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Effectual Versus Predictive Logics in Entrepreneurial Decision-Making: Differences Between Experts and Novices in the State of Maine

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EFFECTUAL VERSUS PREDICTIVE LOGICS IN ENTREPRENEURIAL DECISION-MAKING: DIFFERENCES BETWEEN EXPERTS AND NOVICES IN THE STATE OF MAINE

by

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ABSTRACT

This study is a replication of research done by Dew et al. (2009) that aims to confirm that expert entrepreneurs use effectual logic framework as opposed to the casual, or predicitive, logic utilized by novices. In order to test this theory we provided 5 expert entrepreneurs and 5 novices with a case statement that provided information of an imaginary new venture and asked them to think aloud continuously as they solved decision-making problems relevant to this, and any, new venture while we recorded them. We coded the transcriptions of these recordings according to the scheme of the Dew et al. 2009 study and analyzed the coded results. We found that while the majority of the results were similar, there were notable differences among specific metrics, but not entire constructs. We posit that many of these differences may be attributed to the smaller sample size of this study and the three main differences between the two studies: participant pool, environmental factors, and the recruitment process. We further recommend that additional research be conducted to better understand the influence of the participants environment, innovation engineering training, and the participants overall experience with the recruitment process and execution of the interviews.

DEDICATION

This is dedicated to all the frazzled entrepreneurs out there, without whom I would have had nothing to write about, and to those brave souls who are thinking of striking out on their own entrepreneurship journey, come on in, the water's on fire, but it's totally fine!

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INTRODUCTION

Background

The growing body of entrepreneurial research dedicated to effectuation has only just begun to address the practical differences that contribute to an expert entrepreneur's ability to succeed. Identifying these characteristics could allow us to begin creating an effective method for incubating successful entrepreneurs in Maine, and in turn, lead to increased economic production via innovation. As the field often thrives on shunning academic and traditional approaches to problem solving, it is necessary to identify how the cognitive frameworks utilized by experts differ from those used by novices so as to identify potential teaching opportunities.

According to the existing body of literature, expert novice studies can be an effective way to identify and examine the differences in cognitive processing between expert entrepreneurs and non-experts to better understand what education is necessary. In one such study, it is established by Bedard and Chi that experts are differentiated not by the depth or breadth of their knowledge but rather by the superior way in which they organize, frame, and represent their knowledge (1992). Further research by Baron and Ensley supports the conclusion that the prototype of experts is better defined than that of novices, and experts are seemingly more focused on meaningful objectives that are vital to new ventures (2006).

Motivation

This research is important to the financial future of the state, as Catherine Renault stated in her report about transforming the Maine economy:

> Innovation and entrepreneurship are major drivers of economic growth. Support for them is a primary role of state government in order to increase the well being of its citizens through the provision of well-paying jobs that cannot be easily exported (2014).

As any additional efficiencies in the entrepreneurial life cycle could significantly impact the economic growth of the state, identifying meaningful cognitive differences between experts and novices in this case study could result in substantial improvements to the state's industries by establishing areas for professional development.

It is vital that we work towards identifying new and effective options for educating novice entrepreneurs. While experts will display room for improvement in certain respects, they will also be less open to accepting feedback. Thus, there is a finite window of time where education could significantly improve entrepreneurial outcomes (Chi et. al 2006).

Purpose

In this study, we hope to use the existing structure of expert-novice research in entrepreneurship to bridge the gap between academic works and practical applications and to ultimately contribute to the structure of Maine's existing entrepreneurship programs. We will be replicating Dew et al.'s study, *Effectual versus predictive logics in entrepreneurial decision-making: Differences between experts and novices* with three key differences; The pool of participants will be geographically constrained to the state of Maine, the protocols will not be collected in laboratory settings, and, for convenience,

participants will be selected and recruited via personal contacts rather than lists from national publications (2009).

Objective

We hope to find that the results of this replication will be consistent with the results of Dew et al. yet specific to entrepreneurs in the state of Maine (2009).

Contribution to Literature

As this study is a replication, it contributes to the existing literature by validating the findings of Dew et al. and noting differences that arise (2009). In addition, the current study contributes to the field of entrepreneurial research by suggesting exciting opportunities for further streams of research regarding the influence of the following on research results: training related to innovation for novices, environmental factors on participant responses, and the recruitment process of participants, specifically building rapport with the researcher.

Organization of the Paper

The study will begin with the introduction and background section and move into an extensive literature review of the study being replicated, *Effectual versus predictive logics in entrepreneurial decision-making: Differences between experts and novices*, to provide sufficient information on the basis of this study. Following this, the researcher will update the literature review to include sources from the decade since the previous study was published. It will discuss the expected differences between experts and novices, which are consistent with the first study, and the differences between this replication and the original. Next, the methods and procedures that the two studies share will be explained, and the data of this study will be presented. The results will be further

analyzed, and their limitations stated, our findings will be discussed, and we will conclude with the academic and applied implications of this study.

REVIEW OF EFFECTUAL VERSUS PREDICTIVE LOGICS IN ENTREPRENEURIAL DECISION-MAKING: DIFFERENCES BETWEEN EXPERTS AND NOVICES

Framing

Recent research surrounding causation and effectuation theories relies heavily on the theory of framing. Specifically, the idea that the principal difference between causal and effectual methods is how the entrepreneur frames a problem. The use of the term framing refers to "the decision-maker's conception of the acts, outcomes, and contingencies associated with a particular choice" (Tversky and Kahneman, 1981). Thaler (2000) posits that it would be beneficial to further research the key role of framing, writing that, regarding potential improvements in the field of economics, "prospect theory tells us that choices depend on the framing of a problem, but does not tell us how people will spontaneously create their own frames". Furthermore, it has long been established that the development of increased expertise allows individuals to create more productive frames (Bettman and Sujan, 1987).

This is significant, because the way an individual frames a problem "will determine what they experience as relevant phenomena, what they count as data, what inferences they make about the situation, and how they conceptualize it" (Johnson and Lakoff 2002). Thus, in general, frames are the structure entrepreneurs utilize in order to understand a problem, establish criteria, identify and react to constraints, seek alternatives, and evaluate those alternatives before pursuing a course of action (Gifford, 1992; Elliott et al., 1998).

Causation

The causation process is not the opposite of effectuation. However, the two must be understood as alternatives to one another. Causation is the process used by entrepreneurs who have a very clearly defined and specific vision of the final result that they wish to obtain. Such entrepreneurs go about searching for opportunities that meet these criteria and organizing the necessary resources to achieve this result (Fiet, 2002; Herron and Sapienza, 1992). These theories are based on foundational work by Stigler (1952) that discuss his understanding of rational decision making. In addition, later work by Viale (1992) suggests that a rational decision maker will collect available information relevant to each alternative in a causal framework and use that information and the perceived value of each alternative to select a course of action.

It has been established by Sarasvathy (2001: 245) that "causation processes take a particular effect as given and focus on selecting between means to create that effect". Causation is a useful alternative to effectuation when situationally appropriate (Chandler 2011). However, a significant body of earlier research posits that entrepreneurs identify opportunities and ultimately choose how to pursue them based on the causal framework to the exclusion of other alternatives. This suggests that entrepreneurs with search and implementation skills would be best prepared to succeed (Fiet 2002)(Casson and Wadeson, 2007)(Caplan, 1999), and a causal exercise like a business plan would effectively prepare a prospective entrepreneur for new venture creation. However, while the exercise is still widely used, the empirical evidence regarding the usefulness of business plans is mixed (Honig and Karlsson, 2004; Liao and Gartner, 2006).

Effectuation

In contrast to causal processes, "effectuation processes take a set of means as given and focus on selecting between possible effects that can be created with that set of means''(Sarasvathy, 2001). Entrepreneurs who utilize effectual logics are unlikely to spend time trying to predict in detail the future of their venture and will instead spend time building an antifragile venture that is agile enough to react to an ever changing set of internal and external variables. Rather than attempting to predict the future with such accuracy that it becomes inevitable, the effectual entrepreneur best utilizes the intellectual and physical resources under their control to adjust the outcome to be desirable. In 2008, Sarasvathy clarified that "effectuation is a logic for practicing entrepreneurship as a method and studying it as a science of the artificial", whereby a science of the artificial is taken to mean "one that studies some subset of human artifacts" such as entrepreneurs and their ventures (Nelson 2012)(Sarasvathy, 2008 p. 153)(Sarasvathy, 2008 p. 183). (Dew et al., 2009)

Expertise

The study of expertise has been attracting modern research for the past four decades or more in several domains. One of the earliest domains investigated extensively was chess, specifically the study of chess masters and what differentiated them from non-expert players. It was discovered that, in fact, the superior performance of a master could not be attributed to traditional notions of intelligence as there was no statistical correlation between the two (Chase and Simon, 1973; Simon and Chase, 1973; Doll and Mayr, 1987). These early studies found that instead, mastery of the strategy game could be more accurately attributed to the individual's use of an alternative framing process by which the master identified problems and created or developed solutions. Extensive

research has since been performed to confirm that the results observed in the domain of chess apply to other dynamic domains as well (Ericsson, 2006a,b,c; Klein, 1998).

Recognizing that expertise is domain specific, this study will investigate experts in entrepreneurship where 'entrepreneurship' is defined similarly to the study being replicated as "the creation of new ventures, new products and new markets" (Dew et al., 2009). The term 'expert' is similarly defined as "someone who has attained reliably superior performance in a particular domain" (Dew et al., 2009; Foley and Hart, 1992; Ericsson et al., 1993; Ericsson, 2006a,b,c). In keeping with the original study, this replication will also limit expertise to include 'strong-form' expertise only - that is, expertise through extensive personal knowledge and experience rather than 'weak-form' expertise, which can be garnered via advanced technical modeling (Dew et al., 2009; Mieg, 2001).

Domain Specific Expertise

While expertise cannot be transferred between unrelated settings, several studies, starting as early as 1994, have supported the analysis of entrepreneurship as a domain of expertise (Mitchell, 1994; Mitchell and Seawright, 1995). In subsequent years, research on entrepreneurial cognition has been successfully conducted in the expert-novice framework suggested (Dew et al., 2009; Mitchell et al., 2000; Gustafsson, 2004). While entrepreneurship is strategic and thus shares characteristics similar to other domains such as chess mastery, the differences in the heuristic principles of each separate these two settings into two distinct domains (Shepherd and Zacharakis, 2002; Feltovich et al., 2006). That said, the remarkable thing about the study of expertise is that, regardless of the domain specific differences, the underlying cognitive processes are consistent across

all settings (Mitchell et al., 2000; Feltovich et al., 2006). While theories of effectual logic do not negate the significance of other variables that contribute to the success of expert entrepreneurs, it can be useful to explain the framework in which all of these variables can be understood.

Table 1: Effectual versus causal logic explained from Dew et al. (2009).

Differences between effectual and causal logics from Sarasvathy (2001).

Issue	Causal frame	Effectual frame
View of the future	Predictive. Causal logic frames the future as a continuation of the past. Hence accurate prediction is both necessary and useful.	Creative. Effectual logic frames the future as shaped (at least partially) by willful agents. Prediction is therefore neither easy nor useful.
Basis for taking action	Goal-oriented. In the causal frame, goals, even when constrained by limited means, determine sub-goals. Goals determine actions, including which individuals to bring on board.	Means-oriented. In the effectual frame, goals emerge by imagining courses of action based on given means. Similarly, who comes on board determines what can be and needs to be done. And not vice versa.
Predisposition toward risk and resources	Expected return. Causal logic frames the new venture creation problem as one of pursuing the (risk-adjusted) maximum opportunity and raising required resources to do so. The focus here is on the upside potential.	Affordable loss. Effectual logic frames the problem as one of pursuing adequately satisfactory opportunities without investing more resources than stakeholders can afford to lose. The focus here is on limiting downside potential.
Attitude toward outsiders	Competitive analysis. Causal frames promulgate a competitive attitude toward outsiders. Relationships are driven by competitive analyses and the desire to limit dilution of ownership as far as possible.	Partnerships. Effectual frames advocate stitching together partnerships to create new markets. Relationships, particularly equity partnerships drive the shape and trajectory of the new venture.
Attitudes toward unexpected contingencies	Avoiding. Accurate predictions, careful planning and unwavering focus on targets form hallmarks of causal frames. Contingencies, therefore, are seen as obstacles to be avoided.	Leveraging. Eschewing predictions, imaginative re-thinking of possibilities and continual transformations of targets characterize effectual frames. Contingencies, therefore, are seen as opportunities for novelty creation — and hence to be leveraged.

UPDATED LITERATURE REVIEW

Expert versus Novice: Domain Specific Expertise

Updates to Methods

As the use of expert novice studies are widely accepted, there has been relatively little further research to expand upon the use of these methods. There have, however, been a few meaningful additions to the field. The first regards an update in the scripts cues that comply with the current theory (Mitchell et al., 2009). This research provides new evidence and instruction on how to successfully prompt entrepreneurs to speak meaningfully about the variables chosen as representative of the underlying constructs. It also aids in the distinction between experts and novices. Further study by Baron and Henry found that, in addition to expanding domain-specific skills, deliberate practice resulted in improved cognitive abilities related to the underlying abilities of memory and organization (2010).

Affordable loss

The idea of affordable loss offers a method of prediction that relies on the realistic resources and commitments of the entrepreneur. This is in contrast to traditional prediction models which utilize forecasting or historical figures with limited accuracy and a simplistic representation of complex variables. This model instead offers that a venture is most likely to succeed when the entrepreneur is sufficiently committed to the project and finds the loss of the resources being invested in the venture acceptable, should the worst case scenario occur (Sarasvathy, 2001).

Cognitive Entrenchment

While there is a more extensive body of literature related to cognitive entrenchment, the literature most relevant to this study asserts that experts can avoid the negative effects of extensive deliberate practice by diversifying their interests (Dane 2010). Specifically, inflexibility due to expertise can be avoided if experts are careful to apply themselves with equal vigor to solving problems and gaining skills outside of their chosen domain of expertise. This socialization among domains allows experts to keep their mind sharp and alert to new opportunities where they might otherwise become complacent. This is not an issue for novice entrepreneurs, as they do not have enough experience for it to be relevant. However, it is a distinguishing factor between experts and nonexperts.

Career Motives

One of the emerging areas of research related to effectuation is the specific role that an entrepreneur's previous career track has on his or her cognition. A valuable paper by Yuval et al., for instance, focuses on effectuation theory and refines it by positing that only the time and experience learned while being an entrepreneur should be considered deliberate practice towards expertise in entrepreneurship. However, they also find that the configurations of career management practices in terms of career planning versus career investment rest on the same principles of predictive and creative control that underlie causal versus effectual reasoning (2017). Another study in this field finds that individuals who visualized linear career paths for themselves tended to prefer causal logic while those who identified with spiral or transitory paths were inclined towards effectuation (Gabrielsson and Politis, 2011). In addition, the study recognizes "indications that prior

start-up experience moderates the relationship between career motives and effectual decision-making logic for spiral-minded entrepreneurs" (Gabrielsson and Politis, 2011).

Identity, Creativity, and Self-efficacy

The interrelated interests of identity, creativity, and self-efficacy are presented as one section of literary review. While each topic boasts a significant body of work, the interaction of the trio respect to entrepreneurship is of the most interest.

According to a study by Nielsen and Lassen, identity is "an active and integral part of the effectuation process, and it importantly influences the manner in which the entrepreneur acts and makes decisions in the process" (2012). The aforementioned term includes how entrepreneurs choose to express their identity as well as their construction of it. Another study finds that passion is linked with entrepreneurial behavior and self-efficacy, and it is connected to identity centrality (Murnieks et al., 2014). This is important, as self-efficacy contributes to the entrepreneurial identity, which impacts students' readiness to transfer their learning beyond the classroom (Celuch et al., 2017). Because an inability or unwillingness to transfer learning is a significant barrier to successful entrepreneurship, education research on these topics are of great interest.

Entrepreneurial creativity is impacted by expertise and self-efficacy as well as alertness to opportunity and intrinsic motivation (Mumin et al., 2013). The challenges of teaching entrepreneurship are well known. However, the intersection of creativity and identity with self-efficacy presents interesting opportunities to develop a more effective attitude towards teaching.

The combination of self-efficacy and successful intelligence indicate a propensity for quick action as well as concurrent and repeated goal-driven improvement projects

(Baum and Bird, 2010). This pattern, in turn, was found to result in higher venture growth over four years. Being aware of how these factors interact and the meaningful impact that interaction has on a venture, can once again improve educational outcomes in the field.

Framing

Framing is central to entrepreneurial expertise and has been studied further in recent years. One such study found that bicultural entrepreneurs were able to switch more readily between frames or internalize that behavior into the teams they led. Thus, these individuals were more likely to follow an effectual framework (Liu and Isaak, 2016). Another found that, when effectual framing is utilized by an entrepreneur, it detracts from the usefulness of the traditional business plan. Thus, when teaching entrepreneurship, it may be more relevant to choose another exercise (Monsen et al., 2010). However, the business plan can coexist with other methods as it remains effective for those who think causally and in situations of certainty.

Effectual versus Causal

Partnership Activities

The willingness to form new partnerships is a key difference between experts and novices related to effectual logic. In a recent study, it was found that entrepreneurs who are actively seeking opportunities internationally are more likely to network with all potential partners. This allows them to select a desirable opportunity based on their combined means when one presents itself, in line with effectuation theory (Galkina and Chetty, 2015). They are comparatively less likely to define their end goals causally and search for a partner that fits the opportunity they have already selected.

Legitimacy

Legitimacy is another important topic in the vein of effectuation that is receiving more attention lately. For instance, one paper looks at new businesses and explains that they cannot gain legitimacy from investors or stakeholders alone. Rather, having superior assets in that department may make a business overconfident (Günzel-Jensen and Rask, 2015). The paper focuses on how gaining legitimacy influences learning and the application of effectual decision making. The authors find entrepreneurs and their teams gained overconfidence in the new venture and misinterpreted how, why, and to what extent stakeholders were committed. They also find that overconfidence leads to the rejection of negative feedback and that pre-commitments and legitimacy from high status partners lead to premature contractual and identity commitments.

Environmental Influence

Extensive research is being done on the role that industrial, social, and institutional environments have on entrepreneurs. In a study by Meuleman et al., researchers examined the factors that cause an entrepreneur to choose between the causation and effectuation process when creating a new venture (2010). They find that perceived market and technological uncertainty are positively affected when using the causation approach, and experienced entrepreneurs, when faced with technological uncertainty, are more likely to use effectuation. In addition, they determine that entrepreneurs with higher levels of social capital are significantly more likely to employ both logics, and there are many cases in which people use effectuation and causation approaches when setting up a new venture. Other studies done on specific circumstances, such as home-based online businesses, find that the structure of the conditions may influence the inclination towards effectuation (Daniel et al., 2015). With online, at-home

businesses, pre-commitments had no significant impact, and subjects tended towards effectual logic although they had lower self-efficacy. In addition, the study finds that it is relevant to expand affordable loss to include various types of capital such as the social loss of reputation or status.

Teaching

Over the years, significant improvements have been made to the literature surrounding how to advance the teaching of entrepreneurship. The articles examine the idea that perceived control motivates individuals to engage in actions, and it can be argued that entrepreneurs show preference for professional or managerial identities. Recently, a study by Markowska looked at the factors that determine the process of effectual logic and how it is developed (2010). The study finds that entrepreneurs identify the things that influence and develop effectual logic. An emphasis on the varied impacts of professional and managerial identity in the learning process is necessary in order to effectively enable future entrepreneurs. Lastly, they suggested that creating a better understanding of how individuals learn can link together individual and social paths.

EXPECTED DIFFERENCES CONSISTENT WITH DEW ET AL.

Expertise Generally

The expected differences in this section are replicated from *Effectual versus predictive logics in entrepreneurial decision-making: Differences between experts and novices*, as we hope to confirm that study's results. Just as with the original study, we expect to find two sets of differences between experts and novices in entrepreneurship. The first involves expertise in general, and the second set involves expertise in entrepreneurship specifically. It is our expectation that novices will use a different set of frameworks and logical processes within that framework than experts, due to their causal training and lack of substantive experience.

Analogical Reasoning

As mentioned by Dew et. al (2009), there has been extensive research that speaks to the "association of superior knowledge storage and retrieval abilities of experts with quicker and more accurate problem-solving in a domain" (Chase and Simon, 1973; Simon and Simon, 1978; Anderson, 1981; Camerer and Johnson, 1991; Bedard and Chi, 1992; Shanteau, 1992; VanLehn, 1996). Thus, experts have the advantage over novices in terms of the depth and breadth of their experiential knowledge as well as in their ability to quickly access those stored experiences from long term memory when confronted with new settings and problems, rather than being overwhelmed by short term memories of the situation at hand (Feltovich et al. 2006). The experts' extensive experience also allows them to pursue analogical reasoning, whereby the problem at hand is compared to problems that the expert has solved in the past. Similar situations are stitched together to

predict a likely solution, rather than the analytical reasoning of novices without the experiential resources to efficiently make predictions via this method (Buchanan et al., 2006). The Dew et. al study being replicated confirms that experts utilize analogical reasoning consistently as expected (2009).

Holistic and conceptual thinking

In addition to possessing a more significant knowledge basis, several studies have advanced the idea that experts are also better able to organize that knowledge (Feltovich et al., 2006). In addition, experts are more likely to view problems in terms of the connected systems to which they're related and search for a solution for the entire set of systems rather than a single portion of them (Gitomer, 1988; Chi, 2006a; Klein, 1998; Sonnentag et al., 2006). This is found to be the case in the Dew et. al study referenced by the current study (2009).

Weighting of predictive information

Expert novice studies rely on the empirically supported assumption that experts derive much of their superior knowledge from real world trial and error within the domain in question, while novices must often rely on simulations of varying accuracy in "classroom" environments that are removed from the actual domain (Schenk et al., 1998). As novices will thus be unable to utilize the benefits of extensive experience to question, and subsequently determine, if given data is trustworthy or not, we expect that novices will be more likely than experts to accept and rely on the market research provided in the case, as they were in the Dew et. al study (2009).

Domain Specific Expertise

Non-Predictive as Opposed to Predictive Control

In accordance with effectuation theory, experts are expected to transform the means available to them into new outcomes without regard for ideas about what the final outcome might be. They do this by utilizing the control they have over (non-predictive) variables (Ericsson, 2006a,b,c; Wiltbank et al., 2006; Yates and Tschirhart, 2006). This is the inverse of causal reasoning, whereby an entrepreneur would utilize predictive logic to choose between alternatives based on a predefined vision of the final goal. Entrepreneurs reacted according to expectations in the Dew et. al study referenced as the basis for this replication (2009).

Means-Driven as Opposed to Goal-Driven Action

In a means-driven framework, an entrepreneur would be expected to identify the means available to them, including experience and other resources, and visualize different ways that the these existing resources could be combined to create new ends. This framework utilizes effectual logic and is the process that we expect our expert entrepreneurs will undergo when presented with the problems posed in our research instrument. We expect that our novices, on the other hand, will behave causally and commit to an end goal before attempting to identify and assemble the resources necessary to achieve this goal, as they did in the previous study by Dew et. al (2009).

Affordable Loss as Opposed to Expected Return

An entrepreneur who operates on causal logic is motivated by expected return to seek an opportunity that they predict will produce an outcome equal to or greater than their threshold of a desirable result. Inversely, effectual logic prescribes a theory of affordable loss whereby any opportunity would be desirable so long as the entrepreneur judges the endeavor to be worth equal to, or greater than, the means that they would need to commit to it. Empirical data from studies, including the subject of our replication, have confirmed this result (Dew et. al, 2009).

Partnerships as Opposed to Competitive Analysis

Entrepreneurs who practice effectual logic are considered more likely to take on partnerships and similar relationships prior to establishing the market segments and specific plans of their venture, as established in the original study (Dew et. al, 2009). This allows the aims of the firm to be shaped by the combined means of the collaborators. Casual frameworks demand that entrepreneurs define their goals, markets, and the means necessary to achieve those goals before approaching partners that appear to fit the established plans (Kotler 2000).

Leveraging as Opposed to Avoiding Contingencies

As stated by Dew et. al, expert entrepreneurs utilizing an effectual framework will leverage contingencies with a flexible structure that allows the venture to adapt to both positive and negative contingencies (2009). Causal entrepreneurs, on the other hand, have been observed to strive for robustness by eliminating both upside and downside risks (Denrell and March, 2001).

Initial Differences Between the Replication and Original

Participant Pool

As stated, there are differences between the pool of participants in this replication study and the original due to the adjusted goal of the study. Due to this shift in participants, we anticipate that the differences between experts and novices will not be as stark, and, in some cases, it may not be significant. In addition, three of the five novices selected had at least some training at the University of Maine Student Innovation Center, which trains students in some processes consistent with effectual logic, as it should given that Roach et. al (2016) found that selected constructs related to effectuation positively mediated two different types of innovation. This may skew the results slightly. However, this was the most realistic pool of novices that were willing to participate in research for an undergraduate thesis in the time frame available. Fewer participants were selected due to the time constraints of the researcher. Therefore, this replication has been framed as a case study advocating for further research. As a result, unlike the original study, we make no claims that this pool of respondents, or the results gathered, are representative of the general population or are statistically relevant.

Environmental Factors

Due to practical limitations, these protocols were collected via Skype chat and the location of the participant was the participant's own choice. This may have influenced participant responses and could vary from the original study, as the exact details of the procedure were not specified.

Recruitment of Participants

We expect that the replication will also vary from the original in that the primary researcher for our study had a personal and professional relationship with some, but not

all, of the participants, which may have swayed the responses. The same was not reported in regards to the original study, although it can be presumed that some of the MBA students may have had a relationship to the researchers.

METHODS

Replicated Protocol Analysis

In general, expertise is signaled by the use of a set of cognitive processes shared by all experts (Chi et al., 1982). Identifying and defining these common processes has been the focus of a variety of modern studies on expertise in general and domain specific expertise in a variety of settings, which have contributed to a robust academic foundation for continued research in the field (Buchanan et al., 2006; Chase and Simon, 1973; Charness, 1989; Johnson, 1988; Montgomery and Svenson, 1989; Mukhopadhyay et al., 1992; Qin and Simon, 1990; Riahi-Belkaoui, 1989; Webb, 1975; Young, 1988).

With respect to the validity of the verbal protocol process, Ericsson and Simon compiled and analyzed more than two hundred empirical studies that successfully utilized protocol analysis (1993). Building on this work, Ericsson once more emphasized the advantages of using think aloud protocols with concurrent verbalization rather than alternative methods when he reviewed the literature again in 2006 (2006a,b,c). This method calls for participants to narrate their thoughts as they read through the case statement,answering the related questions. These responses are recorded and transcribed so that they can be coded and further analyzed. It is essential to understand that this is an iterative process whereby the semantic chunk is the most basic unit of data. That semantic chunk is then analyzed and coded so that the worded response can be transformed into dichotomous (yes or no) and numerical frequency data sets, and this becomes the primary data of focus. This data is then analyzed for mean, standard deviation, min, max, F, p, and the two-tailed ChiSq which then becomes the new primary

data set. Lastly, this data set is analyzed once more to draw relevant conclusions by transforming the numerical data into worded statements once more, completing the cycle. This process allows the researcher to gather meaningful insight into how the entrepreneur is actually processing information in the moment while everything is still at the forefront of their short-term memory, rather than relying on the participants' self reported understanding of past events, which is vulnerable to retrospection and introspection biases (Ericsson and Simon, 1980; Ericsson, 2006a,b,c). However, due to the constraints of the study, we were unable to utilize the strict laboratory conditions that would have been ideal.

Subjects - Novice

For the purpose of our research, novice entrepreneurs were considered those who had started at least one venture and who had worked at those ventures for between zero and six years combined with no more than five years at any one venture. This differs dramatically from the study being replicated, as that study's goal was to find areas of development for MBA students. Our study seeks to identify areas for professional development within novice entrepreneurs in the State of Maine. Using this pool does come with some risk, as there is significantly less contrast between our novice and expert pools. However, there is a true novice-ness embodied in our chosen pool; the novices are legitimately interested in entrepreneurship and have actively engaged in attempting to create ventures just like our experts. This truly separates them in terms of experience rather than intention. Novices were identified and chosen via two avenues, the University of Maine Student Innovation Center and Fusion: Bangor, a local networking group. There are two primary issues to consider with this pool that may influence the results of the

study. The primary researcher is personally involved with both groups and knew several of the participants. This personal relationship may have had an impact on how thoroughly participants responded to questions. The protocol used was identical, and no participants had significant prior knowledge of the study. There were four men and one woman sampled in this pool between the ages of 22 and 36, which meant fewer participants and a slightly narrower age band than the original study. In accordance with "deliberate practice", our novices have enough education and experience to be familiar with basic business knowledge that allows them to understand the research instrument, yet they could also be contrasted with experts because (1) they are novices in entrepreneurial thinking, and (2) they have been trained in causal thinking, as each has attended a public university in pursuit of a bachelor's degree.

Table 2: Exploring the age and background of participating novices

Novices	Mean	Standard Deviation	Minimum	Maximum
Year of birth:	1989.8	7.22496	1996	1982
Number of Ventures started:	1.8	0.83666	1	3
Years worked for those ventures -	3.5	2.31840	0.5	5.5
Years worked in a small organization (less than 100 employees)	7.82	4.99119	0.5	14
Years worked in a medium organization (between 100 and 500 employees):	1.5	2.39791	0	5.5
Years worked in a large organization (larger than 500 employees):	2.8	3.89871	0	8

Subjects-Experts

For the purposes of this study, experts are considered entrepreneurs who have started at least two ventures with at minimum 15 years worked in those ventures. In addition, participants had to have worked for the individual ventures for 5 years or more.

This differs from the original study by necessity, as the pool of applicants had to be geographically constrained in order to represent entrepreneurship in Maine specifically. Due to the relatively limited pool of experienced entrepreneurs available in the state, the number of ventures and years worked requirements were lowered to better reflect the environment. There were four men and one woman sampled in this pool between the ages of 47 and 73, which is a smaller sample size and age range than the original study. Expert entrepreneurs were gathered from a list of expert entrepreneurs compiled by Don Gooding, an experienced angel investor in the state, and staff of the University of Maine Student Innovation Center. While Don is based primarily in Portland, subjects varied in their locations across Maine and their primary areas of expertise. Thus, they are only tied by connections to entrepreneurship in Maine and the Maine Angels.

Table 3: Exploring the age and background of participating experts

Experts	Mean	Standard Deviation	Minimum	Maximum
Year of birth:	1959.8	10.56882	1971	1945
Number of Ventures started:	2.2	0.44721	2	3
Years worked for those ventures -	18.6	3.78153	15	25
Years worked in a small organization (less than 100 employees)	20	10.39230	12	38
Years worked in a medium organization (between 100 and 500 employees):	3.2	5.21536	0	12
Years worked in a large organization (larger than 500 employees):	12.8	14.48102	0	30

PROCEDURES

Both novice and expert entrepreneurs were given the description for "venturing" an imaginary computer game that simulates starting and running a new business as described in Appendix A. As the experts and novices did not share a particular technical background, the topic was selected to avoid biasing participants. Individuals were asked to read and think aloud throughout the exercise and answer questions about identifying and creating the potential markets for this product. Participants also had to make other marketing decisions for the theoretical firm as seen in Appendix A. Their protocols were collected via the screen recording of video calls, and such calls were then transcribed, coded, and analyzed. Subjects were asked to set aside 30-45 minutes to complete the exercise but were allowed as much time as they desired without pressure. Several of the participating experts mentioned that the case statement reminded them of their earlier experiences in venture creation, which, in addition to the validity of the original study, added credibility to the representative tasks that were included in this study. This further supports the validity of this expert novice study as "[t]he study of expertise with laboratory rigor requires representative tasks that capture the essence of expert performance in a specific domain" (Ericsson, 2006a,b,c).

We used the coding scheme developed for the original study (and reproduced in Appendix B)...

> ...to extract relevant variables and counts in three categories: (1) Expert–novice differences in general, (2) Domain-specific differences in issues related to marketing, and (3) Domain-specific differences in new venture creation (entrepreneurship). General differences were focused around information processing variables such as total numbers of words spoken, theorizing from

> previous experience (as in the case of pricing theories), etc. Marketing variables had to do with selecting segments, channels, prices and so on. And variables such as the amount of attention paid to resource constraints captured items relevant to new venture creation (Dew et al., 2009).

The coding scheme that was replicated was formulated using the helix process described in Ericsson and Simon (1993). The final coding scheme that they presented can be found in Appendix B. In order to create the code, the original researchers explained that:

> This process calls for repeated circles of coding scheme items generated along a particular axis, such as the three axes of general expertise, marketing and new venture creation in our study. One member of the research team began listing specific items of the coding scheme from four randomly selected protocols, two from experts and two from novices. Thereafter, the same researcher added items to the list from other protocols and refined the list in an iterative fashion until the coding scheme converged into a complete and coherent instrument for analyzing all the protocols… Three minor modifications to the phrasing of particular items emerged from this (Dew et al., 2009).

The primary researcher coded all the protocols using the final coding scheme and without an additional independent coder (blind to the hypothesis) due to the study's time and resource constraints. As only one coder was used, there were not multiple sets of codes that could be compared to examine inter-rater agreement. Thus, it is expected that there is some error due to researcher bias (James et al., 1993). In keeping with the original study, the coded protocols were analyzed with ANOVA when the data was a numerical frequency of occurrence and chi-squared tested when the results were dichotomous (in this case, yes or no).

RESULTS

The results of this study confirmed the previous study's results pertaining to expert-novice differences in all but three categories. In keeping with the format of the expected differences section of this paper, the results will be discussed in the order that they've previously been presented. First, results regarding expertise in general will be presented, and then results from expertise in entrepreneurship will be presented. Lastly, we have included sections on summarizing the results and outlining their limitations. Although p values are listed for the purposes of comparison with the original study, the limitations section further reiterates that the our sample size is too low to be considered congruent with the traditions of cognitive entrepreneurship literature. Thus, the results are not considered statistically rigorous.

Differences Due to Expertise in General

Analogical Reasoning

This study confirms that there are significant differences between experts and novices with regard to certain facets of analogical reasoning, which supports existing literature on the subject in key areas of focus. When asked about what markets they would consider, expert entrepreneurs identified or created a total of 24 distinct markets between them, while novices produced only 6 ($p=0.00403$). While 100% of experts articulated an alternative segment during the scenario, a respectable 40% of novices did as well ($p=0.01242$). However, experts and novices were not observed to vary significantly in the number of words they used during this exercise ($p=0.91085$).

Holistic and Conceptual Thinking

As expected, experts were observed to be more likely to take a holistic approach to solving the problems in this exercise. The experts were more likely to go beyond the marketing problems asked of them in the case statement. All 5 of the experts in this case mentioned considerations related to the business but not within the purview of the marketing inquiries in the research instrument, while only 2 of the 5 novices did the same. These considerations were mentioned by the experts a combined total of 54 times, while the novices mentioned these concerns a combined total of 7 times ($p=0.00039$).

Weighting of Predictive Information

The experts in this participant pool overwhelmingly rejected the market research data provided to them, with a full 100% of participants refusing to believe the numbers. All five of the novices, on the other hand, accepted the data provided, with several relying on these figures to plug into further back-of-the-envelope calculations during the exercise ($p=0.00157$). It is worth noting that the extreme contrast of the experts and novices in this category may be overly emphasized due to the smaller pool of participants.

Differences Due to Entrepreneurial Expertise

Means-Driven as Opposed to Goal-Driven Action

The results in this category were consistent with the existing body of literature, which is to say that expert entrepreneurs were more likely than their novice counterparts to draw on personal experience ($p=0.01498$). Over the course of the study, novice entrepreneurs observably utilized their personal experience a total of 3 times among all of them, with the expert entrepreneurs drawing upon their experiences a total of 13 times.

Affordable Loss as Opposed to Expected Return

Novices are not statistically more likely to chase greater expected value projects according to the data collected in this study, which fails to confirm a portion of affordable loss theory ($p=0.19187$). That said, only one novice mentioned the availability of money or cost of an option, and that one novice brought it up as a concern only once. Conversely, all of the expert entrepreneurs mentioned it a total of 8 times, which confirms previous results related to affordable loss ($p=0.01400$).

Partnerships as Opposed to Competitive Analysis

Expert entrepreneurs appear to be more comfortable with partnerships than novices, as 100% of the experts spoke of partnership opportunities, with 13 mentions related to the topic. Only 20% of novices sought similar relationships, identifying a total of 2 potential opportunities ($p=0.00156$). From a direct sales perspective, while there is no statistically significant difference between experts and novices in their likelihood to choose direct sales ($p=0.11385$), expert entrepreneurs were not observed to be significantly more likely than novices to personally approach customers ($p=0.67329$). This discrepancy could be attributed to the curriculum of the University of Maine Student Innovation Center, as both of the novices that opted to personally approach customers participated in training there. The third novice who has ties to the Innovation center did not pursue direct selling but still spoke of personally contacting customers for purposes other than direct selling.

Summary

Overall, the results of this study support the well established body of empirical research around expert-novice studies and confirmed at some level the validity of the

previous study by Dew et al. (2009) with the use of a more narrow and geographically constrained population. The variable descriptions and results can be found in Tables 3 and 4.

Table 4: Differences due to expertise in general modeled after table 3 in Dew et al. (2009)

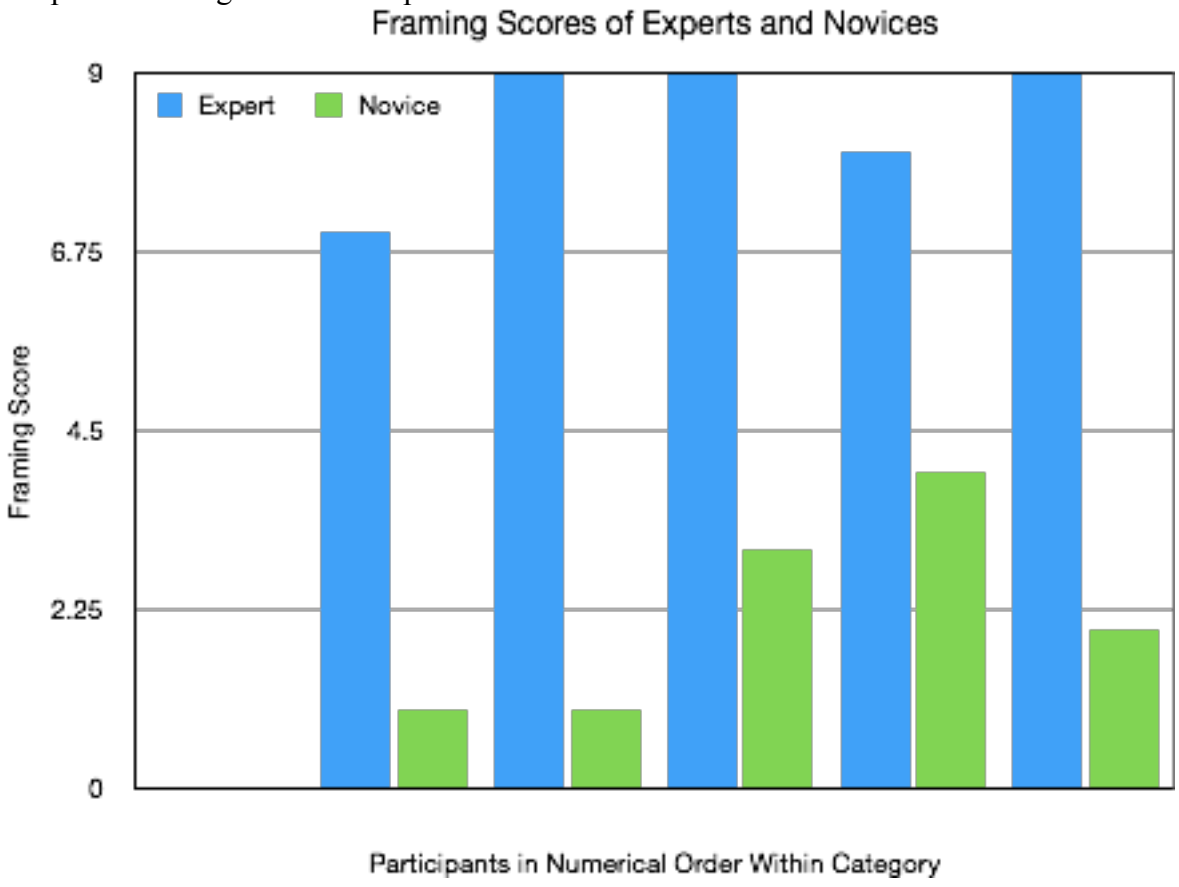
Construct	Variable description	Descriptive statistics	Significance of experts/novices	Significance of original study	Agrees with original study	Summary of findings
Analogical reasoning	Total number of words the participant used to complete the scenario	Max: 3045 Min: 645 S.D. 815.73	F=0.01335 p=0.91085	F=7.71 p=0.007	N	Experts did not talk more than novices
Analogical reasoning	Number of new markets identified by each subject	Max: 10 Min: 0 S.D.: 4.01	F=15.8843 p=0.00403	F=14.93 p=0.000	Y	Experts identify more new markets than novices
Analogical reasoning	Subject articulated an alternative segment during the scenario (Y/N)	Expert: 5Y,0N Novice: 2Y,3N	ChiSq= 6.25133 p=0.01242	ChiSq= 13.92 p=0.000	Y	Experts were more likely to articulate an alternative segment
Holistic and conceptual thinking	Number of thoughts relating to the business but outside scenario questions	Max:16 Min: 0 S.D.: 5.51	F=33.98461 p=0.00039	F=39.81 p=0.000	Y	Experts were more likely to think holistically about a problem
Weighting of (predictive) information	Subject believed and accepted the market research numbers in the scenario (Y/N)	Expert: 0Y, 5N Novice: 5Y,0N	ChiSq= 10.00637 p=0.00157	ChiSq= 15.31 p=0.000	Y	Novices are more likely to believe and accept the numbers they were presented with
Control variable	Count of times subject uses intuition or gut feel to make decisions	Max:1 Min: 0 S.D.: 0.52	F=1.6 p=0.24150	F=1.05 p=0.310	Y	Experts and novices do not differ significantly in their use of gut feelings

Table 5: Differences due to entrepreneurial expertise modeled after table 4 in Dew et al.

Construct	Variable description	Descriptive statistics	Significance of experts/novices	Significance of original study	Agrees with original study	Summary of findings
Means-driven as opposed to goal-driven action	Number of times a subject drew on personal experience	Max: 4 Min: 0 S.D.: 1.43	F=9.52381 p=0.01498	F=20.89 p=0.000	Y	Experts were more likely to draw on personal experience
Affordable loss as opposed to expected return	Times a subject mentioned the availability of money or cost of an option	Max: 3 Min: 0 S.D.: 0.99	F=9.8 p=0.01400	F=41.52 p=0.000	Y	Experts were more concerned with the affordability of a project
Affordable loss as opposed to expected return	Total number of segments chosen by a subject (2nd priority segment counts as .5 of a choice)	Max: 3 Min: 0 S.D.: 0.94	F=2.03175 p=0.19187	F=5.80 p=0.019	N	Novices are not significantly more likely to chase greater expected value projects
Partnerships as opposed to competitive analysis	Times subject mentioned partnership activities	Max: 3 Min: 0 S.D.: 1.35	F=22 p=0.00156	F=13.24 p=0.001	Y	Experts prefer partnerships more strongly than novices
Control variable for: Partnerships as opposed to competitive analysis	Subject choice of direct sales as a channel	Expert: 5Y, 0N Novice: 3Y, 2N	ChiSq= 2.50009 p=0.11385	ChiSq= 0.003 p=0.954	Y	There is no statistically significant difference between experts and novices in their likelihood to choose direct sales
Partnerships as opposed to competitive analysis	Subjects choosing direct channel and personally approaching customers	Expert: 4Y, 1N Novice: 2Y, 1N	ChiSq= 0.17779 p=0.67329	ChiSq= 5.09 p=0.024	N	Experts who chose direct sales were not statistically significantly more likely than novices to personally approach customers

In addition, below is a graphical representation of each expert and novice along with their framing score, a measure of how frequently the individual's response was consistent with the expectations of an expert, similar to Table 6 in Dew et al. (2009). For each of 10 questions an individual answered in an expert way, the individual got 1 point. There were a maximum of 10 points possible, but the highest score received by any participant was a 9, with an overall mean score of 8.4 for experts. The highest score received by a novice was a 4, with a mean score of 2.2 for the novices as a group. Thus, it is clear that there is a significant difference between the two groups.

Graph 1: Framing Scores of Experts and Novices



Limitations

As acknowledged earlier in this report, the sample size used in this research was purposefully small and mostly garnered from personal connections the primary researcher had with participants. It is worth noting that the total sample size of this study is just less than half of the average total sample size (20.5) in the influential expertise studies of Zsambok and Klein (1996). Therefore, while this case study does not reach the acceptable sample size for an expertise study, it is less than an order of magnitude away and should be reliable for drawing inferences, so long as it is understood that such inferences are not statistically supported. The study also includes novice individuals who had received training in some form of effectual processes. This population is overrepresented in the sample due to their relative availability, as many comparable novices without ties to these groups found the time commitments of participating to be burdensome. In addition, given the constraints of the resources available, the time consuming nature of identifying, approaching, and securing the protocols from subjects made it difficult for the primary researcher to conduct a more prolonged recruitment effort. This difficulty was exacerbated by the primary researcher's inexperience and the low response rate from novice entrepreneurs. It is also possible that the age and educational differences between the two pools could have influenced the result. However, given the nature of the study and the limitations of the researcher, this was impossible to control for.

The insufficient sample notwithstanding, the strength of an expert-novice study such as this one is tempered by several assumptions. First, it is assumes that the researcher has selected a pool that contains both experts and novices as claimed. Given only a basic quantitative measure of their involvement in new venture creation, it is

impossible to verify for sure that the experts selected have taken a similarly active role in each of the ventures they've started for the entirety of the time that they've been involved. In addition, it is assumed that the relevant expertise acquired was garnered by this experience rather than other factors. However, while such a hypothesis has frequently been defended, it has not been tested sufficiently to be confident in its accuracy with regards to this particular domain.

DISCUSSION

Agreement Between Studies

In the context of its predecessors, the current study exhibits some congruence with ideas surrounding affordable loss, which dictates that experts "tended to focus on factors pertaining to financial success, rejecting ideas for new products or services that did not appear to offer manageable risk, the capacity to generate positive cash flow, and so on" (Baron and Ensley, 2006). Responses to two of the three representative variables were confirmed to be similar between studies.

In terms of behavioral decision-making, we were able to confirm with some degree of confidence that expertise in the domain of entrepreneurship can be observed in the effectual decision-making frameworks that experts use to examine a problem and its solutions. Our study agrees with previous literature that asserts experts engage in a variety of activities such as partnership building and means-driven goals in order to avoid as much downside risk as possible. The two studies also offer that entrepreneurs may be striving to avoid dependence on predictive information in order to exert more control over the outcomes.

Lastly, the current research also confirms the results of previous entrepreneurial studies on expertise that support an argument against the theory that entrepreneurial success is largely due to luck (Denrell, 2004). The existence of a set of logical processes in expert entrepreneurial decision making that is common to all experts in the domain and that distinctly contrasts the framing utilized by novices implies there are more nuanced factors involved that cannot be attributed to simple luck (Gompers et al., 2006).

Differences Between the Original Study and the Replication

Differences in Results

Not all of the variables chosen as representative of affordable loss, analogical reasoning, and partnership activity agree with previous literature on the subjects. However, in all cases, the findings related to all but one variable confirm the expected result (Dew et al., 2009). That said, as it relates to affordable loss, an analysis of the total number of segments chosen by a subject produced no statistically significant difference between experts and novices with regard to how many segments they chose. Experts were likely to choose several segments under a prioritized model rather than choosing a single segment exclusively. Meanwhile, novices chose simultaneous pursuit of selected segments or combined the simultaneous pursuit of two segments with the prioritized pursuit of the third. In addition, the number of words used by a participant as it related to analogical reasoning varied widely amongst the small pool of participants, which indicates that verbosity may not be as firmly linked to expertise as previously thought. The result may also indicate that experts were inclined to limit their responses to what they viewed as minimally necessary. At the end of the response to question one, participant E 5 was quoted as saying "there are probably more, but that's probably a good start". This indicates that the respondents may not have applied themselves as rigorously as they would have under different circumstances, in order to give a more efficient explanation of their general line of thought. This is a possible explanation for the comparatively lower word count. Lastly, experts who chose direct selling were more likely, but not statistically significantly more likely, than novices to personally approach customers. This difference is likely explained by the participation of select participants in the innovation engineering programs, which place emphasis on speaking directly with

consumers throughout the product cycle. Thus, the differences found in the results likely fall into three categories of variations: the participant pool themselves and their individual training and experiences, the settings in which they were observed, and the contact they had with the researcher both prior to and throughout their recruitment and participation.

Participant Pool

The participant pool selected for this replication study differs in several ways from the experience and criteria of the pool selected for the initial study. The novices in this study were chosen to be true novices in entrepreneurship whereby they had engaged in entrepreneurial activities before and thus were not separated from experts in their desire or willingness to create new ventures. As each of the novices possessed the will to create new ventures and had a small amount of experience in doing such, and because the experts selected were comparatively less experienced than those in the previous study, it is logical that the differences between experts and novices should not be so large as in the original study (Dew et al., 2009). In addition, there are three novice participants that share a common link to the University of Maine Innovation Center as previously mentioned. Effectual ideas are taught as a part of this program (Hall, 2017). It is unknown to what extent this training could skew the results of the study. However, it is worth noting that, of the three categories where this study could not confirm the results of the original study, two of them were affected by unexpected or uncharacteristic responses from different combinations of two of the three total innovation engineering students. The constructs affected were: partnerships as opposed to competitive analysis, as observed by willingness to personally approach customers for direct sales; and analogical

reasoning, according to the total word count of responses. A likely explanation of this phenomena is that the participants absorbed the principles taught through their innovation engineering training, such as thoroughly considering all alternatives, the value of talking or writing to develop or "think through" ideas, and the necessity of involving one's target market throughout the process of creating and marketing new concepts (Hall, 2017). These three principles, while they are not the only principles of innovation engineering, and while they are not taught for the explicit purpose of mimicking effectuation, were each a core measurement of one of the variables that did not yield results similar to the study being replicated (Dew et al., 2009). Thus, it is logical that the training participants received could have affected their response to the case statement.

Environmental Factors

As previously stated, this study was not conducted in a laboratory setting or its equivalent, as previous studies have deemed necessary (Ericsson, 2006a,b,c). Entrepreneurs were asked to participate in a relatively quiet space of their choice with a reliable wifi connection. Subjects generally chose spaces where they frequently spent time related to home or work and obliged in finding a quiet space free from distractions. Spaces had various dimensions, degrees of openness, lighting situations, and ambient noise levels. In addition, subjects were able to choose the day of the week and time of day during which they wanted to take the survey. Several chose based on the available time slots in their existing schedules while others selected a time that they found most desirable. It is unknown to what extent the individual entrepreneurs were at ease within the settings they chose. Research has shown that in psychology, and especially in certain subdisciplines, laboratory studies produced results that were not consistent with real

world observations (Mitchell, 2012). As entrepreneurship, and the cognitive study of it, relies heavily on the underlying psychology of individuals, it is worth considering the practicality of studying entrepreneurs in a laboratory vacuum. While it is scientifically less messy, a bit of mess may be a small price to pay for a more accurate understanding of one of the leading drivers of the U.S. economy (Acs, 2006; Decker et al., 2014; Haltiwanger et al., 2013).

Recruitment of Participants

While the original study does not report any relationship between the subjects and the researchers, it is reasonable to assume that, at the very least, the MBA students who participated would have had some knowledge of the professors running the study. This relationship may have influenced participants in the original case just as the researcher's relationship to individuals in the current study could have influenced this replication. However, the influence of these relationships is unknown as it has not been studied. In addition, the details of the recruiting process were not explicitly revealed in the original study, so it remains unknown to what extent these practices could have differed. There has not been substantial research that would indicate how the recruiting methods in these studies could influence participation. However, the researcher-researched relationship is receiving more attention in the realm of healthcare research. It is not known what impact varying degrees and types of participant preparation have on the individual responses to the case statements. Further research would be necessary to determine the effect of providing different types of preparation, such as the impact of a written or spoken summary of what is expected just prior to beginning the exercise, or an effort by the researcher to provide general "get to know you" conversation for varying lengths of time

before the interview. Anecdotally, expert entrepreneurs seemed to be more comfortable and thoughtful when the researcher began the experience with some general conversation. However, research from the healthcare field indicates that the relationship between the researcher and the researched should be examined further to ensure that future studies utilize best practice techniques that induce full and honest participation (Finlay, 2002; Råheim et al., 2016).

CONCLUSION

This study successfully confirms the majority of the results and conclusions drawn by Dew et al. and suggests exciting possibilities for further research (2009).

In regard to the differences between studies: without a laboratory environment and extensive and careful preparation by the researchers throughout the participant recruitment process, it is quite possible that the question that asked about which segments to sell to in the case statement could have been misinterpreted. This seems to be the most likely source of error, as, according to Mitchell et al., "risk-taking behaviors may in reality be a manifestation of particular scripts" which would support the findings of the original study (2000). On the other hand, it is distinctly possible that this particular group of experts sought the flexibility to draw on multiple segments due to uncertain market conditions. Attitudes towards the choice between flexibility and robustness seem to be shifting in the years since this study was originally conducted, with the introduction of books like *Antifragile* by Nicholas Nassim. It may be worth investigating if the decision to include and simultaneously pursue multiple market segments is truly the mark of a novice entrepreneur or rather a decision made at least in part based on the uncertainty of changing market conditions. It would be interesting to use the new definitions of expert, novice, and non-expert to replicate the study again testing all three groups (Winkler et al., 2016). In addition, confirming this study's results using the phenomenology approach to investigate the same constructs might provide a more holistic understanding of entrepreneurial factors and lifestyle contexts (Berglund, 2015).

This study has highlighted several areas of opportunity for further research and education in the State of Maine. Finding no significant difference between the results of expert entrepreneurs specific to the State versus those found elsewhere in the nation by the previous study, there seems to be little need to replicate the study on a larger scale, as it would be costly and time consuming with little advantage over this case. Both would be attempting to demonstrate the need for further entrepreneurship education in the state of Maine, an idea that is already independently gaining traction. It would be interesting, however, to examine these expert-novice studies with a pool of only female entrepreneurs specific to this geographical area. Contributions to this field could be especially helpful for female entrepreneurs, as studies by Boden and Nucci have confirmed that female entrepreneurs face greater barriers to entry, namely financial resources, and could benefit immensely from more effective entrepreneurial education (2000).

Given the confirmatory nature of the results with limited variations, the researchers wonder what effect the non-laboratory setting could have had on participant results. It has been established that reliable results can be obtained by observing entrepreneurs interacting with these protocols in laboratory-like settings. However, this study should be considered the basis of a new stream of research around the proper setting in which to conduct future studies. There have not been substantial considerations of the setting in which research is conducted for many years. As entrepreneurs never have the luxury of operating in a vacuum, it is illogical to surmise that such a context would produce realistic results. Short of field observation, it may be possible to attain a high level of accuracy when placing participants in a non-laboratory setting. Further research should be conducted to determine what role the day and time of the participation,

conditions of the space, and the entrepreneur's ability to choose a setting have on responses. This knowledge would be useful in designing studies that more thoroughly and accurately examine an entrepreneur's cognitive processes and, additionally, would serve as the basis for a mixed method comparison of an entrepreneur's recorded protocols versus their observed behavior.

We maintain that the study's exclusive use of the local area is a significant constraint, as it influences the resources available to the entrepreneurs as well as the pool of experts available. It would be similarly interesting to replicate this study with a pool of novices who had received innovation training to determine the effectiveness of these programs in bridging the gap between novice and expert logical frameworks. These are our primary recommendations with regard to continuing education. It would be helpful to run a series of workshops that highlight the importance of the variables listed in this study, as we suspect that many novices may not follow this framework due to lack of education as well as inexperience.

APPENDICES

APPENDIX A: RESEARCH INSTRUMENT

Introduction

In the following experiment, you will solve two decision problems. These problems arise in the context of building a new company for an imaginary product. A detailed description of the product follows this introduction.

Although the product is imaginary, it is technically feasible and financially viable. The data for the problems have been obtained through realistic market research — the kind of market research used in developing a real world business plan.

Before you start on the product description and the problems, I do need one act of creative imagination on your part. I request you to put yourself in the role of the an entrepreneur building a company — i.e., you have a little money of your own to start this company, and whatever experience you have to date.

Throughout the experiment you should talk aloud the thoughts you are having. Please start by reading aloud the following instructions.

Description of the product

You have created a computer game of entrepreneurship. You believe you can combine this game with some educational material and profiles of successful entrepreneurs to make an excellent teaching tool for entrepreneurship. Your inspiration for the product came from several reports in the newspapers and magazines about increasing demand for entrepreneurship education; and the fact that a curriculum involving entrepreneurship even at the junior high or high school level induces students to learn not only business-related topics but math and science and communication skills as well.

The game part of the product consists of a simulated environment for starting and running a company. There are separate sub-simulations of markets, competitors, regulators, macroeconomic factors and a random factor for “luck”. The game has a sophisticated multi-media interface — for example, a 3D office where phones ring with messages from the market, a TV that will provide macroeconomic information when switched on, and simulated managerial staff with whom the player (CEO) can consult in making decisions. At the beginning of the game, the player can choose from a variety of businesses the type of business he/she wants to start (For example: manufacturing, personal services, software etc.) and has to make decisions such as which market segment to sell to, how many people to hire, what type of financing to go for, etc. During the game, the player has to make production decisions such as how much to produce, whether to build new warehouses or negotiate with trucking companies, etc.; marketing decisions such as which channels of distribution to use, which media to advertise in and so on; management decisions involving hiring, training, promoting and firing of employees, and so on. There is an accounting subroutine that tracks and computes the implications of the various decisions for the bottom line. The simulation's responses to the player's decisions

permit a range of possible final outcomes — from bankruptcy to a “hockey stick”.

You have taken all possible precautions regarding intellectual property. The name of your company is Entrepreneurship, Inc. The name of the product is Venturing.

Problem 1: Identifying the market
Before we look at some market research data, please answer the following questions — one at a time: (Please continue thinking aloud as you arrive at your decisions)
1.
Who could be your potential customers for this product?

2.
Who could be your potential competitors for this product?

3.
What information would you seek about potential customers and competitors — list questions you would want answered.

4.
How will you find out this information — what kind of market research would you do?

5.
What do you think are the growth possibilities for this company?

Problem 2: Defining the market
In this problem you have to make some marketing decisions. Based on secondary market research (published sources, etc.), you estimate that there are three major segments who are interested in the product:

Segment	Estimated total size
Young adults between the ages of 15 and 25	20 million
Adults over 25 who are curious about entrepreneurship	30 million
Educators	200,000 institutions

The estimated dollar value of the instructional technology market is $1.7 billion.

The estimated dollar value of the interactive simulation game market is $800 million.

Both are expected to grow at a minimum rate of 20% p.a. for the next 5 years.

The following are the results of the primary (direct) market research that you have completed
Survey #1 — Internet users were allowed to download a scaled down version (game stops after 15 min of playing) of the prototype and were asked to fill out a questionnaire

You get 600 hits per day. 300 actually download the product. You have 500 filled out questionnaires.

Willing to pay ($)	Young adults (%)	Adults (%)	Educators (%)
50–100	45	26	52
100–150	32	38	30
150–200	15	22	16
200–250	8	9	2
250–300	0	5	0
Total	100	100	100

Survey #2: The prototype was demonstrated at 2 Barnes & Noble and 3 Borders Bookstores

Willing to pay ($)	Young adults (%)	Adults (%)	Educators (%)
50–100	51	21	65
100–150	42	49	18
150–200	7	19	10
200–250	0	8	7
250–300	0	3	0
Total	100	100	100

Survey #3:Focus Group of educators (high school and community college teachers and administrators)

The educators who participated in the focus group find the product exciting and useful — but want several additions and modifications made before they would be willing to pay a price of over $150 for it. As it is, they would be willing to pay $50–80 and would demand a discount on that for site licenses or bulk orders.

Both at the bookstore demo and the focus group, participants are very positive and enthusiastic about the product. They provide you good feedback on specific features and also extend suggestions for improvement. But the educators are particularly keen on going beyond the "game" aspect; they make it clear that much more development and support would be required in trying to market the product to them. They also indicate that there are non-profit foundations and other funding sources interested in entrepreneurship that might be willing to promote the product and fund its purchase by educational institutions.

Based on your market research, you arrive at the following cost estimates for marketing your product.

Internet	$20,000 upfront + $500 per month thereafter
Retailers	$500,000 to 1 M upfront and support services and follow-up thereafter
Mail order catalogs	Relatively cheap — but ads and demos could cost $50,000 upfront
Direct selling to schools	Involves recruiting and training sales representatives except locally

Competition

None of the following four possible competitors combine a simulation game with substantial education materials — you are unique in this respect.

Company	Product	Description	Price per unit	Sales ($)
Maxis	Sim City	Urban planning simulation	29.95	30 M
Microprose	Civilization	Civilization building simulation	50.00	20 M
Sierra On-Line	Caesar	City building simulation	59.95	18 M
Future Endeavors (New Co. < 1 yr. old)	Scholastic Treetop	CD-ROMs of Scholastic Books	n / a	1 M

The game companies are making a net return of 25% on sales.

At this point, please take your time and make the following decisions: (please continue thinking aloud as you arrive at your decisions)

1.
Which market segment/segments will you sell your product to?

2.
How will you price your product?

3.
How will you sell to your selected market segment/segments?

APPENDIX B. CODING SCHEME

1. Overall
1a.
Total number of WORDS of text for each subject:
1b.
Did this person believe the numbers? Enter Yes or No

1c.
Did this person mention any of the following? Enter yes or no and the count of their mentions
Gut feeling Intuition
My personal choice In my opinion
Total "gut feeling" count:
1d.
Did this person worry about how much money he or she has and what the costs of executing his or her marketing decisions will be? Enter yes or no
1e.
If yes, count how many times they mentioned their concern:
1f.
Did this person go beyond making marketing decisions to talk about building the business as a whole? Enter yes or no
1g.
If yes, count how many times they mentioned each of the following:
What it would take to put a sales force together:

Issues related to the long term:

Theorizing about entrepreneurial decisions/actions:

Insights from previous experience:

Insights from case studies/classes:

2.
Partnerships/affiliations/relationships
2a.
Did this person visualize partnering or building a relationship with someone? Enter yes or no

2b.
If yes, count number of partnerships they visualized:

3.
Segment decision
3a.
Did this person actually decide on one or more segments? Enter yes or no

3b.
Did this person decide to sell to all three segments? Enter yes or no

3c.
If this person chose more than one segment, was it simultaneous or prioritized? Enter S or P

4.
Number of new markets
4a.
Who could be your potential customers for this product?

4b.
What do you think the growth opportunities are for this company?

4c.
Did this person visualize new segments other than the ones suggested? Enter yes or no

4d.
If yes, list the new segments:

5.
Channel decision
5a.
Check off channels they used:
Internet Retail Mail order catalog Direct sales

5b.
Direct sales:
I will personally contact:

I will recruit salespeople:

APPENDIX C.

APPLICATION COVER PAGE

- ***KEEP THIS PAGE AS ONE PAGE – DO NOT CHANGE MARGINS/FONTS!!!!!!!!***
- ***PLEASE SUBMIT THIS PAGE AS WORD DOCUMENT***

APPLICATION FOR APPROVAL OF RESEARCH WITH HUMAN SUBJECTS
Protection of Human Subjects Review Board, 400 Corbett Hall

(Type inside gray areas)
PRINCIPAL INVESTIGATOR: Rebecca Hatt **EMAIL:** Rebecca.l.hatt@maine.edu
CO-INVESTIGATOR: Jason Harkins **EMAIL:** Jason.harkins@maine.edu
CO-INVESTIGATOR: **EMAIL:**
FACULTY SPONSOR: Matthew Skaves **EMAIL:** Matthew.skaves@maine.edu
(Required if PI is a student):
TITLE OF PROJECT: Effectual versus predictive logics in entrepreneurial decision-making: Differences between experts and novices in the State of Maine
START DATE: ~~December 23, 2017~~ 12/28/2017 **PI DEPARTMENT:** Maine Business School
FUNDING AGENCY (if any): None

STATUS OF PI: FACULTY/STAFF/GRADUATE/UNDERGRADUATE Undergraduate (F,S,G,U) U

1. If PI is a student, is this research to be performed:

   for an honors thesis/senior thesis/capstone? Yes for a master's thesis?
   for a doctoral dissertation? for a course project?
   other (specify)

2. Does this application modify a previously approved project? No (Y/N). If yes, please give assigned number (if known) of previously approved project:

3. Is an expedited review requested? Yes (Y/N).

Submitting the application indicates the principal investigator's agreement to abide by the responsibilities outlined in Section I.E. of the Policies and Procedures for the Protection of Human Subjects.

Faculty Sponsors are responsible for oversight of research conducted by their students. The Faculty Sponsor ensures that he/she has read the application and that the conduct of such research will be in accordance with the University of Maine's Policies and Procedures for the Protection of Human Subjects of Research. REMINDER: if the principal investigator is an undergraduate student, the Faculty Sponsor MUST submit the application to the IRB.

Email this cover page and complete application to UMRIC@maine.edu

****

FOR IRB USE ONLY **Application # 2017-12-11** **Review (F/E): E** **Expedited Category:**
ACTION TAKEN:

X Judged Exempt; category 2 Modifications required? Yes Accepted (date) 12/28/2017
Approved as submitted. Date of next review: by Degree of Risk:
Approved pending modifications. Date of next review: by Degree of Risk:
Modifications accepted (date):
Not approved (see attached statement)
Judged not research with human subjects

FINAL APPROVAL TO BEGIN

Date 12/28/2017 01/2017

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Rebecca continues to pursue and support entrepreneurship in her community through Innovate for Maine, Scratchpad, and Maine Startup and Create. She loves that entrepreneurship forces you to wear many hats and always push yourself to improve, which is something she is personally committed to.

She is grateful that she was able to gain experience, and expand her knowledge of what it means to be an entrepreneur, and encourages other young people to pursue similar opportunities. When she is not working or volunteering she enjoys traveling, recreational open water diving, spending time with her family and friends, taking long rides on her 750cc Honda Shadow Ace motorcycle, and seeking new experiences.