The role of entrepreneurs in firm-level innovation: Joint effects of positive affect, creativity, and environmental dynamism

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Abstract
Innovation is often a crucial ingredient in new venture success but at present, we know relatively little about the role of individual entrepreneurs in encouraging its occurrence. The present research addressed this issue by investigating the joint effects, on firm-level innovation, of two variables pertaining to entrepreneurs (their creativity and positive affect) and a key environmental variable (environmental dynamism). Although it has been predicted that affect plays an important role in entrepreneurship [Baron, R. A., 2008. The role of affect in the entrepreneurial process. Academy of Management Review 33(2), 328–340.], relatively little empirical evidence on its effects has been obtained to date (e.g., [Foo, M.D. In press. Emotions and entrepreneurial opportunity evaluation. Entrepreneurship Theory and Practice.]). Further, although the link between creativity and innovation has been described in past literature [Amabile, T.M., 1988. A model or creativity and innovation in organizations. In B.M. Staw and L.L. Cummings (Ed.)., Research in organizational behavior 10, 123–167.], direct evidence for its existence is currently lacking. Findings of the present research indicate that positive affect among founding entrepreneurs is significantly related to their creativity and that creativity, in turn, is positively related to firm-level innovation. Both of these relationships are moderated by environmental dynamism, being stronger in highly dynamic than stable environments.

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1. Executive summary
Innovation has often been identified as an essential ingredient in new venture success (e.g., Ireland and Webb, 2007). At present, however, relatively little direct evidence exists concerning mechanisms through which individual entrepreneurs encourage innovation in their companies. The present research sought to add to current knowledge of this process by investigating the joint effects, on firm-level innovation, of two variables pertaining to entrepreneurs (their positive affect and creativity) and a key environmental variable (environmental dynamism). These variables were selected for inclusion on the basis of a thorough review of prior research and theory, which strongly suggests their relevance to new venture innovation. Creativity has often been viewed as an antecedent of firm-level innovation (e.g., Amabile, 1996), while positive affect has been found to influence many aspects of cognition and behavior (e.g., Forgas, 2000; Lyubomirsky et al., 2005), including ones directly relevant to activities entrepreneurs perform in launching new ventures. Recent theorizing and empirical findings (e.g., Foo, in press) indicate that these effects may extend to the domain of entrepreneurship (Baron, 2008). Environmental dynamism, too, has been found to be an important factor in new venture creation (Aldrich, 2000). The present research tested a model proposing that entrepreneurs’ positive affect is related to their creativity and that creativity, in turn, is related to firm-level innovation. Further, both of these relationships are moderated by environmental dynamism, being stronger in dynamic than stable environments. Results offered support for all these predictions.
The present findings offer several important contributions. First, they provide new evidence for a link between entrepreneurs' creativity and firm-level innovation. In this respect, they help to bridge the gap between individual-level variables such as affect and creativity and the organizational-level variables (e.g., innovation) which are of major interest to the field of entrepreneurship. Second, they provide direct empirical evidence for the role of positive affect in important aspects of entrepreneurship. Such a relationship has been proposed (Baron, 2008), but to date, only a few studies have investigated it directly (e.g., Foo, in press; Foo et al., 2009). Third, by providing evidence that environmental dynamism moderates the relationships between positive affect and creativity, and between creativity and firm-level innovation, the present research reflects recommendations by Hitt et al. (2007) to apply a multi-level approach to efforts to understand complex organizational phenomena. This approach has already gained growing use in several branches of management (e.g., Korsgaard et al., 2008) but has only recently been adopted in entrepreneurship research (e.g., Schindehutte and Morris, 2009).

2. Introduction

More than 40 years ago, Baumol (1968, p. 67) noted that: "Trying to understand entrepreneurship without the entrepreneur is like trying to understand Shakespeare without Hamlet." Similarly, Shane et al. (2003, p.259) suggested: "The entrepreneurial process occurs because people act to pursue opportunities ..." Comments such as these indicate that the field of entrepreneurship recognizes the important role of entrepreneurs in new venture creation. At the same time, however, the field focuses major attention on firm-level outcomes—the survival, growth, and profitability of new ventures. This dual focus raises an important question that has been noted by many researchers (e.g., Baron, 2007; Locke and Baum 2006; Shane et al., 2003): How do the characteristics and actions of individual entrepreneurs ultimately influence firm-level outcomes? This is a complex question, and addressing it fully will require the sophisticated multi-level research described by Hitt et al. (2007)—an approach that is increasingly apparent in current entrepreneurship research (e.g., Hmieleski and Baron, 2009; Schindehutte and Morris, 2009).

We attempt to contribute to this ongoing endeavor by investigating the joint effects on firm-level innovation, of two variables pertaining to entrepreneurs (creativity and positive affect) and a key environmental variable (environmental dynamism). Specifically, we investigate a model suggesting that entrepreneurs’ positive affect is related to their level of creativity and that creativity, in turn, is related to firm-level innovation. The model further proposes that both of these relationships are moderated by environmental dynamism, being stronger in highly dynamic than in relatively stable environments. Consistent with literature in several different fields (e.g., Forgas, 2000; Lyubomirsky et al., 2005), we define affect as referring to a broad range of subjective feeling states. Thus, affect encompasses both moods, which are often relatively long-lasting in nature but not focused on specific events or objects (e.g., cheerfulness, depression), and emotions (e.g., anger, sorrow, joy) which are often shorter in duration and are more specifically directed toward a particular object (e.g., a person, object, event; Frijda, 1993).

Affect refers both to relatively stable, cross-situational tendencies to experience specific subjective feelings (i.e., dispositional affect) and to temporary shifts in such feelings generated by specific events (i.e., state or event-generated affect). We suggest that since innovation is a continuing process, it is more likely to reflect stable affective dispositions on the part of entrepreneurs than fleeting or temporary affective reactions to specific events. Thus, we focus on stable, dispositional affect in the present research. It is important to note, however, that although dispositional and state affect derive from different sources (biological processes and perhaps genetic influences on the one hand versus discrete external events on the other), a substantial body of research indicates that they produce parallel effects in many situations (see Lyubomirsky et al., 2005, for a detailed review). Thus, although the distinction between dispositional and state affect is important, one key goal of the present research (investigating the role of affect in creativity and firm-level innovation), we suggest that focusing on relatively stable (i.e., dispositional) affect is appropriate.

The present study offers several contributions. First, and most generally, it seeks to contribute to current efforts to relate the characteristics of individual entrepreneurs to important firm-level outcomes. Clarifying the mechanisms through which individual entrepreneurs influence firm-level outcomes such as innovation is an essential task if the field of entrepreneurship is to attain full understanding of the new venture creation process. Second, this research provides empirical evidence on the role of positive affect in entrepreneurship. Such a role has been predicted on the basis of existing theory and research (Baron, 2008; Lyubomirsky et al., 2005), but has only recently become a subject of ongoing research (e.g., Foo, in press; Foo et al., 2009). In the present research, potential relationships between positive affect and important aspects of new venture creation are empirically examined. Affect has been found to exert strong and consistent effects on many important organizational processes, ranging from performance appraisals, job interviews, and organizational citizenship, to actual task performance (e.g., Brief and Weiss, 2002; Isen and Labroo, 2003). Further, it has been suggested (Baron, 2008; Mitchell et al., 2007) that affect may have especially strong effects in the domain of entrepreneurship for two important reasons. First, the environments in which entrepreneurs operate are often highly unpredictable and replete with rapid change. Research on the influence of affect indicates that it is precisely in such environments that it exerts its strongest effects on cognition and behavior (e.g., Forgas, 2000; Forgas and Smith, 2007). Second, affect has been shown to strongly influence several tasks entrepreneurs perform in launching and operating new ventures—decision making and judgment, forming productive working relationships with others, persuasion, and eliciting high levels of enthusiasm in others (e.g., Diener and Seligman, 2002; Forgas, 2000). These considerations, plus growing empirical evidence for the important role of affect in the entrepreneurial process (e.g., Foo, in press), strongly suggest the usefulness of further investigations designed to clarify the potential role of affect in key aspects of entrepreneurship.

The present research also offers new insights into the potential link between entrepreneurs’ creativity and innovation by new ventures. Such a relationship has been suggested by many researchers (e.g., Shane, 2003), but here this relationship is investigated
directly. Finally, by including environmental dynamism as a moderating variable, the present research reflects recommendations by Hitt et al. (2007) to apply a multi-level approach to efforts to understand complex organizational phenomena. This approach has already gained growing use in several branches of management (e.g., Korsgaard et al., 2008) but has only recently been adopted in entrepreneurship research (e.g., Schindehutte and Morris, 2009). We believe that the moderated mediation model proposed here represents a useful application of this approach to acquiring insights into key aspects of entrepreneurship. Next, we describe the theoretical and empirical foundations of this model and derive specific, testable propositions from it.

3. Theory and hypothesis development

3.1. Positive affect and creativity

“Feeling and longing are the motive forces behind all human creations...” (Albert Einstein, 1930.)

These words, spoken by one of the world’s most prominent scientists, suggest that he was well aware of the role of affect (i.e., feelings and emotions) in creativity. The suggestion of a link between these variables has been systematically examined in several fields (e.g., social psychology, organizational behavior; Barsade and Gibson, 2007; Brief and Weiss, 2002; Isen and Baron, 1991) and in general, findings indicate that positive moods or feelings (i.e., positive affect) do indeed promote creativity (e.g., Ashby et al., 1999; Lyubomirsky et al., 2005). However, evidence inconsistent with this general pattern has also been reported (e.g., George and Zhou, 2002; Kaufmann and Vosburg, 2002), so until recently, a degree of uncertainty remained concerning the generality of the positive affect—creativity link.

The results of a recent meta-analysis by Baas et al. (2008) have significantly clarified this issue. The findings of this thorough review indicate that positive affect enhances creativity overall, but is most likely to produce such effects when it is combined with high levels of activation (e.g., enthusiasm, elation) and a promotion regulatory focus (a focus on aspirations or accomplishments; Higgins, 1997, 2006). In contrast, positive affect that is not accompanied by high levels of activation (e.g., feelings of calmness or serenity) or that is accompanied by a prevention regulatory focus (a focus on safety and avoiding negative outcomes), is much less likely to promote creativity. Additional evidence indicates that, with a few notable exceptions (e.g., instances in which individuals interpret negative affect as a sign that additional effort is necessary with respect to creative tasks; George and Zhou, 2002), negative affect is less clearly related to creativity. Further, negative affect accompanied by high activation (e.g., fear, anxiety) has been found to be associated with actual reductions in creativity (e.g., Baas et al., 2008).

Overall, then, it appears that the combination of high levels of positive affect and a strong focus on achievement shown by many entrepreneurs (Baron, 2002, 2008) may contribute to their creativity (e.g., Ward, 2004). Previous research on the relationship between positive affect and creativity has revealed several mechanisms through which positive affect exerts such effects. First, positive affect generates increased levels of dopamine in the brain, a neurotransmitter that stimulates brain regions involved in complex cognitive activity. Dopamine facilitates the ease of switching among alternative cognitive sets, a capacity often identified as one key component of creativity (e.g., Baas et al., 2008; Dreisbach and Gotschke, 2004). Second, positive affect has been found to broaden cognitive categories (Fredrickson and Branigan, 2005; Isen and Daubman, 1984), thus increasing the range of items included in such categories. Finally, positive affect enhances unusual or remote associations, another component of creativity (Isen et al., 1985; Gotschke, 2006). Together, these effects combine to enhance creativity, which often involves making cognitive connections between previously unrelated ideas or concepts (e.g., Amabile, 1983, 1988). On the basis of this extensive body of evidence, we propose the following hypothesis:

Hypothesis 1. The higher entrepreneurs’ stable (i.e., dispositional) positive affect, the greater their level of creativity.

3.2. Creativity and innovation

While a relationship between positive affect and creativity is potentially important, another link—one between creativity and new venture innovation—is, perhaps, even more crucial, i.e., does enhanced creativity among entrepreneurs increase firm-level innovation—actual application of the outcomes generated by creativity? Although little or no direct evidence on this relationship is currently available, there are empirical and theoretical grounds for its existence.

First, it has often been assumed that creativity is one of the factors that contribute to innovation. For instance, Amabile (1996, p. 143) notes: “All innovation begins with creative ideas... creativity by individuals and teams is a starting point for innovation...” (Italics added) In other words, the products of creativity—new ideas, principles, or concepts—serve as the “raw materials” for innovation. More generally, creativity is often a necessary condition for subsequent innovations, although not a sufficient one, since many ideas generated by creativity are not commercially feasible or cannot be developed by the persons who generate them (e.g., McMullen and Shepherd, 2006; Ward, 2004).

Second, existing evidence indicates that founding entrepreneurs exert a powerful impact on the cultures of their developing organizations (e.g., Gartner et al., 1994). Especially in the early period following launch, the founders’ values and motives are central to defining the nature of work environments and to the development of norms governing how the new ventures will actually operate (e.g., Baum and Locke, 2004). A high level of creativity on the part of founding entrepreneurs may produce an organizational culture that values both creativity and innovation. Such a culture can be established through the founding entrepreneurs, who demonstrate creativity in their own behavior, and through their support for creativity and innovation on the part of employees.
Finally, extant models of innovation have often emphasized the importance of creativity in the development of new and commercially valuable products or services. For instance, Snow (2007: 101) defines innovation as “…a new product, service, or idea, a new process technology, a new business model,” thus assigning a central role to, originality), a key aspect of creativity. Similarly, Leiblein (2007: 142) notes that in order to generate potentially valuable opportunities, “organizations…employ creative individuals and use ongoing iterative analyses...” thus generating continuous change in tactics and goals. The role of creativity in innovation is also emphasized by Shane (2003), who notes that many founding teams engage in various forms of “brainstorming” in order to increase the number of new ideas available, and so enhance creativity, which then provides an important foundation for innovation. Overall, then, there appear to be theoretical grounds for suggesting that positive affect enhances entrepreneurs’ creativity, and that enhanced creativity, in turn, can encourage firm-level innovation. In past research, innovation has often been measured both in terms of the number of innovations adopted and by radicalness of these innovations (e.g., Smith et al., 2005; Subramaniam and Youndt, 2005). The reasoning above relates to innovation generally, and so applies to both of these measures. Thus, we propose the following hypotheses:

**Hypothesis 2a.** The higher entrepreneurs’ level of creativity, the greater the number of innovations adopted by their new ventures.

**Hypothesis 2b.** The higher entrepreneurs’ level of creativity, the greater the extent to which these innovations are radical rather than incremental in nature.

3.3. Potential moderating effects of environmental dynamism

As noted above, there are both empirical and theoretical grounds for suggesting that positive affect among entrepreneurs enhances creativity and that creativity, in turn, contributes to innovation (e.g., Leiblein, 2007). However, it is crucial to note that these effects, when they occur, do so against a backdrop of powerful environmental variables. Indeed, as suggested by the multi-level perspective described by Hitt et al. (2007), in order to fully understand complex organizational processes (including new venture development and growth), it is usually essential to consider variables operating at different levels of analysis (e.g., individual, group, subunits, organizations, interorganizational, and environmental). The current study incorporates this perspective by examining the potential moderating effects of environmental dynamism with respect to the relationship between positive affect and creativity and the relationship between creativity and innovation.

Dynamism refers to the extent to which environments in which new ventures operate are subject to unpredictable and rapid change—and thus, to high levels of uncertainty (Dess and Beard, 1984; Miller, 2007). As explained below, there are grounds for predicting that dynamism moderates both the link between positive affect and creativity and the link between creativity and innovation, although perhaps through somewhat different underlying mechanisms.

Turning first to the relationship between positive affect and creativity, the meta-analysis by Baas et al. (2008) indicates that positive affect enhances creativity primarily when it is accompanied by high levels of activation. This suggests that the link between positive affect and creativity will be stronger in environments that generate high levels of activation than ones that generate lower levels of activation. For several reasons, highly dynamic environments are more likely to induce high levels of activation among entrepreneurs than less dynamic environments. Highly dynamic environments are unpredictable and filled with rapid and dramatic change; as such, they often involve high levels of uncertainty and risk, plus the necessity for making key decisions on the basis of incomplete information (e.g., Aldrich, 2000; Miller, 2007). Such conditions have been found to engender high levels of stress (e.g., Beehr et al., 2000), and stress, in turn, usually involves high levels of activation (e.g., Stranks, 2005). Thus, for these reasons, levels of activation among entrepreneurs are likely to be higher in dynamic than stable environments, and consistent with findings reported by Baas et al. (2008), these higher levels of activation will lead to a stronger relationship between positive affect and creativity in dynamic than stable environments. On the basis of this reasoning, we propose the following hypothesis.

**Hypothesis 3.** Environmental dynamism moderates the relationship between positive affect and creativity, such that this relationship is stronger in highly dynamic than in more stable environments.

Turning to the link between creativity and innovation, this relationship, too, may be moderated by environmental dynamism. As noted earlier, existing evidence suggests that positive affect enhances creativity (e.g., Baas et al., 2008) and that creativity, in turn, plays a key role in innovation. Creativity, however, merely provides the “raw materials” for innovation. In order for the new ideas generated by creative thinking to be implemented in actual innovations, it is necessary that entrepreneurs be motivated to consider these ideas carefully and implement the ones that appear most beneficial. We suggest that such motivation will often be higher in dynamic than stable environments, because dynamic environments, by their very nature, virtually require rapid and effective innovations in products and services (e.g., Eisenhardt, 1989). As Davila et al. (2006) note, in such environments, innovation is often the key element in achieving rapid growth. Overall then, the link between creativity and innovation will be stronger in highly dynamic than stable environments, because the environmentally-generated pressures to use the ideas generated by creative thought will be stronger in dynamic environments. On the basis of this reasoning, we offer the following hypotheses, which, again, reflect two widely used measures of innovation (number of innovations and radicalness of these innovations).

**Hypothesis 4a.** Environmental dynamism moderates the relationship between creativity and number of innovations adopted by new ventures, such that this relationship is stronger in highly dynamic than in more stable environments.
Hypothesis 4b. Environmental dynamism moderates the relationship between creativity and radicalness of innovations adopted by new ventures, such that this relationship is stronger in highly dynamic than in more stable environments.

In sum, in this research we propose, and test, a moderated-mediation model of the role of positive affect in entrepreneurship (e.g., Preacher et al., 2007). This model (represented in Fig. 1) proposes that among founding entrepreneurs, positive affect promotes creativity, and creativity, in turn, promotes firm-level innovation. Further, the model also suggests that both of these links are moderated by environmental dynamism, being stronger in highly dynamic than stable environments. Because previous research suggests that negative affect does not exert consistent effects on creativity, the model focuses only on the potential influence of positive affect (e.g., Baas et al., 2008). However, this no way implies that negative affect is unrelated to creativity and innovation; rather, it merely reflects the fact that existing evidence concerning the effects of this variable does not provide a strong and consistent empirical foundation on which to base theoretical predictions.

4. Research method

4.1. Sample and procedures

Participants were entrepreneurs (i.e., founders or owners who have participated in the startup process of their businesses) in several Southeastern states of the United States: Alabama, Georgia, Louisiana, Mississippi, and Tennessee. Initially, 154 entrepreneurs were identified by students who interviewed entrepreneurs for a case study assignment in an entrepreneurship class. An additional 354 entrepreneurs' names and addresses were randomly selected from the Reference USA database. Reference USA is the equivalent of Dun & Bradstreet database in providing credit information on businesses and corporations. The invitation letter explained that we sought to survey entrepreneurs on their creativity and firm innovation for a research project. In designing the survey, we conducted face-to-face interviews (each interview lasted from 40 to 60 minutes) with eight entrepreneurs (located in the Southeast) to ensure that items included were correctly interpreted by participants.

A total of 500 surveys were mailed, accompanied by self-addressed and stamped return envelopes. Of the 500 entrepreneurs, 67 returned the surveys, among which 6 were eliminated because the subjects responded that they were not active in the founding process. Another 5 were eliminated because the cover letters were mistakenly returned instead of the surveys. Therefore, 56 usable surveys were generated from the first round. Two rounds of reminders were sent in January and February of 2007 respectively, generating another 43 complete responses. Thus, our final sample size was 99, reflecting a 19.8% response rate.

To check for non-response bias, we compared available firm characteristics from the Reference USA database, including firm size, sales, industry, and year established. The results did not reveal any bias in the sample. The entrepreneurs in our sample were operating in a wide array of industries from agriculture and manufacturing, to health care and social assistance. Among the 99 entrepreneurs, 80% were male, 3.8% were less than 25 years old, 17.3% were between 25 and 34 years old, 22.1% were 35–44 years old, 33.7% were 45–54 years old, and 23.1% were over 55 years old. The average business tenure was 11 years, and the average previous business experience was 14 years. The average firm size was 60 employees and mean sales revenues for 2006 was 12 million dollars.

4.2. Measures

Our data were derived from two sources: replies to a survey and archival industry data. Five-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree) were used for all survey items. Scores for individual items on each scale were averaged to produce a single score for each respondent. Established scales, with well-documented reliability and validity, were utilized whenever possible.

4.2.1. Positive affect

Positive affect was measured using the 10-item scale from the PANAS developed and validated by Watson et al. (1988). The PANAS scale has been used to assess respondents’ general feelings and emotions (i.e., how they feel on the average) in prior research (e.g., Barsky et al., 2004; Watson et al., 1988). Although the full PANAS scale gauges both positive and negative affectivity,

![Fig. 1. A moderated mediation model of the influence of positive affect on innovations.](image_url)
it has also been adapted to measure each of these dimensions separately. For example, Fritz and Sonnentag (2009) employed the 10 positive affect items in their study of proactive behavior and positive affect. Similarly, Barsky et al. (2004) utilized the 10 negative affect items to investigate the relationship between negative affect and job stress. Because our concern was primarily with dispositional positive affect, we used the 10-item positive affect scale from the PANAS and asked respondents to indicate the extent to which they generally (across situations and time) experienced various feelings and emotions (e.g., active, enthusiastic, excited). The coefficient alpha for positive affectivity scale was .82, which was consistent with the reliability of the scale reported in recent research (George and Zhou, 2002).

4.2.2. Creativity

A measure of creativity used extensively in creativity research (e.g., Shalley and Perry-Smith, 2001) and modified by Perry-Smith (2006), was employed. Respondents were asked to rate the extent to which their work in their companies involved (1) new ideas and approaches to customer problems; (2) new applications for existing technology; (3) risk-taking; (4) radical new ideas; and (5) novel long-term vision or applications. The scale demonstrated acceptable reliability (alpha = .74).

4.2.3. Environmental dynamism

Following Boyd (1990), we assessed industry-level environmental dynamism by regressing time against industry sales for the five year period of 2002-2006. This time frame is consistent with our survey data, which were collected at the end of 2006, and asked respondents to report the number of innovations developed in the past 5 years. Data for total industry sales were obtained from the Fundamental Annual section of the Standard & Poor’s Compustat® database which provides U.S. and Canadian fundamental and market information on more than 30,000 active and inactive publicly held companies. The following criteria were incorporated in the search query. First, the search was limited to only U.S. based companies which are active in the database. Second, the search range included “All companies” which resulted in the search of the entire database. Third, the search variables requested included the company’s North American Industry Classification Code (NAICS), the Data Year, the Company Name, and the Total Revenue/Sales for each company. Annual data for the five-year (2002 to 2006) period were obtained following the above procedures. Next, the total sales were summed for each industry category across the 5 years by groupings based on the first two digits (which denote the top level industry classifications) of the NAICS codes. As a result, cumulative sales figures for each top level industry classification across the five year period were acquired. The relevant industry code for each firm in our sample was obtained from the Reference USA database.

To conduct the regressions, time (2002–2006) was entered as independent variables and annual sales as dependent variables for each industry category according to the NAICS code. Then, the standard errors of the regression coefficients were divided by the mean sales values of the 5 years. The result was used as the measure of industry-level environmental dynamism in our study, and reflects the extent to which sales were dynamic (i.e., changing) in each industry. This approach has been used as an archival measure of dynamism in several previous studies (e.g., Hmieleski and Baron, 2009). The mean of the environmental dynamism variable was 1.24, indicating moderate levels of change in average sales volumes. Because the raw dynamism data were right-skewed (skewness statistic = 12.08), natural logs were employed. As a result, the skewness statistic was reduced to 1.61; the resulting mean of the natural logs was .01. Innovation. Innovation has been measured through new product introductions (Katila, 2002). Thus, in our study, the construct of innovation was measured with two indicators of such introductions. First, the entrepreneurs were asked “how many new products or services has your firm introduced in the past 5 years?” This item was used to obtain data on the number of innovations developed by new ventures. This measure of innovation was found to be robust over a wide array of research settings (Damanpour, 1991; Smith et al., 2005). To measure the extent to which these innovations were radical (i.e., innovations that make the organization’s current product or service lines obsolete) rather than incremental in nature, a three-item scale developed by Subramaniam and Youndt (2005) was used. This measure of innovations was based on previous research by Tushman and Anderson (1986) and Henderson and Clark (1990). Respondents were asked to rate how radical each innovation was in terms of (1) making present products obsolete, (2) fundamentally changing current products or services, and (3) making existing expertise in prevailing products/service obsolete (alpha = .87). These three items were averaged to obtain the score for radical innovations. ²

4.2.4. Control variables

A total of 6 control variables were included. At the individual level, entrepreneurs’ age, gender (female = 0; male = 1), previous experience, and business tenure were controlled because they have been found to exert confounding effects on firm performance (Reynolds, 2000). Entrepreneurs’ age was measured with 5 categories: (1) <25; (2) 25–34; (3) 35–44; (4) 45–54; and (5) >55 years old. Previous experience was measured with a 3-item scale that asked respondents to report the number of years of previous managerial, entrepreneurial, and industrial experiences (alpha = .90). Business tenure was measured by means of the number of years the respondent has been working in the current business. At the firm level, previous research has shown that firm size and sales revenues influence innovation and other aspects of entrepreneurial development (Baron and Tang, 2009; Ucbasaran et al., 2009). Firm size was measured by the number of current employees in the firm. Entrepreneurs were also asked to report the

² As noted by a reviewer, one of the items used to measure creativity referred to the extent to which the entrepreneurs’ work involved radical new ideas, and one measure of innovation referred to the extent to which innovations were radical in nature. To assess the conceptual clarity and distinctiveness of these constructs (creativity, innovation), we performed additional analyses in which the creativity item was allowed to cross-load on the radicalness of innovation construct. Results indicated that the creativity item loaded only .06 on innovation, but .89 on creativity. Thus, it appears that the two constructs are indeed distinct, as suggested by the results of a confirmatory factor analysis (reported below).
sales revenues of year 2006. For previous experience, business tenure, firm size, and sales revenues, natural logs were used to account for skewed distribution within the data.

4.3. Discriminant validity

We examined the discriminant validity of our variables prior to hypothesis testing. Although creativity and innovation are theoretically distinguishable constructs, we conducted confirmatory factor analyses (CFA) and calculated the square root of the average variance extracted (AVE) for each variable to empirically evaluate discriminant validity.

To conduct CFA, we first formed a one-factor and a two-factor model. Then we examined the model fit of each and tested chi-square differences to determine which model provided better fit to the data. Results showed that the 2-factor model (reflecting creativity and innovation) fit the data very well (CFI = .90, NFI = .90, AGFI = .80, RMSEA = .08, SRMR = .09, $\chi^2$/df = 3.30) while the one-factor model did not (CFI = .72, NFI = .69, GFI = .72, AGFI = .49, RMSEA = .24, SRMR = .19, $\chi^2$/df = 8.23) (Hu and Bentler, 1999). The chi-square difference test between the two models ($\chi^2$ difference = 101.32, df = 1, $p < .001$) was significant, favoring the 2-factor model. In addition, in the 2-factor model, all items significantly loaded on their respective latent variables.

Next, we calculated the square root of the average variance extracted for each of the 2 variables (Fornell and Larcker, 1981). According to the AVE method, constructs are different if the average variance extracted (AVE) for one construct is greater than their shared variance, i.e., the square root of the average variance extracted (AVE) for a given construct should be greater than the absolute values of the standardized correlations of the given construct with any other construct in the analysis. Results indicated that the square root of the AVE values (.64 for creativity, and .90 for radicalness of innovations) were greater than all corresponding zero-order correlations. Together, the CFA and AVE results indicated that creativity and (radical) innovation were indeed distinct variables, thus suggesting satisfactory discriminant validity.

4.4. Tests for common method variance

In order to check the presence of common method variance, we adopted Harman’s one-factor test (Podsakoff et al., 2003). We entered all the self-reported variables in an exploratory factor analysis with principal axis factoring and varimax rotation. Five factors emerged with eigenvalues greater than 1 and 52.67% of the variance explained. No single factor was dominant with the first factor accounting for 17.35% of the variance. Thus, no common method variance was detected in this study.

5. Results

Table 1 summarizes the means, standard deviations, and correlations for all variables. As indicated in Table 1, entrepreneurs’ positive affect is positively associated with creativity, and creativity is positively related to both number of innovations and radicalness of these innovations.

Tables 2 and 3 present the results of the moderated mediation analyses. Hypotheses were tested using hierarchical regression analysis. After the mean-centering technique had been used, the variance inflation factor (VIF) estimates (1.2–3.4) for all variables in the full models suggested that multicollinearity did not pose a serious problem (Barringer and Bluedorn, 1999).

5.1. Tests of hypotheses

Hypothesis 1 predicts that entrepreneurs’ dispositional (i.e., stable) positive affect is positively related to their creativity. Results relevant to this hypothesis are presented in Model 2 of Table 2 and indicate that, as predicted, positive affect is significantly related to creativity (B = .79, $p < .001$). Hypothesis 2a predicts that creativity is positively related to the number of innovations by entrepreneurial ventures, while Hypothesis 2b predicts that creativity is positively related to the radicalness of these innovations. Results (Model 11 of Table 3) provide support for H2b: creativity is significantly related to the radicalness of innovations (B = .45,

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N = 99 * Logarithm b PA = Positive Affect * $p < .05$ ** $p < .01$. 

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N = 99 * Logarithm b PA = Positive Affect * $p < .05$ ** $p < .01$.
Table 2
Results of the moderation effect of positive affect and environmental dynamism on creativity.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Creativity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
</tr>
<tr>
<td>Age</td>
<td>.10 (.17)</td>
</tr>
<tr>
<td>Gender</td>
<td>.09 (.11)</td>
</tr>
<tr>
<td>Tenure a</td>
<td>−.88 (.39)</td>
</tr>
<tr>
<td>Experience a</td>
<td>−.12 (.71)</td>
</tr>
<tr>
<td>Firm size</td>
<td>−.15 (.20)</td>
</tr>
<tr>
<td>Firm sales a</td>
<td>.06 (.08)</td>
</tr>
<tr>
<td>PA b</td>
<td>.79*** (.20)</td>
</tr>
<tr>
<td>Dynamism</td>
<td>−7.10* (2.97)</td>
</tr>
<tr>
<td>PA* dynamism</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>.19</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.09</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.19</td>
</tr>
<tr>
<td>ΔF</td>
<td>1.84</td>
</tr>
</tbody>
</table>

Note: Unstandardized coefficients are displayed in the table with standard errors in parentheses. * p < .05 ** p < .01 *** p < .001.

Table 3
Results of the moderated mediation analysis.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number of innovations</th>
<th>Radicalness of innovations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td>Age</td>
<td>−.31</td>
<td>−.55</td>
</tr>
<tr>
<td>Gender</td>
<td>−.21</td>
<td>−.21</td>
</tr>
<tr>
<td>Tenure a</td>
<td>−.167*</td>
<td>−.173*</td>
</tr>
<tr>
<td>Experience a</td>
<td>3.03</td>
<td>3.51</td>
</tr>
<tr>
<td>Firm size</td>
<td>1.60**</td>
<td>1.82***</td>
</tr>
<tr>
<td>Firm sales a</td>
<td>−.02</td>
<td>−.23</td>
</tr>
<tr>
<td>PA b</td>
<td>1.38***</td>
<td>1.49***</td>
</tr>
<tr>
<td>Dynamism</td>
<td>−9.21</td>
<td>−9.36</td>
</tr>
<tr>
<td>PA* dynamism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity</td>
<td>.50</td>
<td>.45</td>
</tr>
<tr>
<td>Creativity a</td>
<td>−3.88</td>
<td>−3.88</td>
</tr>
<tr>
<td>R²</td>
<td>.34</td>
<td>.43</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.25</td>
<td>.34</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.34</td>
<td>.09</td>
</tr>
<tr>
<td>ΔF</td>
<td>3.86</td>
<td>7.72**</td>
</tr>
</tbody>
</table>

Note: Unstandardized coefficients are displayed in the table with standard errors in parentheses. * p < .05 ** p < .01 *** p < .001.
radicalness of innovations. Results offer support for H4b (Model 12 of Table 3): dynamism positively moderates the relationship between creativity and radicalness of innovations (B of the interaction between creativity and dynamism = 9.00, p < .05). However, results do not offer support for H4a: dynamism did not moderate the relationship between creativity and number of innovations (Model 6 of Table 3; B = −3.88, n.s.).

5.2. Mediating role of creativity

To test the proposal that dynamism-moderated creativity mediates the relationship between positive affect and radicalness of innovations, we adopted the procedures developed by Baron and Kenny (1986). According to the logic of this procedure, mediation is suggested if the following conditions are met: (a) the independent variable is a significant predictor of both the dependent variable and the mediator, (b) the mediator is a significant predictor of the dependent variable, and (c) the effects of the independent variable on the dependent variable are reduced when the mediating variable is added to the regression equation. Full mediation is indicated if the effect of the independent variable is no longer significant when the mediating variable is added, whereas partial mediation is suggested if the effect of the independent variable is reduced but remains significant.

We first examined the relationship between the independent variable and dependent variable as well as the relationship between the independent variable and the mediator. As shown in Model 10 of Table 3, dynamism-moderated positive affect was significantly related to the radicalness of innovations (B = 15.03, p < .05). As shown in Table 2, a significant relationship exists between dynamism-moderated positive affect and creativity (B = 12.09, p < .05). Second, dynamism-moderated creativity is significantly associated with the radicalness of innovations (B = 9.00, p < .05) as indicated in Model 12 of Table 3. Third and finally, as Models 10 and 12 in Table 3 demonstrate, the coefficient for the dynamism-moderated effects of positive affect on radicalness of innovations became insignificant when the dynamism-moderated effects of creativity were included in the regression equation. The coefficient decreased from 15.03 (p < .05 in Model 10) to 1.67 (n.s. in Model 12). Thus, dynamism-moderated creativity fully mediates the positive relationship between dynamism-moderated positive affect and radicalness of innovations in the present data.

Further evidence of full mediation was obtained by the Sobel test. Sobel (1982) tests calculate the magnitude of the unstandardized indirect effect and its associated standard error. The ratio of the indirect effect over its standard error is referred to as the Sobel statistic, which is compared to a z distribution to determine the statistical significance of the indirect effect. The Sobel tests indicated that the indirect effect of dynamism-moderated positive affect on radicalness of innovations (Sobel statistic = 1.20, p < .05) was in the anticipated direction and statistically significant, providing further evidence for full mediation.

6. Discussion

6.1. Key findings and implications

The present research investigated the relationships between two individual-level variables (entrepreneurs’ positive affect and creativity), and firm-level innovation. Both individual-level variables (i.e., positive affect; creativity) were chosen on the basis of extensive evidence indicating that they are relevant to tasks performed by entrepreneurs—activities that strongly shape new venture performance (e.g., Baron, 2007). Further, creativity has often been identified as an essential antecedent of innovation (e.g., Amabile, 1996), while positive affect has been found to influence many aspects of cognition and behavior (e.g., Cohen, 2005; Forgas, 2000; Isen and Labroo, 2003). On the basis of such evidence, it has recently been suggested that affect may also play an important role in entrepreneurship (Baron, 2008), influencing entrepreneurs’ decisions, their capacity to recognize or create opportunities, the size and quality of their networks, and their motivation and perseverance in the face of adversity (Barsade and Gibson, 2007).

The present research provides empirical data relating to these proposals. Consistent with a large body of previous evidence (e.g., Baas et al., 2008), results indicate that entrepreneurs’ positive affect is significantly related to their creativity. Further, enhanced creativity was found to be significantly related to one measure of new venture innovation (the radicalness of such innovations). Overall, these findings indicate that positive affect is related to important aspects of entrepreneurship—a finding consistent with other results reported recently in the entrepreneurship literature (e.g., Foo, in press). However, such effects are not direct in nature; rather, they are mediated by intervening variables. Specifically, in the present research, creativity was found to mediate the relationship between entrepreneurs’ positive affect and firm-level innovation.

The results of the present research also indicate that both the relationship between positive affect and creativity, and the relationship between creativity and innovation, are moderated by environmental dynamism. Both relationships were stronger in highly dynamic environments than in more stable ones. Although the present research was not specifically designed to explicate the mechanisms underlying these moderating effects, both were predicted on the basis of previous research. With respect to the link between positive affect and creativity, it was reasoned that highly dynamic environments are more likely to generate high levels of activation among entrepreneurs, a condition found, in a recent meta-analysis (Baas et al., 2008) to be required for positive affect to enhance creativity. Turning to the relationship between creativity and firm-level innovation, it was reasoned that innovation is more important in highly dynamic environments than in stable environments (e.g., Ireland and Webb, 2007) and that as a result, the ideas generated by creative thinking are more likely to be carefully considered and actually implemented in dynamic than stable environments. Thus, the relationship between creativity and innovation will be stronger in such environments. Further research is clearly required to clarify the precise mechanisms through which environmental dynamism moderates the relationships between affect and creativity, and creativity and innovation, but evidence for such moderation is informative in and of itself.
At this point, the fact that positive affect was significantly related to radicalness of innovations but not to their overall number (as reported by entrepreneurs), should be addressed. One possible explanation for these findings is that in reporting the number of innovations in their new ventures individual entrepreneurs applied highly diverse criteria. Some may have included only major innovations, while others may have included incremental innovations in their tally. The usefulness of this measure may be readily enhanced in future research through the inclusion of additional clarifying criteria concerning what should and should not be included by entrepreneurs in their tallies of innovations.

6.2. Limitations and suggestions for future research

Although the results of the present research are consistent with the findings of many previous studies (e.g., Baas et al., 2008), they are subject to several limitations that should be carefully addressed in future research. First, several of the measures employed were self-report in nature (e.g., creativity, innovation). Although these measures were based on ones used in previous research and have been shown to possess acceptable reliability and validity, it is clear that the constructs of primary interest (creativity, innovation) are complex. Thus, replication of the present research with additional measures of these variables is necessary before the present results can be accepted with confidence.

Second, although vigorous efforts were made to obtain a broad sample of entrepreneurs, all participants in the present research operated new ventures in one region of the United States. Further, although these new businesses were located in a wide range of industries, it is possible that the sample was not truly representative of entrepreneurs in other industries. Additional data, gathered in other geographic locations—and perhaps outside North America—are necessary to fully evaluate the extent to which the present findings can be generalized to other groups of entrepreneurs operating in environments and contexts different from the ones included here.

Third, although the present data set was carefully designed to assess the key variables of interest, it did not examine other potential mediators of the relationship between affect and innovation aside from creativity. Although results indicate that creativity fully mediated the relationship between positive affect and innovation in the present research, positive affect may also influence innovation through other mechanisms not specifically investigated here (e.g., the optimistic bias, which may be facilitated by high levels of positive affect; e.g., Busenitz and Barney, 1997; Forgas, 2000). Future research should investigate the role of other potential mediators of the relationships between positive affect and firm-level variables such as innovation.

An additional limitation involves use of the PANAS as the measure of affect. Although this measure has been used in many previous studies and has been found to have acceptable reliability and validity (e.g., Watson et al., 1988), researchers who investigate affect have called attention to the fact that the PANAS primarily measures affective states that are high in activation. Specifically, the negative affect (NA) dimension represents the experience of negative affect that is high in activation (e.g., feelings of nervousness, guilt, anger), while the positive affect (PA) dimension represents the experience of positive affect high in activation (e.g., feelings of excitement, enthusiasm; Watson and Clark, 1997). Low activation experiences (both negative and positive) are not included (e.g., bored and sleepy are examples of low activation negative affect; relaxed and calm are examples of low activation positive affect; e.g., Barrett, 2006). Future research should address this important issue through the use of measures that have been designed to assess both the valence (positive, negative) and activation dimensions of affect (e.g., Van Katwyk et al., 2000).

Further studies should also examine the potential role of affect in other aspects of the entrepreneurial process. For instance, does affect play a role in what Kirzner (1979) terms “alertness”—the capacity to recognize emerging opportunities? Research on affect (e.g., Fredrickson and Branigan, 2005; Isen and Daubman, 1984) suggests that positive affect might increase alertness by enhancing entrepreneurs’ capacity to perceive opportunities in complex patterns of environmental change (e.g., changes in demographics, technology, government policies, markets, etc.; Baron, 2006). Investigating the relationship between alertness and affect might provide further insights into the basic nature of alertness (e.g., its foundations in basic perceptual and cognitive processes; Mitchell et al., 2007).

Finally, future research should also examine the role of affect in other aspects of entrepreneurs’ behavior and cognition—for instance the goals that they set for themselves and their new ventures (e.g., Locke and Latham, 2005) and their capacity for tolerating the high levels of stress to which they are exposed (e.g., Beehr et al., 2000). Previous research suggests that affect is strongly related to these and other reactions, so investigating its potential effects on these processes in the domain of entrepreneurship would appear to be an important and potentially valuable task.

6.3. Contributions and conclusions

Despite these limitations, the present findings offer several useful contributions. First, they help clarify the potential role of affect in entrepreneurship. As noted earlier, such a role has been predicted, but to date, only a small number of studies have examined such effects (e.g., Foo, in press; Foo et al., 2009). Second, the present results provide empirical evidence for a link between creativity and innovation. Such a link has often been suggested in past literature (Amabile, 1988), but at present, relatively little direct evidence for it exists.

Second, the present findings add to our understanding of the complex processes through which individual-level variables such as creativity and positive affect ultimately influence organizational-level outcomes such as innovation. Attaining greater understanding of these processes has been identified as an important task by many researchers in the field of entrepreneurship (e.g., Baum and Locke, 2004). The present findings contribute to progress on this task by suggesting mechanisms through which two important individual-level variables—positive affect and creativity—can influence important activities by new ventures.
References


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