your time. The second questionnaire, to be filled in July, will take approximately 20 minutes. You may decline to answer any questions that you do not wish to answer and you can withdraw your participation at any time. There will be no negative consequences and you will neither lose your \$20 compensation nor your chance to win an Ipod Nano.

All information you provide is considered completely confidential. Data collected during this study will be retained for 5 years in a locked cabinet in my supervisor's office CPH 4325. Only researchers associated with this project will have access. Furthermore, because the interest of this study is in the average responses of the entire group of participants, you will not be identified individually in any way in any written reports of this research.

I would like to assure you that this study has been reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo. However, the final decision about participation is yours. If you have any questions or concerns regarding your participation in this survey, please contact Dr. Susan Sykes, Director of the Office of Research Ethics at 519-888-4567 ext. 36005 or by email at [ssykes@uwaterloo.ca](mailto:ssykes@uwaterloo.ca).

If you want to participate, just click on the 'continue' button below. If you have any general questions or comments about this study, please contact Gordon Adomdza at 905-296-3232 or 519-888-4567 ext. 33422 or by email at [gkadomdz@engmail.uwaterloo.ca](mailto:gkadomdz@engmail.uwaterloo.ca). Further, if you would like to receive a copy of the results of this study, please contact Gordon Adomdza.

Thank you for your interest in this study.

Continue

## Web-based Survey

### Preliminary questions

The first few questions are based on unrelated subjects. You may have answered some of the questions in the first phase. Please bear with us.

Q24\_0

● How do you feel now?

1 to 5

	-2	-1	0	1	2	
<b>I am in bad mood.</b> ◀	<input type="radio"/>	▶ <b>I am in good mood.</b>				

1. If you work in a group, rank the contribution of team members to this design project so far, including yours, in order of the highest contributor (1) to the lowest contributor (5). Contribution is in terms of the amount of creative and work effort.

Using initials of first and last names, please rank team members below. For you write "me".  
Don't write your name!

1	<input type="text"/>	
2	<input type="text"/>	1 to 5
3	<input type="text"/>	
4	<input type="text"/>	
5	<input type="text"/>	

2. Now, imagine that you have cheques for a bank account from which you can draw money to buy out your group members' ownership stake in this project. In the space below the sample cheque leaf, write out the maximum amount you are willing to pay your group members (excluding you).



Amount: \$

Next

## YOUR DESIGN PROJECT EXPERIENCE

The following statements deal with your experiences and emotions relating to the building of this design project.

3. Indicate the degree to which you personally agree or disagree with the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree). Please click on a button for each statement on the scale below.

1 2 3 4 5

- 3 1  I am feeling emotionally attached to this design project. Strongly Disagree      Strongly Agree
- 3 2  This project reflects who I am. Strongly Disagree      Strongly Agree
- 3 3  I don't feel any attachment to this project. Strongly Disagree      Strongly Agree

4. The following question is on how much time, on average, you spend on this project? In the space below, please indicate how many hours, in your estimation, you spend on the project per week.

I spend  hours per week.

Next

## PERSONAL EXPERIENCES

You have just finished answering background questions about your design project. Before we go on to commercialization scenarios we will like you to answer some questions on your personal experiences.

5. Think of a current personal possession that is very dear to you. (A possession could be anything you own)

5 1 What can you think of?

How terrible will you feel if you lost this possession?

5 2 Not at all terrible  Somewhat  Extremely terrible

Next

## PERSONAL EXPERIENCES

Now, think of a time in the past when you lost a personal possession. It doesn't have to be similar to your current possession you identified. (please take your time to answer these questions)

What did you lose?

5 3

How much did you cherish it?

5 4

How did you lose it?

5 5

Describe as vividly as you can, your thoughts and feelings when you realised you had lost this possession.

5 6

## PERSONAL EXPERIENCES

Please answer the following questions.

6. How long ago did you experience this loss?

6 1  months  years 6 2

7. How unpleasant or painful was it?

7 1  Extremely unpleasant or painful  Very unpleasant or painful  Moderately unpleasant or painful  Mildly unpleasant or painful  Slightly unpleasant or painful  Not at all unpleasant or painful 7 6

8. To what extent do you still feel the loss, just by thinking about it?

Still feel the pain or unpleasantness  Somewhat  Not at all

9. To what extent do you believe that you may experience a similar loss again in the future?

I definitely believe it could happen again.  Maybe  Not likely to happen again

10. How much concern or worry do you have about the possibility of a similar loss in the future?

Extreme concern or worry  Very much concern or worry  Moderate concern or worry  Mild concern or worry  Slight concern or worry  No concern or worry at all

Next

## COMMERCIALIZATION

**Very Important: Please read this information about commercialization carefully before proceeding**

*Consider the commercialization of your design project. Commercialization is the business of selling your design project for money. You can self-commercialize or do it with a partner.*

*Either way, when successful, commercialization can give you tangible benefits like money and intangible benefits like fame or recognition.*

*However, when unsuccessful, you can have bad experiences: the project may be stolen, imitated or just exploited by your partner or someone else. Sometimes your partner will compete with you, and others will make money at your expense or become famous for something that you created.*

*NB: In the following exercise, you will be answering questions on commercialization scenarios. We know that your project may not be ready for commercialization. We just want you to answer the questions assuming your project is ready for the market.*

Next

## COMMERCIALIZATION

### Very Important: Please read instructions before proceeding

**Instructions:** Now, consider all the rights to your design project: the right to legally own the project, the right to make manufacturing and distribution decisions and the right to benefits from the project. Think of the effort you spent on the design project and your entitlement to these rights.

11. Assume that after an exhausting search for the "perfect partner" for commercialization, you identified the company, Commercialization Agencies Limited (CAL). CAL has partnered with many idea creators in successfully commercializing their ideas. However, as is the case with such companies, there are a few unsubstantiated instances in which the company has been accused of cheating.

Clearly, you have little information about how a business relationship with CAL might turn out but you can indicate what you think about certain issues in doing business with the company.

Imagine you are about to partner with CAL. Indicate the extent to which you agree or disagree with the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree). Please click on a button for each statement on the scale below. NB: Remember we want your personal views.

#### ***In a commercialization relationship with CAL.....***

		1	2	3	4	5				
11 1	<input type="radio"/> I want to be the sole owner of my design project	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				
	<input type="radio"/> I desire to be the main decision-maker on how the project is manufactured and distributed	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				
	<input type="radio"/> I desire to have control over how money is spent on the project	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				
	<input type="radio"/> I am happy to allow CAL to be the sole owner of my project	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				
	<input type="radio"/> I am happy to allow CAL the right to make manufacturing and distribution decisions for my project	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				
11 6	<input type="radio"/> I have no problem with allowing CAL to have control over how money will be spent on the project	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				

Next

## FUND RAISING

### Very Important: Please read instructions before proceeding

#### ● Venture Capital Funding Exercise

In the following exercise your aim is to raise funding for the commercialization of your design project. Two funding options will be presented to you in each round of decision-making. The options are provided by a Venture Capitalist (VC) and an Angel Investor (angel) who are individuals or entities that provide capital for business start-ups.

Up until the time you commercialize a design idea you have total control over such things as: ownership, management decisions and the tangible and intangible benefits from the design project.

However, when you enter into a contract to form a company with another party such as a VC or an angel investor, control over your design idea depends on how many shares you retain in the company. More shares mean more control. Under the terms of the contract, whoever has more than 50% of the shares has ultimate power over the design idea. For instance, if you have 49% of the shares and the VC has 51% of the shares, the VC can decide against implementing some of your ideas. Some future decisions you may or may not be able to make will involve product modifications, pricing, entering new markets, developing related products, etc.

Next

## FUND RAISING

### Very Important: Please read instructions before proceeding

**Instructions:** Now, consider all the rights to your design project: the right to legally own the project, the right to make manufacturing and distribution decisions and the right to benefits from the project. Think of the effort you spent on the design project and your entitlement to these rights.

12. Assume that a VC and an Angel present to you options to choose from. The first pair unveils the following details:

Note: Share allocations change over the next few pages.

#### VC Option 1

- You get \$4 million.
- The VC takes **55%** of the shares.
- You get the **45%** of the shares.

#### Angel Option 1

- You get \$2.5 million.
- The Angel takes **45%** of the shares.
- You get the **55%** of the shares.

Which option will you choose? Please click on ONE button.

VC option 1:

OR

Angel option 1:

12 1

12 2

## FUND RAISING

Very Important: Please read instructions before proceeding

13. Assume that the VC and Angel present to you another pair of options to choose from.

Note: Share allocations change over the next few pages.

### Angel Option 2

- You get \$2.5 million.
- The Angel takes **46%** of the shares,
- You get the **54%** of the shares.

### VC Option 2

- You get \$4 million.
- The VC takes **54%** of the shares,
- You get the **46%** of the shares.

Which option will you choose? Please click on ONE button.

Angel option 2:

OR

VC option 2:

12 2

12 1

## FUND RAISING

Very Important: Please read instructions before proceeding

14. The third pair of options is as follows:

Note: Share allocations change over the next few pages.

### VC Option 3

- You get \$4 million.
- The VC takes **53%** of the shares,
- You get the **47%** of the shares.

### Angel Option 3

- You get \$2.5 million.
- The Angel takes **47%** of the shares,
- You get the **53%** of the shares.

Which option will you choose? Please click on ONE button.

VC option 3:

OR

Angel option 3:

## FUND RAISING

Very Important: Please read instructions before proceeding

15. The fourth pair of options is as follows:

Note: Share allocations change on the next page.

### Angel Option 4

- You get \$2.5 million.
- The Angel takes **48%** of the shares,
- You get the **52%** of the shares.

### VC Option 4

- You get \$4 million.
- The VC takes **52%** of the shares,
- You get the **48%** of the shares.

Which option will you choose? Please click on ONE button.

Angel option 4:

OR

VC option 4:

## FUND RAISING

Very Important: Please read instructions before proceeding

16. The fifth pair of options is as follows:

### VC Option 5

- You get \$4 million.
- The VC takes **51%** of the shares,
- You get the **49%** of the shares.

### Angel Option 5

- You get \$2.5 million.
- The Angel takes **49%** of the shares,
- You get the **51%** of the shares.

Which option will you choose? Please click on ONE button.

VC option 5:

OR

Angel option 5:

## FUND RAISING

Very Important: Please read instructions before proceeding

17. The last pair of options is as follows:

Note: Share allocations are the same.

### Angel Option 6

- You get \$2.5 million.
- The Angel takes **50%** of the shares,
- You get the **50%** of the shares.

### VC Option 6

- You get \$4 million.
- The VC takes **50%** of the shares,
- You get the **50%** of the shares.

Which option will you choose? Please click on ONE button.

Angel option 6:

OR

VC option 6:

## MANAGEMENT ABILITY

### The VC/Angel management ability

18. This question is about how important the management abilities of the VC or the angel is to you in ensuring the success of the company you set up together.

How do you rate the importance of the VC/Angel's management ability?

Please click on a button on the scale below

	1	2	3	4	5	
Not important at all	<input type="radio"/>	Very important				

Next

## IMPORTANCE OF ASSETS AND PATENTS

### High excludability and the importance of third-party complementary assets

**Instructions:** The following questions concern the resources that you will need in successfully commercializing your invention.

To gain access to some of these resources you might need to enter into partnerships with existing companies. However, you may be able to build some of the resources yourself or contract out without a partnership deal.

19. Consider your project idea and the need for the following resources for a successful commercialization. To what extent can you gain access and use of these resources without a partnership deal with an existing company?

Please click on a button on the scale below

		1	2	3	4	5				
19 1	<input checked="" type="radio"/> I can assemble manufacturing resources without a partnership deal with an existing company.	To a small extent	◀	<input type="radio"/>	▶	To a large extent				
	<input checked="" type="radio"/> I can assemble distribution resources without a partnership deal with an existing company.	To a small extent	◀	<input type="radio"/>	▶	To a large extent				
	<input checked="" type="radio"/> I can assemble further project development resources without a partnership deal with an existing company.	To a small extent	◀	<input type="radio"/>	▶	To a large extent				
19 4	<input checked="" type="radio"/> I can assemble after-sales and support service resources without a partnership deal with an existing company.	To a small extent	◀	<input type="radio"/>	▶	To a large extent				

Next

## IMPORTANCE OF ASSETS AND PATENTS

**Instructions:** Assume that you want to commercialize your project. You **have a patent**, which means you can legally prevent others from producing or selling the project. You will need to partner with an existing company. Think of how much control you feel you should give this potential partner.

(For 50% control or lower you make the decisions in the commercialization of your project: for 50% or higher, the company makes the decisions)

20. How much control do you FEEL you should give this potential partner?

I will give the potential partner..... Please click ONE button below

- 20 1  less than 25% control
- between 26% and 50% control
- between 51% and 75% control
- 20 4  between 76% and 100% control

Next

## IMPORTANCE OF ASSETS AND PATENTS

21. Now, assume that you **DO NOT have a patent** on your project idea (you cannot legally protect the idea). How much control do you FEEL you should give a potential partner for access to resources for commercialization?

21 1 will give the potential partner..... Please click ONE button below.

- less than 25% control
- 21 4  between 26% and 50% control
- between 51% and 75% control
- between 76% and 100% control

Next

## EXPERIENCE WITH COMMERCIALIZATION

22. On the scale of 1 to 5 below rank your knowledge of the commercialization process and attendant issues prior to this study

Please click on a button on the scale below

	1	2	3	4	5	
I knew little	<input type="radio"/>	I knew everything				

23. If you had some knowledge about commercialization prior to this study, how did you learn about it?

Please check all that apply.

- 23 1  from reading about it
- seminar/talk/public lecture
- took a course
- personal research
- worked on a project for a company or someone else (coop job, business friend)
- 23 6  worked on commercializing my own project (either design project or another project)

Next

## MOOD

24. How do you feel now?

24 1

24 5

	-2	-1	0	1	2	
I am in bad mood.	<input type="radio"/>	I am in good mood.				

25. In what direction has your mood changed since you started the survey?

25 1  It has changed for the worst.

Worse.

No change

Better

25 5  It has changed for the best.

This question is about the loss you reported earlier at the beginning of the survey

26. To what extent was your mood affected by remembering the loss you suffered?

	1	2	3	4	5	
To a small extent	<input type="radio"/>	To a large extent				

27. What did you feel after answering the questions on the loss you suffered?

Please check all that apply.

27 1  Happiness

Anger

Excitement

Fear

Sadness

27 6  Nothing

Next

## COMMENTS

ii

### Comments

If there is anything else you would like to tell us about your feelings, beliefs, and ideas, please use the space provided below.

### Study Results

If you want a summarized report on this study in the future, please enter your email address below.

Next



DEPARTMENT OF  
MANAGEMENT SCIENCES

# SURVEY MANAGEMENT TOOL Web-based Survey

## CONTROL ORIENTATION SURVEY

### Thank you for your submission.

You are automatically entered into a draw for an Ipod Nano.  
The draw will be held by an independent body and the winner will be contacted by email.  
Three email notifications will be sent to the winner and the prize will be kept till the end of this year 2007.

### Payment Instruction

Payment of \$20 cash is available from the next Wednesday after you complete the study.  
You will need to show your student ID for payment to be possible.  
Please see Sandra Rivers (EIT 3029, x36908).  
If you have already left campus/town and will want alternative arrangement for payment,  
please send an email to Gordon Adomdza ([gkadomdza@gmail.uwaterloo.ca](mailto:gkadomdza@gmail.uwaterloo.ca)).  
If you did not complete the study or completed only the second phase, you get less than \$20.

## D. Final Study: Part 2 - Control Group

The control group were asked to write out an interesting experience that they encountered

WEB-BASED SURVEYLogin

**INFORMATION LETTER FOR CONTROL ORIENTATION SURVEY**

Title of Research :	Control Orientation: The Role of Affect in Commercializing New Ideas
Investigator :	Gordon Adomdza University of Waterloo, Department of Management Sciences (519) 888-4567 Ext. 33422 <a href="mailto:gkadomdz@engmail.uwaterloo.ca">gkadomdz@engmail.uwaterloo.ca</a>

**Welcome back!**

Welcome back to the second phase of the Control Orientation survey.

If you didn't do the first phase, you can still complete the survey subject to slight changes in remuneration. Remember that we want your personal views, not that of your group.

We know your project idea may not be ready for market, but please answer the questions as if it was ready for market. Some questions (just a few) are repeated from Phase 1. Please bear with us. We want to capture any changes in your project since you filled the last survey.

If you need to read the information letter again see below.

This study is being conducted by Gordon Adomdza as part of his Ph.D. dissertation under the supervision of Dr. Scott Jeffrey (UW, Management Sciences) and Dr. Tom Ástebro (UT, Rotman School of Business). We are conducting research on how idea creators or inventors choose among commercialization options. There has been a lot of research into how inventors make decisions when it comes to putting their invention on the market, however, many questions remain. Since you are an idea creator by virtue of your participation in creating your engineering design project, we are inviting you to participate in this study.

If you agree to participate in this study, you will be asked to complete two (2) questionnaires in two (2) time periods. The first questionnaire, which you need to complete within the next two (2) weeks asks general questions about your project idea (for example, how you enjoy the creative process) and your perceptions on some hypothetical economic scenarios (for example, the extent to which certain events will happen). The second questionnaire will be sent to you at the end of July and it will ask for your judgments on economic scenarios (for example, what funding options you will choose for commercializing the design project).

By participating, you will be contributing towards helping the research community to better understand how scientific ideas such as yours could be made successful on the market. You will also learn about commercializing new ideas such as your design project. Further, you will receive \$20 at the end of the second questionnaire and a chance to win an Ipod Nano!

Participation in this study is voluntary, and will take approximately 10 minutes of your time. The second questionnaire, to be filled in July, will take approximately 20 minutes. You may decline to answer any questions that you do not wish to answer and you can withdraw your participation at any time. There will be no negative consequences and you will neither lose your \$20 compensation nor your chance to win an Ipod Nano.

All information you provide is considered completely confidential. Data collected during this study will be retained for 5 years in a locked cabinet in my supervisor's office CPH 4325. Only researchers associated with this project will have access. Furthermore, because the interest of this study is in the average responses of the entire group of participants, you will not be identified individually in any way in any written reports of this research.

I would like to assure you that this study has been reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo. However, the final decision about participation is yours. If you have any questions or concerns regarding your participation in this survey, please contact Dr. Susan Sykes, Director of the Office of Research Ethics at 519-888-4567 ext. 36005 or by email at [ssykes@uwaterloo.ca](mailto:ssykes@uwaterloo.ca).

If you want to participate, just click on the 'continue' button below. If you have any general questions or comments about this study, please contact Gordon Adomdza at 905-296-3232 or 519-888-4567 ext. 33422 or by email at [gkadomdz@engmail.uwaterloo.ca](mailto:gkadomdz@engmail.uwaterloo.ca). Further, if you would like to receive a copy of the results of this study, please contact Gordon Adomdza.

Thank you for your interest in this study.

Continue

## Web-based Survey

### Preliminary questions

The first few questions are based on unrelated subjects. You may have answered some of the questions in the first phase. Please bear with us.

Q24\_0

● How do you feel now?

1 to 5

	- 2	- 1	0	1	2			
I am in bad mood.	◀	<input type="radio"/>	▶	I am in good mood.				

1. If you work in a group, rank the contribution of team members to this design project so far, including yours, in order of the highest contributor (1) to the lowest contributor (5). Contribution is in terms of the amount of creative and work effort.

Using initials of first and last names, please rank team members below. For you write "me".  
Don't write your name!

1

2  1 to 5

3

4

5

2. Now, imagine that you have cheques for a bank account from which you can draw money to buy out your group members' ownership stake in this project. In the space below the sample cheque leaf, write out the maximum amount you are willing to pay your group members (excluding you).



Amount: \$

Next

## YOUR DESIGN PROJECT EXPERIENCE

The following statements deal with your experiences and emotions relating to the building of this design project.

3. Indicate the degree to which you personally agree or disagree with the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree). Please click on a button for each statement on the scale below.

1 2 3 4 5

- 3 1  I am feeling emotionally attached to this design project. Strongly Disagree      Strongly Agree
- 3 2  This project reflects who I am. Strongly Disagree      Strongly Agree
- 3 3  I don't feel any attachment to this project. Strongly Disagree      Strongly Agree

4. The following question is on how much time, on average, you spend on this project? In the space below, please indicate how many hours, in your estimation, you spend on the project per week.

I spend  hours per week.

Next

## PERSONAL EXPERIENCES

We will like you to answer some questions to help us get an idea of how you perceive certain things.

5. Take a moment to reflect on a simple learning experience that you found interesting. We don't mean big life experiences but simple events like an unusual observation you made by the side of the road or on TV.

In a few words, briefly describe the experience.

Next

## COMMERCIALIZATION

**Very Important: Please read this information about commercialization carefully before proceeding**

*Consider the commercialization of your design project. Commercialization is the business of selling your design project for money. You can self-commercialize or do it with a partner.*

*Either way, when successful, commercialization can give you tangible benefits like money and intangible benefits like fame or recognition.*

*However, when unsuccessful, you can have bad experiences: the project may be stolen, imitated or just exploited by your partner or someone else. Sometimes your partner will compete with you, and others will make money at your expense or become famous for something that you created.*

*NB: In the following exercise, you will be answering questions on commercialization scenarios. We know that your project may not be ready for commercialization. We just want you to answer the questions assuming your project is ready for the market.*

Next

## COMMERCIALIZATION

### Very Important: Please read instructions before proceeding

**Instructions:** Now, consider all the rights to your design project: the right to legally own the project, the right to make manufacturing and distribution decisions and the right to benefits from the project. Think of the effort you spent on the design project and your entitlement to these rights.

11. Assume that after an exhausting search for the "perfect partner" for commercialization, you identified the company, Commercialization Agencies Limited (CAL). CAL has partnered with many idea creators in successfully commercializing their ideas. However, as is the case with such companies, there are a few unsubstantiated instances in which the company has been accused of cheating.

Clearly, you have little information about how a business relationship with CAL might turn out but you can indicate what you think about certain issues in doing business with the company.

Imagine you are about to partner with CAL. Indicate the extent to which you agree or disagree with the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree). Please click on a button for each statement on the scale below. NB: Remember we want your personal views.

#### ***In a commercialization relationship with CAL.....***

		1	2	3	4	5				
11 1	<input type="radio"/> I want to be the sole owner of my design project	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				
	<input type="radio"/> I desire to be the main decision-maker on how the project is manufactured and distributed	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				
	<input type="radio"/> I desire to have control over how money is spent on the project	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				
	<input type="radio"/> I am happy to allow CAL to be the sole owner of my project	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				
	<input type="radio"/> I am happy to allow CAL the right to make manufacturing and distribution decisions for my project	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				
11 6	<input type="radio"/> I have no problem with allowing CAL to have control over how money will be spent on the project	Strongly Disagree	◀	<input type="radio"/>	▶	Strongly Agree				

Next

## FUND RAISING

### Very Important: Please read instructions before proceeding

#### ● Venture Capital Funding Exercise

In the following exercise your aim is to raise funding for the commercialization of your design project. Two funding options will be presented to you in each round of decision-making. The options are provided by a Venture Capitalist (VC) and an Angel Investor (angel) who are individuals or entities that provide capital for business start-ups.

Up until the time you commercialize a design idea you have total control over such things as: ownership, management decisions and the tangible and intangible benefits from the design project.

However, when you enter into a contract to form a company with another party such as a VC or an angel investor, control over your design idea depends on how many shares you retain in the company. More shares mean more control. Under the terms of the contract, whoever has more than 50% of the shares has ultimate power over the design idea. For instance, if you have 49% of the shares and the VC has 51% of the shares, the VC can decide against implementing some of your ideas. Some future decisions you may or may not be able to make will involve product modifications, pricing, entering new markets, developing related products, etc.

Next

## FUND RAISING

### Very Important: Please read instructions before proceeding

**Instructions:** Now, consider all the rights to your design project: the right to legally own the project, the right to make manufacturing and distribution decisions and the right to benefits from the project. Think of the effort you spent on the design project and your entitlement to these rights.

12. Assume that a VC and an Angel present to you options to choose from. The first pair unveils the following details:

Note: Share allocations change over the next few pages.

#### VC Option 1

- You get \$4 million.
- The VC takes **55%** of the shares.
- You get the **45%** of the shares.

#### Angel Option 1

- You get \$2.5 million.
- The Angel takes **45%** of the shares.
- You get the **55%** of the shares.

Which option will you choose? Please click on ONE button.

VC option 1:

OR

Angel option 1:

12 1

12 2

---

## FUND RAISING

---

Very Important: Please read instructions before proceeding

13. Assume that the VC and Angel present to you another pair of options to choose from.

Note: Share allocations change over the next few pages.

### Angel Option 2

- You get \$2.5 million.
- The Angel takes **46%** of the shares,
- You get the **54%** of the shares.

### VC Option 2

- You get \$4 million.
- The VC takes **54%** of the shares,
- You get the **46%** of the shares.

Which option will you choose? Please click on ONE button.

Angel option 2:

OR

VC option 2:

---

12 2

12 1

---

## FUND RAISING

---

Very Important: Please read instructions before proceeding

14. The third pair of options is as follows:

Note: Share allocations change over the next few pages.

### VC Option 3

- You get \$4 million.
- The VC takes **53%** of the shares,
- You get the **47%** of the shares.

### Angel Option 3

- You get \$2.5 million.
- The Angel takes **47%** of the shares,
- You get the **53%** of the shares.

Which option will you choose? Please click on ONE button.

VC option 3:

OR

Angel option 3:

---

## FUND RAISING

Very Important: Please read instructions before proceeding

15. The fourth pair of options is as follows:

Note: Share allocations change on the next page.

### Angel Option 4

- You get \$2.5 million.
- The Angel takes **48%** of the shares,
- You get the **52%** of the shares.

### VC Option 4

- You get \$4 million.
- The VC takes **52%** of the shares,
- You get the **48%** of the shares.

Which option will you choose? Please click on ONE button.

Angel option 4:

OR

VC option 4:

## FUND RAISING

Very Important: Please read instructions before proceeding

16. The fifth pair of options is as follows:

### VC Option 5

- You get \$4 million.
- The VC takes **51%** of the shares,
- You get the **49%** of the shares.

### Angel Option 5

- You get \$2.5 million.
- The Angel takes **49%** of the shares,
- You get the **51%** of the shares.

Which option will you choose? Please click on ONE button.

VC option 5:

OR

Angel option 5:

## FUND RAISING

Very Important: Please read instructions before proceeding

17. The last pair of options is as follows:

Note: Share allocations are the same.

### Angel Option 6

- You get \$2.5 million.
- The Angel takes 50% of the shares,
- You get the 50% of the shares.

### VC Option 6

- You get \$4 million.
- The VC takes 50% of the shares,
- You get the 50% of the shares.

Which option will you choose? Please click on ONE button.

Angel option 6:

OR

VC option 6:

## MANAGEMENT ABILITY

### The VC/Angel management ability

18. This question is about how important the management abilities of the VC or the angel is to you in ensuring the success of the company you set up together.

How do you rate the importance of the VC/Angel's management ability?

Please click on a button on the scale below

	1	2	3	4	5	
Not important at all	<input type="radio"/>	Very important				

Next

## IMPORTANCE OF ASSETS AND PATENTS

### High excludability and the importance of third-party complementary assets

**Instructions:** The following questions concern the resources that you will need in successfully commercializing your invention.

To gain access to some of these resources you might need to enter into partnerships with existing companies. However, you may be able to build some of the resources yourself or contract out without a partnership deal.

19. Consider your project idea and the need for the following resources for a successful commercialization. To what extent can you gain access and use of these resources without a partnership deal with an existing company?

Please click on a button on the scale below

		1	2	3	4	5				
19 1	<input checked="" type="radio"/> I can assemble manufacturing resources without a partnership deal with an existing company.	To a small extent	◀	<input type="radio"/>	▶	To a large extent				
	<input checked="" type="radio"/> I can assemble distribution resources without a partnership deal with an existing company.	To a small extent	◀	<input type="radio"/>	▶	To a large extent				
	<input checked="" type="radio"/> I can assemble further project development resources without a partnership deal with an existing company.	To a small extent	◀	<input type="radio"/>	▶	To a large extent				
19 4	<input checked="" type="radio"/> I can assemble after-sales and support service resources without a partnership deal with an existing company.	To a small extent	◀	<input type="radio"/>	▶	To a large extent				

Next

## IMPORTANCE OF ASSETS AND PATENTS

**Instructions:** Assume that you want to commercialize your project. You **have a patent**, which means you can legally prevent others from producing or selling the project. You will need to partner with an existing company. Think of how much control you feel you should give this potential partner.

(For 50% control or lower you make the decisions in the commercialization of your project: for 50% or higher, the company makes the decisions)

20. How much control do you FEEL you should give this potential partner?

I will give the potential partner..... Please click ONE button below

- 20 1  less than 25% control
- between 26% and 50% control
- between 51% and 75% control
- 20 4  between 76% and 100% control

Next

## IMPORTANCE OF ASSETS AND PATENTS

21. Now, assume that you **DO NOT have a patent** on your project idea (you cannot legally protect the idea). How much control do you FEEL you should give a potential partner for access to resources for commercialization?

21 1 will give the potential partner..... Please click ONE button below.

- less than 25% control
- 21 4  between 26% and 50% control
- between 51% and 75% control
- between 76% and 100% control

Next

## EXPERIENCE WITH COMMERCIALIZATION

22. On the scale of 1 to 5 below rank your knowledge of the commercialization process and attendant issues prior to this study

Please click on a button on the scale below

	1	2	3	4	5	
I knew little	<input type="radio"/>	I knew everything				

23. If you had some knowledge about commercialization prior to this study, how did you learn about it?

Please check all that apply.

- 23 1  from reading about it
- seminar/talk/public lecture
- took a course
- personal research
- worked on a project for a company or someone else (coop job, business friend)
- 23 6  worked on commercializing my own project (either design project or another project)

Next

## MOOD

24. How do you feel now?

24 1

24 5

	-2	-1	0	1	2	
I am in bad mood.	<input type="radio"/>	I am in good mood.				

25. In what direction has your mood changed since you started the survey?

25 1  It has changed for the worst.

Worse.

No change

Better

25 5  It has changed for the best.

This question is about the learning experience you reported earlier at the beginning of the survey.

26. To what extent was your mood affected by remembering the learning experience?

	1	2	3	4	5	
To a small extent	<input type="radio"/>	To a large extent				

27. What did you feel after answering questions on the learning experience?

Please check all that apply.

27 1  Happiness

Anger

Excitement

Fear

Sadness

27 6  Nothing

Next

## COMMENTS

ii

### Comments

If there is anything else you would like to tell us about your feelings, beliefs, and ideas, please use the space provided below.

### Study Results

If you want a summarized report on this study in the future, please enter your email address below.

Next



DEPARTMENT OF  
MANAGEMENT SCIENCES

# SURVEY MANAGEMENT TOOL

## Web-based Survey

### CONTROL ORIENTATION SURVEY

#### Thank you for your submission.

You are automatically entered into a draw for an Ipod Nano.  
The draw will be held by an independent body and the winner will be contacted by email.  
Three email notifications will be sent to the winner and the prize will be kept till the end of this year 2007.

#### Payment Instruction

Payment of \$20 cash is available from the next Wednesday after you complete the study.  
You will need to show your student ID for payment to be possible.  
Please see Sandra Rivers (EIT 3029, x36908).  
If you have already left campus/town and will want alternative arrangement for payment,  
please send an email to Gordon Adomdza ([gkadomdza@gmail.uwaterloo.ca](mailto:gkadomdza@gmail.uwaterloo.ca)).  
If you did not complete the study or completed only the second phase, you get less than \$20.

## Appendix 3: Sample interview transcripts from interviews with subjects

### Respondent 1

1. What is the origin of this design project? What prompted the idea in the first place? How exciting was the realization? Any memories?

Answer:

The idea came up in a brainstorming session. It was originally a more complex solution that resulted in problems that we couldn't immediately solve. As a result, we dismissed the idea as not plausible and went about another idea. This other idea was exciting for me - something I wanted to do. However, group members opposed the idea at the start of the design phase and we reverted back to a simpler implementation of our original idea which was plausible. This new implementation, being purely software based, was less interesting to me, thus, I was less excited about it.

2. How difficult or easy was the process of putting together the concept of the design project? What kinds of experiences did you have? Any memories?

Answer:

As first mentioned, the original idea did not seem plausible due to some unsolvable issues. However, when reviewed, we discovered a simpler implementation which was feasible. Our ideas went through several brainstorming sessions which made the whole process difficult. This includes when we finally put together the design ideas of the actual project.

3. Once the concept was put together, how did the development process evolve? Did you and your team members spend more time than you envisaged? Less time? What kinds of challenges did you face?>

Answer:

Our development process involved several major problems that had to be resolved in order for the system to work. As a result, getting through each one was like reaching a milestone. It was generally a step-by-step procedure to get piece-by-piece working which worked well for our project. The time used was approximately what was expected. Certain portions took less, others took more.

4. Do you remember any moments of celebration during the development of the design project? What happened? How good was it? How did you feel?>

Answer:

Reaching each "milestone" (as mentioned above) was rewarding. The group was happy and up-beat each time we triumphed over a problem.

5. Do you remember any moments of frustration during the development of the design projects? What happened? How bad was it? How did you feel?

Answer:

There were several moments of frustration - unexpected issues and difficult problems. Each time we encountered one of these, it was very frustrating. There were feelings of anger and despair at times - like we wouldn't be able to solve an issue.

6. How will you describe the exhibition where the group showcased the idea? How did you feel about seeing the project on display, showing it off, or speaking about it?

Answer:

Personally, I felt good about it. I knew exactly what it was capable of, as well as its shortcomings. In terms of requirements, I knew it would pass, so I wasn't worried. I think my group members were a little more worried than I was.

7. How will you describe your level of attachment to this design > project? How attached do you feel to this project? Why?

Answer:

Personally, I'm not too attached to the project. It wasn't the idea that I was most excited about.

8. If you were to decide on transferring the project to someone else to market, will your attachment to it have any effect on the terms of agreement with this third-party? Why?

Answer:

I would doubt it. With limited attachment to begin with, I would only ensure simple terms to ensure that I benefit from the sale of the idea, nothing spectacular.

9. To what extent will you like to control the rights you have to the product prior to discussing transfer to a third party? What will you like to retain control of? Why?

Answer:

Personally, I would pass off a lot of the control provided I properly benefit from it.

10. Do you think when people create new ideas like this design project; they become attached to it in a way? How? Why?

Answer:

I think that people do, depending on their interest in the idea. If my group were still doing our 2nd idea (which I was most interested in), I would have been more attached to it.

11. Do you think when people create new ideas like this design project; it is difficult for them to allow third-parties to become a part of the commercialization process? How? Why?

Answer:

Again, I think it depends on the interest in the idea and, thus, their attachment.

- Thank you very much for your time. End

## **Respondent 2**

Interview guidelines

1. What is the origin of this design project? What prompted the idea in the first place? How exciting was the realization? Any memories?

Answer:

One team member thought of this idea, it was one of many considered. The intent was to come up with a high-tech solution with some marketing potential. Any field of application would have been OK. There was a lot excitement to finalize the project topic. We knew it would be difficult, but better something interesting to motivate, than something straightforward but dull.

2. How difficult or easy was the process of putting together the concept of the design project? What kinds of experiences did you have? Any memories?

Answer:

It was not a difficult process. Members volunteered ideas, and the group discussed advantages and disadvantages of each. People were not egotistic, hence all such meetings were educational and productive.

3. Once the concept was put together, how did the development process evolve? Did you and your team members spend more time than you envisaged? Less time? What kinds of challenges did you face?

Answer:

A lot more time was invested in the project than the course required/recommended. But we anticipated this from the initial design. There were some insurmountable challenges most due to limitations on the hardware we selected. Project scope needed some adjustment. We plan on doing some additional work before Symposium to better demonstrate the potential of the product at that point.

4. Do you remember any moments of celebration during the development of the design project? What happened? How good was it? How did you feel?

Answer:

Yes.. we always wanted to go out and grab a drink/meal after each milestone. And we did have time for that sometimes... It was nice to socialize with team members instead of discuss the project at those times.

5. Do you remember any moments of frustration during the development of the design projects? What happened? How bad was it? How did you feel?

Answer:

Yes.. sometimes very trivial errors took many days/weeks to find. The waste of time and effort is frustrating. Additionally, when people are stressed, sometimes they feel unhappy about any unbalance of control of the project across the team members.

6. How will you describe the exhibition where the group showcased the idea? How did you feel about seeing the project on display, showing it off, or speaking about it?

Answer:

This will occur in the Winter term (at Symposium). How happy we are will greatly depend on whether we revamp the system in the next four months in our spare time.

7. How will you describe your level of attachment to this design project? How attached do you feel to this project? Why?

Answer:

If it is a commercially viable product, we want to consider prospects of commercialization. We have enough attachment I think to continue forward with it. If we can't get it to work well enough, it will take some conscious effort to pull the plug (at least on my part).

8. If you were to decide on transferring the project to someone else to market, will your attachment to it have any effect on the terms of agreement with this third-party? Why?

Answer:

I'm not sure... My father is an entrepreneur, and I know how attachment limits marketing potential due to insistence on control and resistance to sharing. It will depend on how the majority of the group feels. If enough people want to participate in future development, we will keep control, otherwise, perhaps we should sell all of it.

9. To what extent will you like to control the rights you have to the product prior to discussing transfer to a third party? What will you like to retain control of? Why?

Answer:

I don't think it's beneficial to keep control for emotional reasons. It should depend on interest and potential revenue.

10. Do you think when people create new ideas like this design project; they become attached to it in a way? How? Why?

Answer:

It depends on the motivation behind their development. There can conceivably be three in my opinion: something to pass the course, something to market, or something revolutionary... the last motive will definitely cause emotional attachment. I think any could apply to any group, depending on the idea they came up in time for the proposal submission.

11. Do you think when people create new ideas like this design project; it is difficult for them to allow third-parties to become a part of the commercialization process? How? Why?

Answer:

I think they'll have difficulty taking risks. Because of the amount of development effort already invested. But design project shouldn't be too significant of a problem, because its duration was short, and is already shared with four people.

The way I think of it, if they were able to come up with a great idea once, there will be many more down the road. No need to hang on too tightly...

- Thank you very much for your time.

## Appendix 4: Information on design projects

### A. Project Deliverables

---

#### Design Project Timetable

Term	Deliverable	Comments	Scheme	Code	Submission	Marker
4A	Class of 2007	ECE 492A Engineering Design Project	0.15 credit			
	ECE Access	Lab Request access to project lab space and equipment	ECE Not graded			Lab Instructor
	Project Specification		Pass/Resubmit	PS	UW ACE	Instructors
	Block Verification		Pass/Resubmit	BV	UW ACE	Instructors
	Detailed Design		Pass/Resubmit	DD	UW ACE	Instructors
	Prototype Testing Checklist		Pass/Resubmit	PT	UW ACE	Instructors
	Prototype Demonstration	Submit a hardcopy of the checklist to your consultant for assessment	0.15 letter	PD	Submit with Experience Report	Consultants and Instructors
	Experience Report	Submit online and submit a signed hardcopy to the drop box in the ECE Main Office	Pass/Resubmit	ER	UW ACE and ECE Main Office	Instructors

#### Project Deliverables

Group sign up		Sign up
Proposal sign up		Sign up
Project Agreement	P/F	1 sheet
Abstract	P/F	50-100 words
Statement of Work		4-5 pages
Requirements Specification		2-3 pages
Block Diagram		1-2 pages

Plan and Budget			2-3 pages
Proposal Presentation			15 min.
Proposal Critiques (x2)		P/F	1 sheet
4 A EandCE 492A	0.15	credit	-5% late penalty per day
Block Verification		0.03	2-5 pages
Detailed Design		0.03	5-20 pages
Prototype Testing Checklist		0.03	2-5 pages
Prototype Demonstration		0.03	See PT
Experience Report		0.03	2-5 pages

### **B. News Release on Display of Projects in this sample**

<http://newsrelease.uwaterloo.ca/news.php?id=4934>

2008-01-15 10:28:23

#### **Engineering students showcase innovative tech projects**

WATERLOO, Ont., (Tuesday, Jan. 15, 2008) -- Students from the University of Waterloo's electrical and computer engineering program will exhibit innovative projects, such as an automatic transmission for bicycles and an energy storage system for home use, at the eighth annual design project symposium next week.

They will present design projects covering technological developments in such diverse areas as computing, communications, entertainment, information technology and robotics, as well as in medical, power and transportation systems.

The event will be held Wednesday, Jan. 23. at the William G. Davis Computer Research Centre on the UW campus, from 9 a.m. to 8 p.m. Visitors are welcome to browse the interactive displays and meet with students during the symposium.

"This is an exceptional opportunity for people to see these exciting projects first-hand and to speak with our students," says Bill Bishop, fourth-year design project coordinator. "The symposium showcases the talent and innovation of our outstanding students in the electrical and computer engineering program."

The more than 250 students will present 60 interactive projects in seminar format to guests from industry and the academic community. They will also display design project prototypes at a poster presentation session running the entire day.

The Infusion Cup will be awarded for the best overall design project. The prize is sponsored by Infusion Angels, a company located at the Waterloo Research and Technology Park.

The design projects include:

\* Automatic Bicycle Transmission. The project showcases a prototype automatic transmission system for a bicycle. Riders input various parameters describing their bicycle and cycling style into the system. The design results in increased simplicity for riders, as well as improved customization, precision and performance.

\* Automatic Garbage Pickup Robot. The project's prototype aims to solve garbage pickup problems by creating a machine that automatically detects and collects garbage. The designed system involves a movable mini robot with a video camera. It features a control system that processes the incoming image to identify garbage and sends a signal for the robot to collect the trash.

\* Home Energy Distribution and Storage System. The project presents a prototype energy storage system for homes. It will draw and store energy from the electricity grid during off-peak hours and supply a house with power during the day. The device will include the power electronics necessary to supply the house with electricity of acceptable quality.

\* Smart Avalanche Transceiver. The project's prototype combines existing avalanche transceiver technology with a new system that allows rescuers to locate an avalanche victim faster, more reliably and with less product-specific training. Each device will utilize GPS and continuous inter-device communication to provide information on the victim's whereabouts.

Students participating in the symposium have completed an intensive design project course sequence. The final-year course challenges them to work in groups to identify and address specific design problems.

## **Past Symposiums**

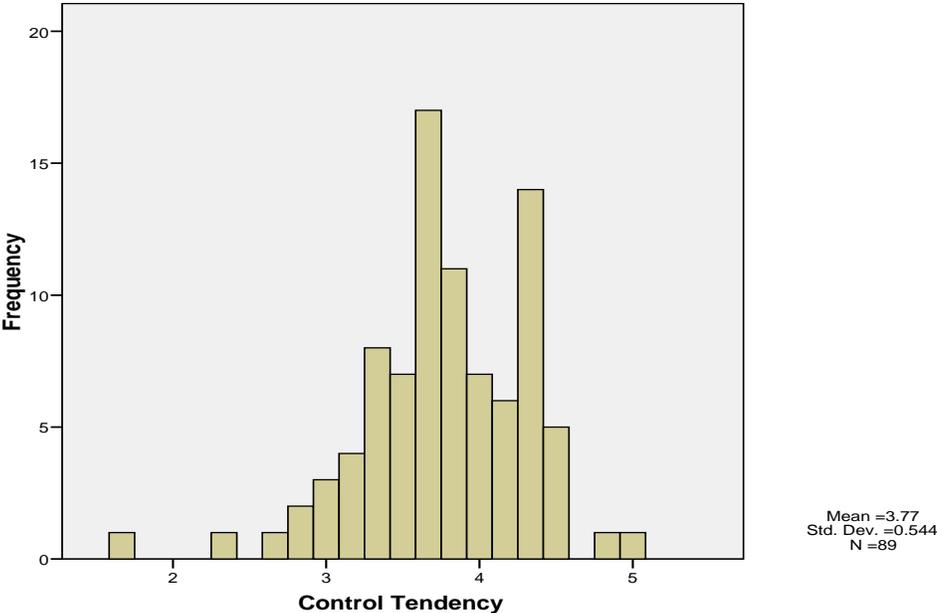
For the past seven years, the design project symposiums have provided excellent opportunities to the general public to view the innovative work of our undergraduate students in Electrical and Computer Engineering. If you have not yet had an opportunity to attend a previous symposium, you can get a feel for the event by viewing the following segment entitled, "[Waterloo's Casinobot](#)", that appeared nationally on the [Daily Planet television show](#).

Waterloo's Casinobot

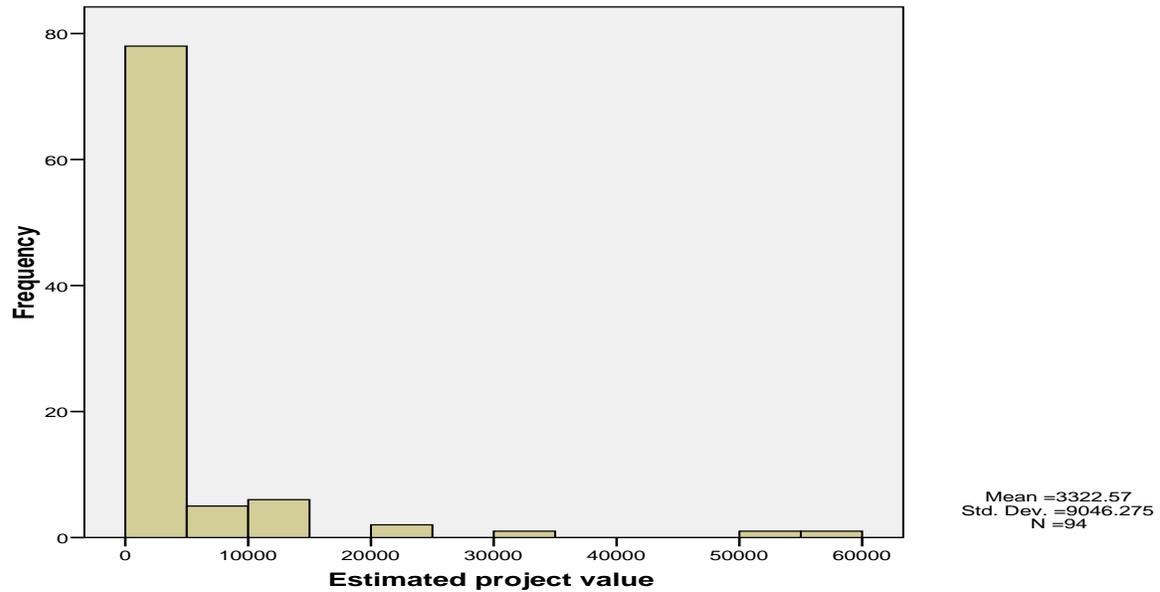
<http://www.exn.ca/dailyplanet/view.asp?date=1/23/2006>

**Appendix 5 : Additional statistical results**

**5.1 Histogram of control tendency measure**



## 5.2 Histogram of estimated project value

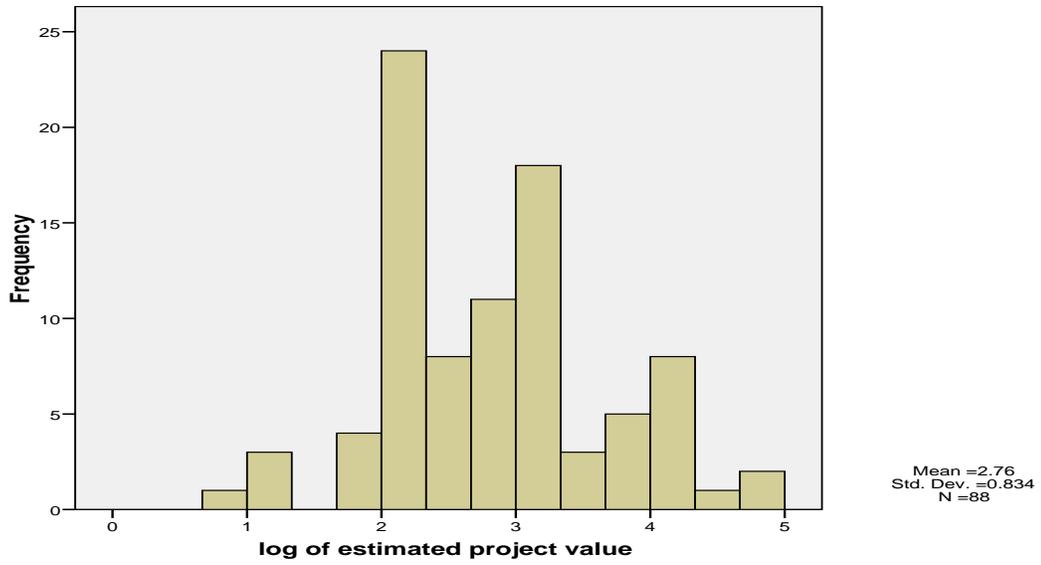


## Descriptive statistics for estimated project value

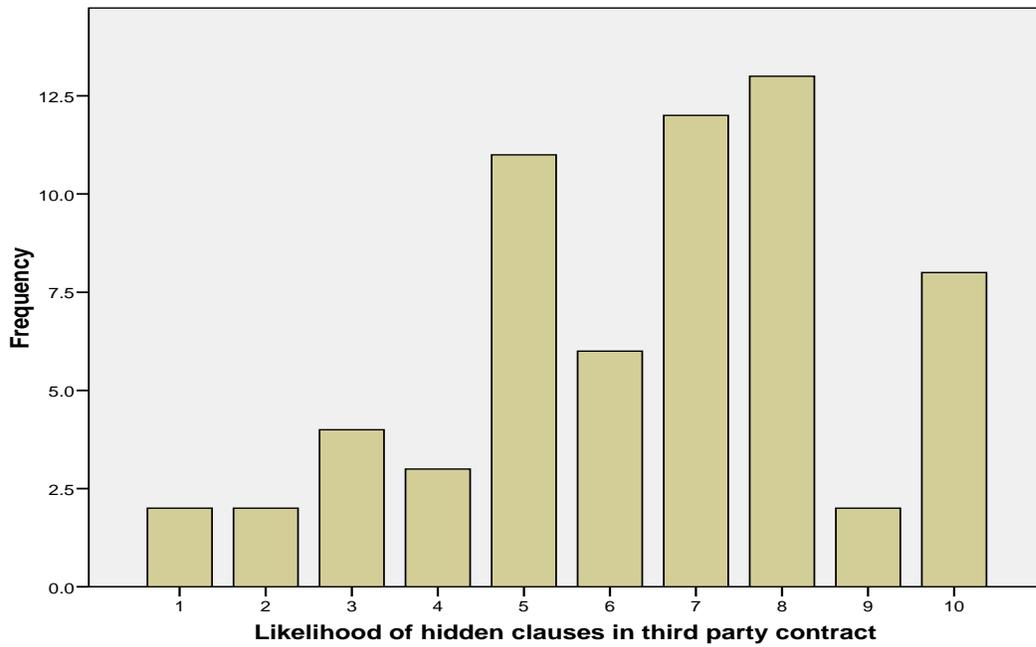
Statistics	Value	
Mean	3322.57	
Median	500.00	
Std. Deviation	9046.28	
Skewness	4.63	
Std. Error of Skewness	0.25	
Minimum	0	
Maximum	60000	
Percentiles		
	25	100.00
	50	500.00
	75	1275.00

(N, 94)

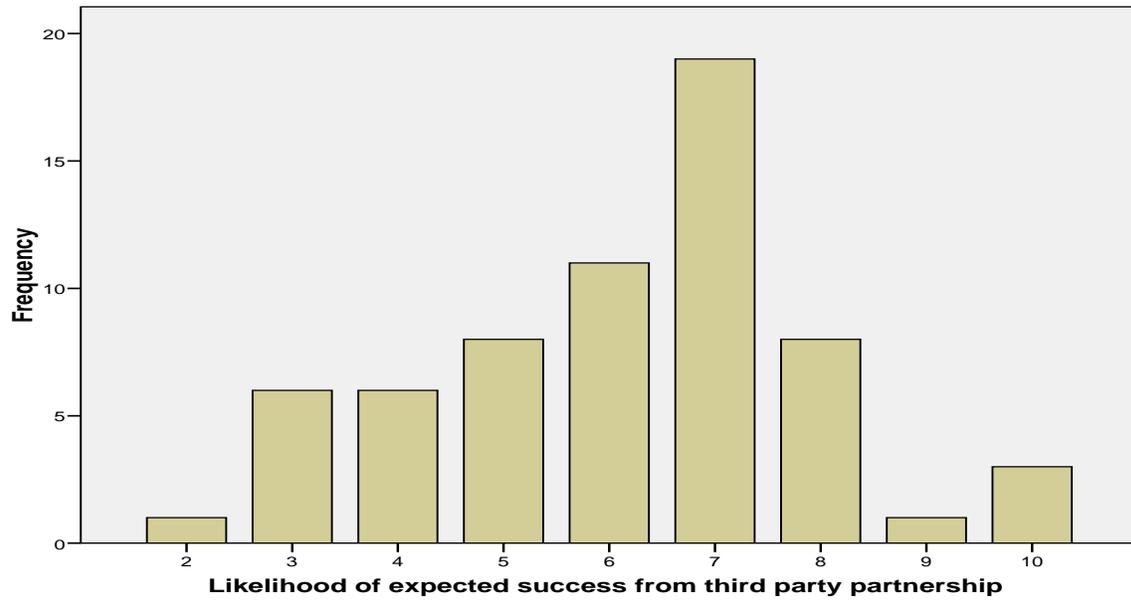
### Histogram of log of estimated project value



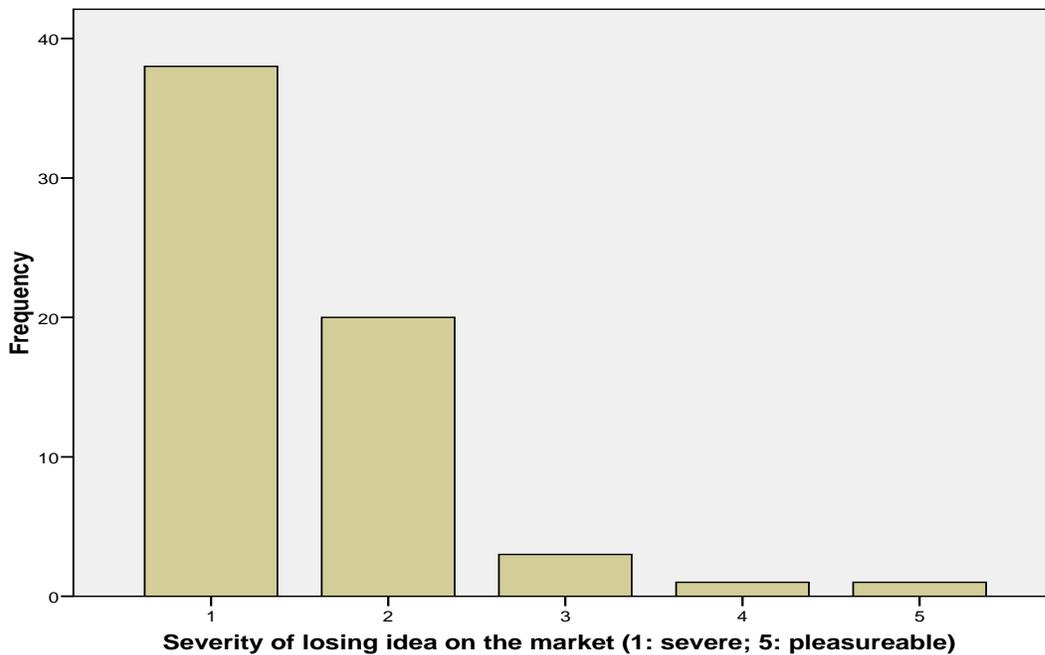
### 5.3 Histogram of trust proxy



#### 5.4 Histogram of perceived likelihood of expected success from a potential collaboration



#### 5.5 Histogram of perceived severity of idea loss on the market



## 5.6 Control Preferences for subjects using the two-item measure of psychological attachment

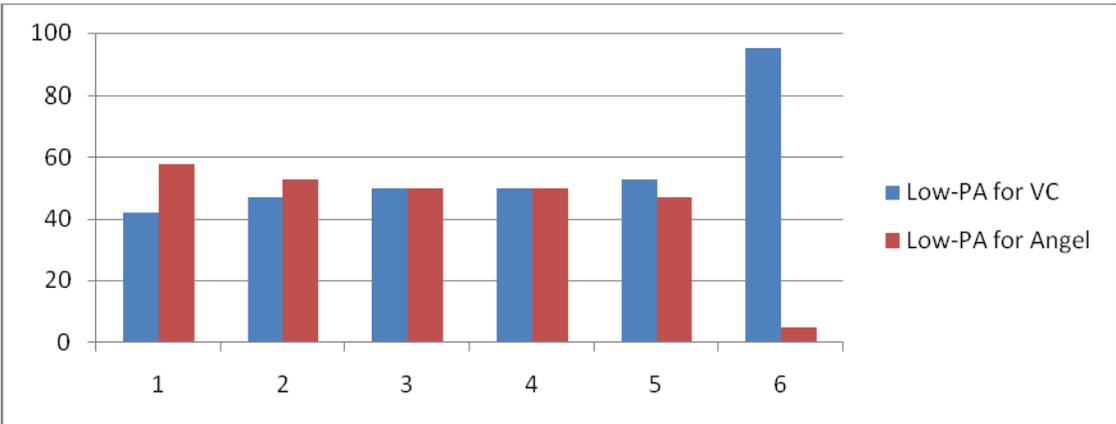
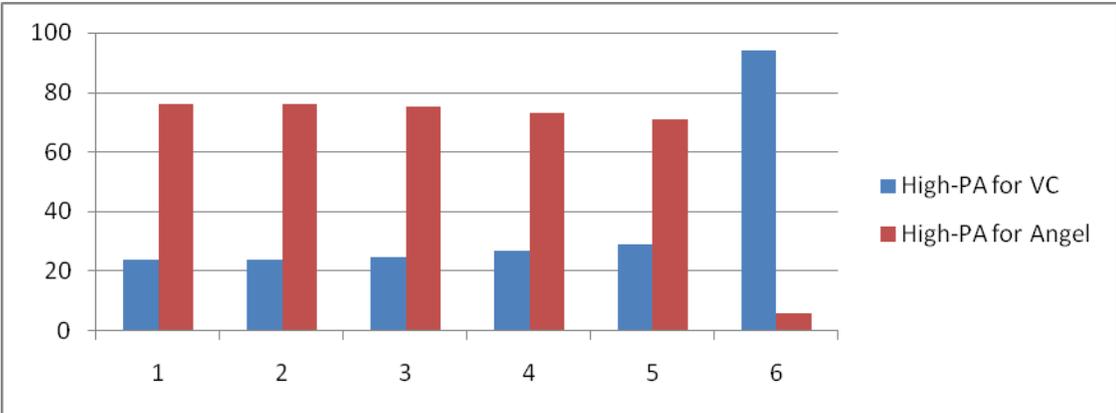
### 1. Percentages of subjects choosing VC and Angel offers

A	Rounds of offers		<b>1</b>		<b>2</b>		<b>3</b>		<b>4</b>		<b>5</b>		<b>6</b>	
			VC	Angel	VC	Angel								
B	High PA	% of subject choices	24	76	24	76	25	75	27	73	29	71	94	6
C			<i>a.13</i>	<i>b.44</i>	<i>a.13</i>	<i>b.44</i>	<i>a.15</i>	<i>b.43</i>	<i>a.16</i>	<i>b.42</i>	<i>a.17</i>	<i>b.40</i>	<i>a.54</i>	<i>b.3</i>
D	Low PA	% of subject choices	42	58	47	53	50	50	50	50	53	47	95	5
E			<i>c.18</i>	<i>d.25</i>	<i>c.20</i>	<i>d.23</i>	<i>c.21</i>	<i>d.21</i>	<i>c.21</i>	<i>d.21</i>	<i>c.22</i>	<i>d.21</i>	<i>c.41</i>	<i>d.2</i>
F	<i>F</i>		3.55†		5.77*		5.93*		4.90*		5.09*		0.02	
G	VC (offer \$4m), takes %		55		54		53		52		51		50	
H	Angel (offer \$2.5m), takes %		45		46		47		48		49		50	

(*N*, 56), \*  $p < 0.05$ , †  $p < 0.10$

Note: The cells denoted as *a*, *b*, *c* and *d*, indicate the percentages of subjects choosing within each round (deals) and sums up to 100%.

**5.7 Percentages of subjects choosing VC and Angel offers within high and low psychological attachment groups**

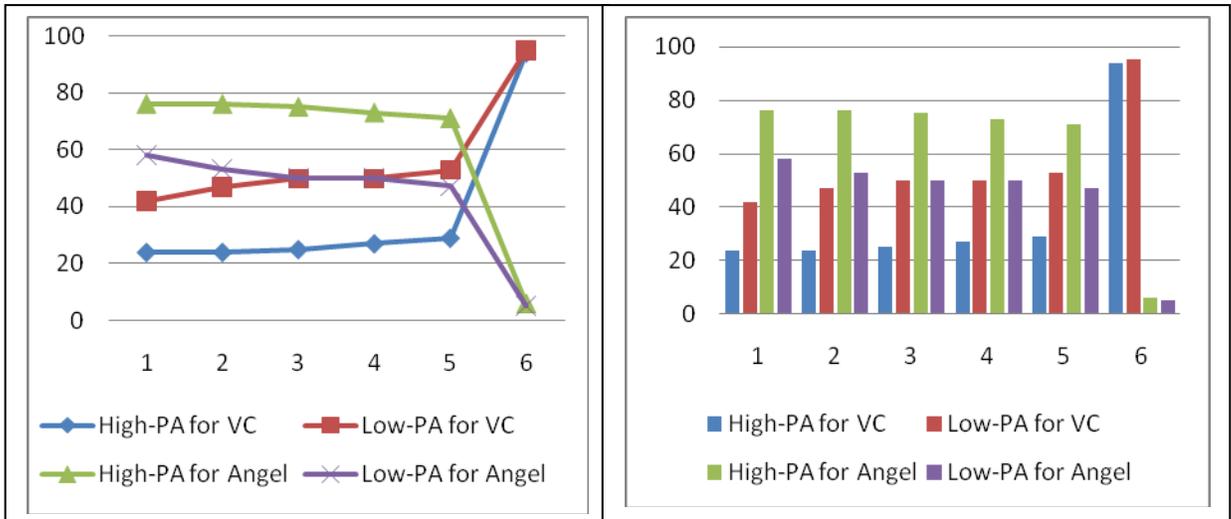


*F*      3.55†    5.77\*    5.93\*    4.90\*    5.09\*    0.02

(*N*, 89),    \* *p* < 0.05,    † *p* < 0.10

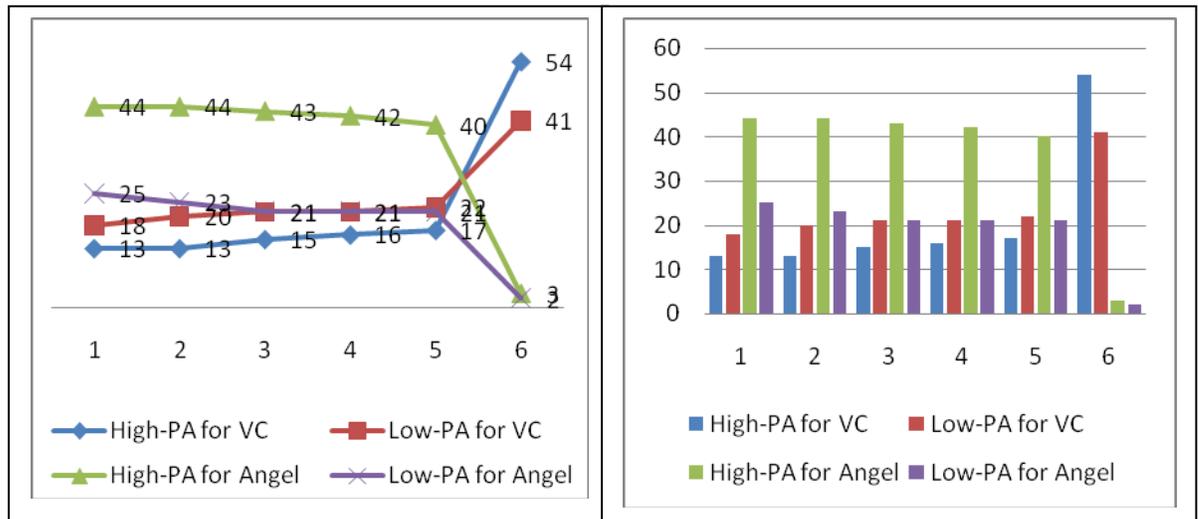
**5.8 Percentages of subjects in high and low psychological attachment groups choosing VC and Angel offers across rounds (a representation of Appendix 6.2)**

Percent subject preferences across rounds

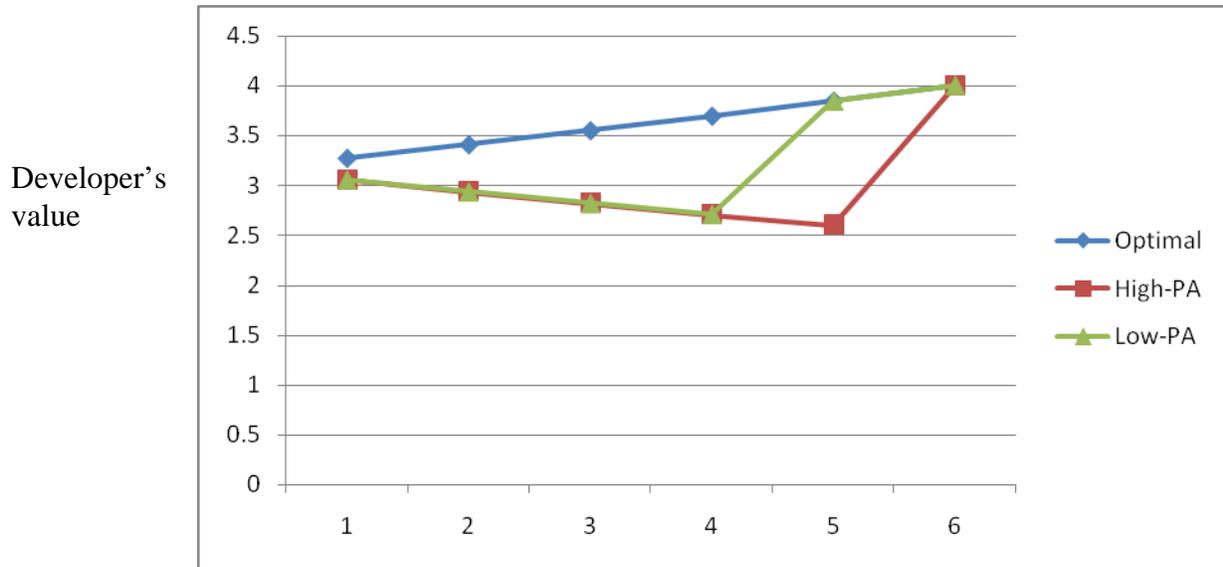


**5.9 Percentages of subjects in high and low psychological attachment groups choosing VC and Angel offers within rounds**

Percent subject preferences within each round



**5.10 Comparison of subjects share preferences in the high and low psychological attachment groups with the optimal choice**



VC (offer \$4m), takes %	55	54	53	52	51	50
Angel (offer \$2.5m), takes %	45	46	47	48	49	50