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J. Michael Haynie

Syracuse University, USA, jmhaynie@syr.edu

Dean A. Shepherd

Indiana University, USA

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**NATIONAL FEDERATION OF INDEPENDENT BUSINESS (NFIB) AWARD
FOR EXCELLENCE IN RESEARCH ON THE GENERAL TOPIC OF ENTREPRENEURSHIP**

**EXPLORING THE ENTREPRENEURIAL MINDSET:
FEEDBACK AND ADAPTIVE DECISION-MAKING**

J. Michael Haynie, Syracuse University, USA

Dean A. Shepherd, Indiana University, USA

ABSTRACT

The ability to sense and adapt to uncertainty may characterize a critical entrepreneurial and organizational resource. We investigate the roles that metacognition and feedback-type play in facilitating cognitive adaptability: the ability to inform and adapt a previously learned decision heuristic given a dynamic task environment. Across four, inter-related conjoint experiments we capture and decompose more than 10,000 ‘entrepreneurial decisions’ nested within 217 individuals, and test hypotheses positioned to assess the concomitant roles of metacognition and feedback-type in the decision-making process. Our findings suggest that metacognitive awareness and cognitive-based feedback are positively related to effective adaptation given a dynamic task environment, and also that metacognitively aware individuals use cognitive-type feedback more effectively than individuals less metacognitively aware.

INTRODUCTION

Competitive business environments are characterized by rapid, substantial, and discontinuous change (Hitt, 2000). Scholars suggest that in order to realize and sustain a competitive advantage in such a context, managers must respond strategically to changes in their organizations’ environment (Hitt, 2000; Ireland & Hitt, 1999). That is, managers must “rethink current strategic actions, organization structure, communication systems, corporate culture, asset deployment, investment strategies, in short every aspect of an organization’s operation and long term health (Hitt, Keats, & DeMarie, 1998: 26).” And while management scholars acknowledge the importance of ‘adaptable’ cognitions, it is noteworthy that most everything we know about cognitive science, social psychology, and learning suggest that to realize an ‘adaptable’ mindset, the manager is fighting an uphill battle. Put simply, the flexibility implied in the statements of the authors cited above is predicated upon the manager’s ability to overcome the bias embedded in existing, learned sense-making mechanisms. Research suggests that such a cognitive task is exceedingly difficult (Rozin, 1976). To date, psychologists investigating adaptable reasoning in management have focused on differences between individuals in terms of the detection and interpretation of information about change (Dutton & Duncan 1987; Aguilar, 1967), problem formulation and sensing (Keisler & Sproul, 1982), normative models of strategic diagnosis (Ansoff, 1979; Nutt, 1979), and on the effectiveness of the behavioral response (Dutton & Duncan, 1987; Dutton & Jackson, 1987). Generally, such research is positioned to investigate individual differences in terms of how decision-makers gather and assign meaning to environmental cues, or similarly how the decision-maker *acts* in response to dynamism and change. However, assumed in this research is consistency across individuals in terms of how information about change and problem formation is *processed and incorporated* in the decision-making process. In this study we pursue a counter-assumption relative to the literature highlighted above, in that we impose homogeneity in the nature of environmental cues, and also homogeneity in *how* those cues are to be interpreted. We then investigate remaining differences in the individual’s ability to effectively adapt existing decision policies in the face of dynamic decision environments.

Although research on cognition continues to proliferate in both the entrepreneurship and management literatures, to date scholars have focused primarily on the cognitive processes and mechanisms that *inhibit* adaptability. In this study we focus on the ‘other side of the cognitive coin’ by demonstrating the

important implications of research positioned to investigate how decision makers effectively respond to novel environments characterized by rapid, substantial, and discontinuous change. This study also informs our understanding of the role that environmental feedback plays in the decision making process. Although the benefits of cognitive over outcome-type feedback are established in the literature (e.g., Balzer et al. 1999; Remus, O'Conner, and Griggs, 1996), little attention has been given to individual differences in ones' ability to 'make the most' of feedback. For example, why are some individuals more adept at utilizing cognitive feedback – integrating the relationships between the task, the feedback, and their own decision policies – in a way to promote cognitive adaptability and thus normatively 'better' decisions? We suggest metacognitive awareness as a partial explanation.

THEORETICAL BACKGROUND AND HYPOTHESES

Feedback and Cognitive Adaptability

A theme incorporated throughout the entrepreneurship and managerial decision literatures, is *cognitive adaptability*: the ability to effectively and appropriately evolve or adapt decision policies (i.e. to learn) given feedback (inputs) from the environmental context in which cognitive processing is embedded. Feedback is most often considered as either outcome or cognitive based (Brehmer, 1995; Sengupta & Abdel-Hamid, 1993). Outcome feedback refers to a feedback type that confers to the decision-maker performance orientated information relative to some objective standard (Brehmer, 1987, 1990; Stermen, 1989a, 1989b). For example, indicating that a student scored a 6 out of a possible 10 points on a quiz is representative of outcome-based feedback. Outcome based feedback does not provide contextual cues to the receiver as to the relationship between performance, the task, and subsequent learning; it provides individuals with only performance results. In contrast, cognitive feedback “refers to the process of presenting the person information about the relations in the environment (task information) ... relations perceived by the person (cognitive information)..and relations between the environment and the person's perceptions of the environment (functional validity information)” (Balzer, Doherty, and O'Conner, 1989). Cognitive feedback has been demonstrated to improve performance on judgment tasks (Remus, O'Conner, and Griggs, 1996). Generally scholars suggest that the benefits of cognitive over outcome-based feedback – in the context of a dynamic and novel decision environment – result from the relational nature of cognitive feedback. Specifically cognitive feedback serves to aid the decision-maker in appropriately interpreting how the decision criteria relevant to a given task relate to each other, holistically in the context of the decision outcome. Presumably those individuals with insight into the how and why a given set of decision criteria relate to some desired outcome are better positioned to learn, and subsequently respond appropriately as the means to achieving a desired outcome change over time. Thus:

Hypothesis 1: Individuals that receive cognitive feedback from the environment in response to their decisions when performing an entrepreneurial task are more effective at adapting their decision policies than those that receive outcome-based feedback.

Metacognition and Adaptability

Schraw and Dennison define metacognition as “the ability to reflect upon, understand, and control one's learning” (1994). Research focused on the role that metacognitive processes play in reasoning and cognitive functioning suggests a cognitive hierarchy, with metacognition describing the process of formulating strategies for processing a changing reality, which in turn serve to elicit a cognitive response. Metacognition captures cognitive processing at a more general, abstract level than cognition. Individuals vary in their propensity to engage in metacognition (Allen & Armour-Thomas, 1993), and there is evidence that it can be taught (Schmidt & Ford, 2003). Shraw and Dennison (1994: 461) cited empirical studies indicating that metacognition is “separate from other cognitive constraints on learning,” and we know that an individual's development and application of metacognitive processes cannot be predicted “with even a moderate degree of accuracy” from domain knowledge (Glenberg & Epstein, 1987). Both

the education and psychology literatures link the ability to regulate metacognitive processes to creativity and the cognitive application of knowledge (Schraw, 1998; Schraw, 1995). These same literatures also suggest that individuals who access metacognitive processes are more adaptable given dynamic and uncertain contexts (Earley & Ang, 2003), which can translate into superior performance (Garner & Alexander, 1989). The extant literature focused on metacognition and decision-making suggests that individuals who are “*metacognitively aware*” are: 1) more likely to recognize the fact that there are multiple cognitive alternatives available to process a given task or situation, 2) more likely to engage in the conscious process of considering those multiple alternatives, and 3) more likely to be sensitized and receptive to feedback from the environment and to incorporate that feedback into subsequent decision frameworks (Melot, 1998; Schraw & Dennison, 1994). Thus,

Hypothesis 2: Individuals with greater metacognitive awareness are more effective at adapting their decision policies on entrepreneurial tasks in response to feedback from the environment than those with less metacognitive awareness.

Metacognition and Decision Feedback

As detailed previously, the positive implications of cognitive feedback for learning have been found across numerous studies, performed in disparate decision-contexts (Remus, O’Conner, and Griggs, 1996; Brehmer, 1980). However, these studies do not address specifically if everyone who receives cognitive feedback benefits equally. Are some individuals more adept at utilizing cognitive feedback – integrating the relationships between the task, the feedback, and their own decision policies – in a way to rethink their decision policies to make normatively ‘better’ decisions? We propose that the answer is yes and that *one* of the origins of this individual difference – the extent to which cognitive feedback confers an improvement in decision performance – is due to heterogeneity in metacognitive awareness. After receiving cognitive feedback, we propose that metacognitively ‘aware’ individuals are more apt to recognize some discontinuity, highlighted by cognitive feedback, between their own cognitions, the attributes of a given task, and the desired outcome and then use that feedback to evolve their decision policies accordingly. Typically, outcome-based feedback provides the decision-maker with inferior or inadequate information (relative to cognitive feedback) concerning the relationship between his/her own decision and some performance outcome (Hammond, Summers & Deane, 1973; Castellan, 1974). As a result, the decision-maker’s ability to make normatively meaningful changes in subsequent decisions is limited - that is to say that while outcome feedback can certainly motivate a change in decision policy, the normative implications of that change are dubious given the nature of feedback. For example, in an experimental study, Castellan (1974) found that outcome feedback framed as a ‘percentage correct’ score actually had a detrimental effect on subsequent decision performance. That said, it could be that individuals who are highly metacognitively aware draw on metacognition to make relational inferences given the outcome feedback. In essence, they transform outcome feedback into cognitive-type feedback by inferring relationships based on intuitions and experiences thus promoting marginal, normative improvements in subsequent decision policies. But the scope to do so, and for those more metacognitively aware to benefit from the feedback, is likely greater when that feedback is cognitive rather than outcome in nature. Thus,

Hypothesis 3: The positive relationship between cognitive (over outcome) feedback and effectively rethinking decision policies is more positive for those individuals with higher metacognitive awareness than those with less metacognitive awareness.

METHODS

Conjoint Analysis

In this study, conjoint analysis is employed to determine the respondents’ decision policies in the context of performing an opportunity evaluation task (an important entrepreneurial task [McMullen & Shepherd, 2006]). Conjoint analysis is a technique that “requires respondents to make a series of

judgments, assessments or preference choices, based on profiles from which their ‘captured’ decision processes can be decomposed into its underlying structure” (Shepherd & Zacharakis, 1997: 207). According to Green, Krieger and Wind (2001: 56), “thousands of applications of conjoint analysis have been carried out over the past three decades”. Because we hypothesize a contingent relationship between metacognitive and feedback-type, conjoint analysis is a highly appropriate method to investigate evaluation policies without relying on the respondents’ introspection, which has been found to be often biased and inaccurate (Fischhoff, 1982; Priem & Harrison, 1994).

Experimental Design

Figure 1 describes our experimental design in detail. In *Part 1* of the experiment, respondents are tasked with evaluating a series of hypothetical entrepreneurial opportunities (profiles) based on a discrete set of evaluative criteria. The profiles are presented to the respondents on a computer screen, and they are asked to indicate their assessment electronically. The scale used to capture the respondent’s evaluations of opportunity attractiveness, defined as the potential that the given opportunity has, if exploited, to confer upon its company a sustainable competitive advantage in the marketplace, is an eleven point Likert-type scale anchored by the end points “not at all attractive” and “very attractive”. Throughout the exercise, respondents receive computer-generated, cognitive-type feedback focused on providing a basis for comparing their own decision policies to what they are told is an ‘optimal’ model of opportunity assessment. That is, the feedback is designed to direct inexperienced entrepreneurs to use all decision criteria and to weight them consistent with the feedback presented. Given this feedback, participants continue the opportunity assessment exercise and evaluate additional sets of opportunity profiles, and again receive cognitive-type feedback. The purpose of Part 1 of the experiment is to facilitate the development of a simple decision policy of opportunity assessment. The extent to which this ‘simple model’ is internalized by the respondents is determined using conjoint analysis and hierarchical linear modeling (HLM) procedures. In *Part 2* of the experiment, the model of assessment that served as the basis for the decision feedback that the respondents received in Part 1 of the study is abandoned, in favor a more complex model of opportunity assessment. This complex model is reflected in the feedback the respondents receive in Part 2 of the experiment. Put simply, the relationships between the evaluative criteria and the appropriate assessment of the opportunity that were reinforced in the form of decision feedback in Part 1 of the study, are now wholly inappropriate in Part 2 of the experiment. Further, the complexity of the assessment task is increased: respondents must incorporate two additional evaluative criteria into their assessment decisions, and are also directed to consider that the impact of certain criteria on the assessment may depend on the different levels of a fourth criterion (three two-way interactions). Finally, in Part 2 of the study, individuals randomly receive *either* cognitive or outcome-based feedback relating their assessments to the ‘optimal model’. We subsequently investigate the role that both metacognition and feedback-type play in promoting adaptation *away from* the ‘simple’ model of assessment learned in Part 1, toward the complex model presented in Part 2 of the experiment.

The Assessment Task

In designing the experiment we utilize an orthogonal fractional factorial design from Hahn and Shapiro (1966). Each opportunity profile differs based on unique combinations of a discrete set of decision attributes, which taken together define the opportunity. There are five decision attributes utilized in this study; four of these attributes focus on resource-dimensions of the opportunity, and the fifth attribute captures the extent to which the opportunity relates to the respondent’s own knowledge, skills and abilities. Consistent with most metric conjoint analyses, each of these attributes is operationalized at two levels (Priem & Harrison 1994), either high or low. In Part 1, the respondent’s evaluation of opportunity attractiveness in the conjoint study is based on three (of the five available) decision criteria which served to define the opportunity. Given three attributes at two levels, our fractional factorial design (Hahn & Shapiro 1966) required respondents to evaluate four profiles in order for us to test all main-effects and two-way interactions. In choosing the fractional factorial design, we followed the general rule of confounding effects of most interest with effects that are unlikely to be significant or, if they are significant, are unlikely to cause much bias in the parameters that are estimated (Green & Srinivasan

1990; Louviere 1988). We fully replicated our design at each stage of the conjoint study. Full replication of the profiles in the experiment allows a comparison of the original profiles with the replicated ones to test reliability and provide the error term necessary to conduct analysis at the individual level. In addition, each experiment included, as the first evaluation task, a 'practice' profile which was excluded from analysis. Therefore, in Part 1 of the study, each participant evaluated a total of seventeen profiles: nine profiles prior to receiving feedback, and eight profiles following feedback. In Part 2 of the study, the respondent's evaluation is based on five decision attributes which taken together define the opportunity. Because in Part 2 we investigate a set of 5 evaluation criteria each at two levels, our fractional factorial design required that each respondent evaluate 16 profiles. Each of the profiles was then fully replicated such that, in total, each individual evaluated 32 profiles (plus one practice profile) before receiving a feedback condition, and 32 profiles (no practice profile) after the feedback. Regression analysis was used to decompose decisions into their underlying decision weights. The instructions to participants were designed to control for unobservable effects on their evaluations. Further, because the study was computer-based, it was impossible for respondents to refer back to previous opportunity profiles for comparison purposes.

Sample

Participants in this study include 217 undergraduate business students enrolled at a large public university. Participation in this study occurred as part of their normal course program; however administration of the experiment was accomplished as part of a specially scheduled session in a laboratory setting where conditions can be controlled. 55% of the sample were male, the average age was 20.44 (*std. 1.48*), 87% were business majors, and none of the sample had taken entrepreneurship courses. Additional demographics of the sample are reported in columns two and three of Table 2. We characterize this sample as consistent with individuals *inexperienced* in performing entrepreneurial tasks. Although there have been some criticisms of the use of students in behavioral (Copeland, Francia & Strauser 1973) and entrepreneurship (Robinson, Huefner & Hunt 1991) research, it is relatively common in the investigation of basic cognitive and psychological questions (e.g., Colquitt 2001; Harkness, Tellegen & Waller 1995), including those for use in management (e.g., Brock & Slusky 1994). As the aim of this study is to explore cognitive adaptability enabled by metacognition and in the performance of opportunity assessment (an entrepreneurial task), a sample with limited prior knowledge or experience in performing entrepreneurial opportunity assessments serves to mitigate potentially confounding effects that prior knowledge and experience may have on the dependent variable – cognitive adaptability. We believe our sample serves that end.

Dependent Variable

Our theoretical focus is on the role that metacognition and feedback-type play in *effective* adaptation given a changing decision environment. Thus the dependent variable should capture both how feedback and metacognition promote change in a given decision policy, as well as the normative implication of that change. Consistent with this purpose, we develop a measure of Effective Decision Policy Change (EDPC) which captures each respondent's ability to effectively adapt their decision policy based on feedback. To calculate EDPC, regression is used to determine individual, standardized coefficients – as weights – for each of the decision attributes employed in the study. For each part of the study (Part 1 & Part 2) weights at t_1 represent the respondent's decision weight for a given attribute *prior to receiving feedback*. Weights at t_2 represent the respondent's decision weight for a given attribute *after receiving feedback*. As part of the above calculation, both before and after receiving feedback, the individual decision weights for each attribute are compared to an 'optimal' decision weight to determine the 'GAP' in decision weight (difference between the respondent's decision weight and the optimal decision weight). The absolute value of each GAP (pre-feedback) is then subtracted from the absolute value of the corresponding attribute GAP (post-feedback), resulting in an accuracy score for a given individual at a given attribute (i.e. Value, Rarity, etc.). This score represents the degree to which the individual moved closer to the optimal weight following feedback (as compared to prior to receiving feedback). *Effective Decision Policy Change* then is represented by the average of the accuracy scores of the decision weights

(in Part 1, three decision weights; in Part 2, five decision weights, and three two-way interactions). Higher and positive *Effective Decision Policy Change* scores depict normative improvement. In analyzing the conjoint data to generate the inputs for calculating *Effective Decision Policy Change*, we found 91% of the individual decision policies are statistically significant ($p < 0.05$) in the first set of responses (prior to feedback), with a mean R^2 of 0.67. 89% of the individual responses were statistically significant ($p < 0.05$) in the second set of responses (post-feedback), with a mean R^2 of 0.76. 88 % of the individuals are significantly reliable in their first set of responses ($p < .01$) with a mean test-retest correlation of .72. 94% of the individuals are significantly reliable in their second set of responses ($p < .01$) with a mean test-retest correlation of .81. Both the explained variance and reliabilities are consistent with previous research (e.g., Choi & Shepherd 2004; Shepherd 1999).

Independent Variables

Feedback. Feedback presented to the respondents throughout this study took one of two forms: either cognitive or outcome based. Consistent with the findings of Balzer et al. (1994), the cognitive feedback presented in this study conveyed information to the respondent concerning: 1) *Task Information* (TI) describing the optimal (objectively correct) relationship between each of the criteria and the attractiveness of an opportunity, 2) *Cognitive Information* (CI) describing individual's own decision policy, depicting the relationship between the assessment criteria and their subjective assessment of opportunity attractiveness, and *Functional Validity Information* (FVI) describing information about the relationship between the task (assessment) and the individual's decision policy (decision weights for each of the attributes). Outcome feedback consisted only of a numerical score that represents the percentage of the respondents' assessments that are in agreement with that of the optimal model. Agreement for outcome feedback is considered to be reached if the inexperienced entrepreneur's assessment is within plus or minus one scale point from that of experts on a given scenario. For example, if an individual respondent, in the process of assessing the 33 scenarios, scores 22 of the 33 within one point of the score from the optimal model, he or she will receive an 'outcome' score of 66%. An example of how both feedback types were presented, consistent with the above descriptions, can be found at Appendix 2. Feedback type was exclusively cognitive in Part 1 of the study. Cognitive feedback was computer generated, and presented to the inexperienced entrepreneur half-way through the task (after the first 8 profiles). The feedback is designed to direct inexperienced entrepreneurs to use all three decision criteria, and to weight them consistent with the feedback presented. The optimal model criteria weights (against which individual performance was compared and feedback generated) were as follows: Value: 10%, Rarity: 30%, and Imitability: 60%. We arbitrarily assigned these weights, and as the purpose of this study is to investigate cognitive adaptability – evolving decision policies from *point A* to *point B* – it was important to assign weights to the optimal model in Part 1 that offered the inexperienced entrepreneurs the opportunity to adapt when presented with an alternative weighting framework (in Part 2). As inexperienced entrepreneurs, the respondents in this study have few, if any, pre-conceptions as to how these criteria normatively 'should' be weighted. In Part 2 of the study, feedback type was randomly assigned as either cognitive or outcome based. Both feedback types were computer generated, and presented to the sample half-way through the task (after the first 17 profiles of Part 2). Like in Part 1, the feedback is designed to direct the sample to use all decision criteria, and also to weight them consistent with the feedback presented. The optimal model from which feedback was referenced was derived from the decision policies of 73 expert entrepreneurs captured as part of a related research study.

Metacognitive awareness. Metacognitive awareness is captured using a 36-item measure adapted from Schraw and Dennison (1994). Schraw and Dennison developed an inventory of items constructed to assess metacognitive awareness embedded in an educational context. Given our interest in a measure of metacognitive awareness not specifically linked to an educational context, we adapted Schraw and Dennison's original items to remove the implication of an education context. Nine of Schraw and Dennison's original items were dropped entirely based on the inability to disentangle the substantive focus of the item from the educational context. Eleven substantively similar items were created and added to the adapted inventory. Employing Structural equation Modeling Procedures, we found this

adapted scale to have good psychometric properties as evidenced by its factor structure, convergent, discriminant, and nomological validity.

Control variables. Theory and research suggest that the extent to which an individual is motivated to perform on a given task, as well as their capacity and propensity to engage in cognitively complex tasks may relate to cognitive adaptability as we have conceptualized it in this study. As such, we selected measures of Need for Cognition (Cacioppo, Petty, and Kao 1982) and Regulatory Focus (Higgins 1997) to serve as control variables in the model. Further, we controlled for age, gender, and academic major.

RESULTS

Table 2 presents the means and standard deviations for the independent variable, the control variables, and the dependent variable as well as an inter-correlation matrix. There are significant, pair-wise correlations within and between the set of independent and control variables suggesting the possibility of multicollinearity confounding the results. Subsequent analysis employing the Variance Inflation Factor (VIF) indicated that - because all VIF scores were less than '2' - multicollinearity is not a serious problem (Neter, Wasserman, and Kutner 1990). Table 2 presents the hierarchical regression results. Results are reported for a base model (Step 1), a main effects model (Step2), and a full model (Step 3). The base model includes only the control variables - - age, gender, academic major, regulatory focus, and need for cognition. The main effects model includes the set of control variables, and the independent variables of feedback condition and metacognitive awareness. The full model includes the set of control variables, the independent variables of feedback condition and metacognitive awareness, and the interaction between metacognition and feedback type. This approach facilitates an investigation of the amount of variance in Effective Decision Policy Change accounted for by the inclusion of additional explanatory variables in both Step 2 and Step 3, 'over and above' the group of variables included in the previous regression model. The results for each model are reported in three columns: the first details the regression coefficients (standardized), the second the associated standard error, and the third column the t-ratio and level of significance (indicated by the number of asterisks following the t-ratio).

The base model, consisting of control variables only, does not explain a significant amount of the variance in *Effective Decision Policy Change* ($R^2 = .038$, $p > .10$). The main effects model (Step 2) explains a significant amount of variance ($R^2 = .164$, $p < .001$) in *Effective Decision Policy Change*. Further, the main effects model represents a significant improvement in explained variance of *Effective Decision Policy Change* over and above base model ($\Delta R^2 = .126$, $p < .001$). Both metacognition and feedback type account for this increased explanatory power. Specifically, feedback type is significant and related to *Effective Decision Policy Change* (standardized coefficient = .331, $p < .001$) such that *Effective Decision Policy Change* improves as one moves from the outcome feedback condition to the cognitive feedback condition. This finding provides support for hypothesis 1. Metacognitive awareness is also significant and positively related to *Effective Decision Policy Change* (standardized coefficient = .128, $p < .005$) such that - all else equal - as metacognition increases, *Effective Decision Policy Change* improves, providing support for hypothesis 2.

The full model explains a significant amount of variance ($R^2 = .221$, $p < .001$) in *Effective Decision Policy Change*. Further, the full model represents a significant improvement in explained variance over and above the main effects model ($\Delta R^2 = .057$, $p < .001$). The interaction between metacognition and feedback type is significant (standardized coefficient = 1.44, $p < .005$) and positively related to *Effective Decision Policy Change*. To better understand the nature of this interaction between metacognition and feedback type, the nature of the relationship is plotted in Figure 2 consistent with the techniques recommended by Cohen and Cohen (1983). The dependent variable - *Effective Decision Policy Change* - is plotted on the Y-axis. Feedback condition is plotted on the X-axis such that moving from left to right along the X-axis represents moving from the outcome to feedback condition. Employing regression coefficients to calculate values of *Effective Decision Policy Change*, the plots represent values of

Effective Decision Policy Change at both one-standard deviation above and below the mean for metacognitive awareness – in each of the feedback conditions (outcome – cognitive). Figure 1 indicates that moving from outcome to cognitive feedback (left to right) improves *Effective Decision Policy Change*. Further, the demonstrated improvement in *Effective Decision Policy Change* is more positive for those individuals high on metacognitive awareness than those low on metacognitive awareness (depicted by the significant and positive change in slope between low and high metacognition). The nature of this interaction suggests that the positive relationship between cognitive (over outcome) feedback and *Effective Decision Policy Change* is more positive for those individuals with higher metacognitive awareness than those with less metacognitive awareness, providing support for Hypothesis 3.

GENERAL DISCUSSION

We posit that the most interesting finding resulting from this research is the significant and positive contingent relationship between feedback and metacognition in explaining cognitive adaptability performance on an entrepreneurial task. Previous research has established that cognitive feedback is effective in promoting subsequent learning and normative improvements in decision-making (Balzer et al. 1994). This article serves to confirm the findings of Balzer et al. and others relative to cognitive feedback, by demonstrating that cognitive feedback does promote significant normative improvements in decision accuracy given an iterative decision process. This article's contribution to the above literature, however, is based on the fact that the results of this study *also* demonstrate that the benefits of cognitive feedback are not conferred equally; specifically not all individuals who receive cognitive feedback realize equivalent improvements in decision accuracy. Metacognitive theory suggests that the extent to which an individual is metacognitively aware should serve to moderate the influences of feedback on subsequent cognitive adaptability. This article's findings provide evidence in support of this proposition. Specifically, the findings indicate that the impact of cognitive feedback on subsequent decision accuracy is significantly 'different' for those individuals who are highly metacognitively aware compared to those low in metacognitive awareness. Put simply, highly metacognitively aware individuals appear to use cognitive feedback more effectively than individuals who are less metacognitively aware, and this performance difference is greater for cognitive feedback than for outcome feedback.

An extension of this research's findings suggest the importance of focusing on the extent to which entrepreneurs, for example, actively seek and subsequently incorporate feedback from their environments relating to their own decision policies. Given this general focus, two concomitant issues are central given the findings of this study. First, do entrepreneurs that exhibit behaviors which facilitate the accumulation of relational feedback as inputs to future decision process – such as seeking input from customers, suppliers, venture capitalists - perform better given dynamic entrepreneurial tasks such as opportunity recognition, evaluation, and new venture creation as compared to those who do not engage in those 'feedback search' behaviors. Further, within that sample of entrepreneurs who engage in feedback search behaviors, are those who are high on metacognition better performers given the entrepreneurial tasks listed above. Further, this perspective affords a new and compelling framework through which to consider many of the constructs related to learning and decision-making already prominent in the strategic management and entrepreneurship literatures. For example, often the explanation for why some entrepreneurs demonstrate superior cognitive processes and outcomes, relative to others, revolves around knowledge – for example, specialized knowledge about opportunities and the generalized knowledge of how to organize specialized knowledge (Alvarez & Busenitz 2001). Although scholars highlight the relationship between specific knowledge and opportunities (Shane 2000), to date entrepreneurship scholars have not explored "knowledge of how to organize specialized knowledge." The findings represented in this study indicate that knowledge accumulated from the environment in the form of feedback – by itself – may be inadequate to promote effective application of that knowledge directed toward a given entrepreneurial task. Our findings suggest that knowledge transfer within the entrepreneurial environment may require metacognitive awareness, and that the more metacognitively aware and capable an individual is, the more likely he or she can take those inputs from the environment

and evolve his/her decision policies accordingly. These findings serve as a bridge to effectively link knowledge with adaptability.

Cognitive Adaptability, Performance, and the Entrepreneurial Mindset

Beginning with McGrath and MacMillan's (2000) conceptualization of the "Entrepreneurial Mindset," scholars have embraced the notion that dynamic decision processes are central to success in an entrepreneurial environment (Ireland, Hitt, and Sirmon 2003). In developing the foundations of the entrepreneurial mindset, Ireland and his colleagues described the cognitive tasks necessary for successful management as: making sense of opportunities in the context of changing goals, constantly questioning ones 'dominant logic' in the context of a changing environment, and revisiting 'deceptively simple questions' about what we think to be true about markets and the firm (Ireland, Hitt, & Sirmon 2003). That said there has been a notable absence in the literature of work focused on capturing and quantifying the cognitive underpinnings of the entrepreneurial mindset. We propose that cognitive adaptability captures some of the cognitive origins of the entrepreneurial mindset, and that cognitive adaptability can be enhanced through the development of metacognition. Our findings suggest that the behaviors characteristic of an entrepreneurial mindset described by Ireland and his colleagues above – generally the ability to adapt thinking process to a changing context and task demands - are manifest as a result of metacognitive awareness. The adaptable thinking and decision-making characteristic of an 'entrepreneurial mindset' was designed into this study, such that performance was assessed based on cognitive adaptability – one of the essences of an entrepreneurial mindset. We offer this study, and thus one of its contributions, as the first empirical investigation of the cognitive origins of an entrepreneurial mindset.

Metacognition as an Individual Difference Measure

The findings of this study highlight the promise of employing metacognitive awareness as an important individual difference measure in future entrepreneurship research. Recently, entrepreneurship scholars have returned to their psychological roots to focus on cognitive processes of the entrepreneur (Baron 1998; Mitchell, Busenitz, Lant, McDougall, Morse & Smith 2002) and have argued that cognition is important as a process lens through which to "reexamine the people side of entrepreneurship" (Mitchell et al 2002). Cognitive approaches to entrepreneurship have devoted considerable energy to defining "entrepreneurial cognitions" in an effort to identify and distinguish entrepreneurs from non-entrepreneurs (Miner, Bracker, & Smith 1989). That said, metacognition, as a cognitive, individual difference measure, is new to entrepreneurship. It is our hope that the findings reported here will motivate future research directed toward the role that metacognitive awareness plays relative to performance given entrepreneurial tasks such as opportunity recognition, discovery, and new venture creation.

CONCLUSIONS

Like many management scholars, we are motivated to investigate the influences of cognition on managerial tasks and subsequent outcomes. However, we represent this study as a subtle but meaningful departure from the extant conventions of cognition research in entrepreneurship and management. Generally, entrepreneurial and managerial cognition research is situated around theory development and testing focused on the role of cognitive processes in *inhibiting* the individual from realizing marginally 'better' performance given a wide range of entrepreneurial tasks and behaviors. We suggest this as the case because the extant literature is focused on the negative consequences that these cognitive mechanisms have on entrepreneurial decision-making and subsequent performance. It was our intention to approach the development and testing of theory focused on cognition as a valuable resource, or as a 'tool' through which the manager may realize marginally 'better' performance given a dynamic environment. This study highlights the normative implications of adaptable thinking given a dynamic context, further investigates the antecedents to adaptability, and begins the process of quantifying those benefits in an entrepreneurial context. Our findings here suggest that cognitive adaptability is important in an entrepreneurial context, and that metacognition does promote cognitive adaptability and thus

improve performance on an entrepreneurial task. The concomitant implications of our theoretical model and empirical findings are hopeful in that metacognition can be learned, thus cognitive adaptability can be enhanced – begetting improved entrepreneurial performance.

CONTACT: Mike Haynie; jmhaynie@syr.edu; (T): 315-443-3392; (F): 315-443-6880; Syracuse University, 721 University Ave, Syracuse, NY 13244.

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Table 1: Means, Standard Deviations, and Correlations

Variable	Mean	SD	1	2	3	4	5	6	7	8
1. Metacognition	274.33	46.86	1							
2. Age	20.44	1.58	-.28**	1						
3. Gender	55% Male	n/a	.057	-.02	1					
4. Academic Major	87% Business ^o	.37	.040	.05	.07	1				
5. Regulatory Focus	35.25	6.88	.08	.04	.05	.04	1			
6. Need for Cognition	36.1	5.01	.29**	-.03	.08	.09	.12	1		
7. Feedback Condition	.5, -.5	n/a	.03	.03	-.01	.00	.02	.02	1	
8. Metacognition * Feedback	-7.5	139.26	.03	.01	.01	-.01	.03	.02	.99**	1
9. Average Accuracy	7.68	13.48	.19**	-.12	.05	.03	-.04	.14*	.33**	.37**

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

^o Remaining 13% represent psychology, economics, and undeclared majors

Table 2: Regression Results

Variable	Base Model (Step 1)			Main Effects Model (Step 2)			Full Model (Step 3)		
	<i>b</i>	<i>SE_b</i>	<i>t</i>	<i>B</i>	<i>SE_b</i>	<i>t</i>	<i>B</i>	<i>SE_b</i>	<i>t</i>
Age	-.07	.11	-1.26	-.05	.11	-.82	-.04	.11	-.36
Gender	.04	.34	.77	.04	.34	.75	.14	.38	.44
Academic Major	.01	.46	.24	.01	.45	.22	.02	.44	.31
Regulatory Focus	-.02	.02	-.37	-.03	.02	-.61	-.04	.02	-.81
Need for Cognition	.13	.03	2.25***	.01	.03	1.63	.09	.03	1.54
Gap 1 - Start Pt.	-.61	.06	-9.67***	-.55	.07	-7.99***	-.52	.07	-7.84***
Metacognition				.01	.01	1.91*	.01	.01	2.25**
Feedback Condition				.77	.37	2.10**	6.34	1.97	3.22***
Feedback Condition * Metacognition							.03	.01	3.67***
R ²	.33***			.36***			.40***		
Adj. R ²	.32***			.34***			.37***		
Δ R ²	.33***			.02***			.04***		

Note: Unstandardized regression coefficients are displayed in the Table.

* p = <0.10; **p = <0.05 ***p = <0.01.

n = 217

Figure 1: Overview of Experimental Design

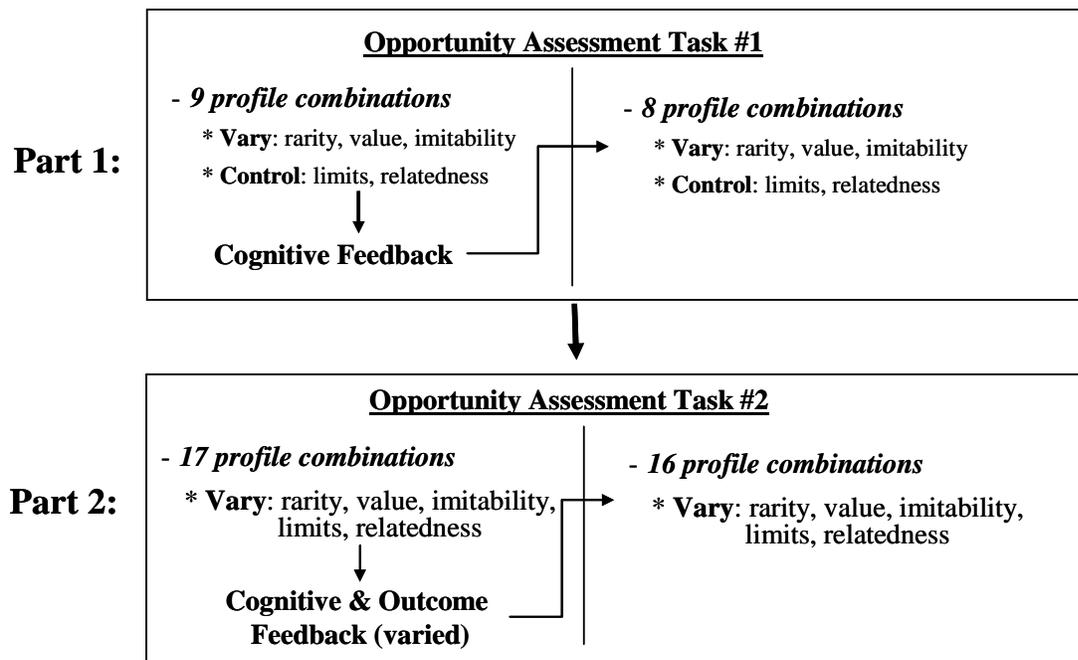


Figure 2: Feedback Condition by Metacognition on Effective Decision Policy Change

