LEARNING FROM FAILURE: HOW ENTREPRENEURIAL FAILURE AIDS IN THE DEVELOPMENT OF OPPORTUNITY RECOGNITION EXPERTISE

Brandon Mueller
Oklahoma State University, brandon.mueller@okstate.edu

Dean A. Shepherd
Indiana University

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ABSTRACT

Failure has been consistently extolled as a fundamental learning experience in entrepreneurship. However, researchers acknowledge that this pervasive view of failure is supported in the literature almost solely on the basis of anecdotal evidence. This study empirically investigates the type of knowledge that can be learned through failure experience as well as the factors that moderate the learning process. We find that business failure can result in heightened usage of structural alignment processes, particularly for those entrepreneurs operating with an intuitive cognitive style, utilizing expert opportunity prototypes, with low levels of mentoring experience.

INTRODUCTION

Failure is simply the opportunity to begin again, this time more intelligently. Henry Ford

Failure has been commonly claimed to be a prerequisite for learning, a belief that has gained widespread expression in the social psychology and organizational behavior literature (Zakay, Ellis, & Shevalsky, 2004). The potential learning benefits of failure are particularly salient to the field of entrepreneurship, where it’s clear that a staggering number of businesses fail and are shut down each year (Singh, Corner, & Pavlovich, 2007). In fact, recent research suggests that many successful entrepreneurs point to past failures as a critical learning opportunity (Minniti & Bygrave, 2001; Sitkin, 1992). The importance of failure to entrepreneurial learning has also been widely recognized by researchers. “Businesses fail, but entrepreneurs do not. Failure is often the fire that tempers the steel of entrepreneur’s learning and street savvy” (Timmons, 1999: 47). “In order to succeed one first has to experience failure. It is a common pattern that the first venture fails, yet the entrepreneur learns and goes on to create a highly successful company” (Timmons, 1999: 30).

Given the preponderance of extant theorizing and anecdotal evidence espousing the significance of learning from failure, it is surprising that studies in entrepreneurship focus overwhelmingly on entrepreneurial success. It’s also surprising given that prominent theories in the field explore core processes, such as opportunity recognition, as operating through trial and error learning processes (Alvarez & Barney, 2005; Sarasvathy, 2001). Entrepreneurs have been shown to learn from what doesn’t work; hence learning from failure is a key feature of the entrepreneurial process. However, despite pervasive acknowledgment that failure may provide key learning opportunities that can better position an entrepreneur for success (Minniti & Bygrave, 2001), there have been few empirical investigations to further our understanding of how entrepreneurial failure translates into entrepreneurial learning.

This study makes three primary contributions to the literature. First, while extensive attention
has been given to exploring how various types of entrepreneurial experience benefit a new venture (Gartner, 1990; Sarasvathy, 2001), we have little understanding of the specific knowledge conferred to entrepreneurs through failure experiences. This study finds that failure experiences can promote the development of opportunity recognition expertise in the form of structural alignment processes. Secondly, while significant work has been done in articulating the use and importance of structural alignment processes to opportunity recognition (Gregoire, Barr, & Shepherd, 2010), we advance our understanding of this process by empirically showing the critical role that expert opportunity prototypes and high levels of prior knowledge play in facilitating the use of structural alignment. Thirdly, this study explores why certain entrepreneurs are better able to translate failure experience into entrepreneurial opportunity recognition knowledge. We find that mentoring experience, an intuitive cognitive style, and expert opportunity prototypes play critical roles in explaining variance in how well entrepreneurs learn from failure.

The rest of the paper proceeds as follows. First, we introduce the concept of structural alignment processes and clarify their significance to opportunity recognition. Then, we extend theory regarding learning from failure and present our hypotheses. Next, we introduce the measures and research methods. Finally, we report and discuss the results.

**Theory and Hypotheses**

Structural alignment processes have been shown to influence performance on creative tasks such as scientific innovation and new product ideation (cf., Dahl & Moreau, 2002), tasks akin to entrepreneurial opportunity identification. They have also been found to be more directly involved in other higher-order reasoning processes (Keane, Ledgeway, & Duff, 1994) including new category formation (Namy & Gentner, 2002), learning (Loewenstein & Gentner, 2005), and problem solving (Catrambone & Holyoak, 1990). Consistent with this, entrepreneurial scholars have found that expert entrepreneurs display a cognitive preference towards aligning structural relationships when attempting to identify entrepreneurial opportunities (Gregoire et al., 2010). The use of structural alignment processes enables an individual to seek matches between market domains and technologies in pursuit of opportunity identification (Gregoire et al., 2010; Gregoire & Shepherd, 2011). As such, the development of structural alignment processes is a critical component in enabling entrepreneurs to identify and act on business opportunities and, thus, is the primary outcome of interest to this study.

At its core, structural alignment is a cognitive tool that is used to compare things and draw implications from the comparison (Gregoire et al., 2010). In respect to recognizing opportunities, Gregoire and his colleagues (2010) found that expert entrepreneurs compare the structural (as opposed to superficial) characteristics of markets and technologies in an attempt to align the two. More specifically, in opportunity recognition, structural alignment consists of matching the structural characteristics of a technology/product (its ultimate benefits and/or capabilities) to the structural characteristics of a market (the needs/desires of a target population) (Gregoire et al., 2010).

Extant research has revealed the importance of prior knowledge in explaining why certain entrepreneurs recognize particular opportunities that others are simply unable to see (e.g., Corbett, 2005; Dimov, 2007). However, most of these studies fail to specify the cognitive mechanism by which prior knowledge informs opportunity recognition. Cognitive research indicates that prior knowledge facilitates the alignment of structural comparisons. For example, experts in a given
domain find it easier to make structural comparisons (as opposed to superficial comparisons) because they have richer mental representations to compare objects or phenomenon (Chi, Feltovich, & Glaser, 1981). Similarly, experienced entrepreneurs will have a greater depth of knowledge regarding markets, technologies, and products that enable them to better align the capabilities/benefits of a given business solution to the needs/desires of a target population. Prior knowledge enables entrepreneurs to focus on key structural parallels and to recognize opportunities within markets that share few superficial features with the original context of the technology and/or product (Gregoire et al., 2010). Therefore,

**Hypothesis 1:** Entrepreneurs with higher levels of prior knowledge will use more structural alignment processes when attempting to identify business opportunities than will entrepreneurs with lower levels of prior knowledge.

Prototype theory (Whittlesea, 1997) suggests that through experience individuals construct prototypes—cognitive frameworks which typify the most common members of a given category—which are used to classify or categorize incoming information. Prototypes have been shown to be instrumental to both manager and entrepreneur in helping them to characterize new information or environmental stimuli as representing a potential threat or opportunity (Baron and Ensley, 2006). Previous research on prototypes indicates that expert prototypes are more clearly defined, possess a greater richness in content, and are more closely linked to key attributes of the domain than are novice prototypes (Knowlton, 1997). As such, the development of expert opportunity prototypes is a critical component in enabling entrepreneurs to recognize and act on business opportunities (Baron and Ensley, 2006).

More specifically, Baron and Ensley (2006) showed that the opportunity prototypes of expert entrepreneurs focus more on the attributes of a business that have been shown to lead to success. These attributes include the ability to solve a customer’s problems, create a positive cash flow, quickly generate revenue, present manageable risk, and present opportunities to network with others in developing the venture (Baron & Ensley, 2006). Prototype models of pattern recognition suggest that as entrepreneurs encounter new information, they will compare this information to what they already know in order to detect links between diverse events and perceive recognizable patterns in these connections. In other words, individuals are constantly inundated with an overwhelming amount of environmental information (Ocasio, 1997), some of which will attract their attention, while other bits are never consciously processed. A highly developed cognitive framework, such as that provided by advanced prototypes, helps to identify and flag new information as particularly relevant (Baron & Ensley, 2006). It is likely that those entrepreneurs possessing more expert opportunity prototypes will attend to more relevant environmental stimuli pertaining to market needs or technology capabilities – information that is critical to the structural alignment process. Therefore,

**Hypothesis 2:** Entrepreneurs possessing expert opportunity prototypes will use more structural alignment processes when attempting to identify business opportunities than will entrepreneurs with less expert prototypes.

Recent research in entrepreneurship has revealed that failure can be an important source of knowledge. In fact, failure experiences are largely believed to lead to the development of skills and knowledge that can be highly useful in subsequent entrepreneurial ventures (Minniti & Bygrave,
Sitkin (1992) argues that failure is a prerequisite for learning as such experiences provide the opportunity to pinpoint exactly why a failure has occurred.

Psychological research has reinforced the view of failure as a powerful force, capable of radically altering cognition and the mental models that govern action and interpretation (Cope, 2011). Louis and Sutton (1991) have suggested that failures prompt learning by triggering the process of hypothesis testing, intensifying the attribution process, and stimulating sense-making efforts. In so doing, failure can fuel a Lewinian “unfreezing” process, where old ways of perceiving, thinking, and acting are destabilized and new cognitive processes can be experimented with and adopted, oftentimes for the first time (Louis & Sutton, 1991).

In this study, we specifically examine the learning benefits of failure as related to opportunity recognition. As has been identified by previous research, opportunities are often initially perceived as imprecisely defined market needs and/or under-utilized resources and capabilities of a technology/product (Kirzner, 1997). Exploration into the viability of a given opportunity consists of attempts to explore how basic technologies or product innovations can be “fit” to a possible need or problem in the market (Ardichvili, Cardozo, & Ray, 2003). Successful entrepreneurs will often work diligently to more precisely define a market in terms of the benefits and value sought by customers, as well as to more precisely define a product or service in terms of what they might potentially provide in terms of benefits and capabilities. This process is akin to that of structural alignment – the process of aligning the needs/desires of a market with the benefits/capabilities of a technology/product innovation.

Entrepreneurial failure is often precipitated by the lack of a “fit” between market need and product/technology benefit (De Koning, 1999). This type of failure likely stimulates entrepreneurs to pursue understanding of what went wrong, so that they can revise beliefs and develop new processes to direct future action (Cannon & Edmondson, 2005). In this case, it is likely that failure will emphasize the importance of aligning market and product/technology structural characteristics in opportunity recognition, leading to a distinct change in the subsequent cognitive processing of the entrepreneur. Therefore,

_Hypothesis 3: Entrepreneurs who have experienced higher levels of business failure will use more structural alignment processes when attempting to identify business opportunities than will entrepreneurs who have experienced less business failure._

Experiential learning theory conceptualizes effective learning as a process combining both direct action and personal reflection (Cope & Watts, 2000). Such reflection would include the learner examining his or her attitudes, beliefs, cognitions, and ideas relative to the failure so that they can be examined, tested, and integrated with new ideas and perspectives (Kolb & Kolb, 2005). However, the process of reflection can be materially improved through thoughtful analysis and discussion of the failure with others. Others may be able to add important perspectives or insights that deepen the analysis and help to counteract biases that may be coloring one’s perception (Cannon & Edmondson, 2005). Failure has been commonly found to result in attribution bias – the tendency of an individual to attribute too much blame to other people and external factors (Zuckerman, 1979). Without the aid of external perspective, these types of self-serving biases can reduce the ability to learn from failure (Cannon & Edmondson, 2005).
Entrepreneurial mentoring is based on a supporting relationship between an experienced mentor and a novice mentor, designed to help advance the latter’s personal development (St-Jean & Audet, 2009). This type of mentoring involves the sharing of experience, advice, and counsel designed to assist the novice entrepreneur in developing skills as well as to avoid missteps (St-Jean & Audet, 2009). While there are few studies that look at the benefits of mentoring to the mentor, research into the similar practices of collaborative learning and peer teaching have shown that the process of teaching content to another holds a number of benefits to the teacher. These benefits include accelerating teacher learning, enhancing understanding, and extending the application of learning to new contexts (Svinicki, 1991). In other words, when an individual shares with another the story of his or her failure, that discourse can help them better assess, analyze, and understand the reasons for failure, as well as point them to changes they can make in the future. Therefore,

Hypothesis 4: Entrepreneurs who have experienced high levels of business failure, and who have high amounts of mentoring experience will use more structural alignment processes when attempting to identify business opportunities than will entrepreneurs with high levels of business failure who have less mentoring experience.

Cognitive style has commonly been defined as an individual’s consistent approach to organizing and processing information during learning (Messick, 1984). Cognitive style has been assessed in a number of different ways, but one of the more popular conceptualizations has focused on the intuition-analysis dimension of cognitive style. Analysts have been found to prefer high attention to detail, a focus on ‘hard data,’ and often adopt a sequential, step-by-step approach to learning (Hayes & Allinson, 1998). In contrast, intuitives are less concerned with detail, adopt a more holistic perspective, and use an open-ended approach to problem-solving (Hayes & Allinson, 1998). Past research has shown that the effect of cognitive style upon performance varies depending on the nature of the task (Allinson & Hayes, 1996). For example, Mintzberg (1976) has proposed that planning and management science, because of the emphasis on logic and articulation, require a more analytical cognitive style while management at the policy level, because it involves coping with ambiguity and complexity, requires a more intuitive style.

In terms of individual learning, analysts and intuitives have been found to observe, reflect, and process their experiences differently, leading to significant differences in learning preferences (Hayes & Allinson, 1998). The matching of cognitive style with an appropriate learning environment can help eliminate barriers to learning which arise when mismatches occur (Hayes & Allinson, 1996). Oftentimes, entrepreneurs are forced to operate in environments of high uncertainty, where intuitive, holistic, and contextual thinking is necessary in order to process information and make quick decisions (Allinson, Chell, & Hayes, 2000). Failure represents a context where there is often an abundance of ambiguous information and high uncertainty, thus entrepreneurs are forced to utilize a more open-ended approach to problem solving and lateral modes of reasoning. These types of information processing represent strengths of the intuitive, where analytics prefer a more structured approach involving more systematic methods. Therefore,

Hypothesis 5: Entrepreneurs who have experienced high levels of business failure, and utilize a more intuitive cognitive style, will use more structural alignment processes when attempting to identify business opportunities than will entrepreneurs with high levels of business failure who utilize a more analytical cognitive style.
Learning from failure can be especially difficult when that failure occurs in a domain deemed irrelevant to the organization's future. In this scenario, failure is unlikely to stimulate attention, consideration, or responsive action (Payne, 1989). It is an essential prerequisite to learning that the domain within which failure occurs be familiar enough that novel outcomes are recognizable and interpretable (Sitkin, 1992). When the operating domain is foreign, it is often very difficult to draw useful knowledge from the failure experience, in part because of the struggle to plan or anticipate outcomes when operating in unfamiliar territory (Sitkin, 1992).

Consistent with this, one criteria for learning from failure is that failures need to occur in domains that are familiar enough to encourage effective learning (Sitkin, 1992). Familiarity and experience in a given domain enable individuals to operate at a higher level of specificity in understanding the cause and effect relationships resulting in failure, as well as to create potential guides for behavior in subsequent ventures (Abramson, Seligman, & Teasdale, 1978). Entrepreneurs who are operating with more expert opportunity prototypes have a richer, more fine-tuned understanding of what characteristics are more closely tied to entrepreneurial success (Baron & Ensley, 2006). These advanced opportunity prototypes likely help an entrepreneur narrow down those aspects of the business that have led to its downfall, as well as help to map out potential changes in behavior to alleviate errors and enhance subsequent performance. Therefore, Hypothesis 6: Entrepreneurs who have experienced high levels of business failure, and have more expert opportunity prototypes, will use more structural alignment processes when attempting to identify business opportunities than will entrepreneurs with high levels of business failure who have less expert opportunity prototypes.

The conceptual model illustrating the above hypotheses is shown in Figure 1.

**Method**

**Sample**

Our sample of entrepreneurs consisted of individuals attained through two channels. First, entrepreneurs were identified through the use of the OneSource Corp Tech database, a database well-used in the management literature as a rich source of data (Gardner, 2005). Second, entrepreneurs were identified through their inclusion in technology parks or incubators. For both sample sources, entrepreneurs were selected on the basis of industry, location, company size, formation date, and available contact information. For industry, entrepreneurs were targeted as sample participants on the basis of their businesses operating primarily within high potential, technology-related industries. Previous research has found that the fast-changing nature of technology-intensive firms leads decision makers in these fields to more frequently make decisions about opportunities (Hughes, 1990). In terms of location, entrepreneurs were drawn from nearby states including Illinois, Indiana, Iowa, Kentucky, Michigan, and Wisconsin. Entrepreneurs were drawn from companies of up to 500 employees, formed within the last 10 years, where contact information for a president/CEO/owner was made available. We concentrated on presidents/CEOs/owners to capture primary decision makers related to entrepreneurial opportunities.

The recruitment process consisted of sending a letter to each of the companies targeted. This letter was from the primary researchers and described the purpose of the research, why each
individual was being targeted, and informed them that they would be contacted by telephone in the next few days. In order to regulate the running of the experiment, we sent letters out in groups of approximately 100. Within a week of the mailing, we made a follow-up phone call to each of the letter recipients (i.e. the president/founder/owner) to discuss the nature of the study and ask them to participate. For those who agreed to participate in the study, we scheduled a day and time for each entrepreneur to expect a phone call and for the learning interaction to begin. Data were collected over an 8 month period beginning in May, 2010 and concluding in December, 2010.

A total of 550 entrepreneurs were sent letters requesting participation in this study. Of that number, 309 entrepreneurs were eventually contacted over the phone with 114 eventually agreeing to participate, representing a response rate of 21%. The participating entrepreneurs were on average 52.45 (sd. = 12.86) years old; 96% were male; 20% held a PhD degree as their highest qualification, 25% had a Master’s degree, 40% had a Bachelor’s degree, and the remainder had either some college experience or a high school diploma. Additionally, on average each entrepreneur had started 3.18 (sd. = 3.11) businesses in their career with 28% experiencing some form of business failure during the course of their entrepreneurial experience.

Research Design and Data Collection

This study consisted of entrepreneurs engaging in opportunity recognition exercises based upon 3 hypothetical business scenarios. We began each exercise by asking the entrepreneur to read through scenario 1, before subsequently attempting to identify relevant business opportunities, as well as to assess and explain which opportunity they believed represented the “best” opportunity. This same process was followed for scenario 2 and scenario 3, after which the conversation with the entrepreneur ended. Following the phone call, entrepreneurs completed a post-interaction survey. The business scenarios used in this exercise were based upon the vignettes utilized by Gregoire and colleagues (2010) in their efforts to identify opportunity recognition processes amongst a sample of expert entrepreneurs.

Measures and Validation

A number of the study’s measures were derived through verbal protocol analysis involving data coding. The general process used to code the dependent variable (use of structural alignment processes), expert prototypes, and prior knowledge measures is detailed immediately below. The more specific coding parameters are expanded upon within each measure’s description.

In adherence to the standards of verbal protocol and content analysis (cf. Krippendorff, 2004), two coders independently coded the raw data; the coding was done by the first author of this study and a doctoral student who was blind to both the theoretical rationales and the hypotheses involved in this research. The coders began by walking through the coding of one transcript together, checking for understanding and consistency in coding methodology. They then coded an additional transcript separately, before meeting to compare and discuss results. Consistent with the recommendations detailed by Schulz-Hardt and colleagues (2006), one coder (the first author of this study) coded all 114 of the conversations while the second coder independently coded 30 of the conversations, which were randomly selected from the complete pool of entrepreneur interactions.

Dependent variable – Use of structural alignment processes. The dependent variable is the use
structural alignment processes by entrepreneurs over the course of the three exercises. In accordance with the work of Gregoire et al. (2010), the transcripts of the entrepreneur conversations were coded to reflect the use of high order structural alignment processes by the entrepreneur during the course of the opportunity identification exercises. More specifically, as detailed by Gregoire et al. (2010), high order structural alignment occurs where participants focus on the ultimate benefits of the technology/product or market activities and their causes or the problems of the technology/product or market activities and their causes. This coding methodology is more explicitly outlined by Gregoire et al. (2010) in coding high order structural alignment via verbal protocol analysis.

Coding of entrepreneur conversations involved noting each instance where the entrepreneur utilized a high order structural alignment process during their engagement in the opportunity identification exercises. The two coders agreed on 94% of the entrepreneurial structural alignment coding instances. In the 6% of cases where the coding differed, the two coders met to determine the validity of the coding, came to an agreement, and made the requisite change to the data before proceeding with data analysis. These results indicate acceptable levels of interrater reliability (cf. Neuendorf, 2002).

**Expert prototypes.** As assessed by Baron and Ensley (2006), expert opportunity recognition prototypes were found to include opportunities that solve a customer’s problems, have the ability to generate positive cash flow, can quickly generate revenue, present manageable risk, and involve others in the entrepreneur’s network who can help develop the venture. Coding verbalizations of the opportunity recognition process involved noting each instance where the entrepreneur referenced an expert prototype in either recognizing or evaluating an opportunity idea. The two coders agreed on 96% of the expert prototype coding instances, and in the 4% of cases where the two coders differed, the two coders met to determine the validity of the coding, came to an agreement, and made the requisite change to the data before proceeding with data analysis. These results indicate acceptable levels of interrater reliability (cf. Neuendorf, 2002).

**Cognitive style index.** We used Allinson and Hayes’ (1996) 38 item scale to measure entrepreneurs’ cognitive style. The items were designed to be true/false statements, with an additional response of ‘uncertain.’ Example items include, “Formal plans are more of a hindrance than a help in my work” and “I am inclined to scan through reports rather than read them in detail.” In computing the overall measure, each item response was allocated a certain number of points: true was assigned a score of 2, 1 for uncertain, and 0 for false. The item scores were summed, with higher scores indicating a more analytical respondent and lower scores indicating a more intuitive respondent. The measure produced a Cronbach’s coefficient alpha of .85.

**Prior knowledge.** In accordance with the coding procedures of Gregoire et al. (2010), we coded entrepreneur conversations on the dimension of prior knowledge. This dimension assesses the level of knowledge that anchors the thoughts and reasoning of entrepreneurs expressed during their conversations. Three levels of prior knowledge were coded for in our analysis: high, medium, and low.

For the purposes of this study, prior knowledge was coded consistent with the high level of prior knowledge coding scheme. Coding of the entrepreneur conversations involved noting each instance where the entrepreneur utilized a high level of prior knowledge during their engagement in the opportunity identification exercises. The two coders agreed on 94% of the prior knowledge coding instances. In the 6% of cases where the coding differed, the two coders met to determine
the validity of the coding, came to an agreement, and made the necessary change to the data. These results indicate acceptable levels of interrater reliability (cf. Neuendorf, 2002).

**Mentoring experience.** Each entrepreneur’s mentoring experience was assessed through a single question, “How long (in years) have you served as a mentor?”

**Failure.** An entrepreneur’s prior experience with failure was assessed with the question, “How many businesses have you closed or sold due to bankruptcy, liquidation, or receivership, or because it failed to meet your expectations?”

**Control variables.** We introduced two control variables: the entrepreneur’s age and their previous entrepreneurial experience. Previous entrepreneurial experience was operationalized as the total number of ventures started by the entrepreneur. These two factors were controlled for in order to limit the influence either factor might have upon how/if an entrepreneur learns from experience and/or failure.

## Results

We used hierarchical regression analysis to test our hypotheses. As recommended by Aiken and West (1991), the independent variables were mean centered prior to the creation of interaction terms. All VIF’s were below 2, with a maximum VIF of 1.45. Since all VIFs are well below the generally accepted limit of 10, we concluded that multicollinearity is unlikely to have confounded the results (Kutner, Nachtsheim, & Neter, 2004). In Table II we present the means, standard deviations and bivariate correlations for variables used in the regression analyses. In Table III, we present the results of the hierarchical regression analysis.

The first step in the regression (Model 1) consisted of the study’s control variables. The control variables explained a significant amount of the variance in the use of structural alignment processes (Model 1: $R^2 = .062; p < .05$), with age as the lone control variable registering as significant ($p < .05$). The second step was to add the main effect variables (Model 2). The addition of the main effect variables explained a significant share of the variance in the entrepreneur’s use of structural alignment processes (Model 2: $R^2 = .480; p < .01$). This also represents a significant increase over and above Model 1 ($\Delta R^2 = 0.418; p < 0.01$). Hypothesis 1 posited that entrepreneurs with higher levels of prior knowledge use more structural alignment processes than entrepreneurs with lower levels of prior knowledge. The coefficient for prior knowledge was significant ($\beta = 0.544, p < 0.01$), and therefore, Hypothesis 1 was supported. Next, Hypothesis 2 stated that entrepreneurs with more expert opportunity prototypes use more structural alignment processes than entrepreneurs with less expert prototypes. As shown in Model 2, the coefficient for expert prototypes was significant ($\beta = 0.273, p < 0.01$). Thus, Hypothesis 2 was supported. Hypothesis 3 posited that entrepreneurs who have experienced more business failure use more structural alignment processes than entrepreneurs with less business failure. Again, the main effect of business failure upon the use of structural alignment processes was significant ($\beta = 0.156, p < .05$), providing support for Hypothesis 3.

Step 3 in the regression (Model 3) was to enter the two-way interaction terms. This model significantly explained variance in the use of structural alignment processes (Model 3: $R^2 = .552, p < 0.01$) and represents a significant increase over and above the main effects only model ($\Delta R^2$ ...
The findings for Model 3 demonstrate a significant negative interaction term for mentoring experience and failure on the usage of structural alignment processes ($\beta = -0.174, p < 0.05$), as well as a significant negative interaction term for cognitive style and failure upon the usage of structural alignment processes ($\beta = -0.173, p < 0.05$). Additionally, we found a significant positive interaction term for expert prototypes and failure upon the usage of structural alignment processes ($\beta = 0.150, p < 0.05$).

To determine the nature of the significant interactive effects, based on the regression coefficients, we graphed the three interactions on the use of structural alignment processes. Figure 2 shows a plot of the incidence of entrepreneurial failure on the usage of structural alignment processes for analytical and intuitive values of cognitive style. Figure 3 illustrates a plot of incidence of entrepreneurial failure on the usage of structural alignment processes for high and low values of expert prototypes. Finally, Figure 4 displays a plot of incidence of entrepreneurial failure on the usage of structural alignment processes for low and high values of mentoring experience. We plotted values for cognitive style (Figure 2), expert prototypes (Figure 3), and mentoring experience (Figure 4) at one standard deviation above and below their means as recommended by Cohen and Cohen (1983).

The nature of the interaction in Figure 2 indicates that following high levels of business failure, entrepreneurs operating with an intuitive cognitive style will use more structural alignment processes than will entrepreneurs operating with an analytical style. This finding provides support for Hypothesis 5. The interaction shown in Figure 3 indicates that following high levels of business failure, entrepreneurs equipped with high levels of expert opportunity prototypes will use more structural alignment processes than will entrepreneurs with low levels of expert opportunity prototypes. This finding provides support for Hypothesis 6. Figure 4 reveals that after high levels of business failure, entrepreneurs with low mentoring experience will use more structural alignment processes than will entrepreneurs with high mentoring experience. These results do not support Hypothesis 4.

**DISCUSSION**

Entrepreneurial failure has largely been lauded in extant literature as providing a wide variety of uniquely valuable entrepreneurial knowledge to the entrepreneur. However, little prior work has empirically explored the type of knowledge that can result from failure experiences, or the cognitive factors that can moderate the learning process. This study has focused on how failure experience can influence the learning of opportunity recognition expertise, finding that entrepreneurial failure can serve as a powerful cognitive agent in helping to develop expertise in the form of structural alignment processes. This finding supports the belief that failure experience can be beneficial to the entrepreneur in the long run, helping to equip him or her for success in subsequent ventures.

Additionally, this study found that certain cognitive properties of the entrepreneur – an intuitive cognitive style and the possession of expert opportunity prototypes – help enable an entrepreneur to better make sense of a failure experience and translate such experiences into opportunity recognition knowledge. In that sense, the translation of experience into knowledge (Kolb, 1984) is dependent on the complementary integration of an entrepreneur’s cognitive tools. Entrepreneurial learning is a complicated process operating in a complex environment. Cognitive
tools such as an intuitive cognitive style and opportunity prototypes may be critical pieces of a ‘cognitive toolset’ that better enable entrepreneurs to learn from their experiences.

CONTACT: Brandon Mueller; brandon.mueller@okstate.edu; (T): 405-744-8610; Oklahoma State University, 420 Business, Stillwater, OK 74078, USA.

REFERENCES


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**TABLE 1: Means, Standard Deviations, and Correlations of the Study Variables**

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<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
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<th>3</th>
<th>4</th>
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<td>Age</td>
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<td>Education</td>
<td>4.37</td>
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<td>Cognitive style index</td>
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<td>Prior knowledge</td>
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<td>1480.99</td>
<td>0.09</td>
<td>-0.07</td>
<td>0.04</td>
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<td>Expert prototypes</td>
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<td>2.85</td>
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<td>0.18</td>
<td>0.03</td>
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<td>Mentoring experience</td>
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<td>0.15</td>
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*p < 0.05; **p < 0.01

**TABLE 2: Results of Hypothesis Testing Using Hierarchical Regression**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
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<tr>
<td>Cognitive style index</td>
<td>0.016</td>
<td>-0.055</td>
<td></td>
</tr>
<tr>
<td>Prior knowledge</td>
<td>0.544**</td>
<td>0.513**</td>
<td></td>
</tr>
<tr>
<td>Expert prototypes</td>
<td>0.278**</td>
<td>0.200**</td>
<td></td>
</tr>
<tr>
<td>Failure</td>
<td>0.156**</td>
<td>0.265**</td>
<td></td>
</tr>
<tr>
<td>Mentoring experience</td>
<td>-0.120</td>
<td>-0.174*</td>
<td></td>
</tr>
<tr>
<td>Failure X Mentoring experience</td>
<td>-0.174*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure X Cognitive style index</td>
<td>-0.173*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure X Expert prototypes</td>
<td>0.150*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R^2: 0.062**  0.480**  0.553**  0.553**

Adj. R^2: 0.045**  0.446**  0.509**  0.509**

P R^2: 0.062**  0.418**  0.073**  0.073**

Note: Standardized regression coefficients are displayed in the table.
*p < 0.05; **p < 0.01