

Affect and Creativity at Work

Teresa M. Amabile

Harvard University

Sigal G. Barsade

University of Pennsylvania

Jennifer S. Mueller

New York University

Barry M. Staw

University of California at

Berkeley

This study explored how affect relates to creativity at work. Using both quantitative and qualitative longitudinal data from the daily diaries of 222 employees in seven companies, we examined the nature, form, and temporal dynamics of the affect-creativity relationship. The results indicate that positive affect relates positively to creativity in organizations and that the relationship is a simple linear one. Time-lagged analyses identify positive affect as an antecedent of creative thought, with incubation periods of up to two days. Qualitative analyses identify positive affect as a consequence of creative thought events, as well as a concomitant of the creative process. A preliminary theory of the affect-creativity cycle in organizations includes each of these links and proposes mechanisms by which they may operate. ●

Organizations are affectively laden environments. Not only have theoretical reviews pointed to a prominent role for affect in a range of organizational processes (Fineman, 1993; Brief and Weiss, 2002; Barsade, Brief, and Spataro, 2003), but recent empirical research has also begun to validate affective influences on a number of work outcomes, including task quality, productivity, and efficiency (George, 1991; Staw and Barsade, 1993; Staw, Sutton, and Pelled, 1994). Relatively less attention has been paid, however, to organizational creativity as an outcome influenced by affect. Creativity—coming up with fresh ideas for changing products, services, and processes so as to better achieve the organization's goals—has been heralded as a key to enduring advantage. Creative responses by employees at all levels in the organization have therefore taken center stage in discussions of organizational innovation, and considerable research has been focused on factors that may foster or impede creativity in organizations (e.g., Amabile, 1988; Woodman, Sawyer, and Griffin, 1993; Ford, 1996; Oldham and Cummings, 1996). In spite of this high level of attention, however, there has been only limited progress in understanding the role of affect as an antecedent and consequence of creativity in the workplace.

Creative activity appears to be an affectively charged event, one in which complex cognitive processes are shaped by, co-occur with, and shape emotional experience. The biographies, letters, and journals of well-known creative individuals abound with emotional drama. Popular literature has often described affective dysfunction as an ingredient of creativity, using stories of artists such as Vincent Van Gogh and Sylvia Plath to illustrate the troubled life of the creative genius. Less publicized are the more positive images of creatives, such as the mathematician Henri Poincare, who reported that he experienced creative breakthroughs while on vacation, relaxed and comfortable (Vernon, 1970), or Mozart, who claimed that pleasant moods were most conducive to his creativity: "When I am, as it were, completely myself, entirely alone, and of good cheer—say, traveling in a carriage, or walking after a good meal, or during the night when I cannot sleep; it is on such occasions that my ideas flow best and most abundantly" (Vernon, 1970: 55).

© 2005 by Johnson Graduate School,
Cornell University.
0001-8392/05/5003-0367/\$3.00.



The second, third, and fourth authors contributed equally; the order of their names is alphabetical. This research was supported by the Harvard Business School Division of Research, as part of the multi-study research program entitled "The T.E.A.M. Study: Events That Influence Creativity." Earlier versions of this paper were presented at the Academy of Management meetings, the University of Chicago, and Yale University. We gratefully acknowledge the help of several individuals in carrying out this research and preparing this manuscript: Susan Archambault, Debbie Siegel, Rasheea Williams, Talia Grosser, Allison Bonk, Elizabeth Schatzel, Dean Whitney, Jeremiah Weinstein, Steven Kramer, Jessica Tobiason, Giovanni Moneta, Lynn Miller, Tom Wojcik, Shelley Patterson, Mel Marsh, Candis Cook, Paul Odomirok, Joyce Majewski, and Toby Stuart. We also thank Joe Porac, Linda Johanson, and the anonymous ASQ reviewers for their helpful insights and comments.

An extensive experimental literature in psychology has examined the relationship between affective processes and cognition, including creative cognition, at single points in time (for reviews, see Fiedler and Forgas, 1988; Isen, 1999a, 1999b; Forgas, 2001). Although studies outside the laboratory are rare, some research using non-experimental methods to examine affect and creativity in work organizations has appeared in the recent literature (George and Zhou, 2002; Madjar, Oldham, and Pratt, 2002). But little is known about how naturally occurring affective experiences in the flow of people's daily work lives might relate to their creative thinking on the job, and there is a dearth of research on the affect-creativity relationship over time. Moreover, although a number of scholars have suggested mechanisms by which affect might influence creativity, there is as yet no general theory of the reciprocal interplay between affect and creativity in organizations.

Our study addresses these empirical and theoretical gaps by exploring the affect-creativity relationship in a number of different ways, using both quantitative and qualitative longitudinal data on affect and creativity in organizations. We investigate the nature and form of the relationship, examining affective valence (positivity-negativity), intensity, ambivalence, and lability. In addition, we take advantage of our longitudinal data to explore the temporal dynamics of affective experience and creative thinking.

THEORY

Creativity is generally defined as the production of novel, useful ideas or problem solutions. It refers to both the process of idea generation or problem solving and the actual idea or solution (Amabile, 1983; Sternberg, 1988a; Weisberg, 1988). In his evolutionary theory of creative thinking, Simonton (1999) proposed a process of variation and selective retention, building not only on Darwin's theory of organic evolution but also on Campbell's (1960) evolutionary model of the creative process. Although it does not incorporate affect, Simonton's theory is particularly useful for considering the relationship between affect and creative thought. In this theory, the process of variation primarily contributes to idea novelty, and the process of selection primarily contributes to idea usefulness. Drawing on the assumption that novelty is the distinguishing feature of creative work over and above work that is solely useful or well done (Amabile, 1996), Simonton focused his theory on variation. In a significant modification of Campbell's original ideas, Simonton suggested that variation need not be (and usually is not) blind or random. Rather, it is guided by the existence of knowledge elements that are available for combination into new variations within the creator's mind, by the extent to which the creator's mind treats those elements as relevant to the problem at hand, and by heuristic processes for combining those elements.

A central construct of Simonton's theory is that the probability of novelty varies with the number of cognitive elements available for association and with the breadth of those elements that are treated as relevant to the problem. The importance of the number and breadth of cognitive elements is

highlighted by other creativity theorists as well (Langley and Jones, 1988; Sternberg, 1988b). Both of these aspects of cognition should contribute to greater variation in idea possibilities, increasing the population of unusual possibilities from which to choose in the selection process. According to Simonton, the initial selection of ideas goes on within the mind of the individual creator, through a process of testing them against relevant criteria for usefulness or appropriateness, as well as criteria for novelty. Once an idea has been selected by the creator, developed, and communicated, there is often a second selection process by relevant individuals in a social group or intellectual community. Thus, because creativity depends in large part on novelty, and because novelty is largely a function of cognitive variation, anything within the range of normal cognition that increases variation is likely to increase the probability of creativity. Affect is one source of such variation.

The Nature and Form of the Affect-Creativity Relationship

Positive affect and creativity. Some theories of affect suggest that creativity may be particularly susceptible to affective influence, mainly because positive affect leads to the sort of cognitive variation that stimulates creativity (Clore, Schwarz, and Conway, 1994). For example, Isen (1999a, 1999b) proposed that positive affect has three primary effects on cognitive activity. First, positive affect makes additional cognitive material available for processing, increasing the number of cognitive elements available for association. Second, it leads to defocused attention and a more complex cognitive context, increasing the breadth of those elements that are treated as relevant to the problem. Third, it increases cognitive flexibility, increasing the probability that diverse cognitive elements will in fact become associated. Isen concluded that, together, these processes lead positive affect to have a positive influence on creativity.

Similarly, in her broaden-and-build model of positive emotion, Fredrickson (1998, 2001) proposed that positive emotions, such as joy and love, broaden a person's available repertoire of cognitions and actions. She noted that "experiences of certain positive emotions prompt individuals to discard time-tested or automatic (everyday) behavioral scripts and to pursue novel, creative, and often unscripted paths of thought and action" (Fredrickson, 1998: 304). Fredrickson posited that positive emotions broaden the scope of attention (increasing the number of cognitive elements available for association) and the scope of cognition (increasing the breadth of those elements that are treated as relevant to the problem). These are the same aspects of mental activity that, according to the evolutionary theory, should lead to greater variation and thus increase the probability of creativity.

The most extensive body of empirical support for a link between positive affect and creativity comes from Isen's (1999a, 1999b) program of laboratory research. In these studies, positive mood has been induced by a number of different stimuli, including an event (such as the experimenter giving participants a treat or gift), a film clip (such as a comedy), or an excerpt of affect-laden music. The most consistent finding

of these experiments has been that induced positive mood leads to higher levels of performance on dimensions relating to creativity. For example, in three experiments with college students, positive mood led to more unusual (but still appropriate) word associations (Isen et al., 1985). Similarly, in a series of four experiments, positive mood positively influenced the performance of college students on a number of ingenuity tests (Isen, Daubman, and Nowicki, 1987; Estrada, Isen, and Young, 1994). Other studies have shown that subjects in happy moods display greater fluency, generating more responses and more divergent responses than subjects in neutral or sad moods (Abele-Brehm, 1992; Hirt et al., 1996; Vosburg, 1998). Finally, experimentally induced positive mood has led to enhanced performance on exercises requiring flexible problem solving, including tasks as diverse as grouping objects (Isen and Daubman, 1984), grouping people (Isen, Niedenthal, and Cantor, 1992), and integrative bargaining exercises in which achieving the optimal win-win outcome requires considerable exploration of alternatives (Carnevale and Isen, 1986). Taken together, these empirical results provide substantial evidence that positive affect can induce changes in cognitive processing that facilitate creative activity.

Negative affect and creativity. Other theorists have suggested that negative affect leads to greater creativity. A cornerstone of this perspective is empirical evidence of a relationship between affective illness and creativity. In a study of 1,005 prominent twentieth century individuals from over 45 different professions, Ludwig (1992) found a slight but significant correlation between depression and level of creative achievement. In addition, several systematic studies of highly creative individuals and their relatives have uncovered a higher incidence of affective disorders (primarily bipolar illness and depression) than that found in the general population (e.g., Andreasen, 1987; Jamison, 1993; Post, 1996). In a recent review of the literature over the past 30 years, Feist (1999) concluded that there is a reliable relationship between affective illness and high levels of creative accomplishment, although he noted that the relationship applies primarily to artistic, not scientific, creativity.

The possibility that negative affect might boost creativity in normal populations is suggested by the "mood-as-input" model of Martin and his colleagues (Martin et al., 1993). This model posits that people use their current mood as an informational cue, with positive mood signaling that all is well, and negative mood signaling that something is amiss in the situation. The result of this assessment can mean that people will stop working on tasks when they experience positive affect but will continue to be motivated on tasks when they experience negative affect. George and Zhou (2002) applied the mood-as-input model to creativity, proposing that the information provided by affective states can influence an individual's effort and persistence on creative activities at work. They suggested that when people are experiencing positive affect, are aware of that affective state, and are in a situation that clearly calls for creativity, they will interpret their positive mood as an indication that they have met their creative goal

and additional effort is not needed. Thus, under these conditions, positive affect should be negatively related to creativity. By contrast, when people are experiencing negative affect, are aware of that affective state, and are in a situation that clearly calls for creativity, they will interpret their negative mood as an indication that they must try harder to find a creative solution. The results of a cross-sectional study conducted in a large manufacturing organization supported these hypotheses (George and Zhou, 2002), although an earlier experimental study testing the mood-as-input model found support only on quantitative aspects of performance and not on creativity (Hirt et al., 1997).

Some laboratory experiments have found a facilitative effect of negative affect on creativity. Kaufmann and Vosburg (1997) found a negative influence of both naturally occurring and induced positive affect on insight problems and a positive influence of induced negative affect. Yet most experimental studies of mood and creativity have failed to find an impact of induced negative affect on creative performance (Isen and Daubman, 1984; Isen et al., 1985; Jausovec, 1989; Murray et al., 1990; Hirt et al., 1996; Grawtich, Munz, and Kramer, 2003). For example, Isen, Daubman, and Nowicki (1987) found no influence of negative affect (but a positive influence of positive affect) on essentially the same task as that used by Kaufmann and Vosburg (1997). Moreover, one study of naturally occurring negative mood demonstrated an inverse relationship between negative mood and creativity (Vosburg, 1998), and a field study (Madjar, Oldham, and Pratt, 2002) found no relationship between negative mood at work and creativity.

On balance, the empirical literature is more consistent in its support for a positive rather than a negative link between affect and creativity, but because most of the research on affect and creativity is laboratory-based, one must conclude that the relationship in organizational settings is still very much an open question. Therefore, this study will attempt to bring clarity to this issue through the use of extensive field data. We first address the sign of the simple relationship between positive affect and work creativity: Is it positive or negative? We then search for more complex patterns in the relationship, such as curvilinear effects of affective intensity, affective ambivalence effects, or affective lability effects.

Curvilinear relationships between affect and creativity.

The analyses employed in most prior empirical research in this domain have assumed a linear relationship: higher levels of affect relate to higher levels of creativity. But there is reason to believe the relationship might be curvilinear. For example, there might be a U-shaped relationship, whereby intense negative or positive affect contributes to creativity, and moderate levels of affect are insufficient to stimulate the needed cognitive resources. Indirect support for this possibility derives from neuropsychological research demonstrating that intense emotional experiences enhance memory via stimulation of the amygdala, a brain region associated with cognitive encoding (Canli et al., 2000; Cahill et al., 2004). A study of autobiographic memory showed similar results (Talarico, LaBar, and Rubin, 2004). The emotional intensity of experi-

ences, whether they were positive or negative, led to stronger memories. Thus it may be that emotional intensity is beneficial to creativity, given that enhanced memory is one mechanism that might contribute to the breadth or variability of cognitive activity.

Alternatively, the affect-creativity relationship could follow an inverted U-shaped function (James, Brodersen, and Eisenberg, 2004). This possibility follows from the early theoretical work of Yerkes and Dodson (1908), who proposed an increase in cognitive resources as arousal increases from low to moderate levels and a decrease in mental efficiency as arousal exceeds the moderate optimum. In line with this reasoning, there may be a cognitive penalty for strong emotions, be they positive or negative. Frijda (1986) asserted that positive and negative emotions are both characterized by "control precedence," such that emotions absorb available cognitive resources because they require direct attention. Building on Frijda's theory, Weiss and Cropanzano (1996: 54) stated that "people in an emotional state tend to be controlled by that state, they tend to be preoccupied by the emotion, and there is a persistence to behaviors designed to deal with the emotion." In this view, powerful emotions at work, both negative and positive, may distract from task performance.

Martindale's (1999) neural network model of creativity proposes a similar pattern in creative performance. This model suggests that only in situations of lower than average arousal can the mind attend to the associative connections necessary for novel ideas; under stronger arousal states, attention is so focused on the arousal-inducing situation that innovative associations are less likely to come to awareness. Empirical research has provided some support for this model. For example, Toplyn and Maguire (1991) found an inverted-U relationship when examining the effect of noise-induced stress on creative performance.

Affective ambivalence. It is also possible that the simultaneous experience of positive and negative affect may stimulate creativity by increasing the breadth of cognitive material available. According to mood congruency theory, a given mood state can enhance the likelihood of recalling information that was encoded during a similar mood (Blaney, 1986). Thus, relative to states in which only a single emotion is experienced, simultaneously experiencing positive and negative emotions may serve to activate a greater number of memory nodes, thereby increasing both cognitive variability and creativity. Because memory nodes are associated with others in a network in which the most similar associations are the strongest (Bower, 1981), holding positive and negative emotions simultaneously may lead to a crossover between nodes that may otherwise have been held separately in memory (Richards, 1994). Some empirical evidence supports this view. Rothenberg (1990) reported that holding opposite or antithetical thoughts in mind simultaneously increases the probability that these opposing thoughts will be integrated into a new creation. The same thing may happen with emotions, as demonstrated in a recent laboratory study showing a positive effect of emotional ambivalence on creativity (Fong, 2003).

Affective lability. Jamison (1993) suggested that changes in mood may be more important for creativity than static mood states, particularly changes from negative to positive emotions. She offered as an example her study of British artists, who often described marked improvements in mood just prior to intense creative activity (Jamison, 1989). Jamison (1995: 67) suggested that affective lability enhances creativity because it “blends or harnesses seemingly contradictory moods, observations, and perceptions.” Similarly, Prentky (1989) hypothesized a connection between affective lability and “A-type” thinking, which is characterized by extensive scanning, rapidly incorporating very diverse pieces of information, and “erratic mental threshing” of that information. Such theoretical notions have generally been tested on clinical populations diagnosed with affective disorders. One such study found that the administration of lithium (for two consecutive weeks) to patients with bipolar disorder decreased the number of associations made (assessed using various word association tests), while the discontinuation of lithium increased the production of associations (Shaw et al., 1986). The authors concluded that the administration of lithium may have “indirectly reduced creative productivity by eliminating mood swings in patients dependent on such alterations for inspiration and energy” (p. 1166). Thus affective lability may increase the variety and breadth of associations generated overall, which provide an important input to the creative process.

Several theorists have questioned the logic of the proposed connection between affective lability and creativity (Ludwig, 1992), as well as its empirical basis (Waddell, 1998).

Nonetheless, we searched for a relationship between affective lability and creativity in the present study because of the plausibility of the theoretical arguments, the demonstration of affect swings in non-clinical populations (Larsen, Diener, and Emmons, 1986), and the suggestive evidence of such a relationship in clinical populations.

Temporal Dynamics of the Affect-Creativity Relationship

In developing a preliminary theory of affect and creativity at work, it is important to specify more than the basic form of the relationship between the two variables. It is also important to explore temporal aspects of the relationship: whether positive (or negative) mood, or change in mood, predictably precedes creativity; whether creativity predictably precedes mood; and whether affect and creativity occur simultaneously. Theoretically, these three patterns are not mutually exclusive; any and all may exist. In the present study, we take advantage of daily measures of mood and creativity across many weeks to begin examining temporal aspects of the relationship.

Affect as an antecedent of creativity. If, as suggested by the experimental literature, positive mood enhances creativity at work, we would expect a given day's creativity to follow reliably from the previous day's mood, above and beyond any carry-over of that previous day's mood. Theory and research on “incubation,” long recognized as a part of the creative process (Wallas, 1926; Simonton, 1999), suggest such cross-

day effects. Incubation is a process of unconscious recombination of thought elements that were stimulated through conscious work at one point in time, resulting in novel and useful ideas at some later point in time. Anecdotal reports of incubation effects in creativity abound, ranging from Kekule's dreaming the structure of the benzene ring to Poincare's sudden mathematical insight in boarding a train while on vacation (Vernon, 1970; Mazzarello, 2000; Maquet and Ruby, 2004). Thus if positive mood on a particular day increases the number and scope of available thoughts, those additional thoughts may incubate overnight, increasing the probability of creative thoughts the following day.

Recent advances in neuroscience provide intriguing evidence of the mechanisms underlying incubation effects, particularly those that occur during sleep. This research reveals that people's experiences while awake can be consolidated into memory and result in enhanced performance the next day without any additional practice or engagement in the task (Karni et al., 1994; Maquet et al., 2000; Stickgold, James, and Hobson, 2000; Walker et al., 2003; Gaab et al., 2004). Moreover, there is mounting evidence that sleep can facilitate the types of memory and learning processes, such as associative memory (Stickgold et al., 1999), that contribute to creative problem solving (Stickgold and Walker, 2004). In a particularly relevant experiment, Wagner and colleagues (2004) demonstrated that problem solving insight can be dramatically enhanced by a period of sleep following initial work on a problem. After practice in doing a mathematical task that had a clue embedded within it, 59 percent of participants who slept for an intervening eight hours gained insight into the problem via the embedded clue, even though they had not been told that the clue existed, nor were they aware of the clue upon waking. By contrast, in the four control groups that did not have an intervening night's sleep, at most only 25 percent of participants gained insight into the problem.

An interesting question for the incubation of creativity is how long such an incubation period lasts. Theoretically, the incubation period can vary from a very brief period (e.g., a few moments) to days or weeks. Neuroscience researchers examining incubation effects on learning have found that most of the learning occurs during the first night of sleep after training but that improvement can continue for up to another four nights (Stickgold, James, and Hobson, 2000; Walker et al., 2003; Atienza, Cantero, and Stickgold, 2004). To our knowledge, there has not yet been any research on incubation effects in organizational creativity. Our longitudinal data allow us to address this gap. If the broadened cognitive associations initiated by positive moods incubate over spans of one night or more, we should be able to detect an effect of one day's mood on the next day's creative thinking (above and beyond the effects of the next day's mood). Moreover, by examining time lags of various lengths, we can begin to specify the typical length of the creative incubation period in organizational settings.

Affect as a consequence of creativity. Not only might affect precede creativity, but creative outcomes might provoke affect as well. At its simplest level, the experience of creativi-

ty is itself a work event, and like other events in the organizational context, it could evoke emotion (Weiss and Cropanzano, 1996). Qualitative research and anecdotal first-person accounts of creative achievement in the arts and sciences suggest that creative insight is often followed by feelings of elation (Gruber, 1995; Feist, 1999; Shaw, 1999). For example, Einstein called his 1907 general theory of relativity "the happiest thought of my life" (Rothenberg, 1990: 14). Systematic empirical evidence on this matter is still very tentative, however. In a direct test of whether mood is altered by doing a creative task, Feist (1994) found that college students interested in art experienced an increase in positive mood after engaging in an artistic creativity task; there was no such effect for science students after engaging in a scientific creativity task.

In contrast to the possible incubation effects of affective state on subsequent creativity, the affective consequences of creativity are likely to be more direct and immediate. In general, affective events provoke immediate and relatively fleeting emotional reactions (Frijda, 1993; Frijda and Mesquita, 1994; Oatley and Jenkins, 1996; Russell and Barrett, 1999). Thus, if creative performance at work is an affective event for the individual doing the creative work, such an effect would likely be evident only in same-day data. Our daily qualitative data allow us to put this logic to an empirical test.

The simultaneity of affect and creativity. In considering the temporal links between affect and creativity, one must also include the possibility of simultaneity. As Sandelands (1988: 439) noted, "Feeling and doing are coexistent, coterminous, and coordinate. Feeling merges with doing and is experienced as a quality of its form." Such work feelings may be closely tied to the creative experience itself. Csikszentmihalyi (1975, 1996) suggested that creative behavior is often characterized by a "flow state," a temporary psychological merger of the person with the activity, which inherently involves positive feelings such as enjoyment and enthusiasm. Conceptually, these feelings are similar to those described as components of intrinsic motivation (Deci and Ryan, 1985): feeling passionately involved with the work, deeply interested in it, positively challenged by it, and enjoying it as it is unfolding. A considerable research literature has identified intrinsic motivation as the form of motivation that is most closely associated with creativity (Amabile, 1996). Like the affective consequences of creative thinking, these simultaneous feelings may not last long enough to be evident in longitudinal analyses. We use our daily qualitative data to search for affective concomitants of creative activity.

Overview of the Study

The present study used quantitative and qualitative data collected daily for several months from individuals working on organizational projects that called for creativity. The data included multiple measures of affect, as well as multiple measures of creativity. Some measures collected from participants were scale-rated responses to specific questions, while others were open-ended descriptions of their day-by-day experiences at work. Capitalizing on the breadth and

depth of these data, we delved deeply into the affect-creativity relationship. We carried out quantitative analyses to examine the basic nature and form of the relationship, addressing several research questions: Is there a positive or a negative linear relationship? Is creativity facilitated by fluctuation across the range from negative to positive affect? Might creativity be higher on days of mixed emotion, when both positive and negative emotions occur? And is there a curvilinear relationship, whereby creativity is highest at some optimal level of affect along a continuum from extremely negative to extremely positive? We then used both quantitative and qualitative analyses to examine possible temporal patterns, such as creative thought following affect, affect following creative thought, and affect co-occurring with creative thought.

METHODS

Participants

The data for our study were drawn from a multi-study longitudinal research program designed to examine the interrelations among organizational incidents, subjective experience, work environment, and performance. The participants in this study were 222 individuals serving as members of 26 project teams from seven companies in three industries (chemicals, high tech, and consumer products). Participants were told that the broad purpose of the study was to examine antecedents of successful performance, specifically, "This study is designed to radically increase our knowledge about how managers and teams can bring about more consistently desirable project outcomes. We will accomplish this by carefully examining events that occur during the life of the project and relating them to the work environment, team work motivation, and ultimate project outcomes." Because the central outcome variable of interest in the research program was work creativity, participants were selected only if creativity was a possible and desirable outcome of their team's project. For the majority of participants, that project was their primary assignment. These projects included developing new products (e.g., an ultra-strong fiber, a new home health care product), creating new processes (e.g., a new operational logistics tracking system; a method for testing the effectiveness of home health care products), and solving complex client problems (e.g., integrating the information systems of a large, complex organization in the service industry). Thus, all participants focused on "knowledge work." Most individuals participated in the study throughout the entire course of their team's project or a discrete phase of that project. Because the projects varied in length, individual participation ranged from 9 to 38 weeks, with a mean of 19.04 weeks.

At the beginning of the study, all participants completed a demographic questionnaire, including information on sex, age, level of education, and company tenure. These measures were used as controls in the quantitative analyses. The mean age of participants was 38.17 years (range = 22–68), and 77 percent of the participants were men. Our sample was highly educated and thus can be considered professionals; 82 percent were college graduates, and many had engaged in postgraduate work.

Procedure and Instruments

Daily questionnaire. To obtain daily measures tracking affect and creativity in the work lives of study participants, we employed the Electronic Event Sampling Methodology (Amabile et al., 1997). This is an adaptation of the Experience Sampling Methodology developed by Csikszentmihalyi and Larson (1987). The Electronic Event Sampling method consists of electronic administration (via e-mail) of a daily questionnaire every day, Monday through Friday, through the entire course of the participant's target project or project phase. Participants were asked to complete their daily questionnaires independently, near or after the end of their workday. They were told that all responses should refer to that particular day's experiences at work.

We took several steps to maintain good response rates, including having initial and mid-project meetings with participants, a promised (and delivered) post-study workshop to review with each team its results and their implications, a promised (and delivered) post-study meeting with top management to summarize the primary positive and negative aspects of the organization's work environment, periodic small gifts to participants, monthly personal phone calls to each participant, and follow-up inquiries to any participant who missed more than two consecutive daily questionnaires. Data or results were not discussed with participants until their participation was completed.

Of the 238 participants initially in the sample, the mean response rate on the daily questionnaire, after taking into account holidays, vacations, and sick days, was 75 percent (with a minimum of 16 percent and a maximum of 100 percent). Sixteen participants were dropped due to response rates below 20 percent, yielding the sample of 222 employees in the analyses. Participants dropped due to low response rates did not differ significantly from participants kept in the study on sex, age, education level, length of employment, measures of affect, or measures of creativity. Participants completed an average of 52 daily questionnaires (range = 12–157), yielding a total sample of 11,471 daily questionnaires.

The daily questionnaire included a variety of items relating to our measures, as well as constructs used for other studies in the research program.¹ A 7-point response scale (1 = not at all, 7 = extremely) was used for self-ratings on the numerical measures used here. There were also two free-response items of central interest to the present study. The first called for the participant to "briefly describe one event from today that stands out in your mind as relevant to the target project, your feelings about the project, your work on the project, your team's feelings about the project, or your team's work on the project," and the second invited participants to "add anything else you would like to report today." We use the generic term "narrative" to refer to each day's combined narratives from a given participant's responses to these two questions. Participants' diary narratives ranged from 1 to 855 words, with a mean of 54 words per day.

¹

The entire daily questionnaire is available from the first author.

Note that the free-response questions did not ask participants to report anything in particular, did not encourage them to report instances of creative thinking, and did not encourage them to report on their affective states. Moreover, they were asked specifically to focus on that day's events, rather than providing retrospective reports. Because the questions called for reports of specific events close in time to when they occurred, without prompting concerning the nature of those reports, and because participants had been assured that their confidentiality would be protected, we view the reports as largely veridical accounts of the events, thoughts, and emotions that participants experienced during the day (see also Kahneman et al., 2004). Although the absence of something in such a narrative report should not be taken to mean that it did not occur, the presence of something can be taken to mean that it was indeed part of the participant's experience that day.

Content coding of narratives from the daily questionnaire.

A narrative content coding protocol was used to identify indicators of mood and creative thought in the daily diary narratives (Amabile, Mueller, and Archambault, 2000). In response to our request to "briefly describe one event" in each day's narrative, participants generally wrote about multiple specific events that were interwoven into a coherent narrative. On average, rather than one event, each narrative described 5.36 specific related events. To render the narrative coding and the analyses based on it as precise as possible, we created a method for identifying each specific event reported within each daily narrative. Five independent coders trained in this method parsed the daily narratives into specific events, yielding a total of 63,789 events from the 11,471 narrative diaries. Agreement on this parsing of events exceeded 70 percent for each coder pair. After the parsing, and after a rigorous training program, the same five coders coded each narrative on affect and creative thought. Each of them coded approximately one-fifth of the diary narratives, with overlapping subsets of the narratives being coded by multiple coders as reliability checks. The dimensions used to identify affect and creative thought are described in the "Measures" section below.

Monthly peer-rating questionnaire. Participants completed monthly ratings, on 7-point scales (1 = very low/very poor, 7 = very high/very good), of the contributions of each of their teammates over the previous month. Several dimensions, including creativity, were rated. The response rate was 68 percent.

Measures

Affect. A quantitative measure of positive mood was constructed from six self-report items on the daily questionnaire. Because the present study was part of a broader research program on creativity, and because participants were expected to complete this questionnaire daily, only a limited number of affect items could be included. The six items focused on the pleasantness dimension of affect. This dimension is one of two components of the commonly used circumplex model, in which the construct of affect is represented by the

dimensions of pleasantness and energy (Russell, 1980). By focusing on the pleasantness or evaluative dimension of affect, we take a measurement approach similar to that used by other organizational researchers examining the influence of emotions (e.g., Staw and Barsade, 1993; Wright and Staw, 1999; Barsade et al., 2000; Totterdell, 2000; Bartel and Saavedra, 2001; Barsade, 2002). Moreover, this approach mirrors the types of measures used by psychological researchers examining the influence of affect on creativity in lab settings (Isen, 1999a, 1999b).²

Participants rated the extent, on a 7-point scale, to which they felt each of the following “today”: happy; satisfied with the team; enjoyment of work; frustrated (reverse-scored), and frustrated with the team (reverse-scored).³ In addition, after completing the diary narrative, participants rated the impact of the day’s reported event(s) on their “feelings about the project.” This was also a 7-point scale, ranging from extremely negative to extremely positive. The mean of these six items constituted the individual’s *Self-rated positive mood* measure for the day ($\alpha = .79$).

To provide triangulation for results obtained with the self-rated mood measure, we also constructed a more indirect and less obtrusive measure of mood from the coding of the diary narrative, *Coder-rated positive mood*. Each specific event described in each diary narrative was coded on a valence dimension, defined for coders as “how the reporter [the participant] appeared to feel about the event or view the event.” For each event, the coder chose a valence code of negative, neutral, positive, or ambivalent. Inter-coder agreement on the valence coding was 90 percent.

We also coded a *Main event* dimension, defined for coders as “the main thing or most important thing” in the narrative. From all specific events described in a given narrative, the coder chose one as the main event (with an inter-coder agreement of 63 percent). Reasoning that the day’s affective experience was likely more influenced by the participant’s feeling about the main thing reported, we assigned a greater weighting to the valence of main events. Main events were assigned a value of +2 or -2 (for positive and negative valence, respectively), and all other events were assigned a value of +1 or -1 (for positive and negative valence, respectively). Events whose valence had been coded as neutral or ambivalent were counted as 0. All weighted valence scores for each diary narrative were then summed to produce the *coder-rated positive mood* measure for each individual on each day.

A multilevel model controlling for intra-individual variance (i.e., repeated measures for each person), as well as team and company, showed that the two measures of daily positive mood, self-rated positive mood and coder-rated positive mood, correlated significantly ($\beta = .41, p < .001$).

Creativity. Researchers have long debated the assessment of creativity, and many different methods have been used (see Puccio and Murdock, 1999). A recent review of assessment methods used by contemporary organizational creativity researchers (Amabile and Mueller, 2006) revealed that the

2

This differs from the PANAS measures of positive affect (PA) and negative affect (NA) (Watson, Clark, and Tellegen, 1988), which are composed of adjectives that can be placed on the diagonal of the circumplex. PANAS adjectives are a blending of both pleasantness and energy (e.g., attentive, determined, enthusiastic for PA, and afraid, irritable, and nervous for NA). Unfortunately, as Larsen and Diener (1992) pointed out, PANAS measures omit most of the pleasant and unpleasant adjectives that are commonly associated with positive and negative affective states, such as “happy,” “sad,” “satisfied,” “cheerful,” “gloomy,” and so on. Therefore, PANAS items may not coincide with the everyday language of positive and negative moods as well as pleasantness items do. In addition, PA and NA are not as congruent with the experimental literature on moods as pleasantness items are. Most experiments on affect have manipulated pleasantness by procedures such as seeing an amusing or sad film or receiving a modest but pleasant gift, and they have used simple evaluative scales (or a small set of pleasantness items) to measure the strength of these affect manipulations (e.g., Martin et al., 1993; Isen, 1999a, 1999b).

3

Although satisfaction ratings do not, by themselves, adequately assess affect at work (Weiss and Cropanzano, 1996), we included such a rating because satisfaction is commonly used as a pleasantness anchor in circumplex scales (e.g., Barrett, 2004) and its inclusion increased scale reliability. The self-rated positive mood measure incorporates only one type of negative affect (frustration) because the space available for affect items on the daily questionnaire was so restricted, but previous researchers have proposed that frustration is likely one of the most common negative emotions at work (Staw, Sutton, and Pelled, 1994).

most commonly adopted approach involves subjective assessment, in which one or more experts or peers make scale-rated assessments of the creativity of individuals or their work (e.g., Amabile et al., 1996; Oldham and Cummings, 1996; George and Zhou, 2002). Our study design required daily measures, but it was not feasible to collect daily observer ratings of creativity in our participating organizations; such ratings could only be collected monthly. More importantly, it seemed unlikely that any observers would have accurate day-by-day knowledge of an individual's creative thinking. Thus, we created a new measure, *Daily creative thought*, consisting of coders' identifications of spontaneously reported creative thought or problem solving in the daily narrative. Not only can it be assessed daily, but this coder-rated measure of creative thinking also has a more objective basis than observers' ratings. There is precedent in the literature for considering self-reports of specific daily events as veridical (Kahneman et al., 2004), and the coders who rated our participants' narrative reports did not have any acquaintance with the participants or their organizations. This eliminates many of the biases that might arise due to the interpersonal relationships usually associated with observer ratings (Cardy and Dobbins, 1986). Nevertheless, because observers' assessments are the standard measure of creativity in contemporary empirical studies, we also used monthly peer assessments to validate this new measure of creativity and to serve as a second dependent measure of creativity. We describe each measure below.

We obtained peer assessments of creativity from the monthly questionnaire distributed to all study participants. The relevant item on that questionnaire asked participants to use a 7-point scale to rate each teammate on the person's "creative contribution to the project during the past month," with creativity defined as "the production of NOVEL AND USEFUL ideas" (caps in original). To assess the degree to which teammates agreed when rating their peers, we first calculated intraclass correlation coefficients for the peer ratings and then calculated an effective scale reliability by applying the Spearman-Brown formula (Gulliksen, 1987). The resulting reliability coefficient was .81. The averaged ratings of each individual participant by all of his or her teammates constituted the *Monthly peer-rated creativity* measure.

The coding of creative thinking in the narratives was based on Weisberg's (1988) description of creativity as both the act of novel problem solving or idea generating and the actual solution or idea. To be considered novel problem solving, according to Weisberg, the activity cannot be merely rote (the carrying out of a familiar algorithm). Following this reasoning, our coding scheme defined creative thought as any of the following: (1) a discovery, insight, or idea; (2) the act of searching for a discovery, insight, or idea; (3) solving a problem in a non-rote way; or (4) the act of searching for a problem solution in a non-rote way. Examples of narratives that were coded as containing evidence of creative thought include the following: "I tried everything I knew to do on the [equipment] in order to compound the resin and nothing worked. Then I tried something that had not been done

before, to my knowledge, and it is working wonderfully at this moment;" "Today, I formulated an adhesive in a way that may solve a problem that I have been encountering;" "Work[ing] on the details of how the image will be produced, I really got into the problem and came up with an elegant method for dealing with overloaded tasks."⁴

Because this study focused on individual day-by-day creativity, we took a conservative approach to ensuring that the creative thought event could be reasonably attributed to the individual on the day in question. To be coded as evidence of a creative thought, the event had to describe active, non-rote problem solving or idea generation that was done by the individual participant on the day that he or she reported it. We did not count as creative any passive event (e.g., "Jessica gave me a great idea today"), any rote problem solving (e.g., "I cranked the numbers through the standard program to get the final figure"), anything done by someone else (e.g., "Andy came up with a great solution"), or anything that did not happen that day (e.g., "I had a great idea last week," or "I hope to think of a solution to this problem tomorrow"). This coding procedure yielded a set of only 364 creative thought incidents, out of the total of 63,789 reported events, with only 56 percent of participants reporting a creative thought incident. This finding of the infrequency of creative thought confirms theoretical (Poincare, 1921) and empirically based statements that creativity is a rare phenomenon (Simonton, 1988, 2003) and suggests that our measure is a conservative estimate of actual creative thought.

Intercoder agreement for the creative thought identifications was 96 percent. Each event in each daily narrative was coded as to whether it described a creative thought incident (1 = Yes, 0 = No), and a sum was computed across all events in the narrative. To correct for the increased probability of reporting a creative thought event when more events were reported in total within the narrative, we divided each narrative's creative thought sum by the total number of specific events in the narrative. The resulting ratio was our measure of *Daily creative thought*.

In a multilevel model controlling for intra-individual variance (i.e., repeated measures for each person), as well as team and company, the creative thought measure correlated significantly with the monthly peer-rated creativity measure ($\beta = .16, p < .05$).⁵ This provides some validation for our new measure against the more commonly used observer rating.

Qualitative Analysis

We qualitatively analyzed each of the 364 narratives in which participants mentioned generating ideas or solving problems. For each, we noted (a) whether the participant mentioned his or her affective reaction to the creative thought event, (b) if so, whether that reaction was positive, negative, or mixed, (c) whether there was some intervening event between the creative thought event and the emotion, and (d) whether the emotion appeared to occur simultaneously with the creative thought, rather than following from it. This coding was carried out by two new coders, who achieved acceptable reliability.

4

Throughout this paper, examples are excerpts from participants' daily questionnaire diary narratives and have been edited for confidentiality. Some additional editing, indicated by brackets in the text, was done to correct typographical errors or provide clarification.

5

This is a standardized coefficient. The multilevel model automatically controls for repeated measures and team. Because teams are nested within companies, controlling for team also automatically controls for company.

bilities on the coding categories (ranging from 88 percent to 98 percent).

Quantitative Analysis

Data aggregation. Our data collection efforts yielded two quantitative data sets. First, the daily data form a panel data set with information on 222 respondents for each project day, yielding a total of 11,471 respondent/day observations. Second, the monthly peer-rated data form a panel data set on 222 respondents, yielding a total of 762 respondent/month observations. To examine the relationship between affect and creativity at the monthly level, we aggregated the daily mood data to create a single average score for each person for each month.

Lagged analyses. We took advantage of the longitudinal nature of the study to address our temporal research questions by conducting lagged analyses predicting a given day's data from the previous day's data. Because they control for autocorrelation, these analyses allowed us to examine the relationship between a particular day's mood and the next day's creativity while controlling for the effect of that next day's mood. Similarly, these analyses allowed us to examine the relationship between a particular day's creativity and the next day's mood while controlling for the effect of that next day's creativity.

Models. Because the design of the study involves days nested within participants, nested within teams, nested within companies, we used multilevel models in our analyses. In this way, we controlled for unique variance from team and company in all of the analyses, and we also controlled for the repeated measures from individual participants. These daily analyses also controlled for autocorrelation (the tendency for consecutive days to correlate) in both predictor and dependent variables. Finally, we controlled for the demographic variables of education, sex, company tenure, and age.

All analyses employed multilevel models with fixed and random effects models using the SAS "proc mixed" program (Singer, 1998). Random effects models control for intra-individual variation (the tendency for a given participant to respond in a consistent way across time) as well as intra-team variation while examining the relationship between predictors and outcomes across time. These models produce a fixed effect beta coefficient, which represents the average relationship between the predictor and the outcome variable across time, while controlling for several sources of variation (e.g., intra-individual, team, company, and autocorrelation).

The basic form of the multilevel model with fixed and random effects is described by the equation:

$$Y_{ijt} = \beta_0 + \beta_1 x_{1ijt} + u_j + v_{ij} + \varepsilon_{ijt}$$

In this equation, Y_{ijt} is creative thinking for person i in team j on day t , x_{1ijt} is positive mood for person i in team j on day t , u_j is a random effect for team j (normally distributed with vari-

ance σ^2_{ν}), ν_{ij} is a random effect for person i on team j (normally distributed with variance $\sigma^2\nu$), and ϵ_{ijt} is the residual error, which is autoregressive of order 1.

RESULTS

Table 1 presents descriptive statistics and correlation coefficients for all study variables, controlling for team and company.

The Nature and Form of the Affect-Creativity Relationship

As shown in table 1, several zero-order correlations provide preliminary evidence that positive mood was associated with higher levels of creativity. Multilevel regressions predicting creativity from affect generally yielded the same pattern of results. Table 2 shows that, controlling for team, autocorrelation, repeated measures, and intra-individual variance, self-rated and coder-rated positive mood related positively and significantly to same-day creative thought (see table 2, models 1 and 2, respectively).⁶ Table 3 presents similar analyses predicting monthly peer-rated creativity from same-month affect. Self-rated positive mood (aggregated to a single score per participant for each month) positively and significantly related to monthly peer-rated creativity (table 3, model 1). Coder-rated positive mood (also aggregated to a single score per participant for each month), however, did not significantly relate to monthly peer-rated creativity (table 3, model 2).

We then investigated the possibility that there might be a curvilinear component to the affect-creativity relationship, in addition to the linear relationship revealed by the regressions in models 1 and 2 of tables 2 and 3, but our multilevel analyses revealed no evidence of a curvilinear relationship. Betas for all squared predictors were non-significant: self-rated positive mood predicting daily creative thought; coder-rated positive mood predicting daily creative thought; self-rated positive

6

As described earlier, these analyses used the pleasantness dimension of the affective circumplex model (Russell, 1980) to measure the overarching state of positive affect. Although this is a key component of affective experience (Lazarus, 1991; Cacioppo and Berntson, 1999), examining whether these effects occur with discrete emotions could offer additional insight into the creative process. For this reason, we had three new coders rate each event narrative ($N = 11,471$) on the following five basic discrete emotions: joy, love, anger, sadness, and fear. Each discrete emotion was rated on a 5-point scale (1 = not at all, 5 = very much), and the inter-coder reliability for each category exceeded .77. We then conducted analyses identical to those we report for the positive affect measures and found essentially the same results. Same-day joy was associated with higher creativity, and same-day anger, sadness, and fear were associated with lower creativity.

Table 1

Means, Standard Deviations, and Multilevel Models Examining All Bivariate Relationships among All Major Variables*

Variables	Mean	S.D.	1	2	3	4	5	6	7
<i>Control variables</i>									
1. Sex (0 = male, 1 = female)	0.23	0.42	—						
2. Age	38.11	10.23	-.13*	—					
3. Company tenure (in years)	7.60	9.06	-.14*	.61*	—				
4. Education†	4.78	1.38	-.03	.01	-.11	—			
<i>Positive mood measures</i>									
5. Self-rated positive mood	4.68	0.62	-.06	.13	.16*	-.00	—		
6. Coder-rated positive mood	0.05	0.40	-.07	.12	.03	.13*	.41***	—	
<i>Creativity measures</i>									
7. Creative thought	0.03	0.05	.10	.01	-.00	.03	.03***	.02**	—
8. Monthly peer-rated creativity	4.70	0.85	-.16*	-.09	-.09	.12	.18*	.02*	.16*

* $p < .05$; ** $p < .01$; two-tailed tests.

* Standardized coefficients are reported. The multilevel models automatically control for repeated measures and team. Because teams are nested within companies, controlling for team also automatically controls for company.

† 1 = Some high school; 4 = college graduate; 8 = Ph.D.

* These analyses were conducted at the daily level, $N = 10843$ – 11403 . All other variables were analyzed at the individual level, $N = 222$.

Table 2

Multilevel Models Predicting Daily Creative Thought (at Time t)*

Variables	Model							
	1	2	3	4	5	6	7	8
<i>Control variables</i>								
Sex (0 = male, 1 = female)	.001	.001	.009	.010	.008	.008	.009	.008
Age	.038	.034	.037	.034	.035 [•]	.034	.034	.034
Company tenure	-.054 ^{••}	-.047 ^{••}	-.053 ^{••}	-.048 ^{••}	-.050 ^{••}	-.048 ^{••}	-.046 ^{••}	-.048
Education	.004	.003	.004	.003	.004	.005	.006	.005
<i>Affect variables (Time t)</i>								
Self-rated positive mood	.044 ^{•••}							
Coder-rated positive mood		.030 ^{•••}						
<i>Affect variables (Time t-1)</i>								
Self-rated positive mood			.020 ^{••}					
Coder-rated positive mood				.019 ^{••}				
<i>Affect variables (Time t-2)</i>								
Self-rated positive mood					.019 [•]			
Coder-rated positive mood						-.005		
<i>Affect variables (Time t-3)</i>								
Self-rated positive mood							-.001	
Coder-rated positive mood								-.005
N	11067	11134	10859	10922	10651	10710	10443	10710

• $p < .10$; •• $p < .05$; ••• $p < .01$; two-tailed tests.

*Standardized coefficients are reported. The multilevel models automatically control for repeated measures, autocorrelation, and team. Because teams are nested within companies, controlling for team also automatically controls for company.

Table 3

Multilevel Models Predicting Monthly Peer-rated Creativity (N = 706)*

Variables	Model 1	Model 2
<i>Control variables</i>		
Sex (0 = male, 1 = female)	-.131 ^{••}	-.130 ^{••}
Age	-.081	-.087
Company tenure	-.045	-.030
Education	.111 [•]	.110 [•]
<i>Affect variables</i>		
Self-rated positive mood	.093 ^{••}	
Coder-rated positive mood		.042

• $p < .10$; •• $p < .05$; two-tailed tests.

* Standardized coefficients are reported. The multilevel models automatically control for repeated measures and team. Because teams are nested within companies, controlling for team also automatically controls for company.

mood predicting monthly peer-rated creativity; and coder-rated positive mood predicting monthly peer-rated creativity.

We also investigated the possibility that people are more creative when they are ambivalent, that is, when they simultaneously experience conflicting emotions, both negative and positive affect on the same day. To calculate affective ambivalence, we separated each daily narrative's coder-rated positive mood score into its positive and negative components by disaggregating its positive valence from its negative valence scores. We then created a dichotomous affective ambivalence variable for each daily diary narrative, whereby a value of 1 indicated that there was both coder-rated positive valence and coder-rated negative valence in the narrative, and a value of 0 indicated that either there was only one type of

valence (i.e., only positive or only negative) or neither. Multi-level regressions, however, revealed no significant associations between affective ambivalence and daily creative thought or between month-aggregated affective ambivalence and monthly peer-rated creativity.

As we noted, the literature suggests additional ways in which positive and negative affect might play a role in creativity. Emotional lability, or fluctuation in affective experience across the range of negative to positive mood, is one possibility. We used the standard deviation of each participant's self-rated positive mood to represent the degree of emotional lability in the participant's day-to-day affect (Emmons, 1987), but we found no significant association between this measure and either daily creative thought or monthly peer-rated creativity.

To further assess how emotional lability might influence creativity, we investigated whether creativity on a given day might be predicted by a change in affective state from the prior day. This possibility is suggested by the clinical literature showing that highly creative individuals with affective disorders may do their most creative work when they are emerging from the depths of depression (Jamison, 1989). We took three analytic approaches to examining this possibility. First, we calculated a change score by subtracting each day's mood from the next; this method predicted creativity from mood change in either the positive or the negative direction. There was no significant association, however, between creative thought and change in either self-rated positive mood or coder-rated positive mood. Second, we examined the sheer magnitude of change by predicting creativity from the absolute value of the change in mood. Neither the absolute value of the change in self-rated positive mood nor the absolute value of the change in coder-rated positive mood significantly related to creative thought. Third, we constructed a highly specific test of the "emergence from depression" hypothesis. We created a variable capturing whether, and by how much, the participant's mood started out negative on one day and improved on the subsequent day (i.e., started out below the mood scale's midpoint of 4 on one day and moved higher on the next day). There were 1,527 day-pairs in the database that fit this criterion, with positive change scores ranging from .03 to 5.50 on the 7-point scale; all other days were scored as zero. Using this measure, we found no association between mood improvement and creative thinking.

Taken together, these results suggest that the nature of the relationship between affect and workplace creativity is positive and that the form of the relationship is a simple linear one.

Temporal Aspects of the Affect-Creativity Relationship

Affect as an antecedent of creativity. We next looked for evidence of an incubation effect, by which positive affect at one point in time stimulates creativity at a later point in time. Lagged multilevel analyses, in which each day's creativity is predicted from the previous day's mood, showed significant positive effects on creative thought of both self-rated positive mood (table 2, model 3), and coder-rated positive mood (table

2, model 4). These results suggest that positive affect can function as an antecedent to creativity and that such influence is detectable over the time span from one day to the next. We then tested the boundaries of this phenomenon by conducting lagged analyses over a two-day span and also a three-day span, in models 5, 6, 7, and 8 in table 2. Self-rated positive mood was marginally associated with creative thought two days later ($p < .10$), but coder-rated positive mood was not. Thus there is weak evidence for an incubation effect continuing into the second day after a positive affective experience. There were no associations over the three-day span. These analyses suggest that, typically, incubation effects in organizations may span up to two days.

Affect as a direct consequence of creativity. We next investigated the possibility that affect might also function as a consequence of creativity, using two different approaches. First, we conducted lagged multilevel regressions predicting each day's mood from the previous three days' creative thought. As presented in table 4, we found no evidence that creative thought on a given day predicts either self-rated or coder-rated positive mood on subsequent days. This suggests that creative thinking does not have affective consequences that continue beyond the day on which the creative thinking occurs.

Because specific affective events generally provoke discrete and relatively fleeting emotions, (Frijda, 1993; Frijda and Mesquita, 1994; Oatley and Jenkins, 1996; Russell and Barrett, 1999), it may not be possible to detect the emotional consequences of creative thinking by examining next-day affect. Thus, day-lagged analyses may not be sufficiently sensitive to empirically identify affective reactions following creativity. Therefore, as a second approach to exploring the affective consequences of creativity, we used qualitative analysis of the diary narratives to identify same-day accounts of the emotions evoked by creative thinking.

Table 4

Multilevel Models Predicting Self-rated and Coder-rated Positive Mood (at Time t)*						
Variable	Model 1 Self-rated positive mood	Model 2 Coder-rated positive mood	Model 3 Self-rated positive mood	Model 4 Coder-rated positive mood	Model 5 Self-rated positive mood	Model 6 Coder-rated positive mood
<i>Control variables</i>						
Sex (0 = male, 1 = female)	-.013	-.024	-.014	-.027	-.010	-.025
Age	-.005	.034	-.013	.033	-.017	.032
Company tenure	.122	.005	.127*	.004	.131*	.006
Education	.011	.042*	.012	.041*	-.010	.039*
<i>Creativity variable</i>						
Creative thought (Time t-1)	.004	-.001				
Creative thought (Time t-2)			.009	-.003		
Creative thought (Time t-3)					-.006	-.010
N	10857	10922	10646	10710	10435	10498

* $p < .05$; two-tailed tests.

* Standardized coefficients are reported. The multilevel models automatically control for repeated measures, autocorrelation, and team. Because teams are nested within companies, controlling for team also automatically controls for company.

We conducted a qualitative analysis of all 364 event descriptions that reported a creative thought event. Given that the event description question on the diary form was open-ended and did not request any particular type of information (such as information on creativity or emotion), it is not surprising that 293 (80 percent) of the 364 creative thought event descriptions contained no mention of a direct emotional reaction to that event. This does not mean that emotional reactions to creative thought events were absent on those days; rather, it indicates that participants did not choose to mention any such reactions that might have occurred.

Of the 71 event descriptions that did mention a direct emotional reaction to the creative thought event, the most frequent reaction, by a wide margin, was positive emotion. These positive reactions were widespread, appearing in the narratives of various participants across 19 of the 26 teams in the study. In total, 61 (86 percent) of this set of narratives described a primary reaction of joy, pride, satisfaction, relief, or other positive feelings. By contrast, only 10 (14 percent) described a negative reaction such as anger, sadness, or fear. Table 5 presents representative examples of the positive and negative reactions to creative thought events.

Table 5

Examples of Participants' Reports of Affective Reactions to Creative Thought Events*

Positive reaction (86% of all reactions to creative thought events)

- "I figured out why something was not working correctly. I felt relieved and happy because this was a minor milestone for me." (Female participant in a high-tech company)
- "I smashed that bug that's been frustrating me for almost a calendar week. That may not be an event to you, but I live a very drab life, so I'm all hyped. No one really knows about it; three of the team that would be involved are out today—so I have to sit here rejoicing in my solitary smugness." (Male participant in a high-tech company)
- "I tried everything that I knew to do . . . in order to compound the resin and nothing worked. Then I tried something that had not been done before, to my knowledge, and it is working wonderfully at this moment. Ain't science wonderful? . . . God, I love it when a plan comes together." (Male participant in a chemicals company)
- ". . . [In] consideration of the enormous complexity and machinery involvement, I was forced to think. An alternative idea soon came to mind. [*Description of the idea.*] This not only simplifies our [current] trial tremendously, it also vastly increases the probability of success for the [trial next week]. It alternatively saves about six man days of labor, a week of schedule time, and over a thousand dollars in outside cleaning costs. This WIN-WIN eureka boosted our spirits and let us finish the week on a high note." (Male participant in a chemicals company)
- "Brought some of my personal camera equipment in today and utilized it to create a high magnification video analysis system . . . to understand issues with tuft shooting. Felt this was very creative work on my part—passing on my knowledge of optics and photography to an engineer that will continue with this work. Passing on such knowledge 'makes my day.'" (Male participant in a consumer products company)
- "I did end the day on a positive note by figuring out how to build a pallet for the household container line that I've been struggling with." (Female participant in a consumer products company)
- "I came up with the nomenclature proposal and am quite proud of myself for general cleverness and ease of use." (Female participant in a chemicals company)
-

Negative reaction (14 % of all reactions)

- "I made some [new technology] prototypes today. The filaments were very difficult to handle and I felt frustrated not knowing how to put this concept into manufacturing." (Male participant in a consumer products company)
- "Discovered my programming solution may not be perfect in all cases (i.e., I found bugs!) but I'm trying to fix them." (Female participant in a high-tech company)
- "Spent some quality time drawing up an idea on the CAD for a . . . container. I feel that I was able to solve several problems that our team had identified as something the customer may desire. However, I don't hold much hope for serious consideration. [This] idea is somewhat radical, but I feel that, if we are to grow in the . . . market, it will take something totally new." (Male participant in a consumer products company)
-

* Examples are excerpts from participants' daily questionnaire diary narratives and have been edited for confidentiality. Some additional editing, indicated by brackets in the text, was done to correct typographical errors or provide clarification.

As illustrated in table 5, the spontaneously mentioned positive reactions to creativity ranged from mild feelings of pleasure to intense feelings of elation. Sometimes the participant had been unable previously to find a solution or appropriate idea and expressed happiness that the "Eureka" moment had finally come. On other occasions, the reactions were feelings of warmth toward and pride in oneself for coming up with an idea or solving a problem. Direct negative reactions to creative thought events were rare and generally milder, and the reasons for them varied. Of the few instances in which anger followed directly from creative thinking, all were occasions in which the participant felt frustrated by some unfinished aspect of the work, by some technical problem that had cropped up, or by his or her own inability to figure out some vexing aspect of the task. One participant indicated fear following a creative event (in this case, developing a computer program) because she found some errors in her solution. In a few other instances, participants expressed hopelessness about their idea's ultimate adoption or disappointment in themselves for an inelegant solution or for not solving the problem more quickly. Mixed emotions following a creative thought event were extremely rare. Across the 71 event descriptions in which direct emotional reactions were described, only two described both a positive and a negative emotion. In both cases, the primary reaction of joy was tinged with disappointment (e.g., "Yippee! I finally figured why one of the production problems occurred. I was disappointed it took so long but relieved it's over.") Thus, overwhelmingly, when our study's participants reported their direct emotional reaction to a creative thought event, the reaction was one of unalloyed happiness.

Affect as an indirect consequence of creativity. Our qualitative analysis identified an additional 20 narratives in which the participants did not report their immediate reactions to the creative event but did report their emotional response to some intervening event, specifically, the reception that their creative thought received from some other person. In most cases, that other person was a coworker or manager; in a few instances, it was a customer. Not surprisingly, when that person responded positively to the idea, the participant felt pleased. For example, a male participant in a high-tech company reported, "I finally got a chance to talk to [a teammate] about the Customer Administration side of things. He kept responding with 'Good question.' He even liked some of my solutions to problems. This made me feel pretty good."

But such positive sequences were quite rare. In only four of the 20 narratives did participants report positive emotional reactions to others' assessments of their ideas. In the other 16 narratives, participants reported negative emotional reactions to their ideas being rejected or ignored. Most frequently (in 11 of the 16), the participant reported feeling angry, as illustrated by this narrative from a male participant in a consumer products company: "Met with [the Senior Product Manager for the U.S.] to discuss the project. She came across as being very territorial, and completely rejected any ideas I put forth, and shows no interest in working together on projects that are mutually beneficial. This meeting left me

feeling very frustrated.” Similarly, a female participant in a high-tech company reported, “Had a meeting to describe the process we will be going through for the remainder of design. Very frustrated because I was not getting my ideas across. I still don’t feel that the whole team is on the same page.” Finally, there were four narratives in which the creative thought event led indirectly to feelings of sadness. In each instance, the participant’s ideas had been ignored or rejected. For example, as a female participant in a chemicals company reported, “I was disappointed when my suggestion for solving a problem was not even taken into consideration by [two teammates].”

Affect as a concomitant of creativity. The qualitative analysis also uncovered 14 creative thought narratives in which an emotion seemed intertwined with the creative process itself. In 13 of the 14, that emotion was positive. Most often, the described feeling state was mild pleasure in or enjoyment of the creative activity while the participant was engaging in it, although sometimes it was expressed as strong passion for the work. The following are some representative examples:

Today I started designing some new screens for the users to use when they input their data. This is something I haven’t done in a long time and I really enjoyed it. I used to design screens all the time, but since I’ve been in this office, I don’t get to use that skill . . . it must be two years . . . so I had to jog my memory, but it was fun. (A female participant in a high-tech company)

I really enjoy the type of work I was doing today—like solving a great big puzzle and using really great tools to do it. (A female participant in a high-tech company)

Brainstormed some new product ideas for [the gardening tool]. I enjoyed being creative and being directly involved with new product creation again. (A male participant in a consumer products company)

[A teammate] and myself discussed what speeds and controls we needed on the equipment. I made my recommendations on what gear ratios to go with and he turned me loose to go do it. I enjoyed today’s work because of my mechanical background. (A male participant in a chemicals company)

Across the 13 narratives, where the positive affect described by participants appeared as a concomitant of the creative activity, their “work feelings” (Sandelands, 1988) match closely the feeling states associated with intrinsic motivation (Deci and Ryan, 1985; Amabile, 1996): enjoyment of and interest in the work itself, excitement about exercising or increasing competence, and satisfaction in feeling positively challenged.

DISCUSSION

Scholars are still in the early stages of mapping the affect-creativity relationship in organizations. For this reason, we began our study with the aim of broadly exploring the nature, form, and temporal dynamics of that relationship. Our quantitative and qualitative data, collected over long periods of time from people doing creative work in organizations, afforded an unusual opportunity to understand the affect-creativity rela-

tionship. Analyses of these data yielded several insights. First, and most fundamentally, we found consistent evidence of a positive relationship between positive affect and creativity and no evidence of a negative relationship. Despite some prior empirical evidence to the contrary (e.g., Kaufmann and Vosburg, 1997), this basic result matches findings from most previous experimental work on the phenomenon (see Isen, 1999a, 1999b). Significantly, it demonstrates the phenomenon in a setting far different from the experimental laboratories that have served as venues for most research on this question: business organizations, where people do creative thinking to solve problems in their work.

In evaluating the validity of any research findings, it is important to consider the methodology used to generate the results (Campbell, 1969; Singleton and Straits, 1999). This study capitalized on a wide variety of methods to assess both affect and creativity. We relied on peer ratings, as well as coder assessments of daily narratives, to measure creative behavior. Our measurement of affect was likewise multifaceted. We used the pleasantness dimension of the affective circumplex model (Russell, 1980), operationalized by both self-reports and coders' assessments of daily narratives. Given this diversity of measurement, the discovery of a consistent relationship between positive affect and creativity should be taken seriously. This consistency is particularly notable given that it emerged within the complexity of organizational life, where people are engaged in a variety of work activities under ever-changing circumstances.

As described at the outset of this paper, considerable anecdotal and empirical evidence suggests a connection between creativity and clinical illness such as manic-depression (Jamison, 1993). There may be several reasons for the apparent discrepancy between those findings and ours, but the choice of subject populations may be an important one. The evidence on affective illness and creativity comes mostly from the realms of writing and the arts, in which creators work as individuals, with little evidence from the realms in which most of our study's participants worked, team projects in science and engineering (Feist, 1999). The non-clinical nature of our sample may also be relevant. Affective illness may involve processes that, perhaps in combination with cognitive or personality traits, reverse the usual connection between positive affect and creativity (see Mikulincer and Sheffi, 2000, for some empirical evidence).

In our sample of working professionals, participants' daily affect was moderately positive on average, with a mean affect of 4.6 on our 7-point scale of self-rated positive mood. Although it is unlikely that many in the sample were suffering affective illness, negative moods were still frequent enough in these data (i.e., 2,020 days with a mean of less than 4) to allow an examination of the negative affect-creativity hypothesis. Regardless, the results demonstrated that the daily experience of positive, not negative, affect was more commonly associated with creativity, at least within our non-clinical population of knowledge workers.

In this study, we were able to go beyond the sign (positive or negative) of the affect-creativity link to explore the form of the relationship. The results of this exploration suggest a purely linear relationship, at least within the range of affect experienced by the participants in the study. There was no evidence of either a concave or a convex relationship. In addition, emotional lability bore no relationship to creative thought in our data, either when operationalized as variability across the range of negative to positive affect or when operationalized as change from the prior day's affect. Similarly, there was no indication of an ambivalence effect, as we found no evidence that people were more creative when they experienced both positive and negative affect on the same day. Thus, the weight of evidence supports only a linear form of the affect-creativity relationship, in which the more positive a person's affect, the higher his or her creativity in a work setting. Nonetheless, it is possible that, across the full range of human emotional experience and creative activity outside organizational settings, curvilinear effects might still exist. Therefore, future research could usefully explore nonlinearities in more extreme cases, such as very intense positive affect undermining creativity by distracting attention from the problem at hand.

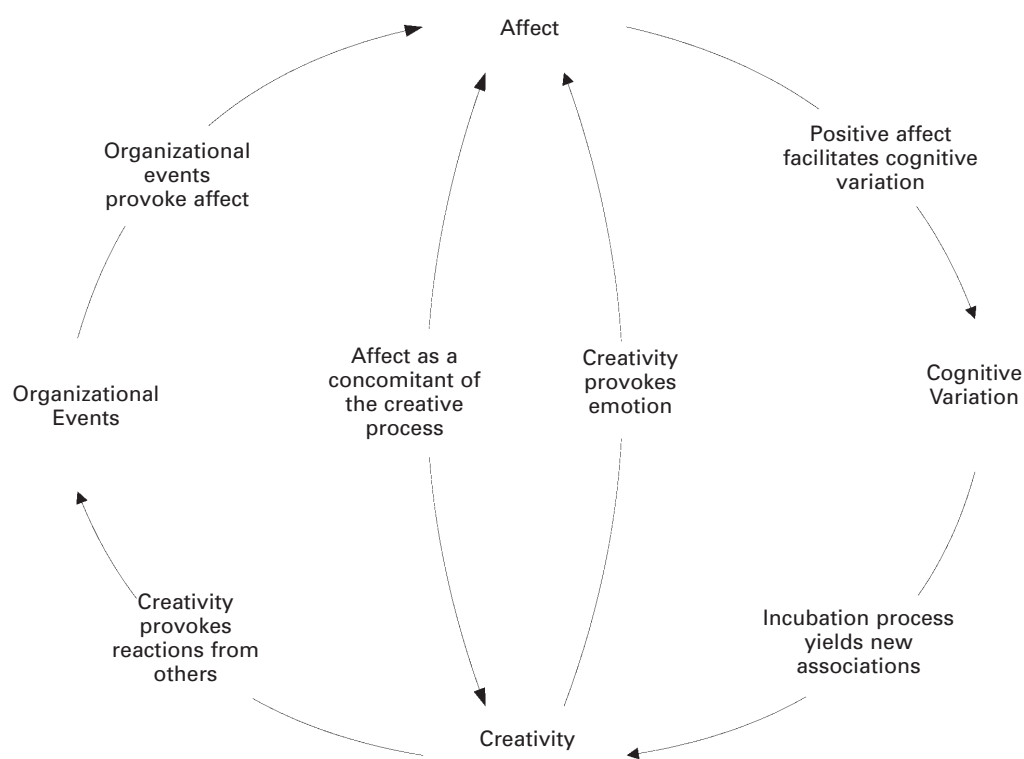
Finally, our exploration of the temporal patterning of affect and creativity, within single days and across days, uncovered evidence of four distinct patterns of influence: affect can operate as an antecedent to creativity; affect can operate as a direct consequence of creativity; affect can operate as an indirect consequence of creativity; and affect can occur simultaneously with creative activity. Thus, it appears that people's feelings and creative cognitions are interwoven in several distinct ways within the complex fabric of their daily work lives.

Toward a Theory of Affect and Creativity in Organizations

This study suggests the outlines of a general theory of affect and creativity in organizations. Rather than attempting a comprehensive listing of all psychological and environmental factors that might play a role in human creativity (e.g., Kaufmann, 2003; James, Brodersen, and Eisenberg, 2004), we constructed a more focused model that would account for the findings of our study, reflect the relevant literature, and serve as a basis for testable hypotheses in future research on creativity in organizations. Figure 1 presents a schematic of the theoretical model. As indicated by its title, we consider the affect-creativity system to be a cycle, whereby influences at any point can begin a dynamic pattern of increasing or decreasing positive affect and creativity. The model incorporates not only a process by which affect influences creativity but also processes by which affect functions as a concomitant of creative activity, a direct consequence of creative thinking, and an indirect consequence of creative thinking.

Positive affect facilitates cognitive variation. The first link in our affect-creativity cycle depicts the influence of positive affect on cognitive variation. Although our study did not specifically assess variation, its inclusion in the model is based on existing theories of affective influences on cogni-

Figure 1. The organizational affect-creativity cycle.



tion and at least indirect support from the results of our study. Fredrickson’s (1998) broaden-and-build theory of positive affect and Isen’s (1999a, 1999b) explanation of affective influences on cognition both suggest that positive feelings at work increase the breadth of cognitive associations that people make as they think about their work. That is, when positive affect increases, the scope of attention broadens and cognitive flexibility increases, increasing the probability that diverse cognitive elements will be associated. Such an increase in variation is depicted in our model as an important mediating process, in line with prior models taking an evolutionary perspective on creativity (Campbell, 1960; Simonton, 1999).

The incubation process. The second link in our model specifies an incubation process (Wallas, 1926; Campbell, 1960; Simonton, 1999), whereby the broadening cognitive associations set in motion by a positive affective state may continue to operate even after that state dissipates. Theoretically, the incubation process could be quite brief, with effects on creative thought manifested the same day. Or it could be a more lengthy process, playing out overnight, over the course of several days, or even over weeks and months. Recent neuroscience studies have demonstrated that learning can be improved, and creative insight fostered, by incubation periods ranging from one night to considerably longer—in the absence of any additional training (Stickgold, James, and Hobson, 2000; Walker et al, 2003; Stickgold and Walker,

2004; Wagner et al., 2004). Given our finding of a next-day (and possibly a second-day) boost in creativity following positive affect, we propose an incubation function that extends to one day and possibly two days but undergoes considerable decay by the third day. Because this is the first empirical evidence on creative thought incubation in the organizational literature, our predictions on the decay function should be considered preliminary at this point.

Creativity provokes emotion. The model's third link proposes that creativity—generating a new idea or solving a complex problem—provokes a direct emotional reaction in the person generating the idea. The small existing literature on this link (Gruber, 1995; Feist, 1999; Shaw, 1999), based primarily on anecdotal reports and non-organizational data, suggests that creativity leads to joy. Our study demonstrates that this effect does in fact appear in organizational settings. Based on our same-day qualitative analysis, we found that getting an idea or solving a problem most often evokes positive emotions, ranging from mild feelings of pleasure or pride to extreme elation or relief. In addition, our analysis revealed that creative activity can occasionally be a negative affective event, evoking feelings of anger when technical difficulties are encountered or one's own cognitive limitations are experienced. In addition, sadness can result from disappointment in the idea or solution or a sense of hopelessness about the idea's eventual adoption.

Our temporal analyses suggest that the impact of creativity on affect is rather immediate and not particularly long-lived. In the qualitative analysis, we discovered only one instance of a respondent reporting a next-day emotional reaction to getting an idea or solving a problem—elation, which he had also reported the previous day, when he got the idea. This absence of next-day reactions is consistent with the null results of our quantitative analysis predicting each day's affect from the prior day's creative thought. It is also consistent with affect theories proposing that discrete events provoke immediate and automatic emotional reactions that are relatively fleeting (Weiss and Cropanzano, 1996; Wilson et al., 2005). Taken together, the results of our qualitative and our quantitative analyses suggest that the emotional reaction to being creative may dissipate quickly, generally by the next day.

The emotionality of the creative process. The affect-creativity model incorporates the possibility that the creative act can be an emotional experience in and of itself (Sandelands, 1988; Csikszentmihalyi, 1996). Such a concomitant effect, depicted in figure 1 with a double-headed link between affect and creativity, did appear occasionally in our qualitative analysis of the diary narratives. People reported feeling passionately involved with their work, deeply interested in it, positively challenged by it, and enjoying it as it was unfolding. Although such reactions are consistent with those ascribed to intrinsic motivation (Deci and Ryan, 1985; Amabile, 1996), prior creativity theory (Amabile, 1988, 1996) has proposed an essentially static relationship between feelings of intrinsic motivation and creativity. Our findings, and our model of the affect-creativity linkage in organizations, suggest a more

dynamic view. The feelings of enjoyment that arise in the course of doing an activity creatively may set up a virtuous cycle of enhanced creativity and enhanced intrinsic enjoyment.

Creativity provokes affective organizational events. The last two links in our model are also somewhat speculative, having their empirical basis in a small number of diary narratives. But, in the context of organizational life, they may be particularly important. The link between creativity and organizational events denotes the possibility that, as individuals communicate their new ideas and problem solutions, they may set off events within the organization. Those events that appeared most prominently in our study were the reactions of others—teammates, peers, or managers—to the creative thought. These reactions, in turn, generally provoked an immediate emotional response in the participant. The nature of this linkage was relatively straightforward. When reactions to a person's ideas were positive, that person felt happy, whereas negative reactions led to feelings of anger or disappointment.

Although this indirect relationship between creativity and affect has not been described in prior literature, it is consistent with the proposition in affective events theory (Weiss and Cropanzano, 1996) that work events provoke affect when they provide positive or negative information relevant to personally important goals. It is also consistent with empirical evidence that, among all of the events that occur in the normal course of organizational life, the receipt of feedback on one's work, positive or negative, is among the most emotionally powerful (Stone and Neale, 1982).

The affect-creativity cycle. As illustrated in figure 1, the affective states that follow from an idea's reception by others in the organization may give rise to subsequent changes in cognition and creativity. When reactions to ideas are encouraging, a virtuous cycle may be established, in which cognitive variation and creativity are subsequently increased. In contrast, if reactions to ideas are negative, the affect-creativity cycle may be truncated. At the extreme, a vicious cycle could ensue, in which the individual is disappointed in his or her own work, and the absence of positive feedback on that work leads to lower levels of positive affect, narrower cognition, and, ultimately, to even lower levels of creativity over time.

An affect-creativity cycle could also be established in the absence of organizational reactions to an individual's ideas and, in fact, even without the individual communicating those ideas to other people. If, as the model proposes, creative thought directly provokes positive emotion in the individual doing the thinking, that positive affect could lead to increased cognitive variation, which, after some period of incubation, may result in further creative thought—and further positive affect. Similarly, if creative thought directly provokes the less-frequent negative emotions we observed, they could set off a cycle of decreasing cognitive variation, diminished creative thought, and decreased positive affect over time. If either cycle were to continue without an intervening force (such as

an organizational event) to interrupt it, a positive or negative spiral could ensue. A recent study has found evidence of upward spirals between positive emotions and effective coping behaviors (Fredrickson and Joiner, 2002), suggesting the possibility of similar spirals between emotions and creativity in the workplace.

Incorporating Affect into Creativity Theories

The phenomena identified in our study and specified in our model point to a more prominent role for affect than currently appears in organizational theories of creativity. Prevailing theories focus on individual personality, skill, and motivation, along with aspects of the work environment (Amabile, 1988, 1996; Woodman, Sawyer, and Griffin, 1993; Ford, 1996). To the extent that affect is included at all, it appears as one of several elements of the motivation for creativity. For example, in the componential theory of organizational creativity, Amabile (1988, 1996) posited that people are most creative when they are intrinsically motivated by their interest in the work itself. Although the intrinsically motivated state is described as a generally pleasant one, the theory's central mechanisms are cognitive rather than affective; affect is not a primary cause of either the motivation or the creativity, nor is it a consequence of creativity. The results of our study, along with those of two other recent studies (George and Zhou, 2002; Madjar, Oldham, and Pratt, 2002), underscore the importance of fully integrating affect into theories of creativity.

Because the model we have specified in figure 1 is quite general, it might extend beyond organizational creativity to creativity in other domains such as the arts and sciences. If positive affect broadens a person's repertoire of cognitions and actions (Frederickson, 1998, 2001), and if this kind of broadening increases variation and novelty in problem solving (Simonton, 1999), then affect may also merit a more prominent place in general theories of the creative process than it has previously occupied. Specifically, we believe that affective processes and their consequences may constitute a logical extension of evolutionary models of creativity (Campbell, 1960; Simonton, 1999). Propositions about the role of affect could therefore help illuminate the mechanisms underlying cognitive variation and selection, as well as add to the list of conditions that increase the probability of useful variation.

Awareness of Affect-Creativity Processes

An intriguing finding that emerged from our qualitative analysis is that participants' narratives rarely mentioned the affective state that preceded a creative thought event. In fact, across all of the 11,471 narratives on the daily questionnaire, there was seldom any description of the person's general mood preceding whatever event was reported in the narrative. It was more common for participants to report an event that happened during the day and then describe the emotional reaction they had to that event. Of the 364 narratives reporting a creative thought, 20 percent mentioned the respondent's emotional reaction to that event, but only 9 percent mentioned a prior affective state.

Given that our lagged quantitative analyses showed that prior positive mood did predict creative thought, why didn't our participants mention their prior mood? It seems unlikely that they were reluctant to describe their affective states, because many narratives contained expressions of either positive or negative emotions. Rather, it seems more likely that they were simply unaware of the influence of mood on their creative thinking. This explanation is consistent with empirical demonstrations that people are typically unaware of what influences their cognitive processes (Nisbett and Wilson, 1977). It is also consistent with affective theory positing that people are considerably more aware of their discrete emotional reactions to particular events than they are of the impact of their general mood states on their thoughts and behaviors (Frijda, 1993). Brief (2001), like others (Zajonc, 1980; Murphy, 2001), has noted the possibility that affective influences may occur outside of awareness, although the study of such effects has received little attention from organizational researchers (Barsade, Brief, and Spataro, 2003).

Future Research

Our study, as well as the affect-creativity model derived from this research, opens a number of broad areas for future research. First among them is how discrete positive and negative emotions relate to creativity. In this study, we used the pleasantness dimension of the affective circumplex model (Russell, 1980) to measure the general state of positive affect. Although many emotion theorists have argued that this evaluative dimension is the key component to emotion (e.g., Lazarus, 1991; Cacioppo and Berntson, 1999), such a pleasantness scale may not have the precision necessary to fully explain the creative experience. To build more nuanced models, future research might focus more than we did in the present study on discrete positive and negative emotions such as joy, love, anger, fear, and sadness (Shaver et al., 1987; Frijda, 1993; Lazarus and Cohen-Charash, 2001) as antecedents, concomitants, and consequences of creativity. Our qualitative analysis uncovered a bit of suggestive evidence on the discrete emotion of task-induced frustration. We identified 15 narratives in which the participant described being frustrated by repeated failures to solve a complex problem, followed by creative thought (often followed by positive emotion). It is possible that, under the particular emotional state of frustration with the task, a person might have heightened motivation to triumph over it and thus allocate more time and effort to the problem. This could, in itself, increase the likelihood of a breakthrough on the problem, a suggestion consistent with some recent research (George and Zhou, 2002).

A second area concerns possible moderators of the affect-creativity relationship. It is quite likely that individual dispositions modify the impact of affect on creativity (Kaufmann, 2003; James, Brodersen, and Eisenberg, 2004). For example, people with highly positive dispositional affect—a relatively stable tendency to experience positive affect in a variety of situations (Watson and Walker, 1996; Watson, 2000)—may be less prone to the cycle proposed in our model. Although such individuals may produce generally higher levels of cre-

ative thought (because of a generally higher level of cognitive variation), they may also be less prone to external influences on their affect. The personality dimension of openness to experience (McCrae, 1987) may also moderate the link between affect and cognitive variation. Prior research has shown that openness to experience—a broad tendency toward unconventionality, intellectual curiosity, imaginativeness, aesthetic sensitivity, and emotional differentiation—facilitates cognitive variation in much the same way as positive affect, leading to higher levels of creativity (Feist, 1998). Therefore, openness could amplify the impact of positive affect on both cognitive variation and creativity.

The broader organizational context constitutes another class of potential moderators. For example, in a work environment rich in constructive and encouraging feedback, a single negative reaction to a creative idea might not provoke a negative emotional reaction. Alternatively, through a contrast effect, it might provoke an even stronger negative emotional reaction. Another potential moderator could be the amount of time pressure in the organization. A work environment with high time pressure might dampen the impact of positive affect on creativity by truncating the incubation process through which cognitive variation yields creative thought. Environments that allow ideas to gestate may be more facilitative of the affect-creativity cycle. These are but a few of the possible moderators that may prove fruitful for further organizational research.

Another area of research revealed by our study is the incubation process. Our free-response measure of creative thought had the advantage of being non-obtrusive. We did not ask participants to report on their creative thoughts (or on any other specific type of event), so as to reduce respondent bias and bolster our confidence in the veridicality of their reports. Yet this conservative approach likely missed many instances of creative thought. It also did not allow us to follow creative ideas closely as they emerged and developed over time. Such a detailed exploration might have been facilitated by a methodology that collected measures specifically on affect and creative thought, several times per day, for fewer days (perhaps two weeks). With this kind of intensive design, future research might be able to pinpoint very specific affective influences on, concomitants of, and consequences of creativity. It might also be possible to identify more precisely the lower and upper bounds of incubation processes in organizations, as well as to examine the role and status of the incubation process in the day-to-day work of organizations.

Finally, there is a need for research into the level or levels at which the affect-creativity cycle operates. Given the nature of our data, derived as they were from independent individual diaries, we focused on the individual level of analysis. Nevertheless, a literature on shared affect in groups and organizations has recently begun to develop, illuminating such processes as emotional contagion among coworkers (Hatfield, Cacioppo, and Rapson, 1994; Kelly and Barsade, 2001). Hence, future research might explore whether the influence of positive affect on creativity generalizes to group and organizational levels. One recent experiment suggests effects at the group level. In that study, induced positive affect had a

positive effect on creative performance in temporary work groups; there was no effect of induced negative affect (Grawitch, Munz, and Kramer, 2003). Thus it is possible that shared positive emotion (Barsade, 2002) or positive morale in groups (George, 1990) might prompt more flexible decision making and wider search behavior, leading to more creative group solutions. At a broader level, organizations with positive affective cultures (Barsade, Brief, and Spataro, 2003) might be more willing to engage in risky ventures, more accepting of minority opinions, and more willing to use decentralized control. Although there already has been some research on the relationship between threats facing an organization (an aversive or negative affective state) and forms of organizational rigidity (Staw, Sandelands, and Dutton, 1981), there have, to our knowledge, been no studies investigating the relationship between affect and innovation at the organizational level.

Some recent work in sociology provides a good foundation for a more macro-level approach to affect and creativity in organizations. Burt (2004) found that people whose social networks span structural holes in their organizations are more likely to produce an idea about a particular organizational problem and more likely to produce an idea judged by top managers as having high value. His explanation for this finding bears a striking conceptual similarity to the evolutionary theories of creativity: spanning structural holes exposes the individual to more, and more diverse, information and perspectives, which can then be brought together in new ways to yield a creative insight. Given evidence from psychology that people are more friendly and sociable when they experience positive affect (Isen, 1999b), it is possible that they may therefore be more likely to talk to a diversity of others across the organization, spanning structural holes and consequently gaining what Burt calls a "vision advantage." Thus, when people and groups experience more positive affect, they might be more likely to gather the cognitive fuel necessary for creative thought.

This study demonstrated that people's subjective experience at work matters, as does the affective side of their organizations, not only because positive affective experience is related to intrapersonal outcomes such as job satisfaction (Judge and Ilies, 2004) but also because it is directly related to how creatively people will think on the job. Although creativity and innovation are often touted as necessary components of organizational performance, scholars' understanding of the creative process and the factors influencing it is still quite limited. We hope that our preliminary model of the affect-creativity cycle will tempt organizational researchers to explore the many questions raised by this work. In addition, as difficult as our data collection and analysis were, we believe that a naturalistic, longitudinal approach presents distinct advantages for extending the empirical knowledge of organizational behavior. For these reasons, we hope that this study will not only help shed new light on affect and creativity in organizations but will also highlight the possibilities and challenges of conducting longitudinal research on the complexities of organizational life. Only through such investigations will we devel-

op an understanding of the connections between how people feel, how they think, and how they perform in work organizations.

REFERENCES

- Abele-Brehm, A.
1992 "Positive and negative mood influences on creativity: Evidence for asymmetrical effects." *Polish Psychological Bulletin*, 23: 203–221.
- Amabile, T. M.
1983 *The Social Psychology of Creativity*. New York: Springer-Verlag.
1988 "A model of creativity and innovation in organizations." In B. M. Staw and L. L. Cummings (eds.), *Research in Organizational Behavior*, 10: 123–167. Greenwich, CT: JAI Press.
1996 *Creativity in Context: Update to the Social Psychology of Creativity*. Boulder, CO: Westview Press.
- Amabile, T. M., R. Conti, H. Coon, J. Lazenby, and M. Herron
1996 "Assessing the work environment for creativity." *Academy of Management Journal*, 39: 1154–1184.
- Amabile, T. M., and J. S. Mueller
2006 "Assessing creativity and its antecedents: An exploration of the componential theory of creativity." In C. Ford (ed.), *Handbook of Creativity*. Mahwah, NJ: Lawrence Erlbaum (in press).
- Amabile, T. M., J. S. Mueller, and S. Archambault
2000 "Detailed event narrative analysis (DENA) coding scheme." Harvard Business School Working Paper #03-080.
- Amabile, T. M., D. Whitney, J. Weinstock, L. Miller, and C. Fallang
1997 "What really happens in creative projects: Event sampling through electronic data collection." Harvard Business School Working Paper #98-036.
- Andreasson, N. C.
1987 "Creativity and mental illness: Prevalence rates in writers and their first-degree relatives." *American Journal of Psychiatry*, 144: 1288–1292.
- Atienza, M., J. L. Cantero, and R. Stickgold
2004 "Posttraining sleep enhances automaticity in perceptual discrimination." *Journal of Cognitive Neuroscience*, 16: 53–64.
- Barrett, L. F.
2004 "Feelings or words? Understanding the content in self-report ratings of experienced emotion." *Journal of Personality and Social Psychology*, 87: 266–281.
- Barsade, S. G.
2002 "The ripple effect: Emotional contagion and its influence on group behavior." *Administrative Science Quarterly*, 47: 644–675.
- Barsade, S. G., A. P. Brief, and S. E. Spataro
2003 "The affective revolution in organizational behavior: The emergence of a paradigm." In J. Greenberg (ed.), *Organizational Behavior: The State of the Science*: 3–51. Mahwah, NJ: Lawrence Erlbaum.
- Barsade, S. G., A. J. Ward, J. D. F. Turner, and J. A. Sonnenfeld
2000 "To your heart's content: The influence of affective diversity in top management teams." *Administrative Science Quarterly*, 45: 802–836.
- Bartel, C. A., and R. Saavedra
2001 "The collective construction of work group moods." *Administrative Science Quarterly*, 45: 197–231.
- Blaney, P. H.
1986 "Affect and memory: A review." *Psychological Bulletin*, 99: 229–246.
- Bower, G.
1981 "Mood and memory." *American Psychologist*, 36: 129–148.
- Brief, A. P.
2001 "Organizational behavior and the study of affect: Keep your eyes on the organization." *Organizational Behavior and Human Decision Processes*, 86: 131–139.
- Brief, A. P., and H. M. Weiss
2002 "Organizational behavior: Affect in the workplace." *Annual Review of Psychology*, 53: 279–307.
- Burt, R. S.
2004 "Structural holes and good ideas." *American Journal of Sociology*, 110: 349–399.
- Cacioppo, J. T., and G. G. Berntson
1999 "The affect system: Architecture and operating characteristics." *Current Directions in Psychological Science*, 8: 133–137.
- Cahill, L., M. Uncapher, L. Kilpatrick, M. T. Alkire, and J. Turner
2004 "Sex-related hemispheric lateralization of amygdala function in emotionally influenced memory: An MRI investigation." *Learning and Memory*, 11: 261–266.
- Campbell, D. T.
1960 "Blind variation and selective retention in creative thought as in other knowledge processes." *Psychological Review*, 67: 380–400.
1969 "Prospective: Artifact and control." In R. Rosenthal and R. L. Rosnow (eds.), *Artifact in Behavioral Research*: 351–382. New York: Academic Press.
- Canli, T., Z. Zhao, J. Brewer, J. Gabrieli, and L. Cahill
2000 "Event-related activation in the human amygdala associates with later memory for individual emotional response." *Journal of Neuroscience*, 20: RC99.
- Cardy, R. L., and G. H. Dobbins
1986 "Affect and appraisal accuracy: Liking as an integral dimension in evaluating performance." *Journal of Applied Psychology*, 71: 672–678.
- Carnevale, P. J., and A. M. Isen
1986 "The influence of positive affect and visual access on the discovery of integrative solutions in bilateral negotiation." *Organizational Behavior and Human Decision Processes*, 37: 1–13.

- Clore, G.L., N. Schwarz, and M. Conway**
1994 "Cognitive causes and consequences of emotion." In R. S. Wyer and T. K. Srull (eds.), *Handbook of Social Cognition*: 323-417. Hillsdale, NJ: Lawrence Erlbaum.
- Csikszentmihalyi, M.**
1975 *Beyond Boredom and Anxiety*. San Francisco: Jossey-Bass.
1996 *Creativity: Flow and the Psychology of Discovery and Invention*. New York: Harper-Collins.
- Csikszentmihalyi, M., and R. W. Larson**
1987 "Validity and reliability of the experience-sampling method." *Journal of Nervous and Mental Disease*, 175: 526-536.
- Deci, E. L., and R. M. Ryan**
1985 *Intrinsic Motivation and Self-determination in Human Behavior*. New York: Plenum Press.
- Emmons, R. A.**
1987 "Narcissism: Theory and measurement." *Journal of Personality and Social Psychology*, 52: 11-17.
- Estrada, C.A., A. Isen, and M. J. Young**
1994 "Positive affect improves creative problem solving and influences reported source of practice satisfaction in physicians." *Motivation and Emotion*, 18: 285-299.
- Feist, G. J.**
1994 "Affective consequences of insight in art and science students." *Cognition and Emotion*, 8: 489-502.
1999 "Affect in artistic and scientific creativity." In S. W. Russ (ed.), *Affect, Creative Experience, and Psychological Adjustment*: 93-109. Philadelphia: Brunner/Mazel.
- Feist, G. J.**
1998 "A meta-analysis of personality in scientific and artistic creativity." *Personality and Social Psychology Review*, 2: 290-309.
- Fiedler, K., and J. P. Forgas**
1988 *Affect, Cognition, and Social Behavior: New Evidence and Integrative Attempts*. Lewiston, NY: C. J. Hogrefe.
- Fineman, S.**
1993 "Organizations as emotional arenas." In S. Fineman (ed.), *Emotion in Organizations*: 9-35. London: Sage.
- Fong, C.**
2003 "The effects of emotional ambivalence on creativity." Unpublished dissertation, Stanford University.
- Ford, C. M.**
1996 "A theory of individual creative action in multiple social domains." *Academy of Management Review*, 21: 1112-1142.
- Forgas, J. P.**
2001 "Introduction: Affect and social cognition." In J. P. Forgas (ed.), *Handbook of Affect and Social Cognition*: 1-24. Mahwah, NJ: Lawrence Erlbaum.
- Frederickson, B. L.**
1998 "What good are positive emotions?" *Review of General Psychology*, 2: 300-319.
2001 "The role of positive emotions in positive psychology." *American Psychologist*, 56: 218-226.
- Frederickson, B. L., and T. Joiner**
2002 "Positive emotions trigger upward spirals toward emotional well-being." *Psychological Science*, 13: 172-175.
- Fridja, N. H.**
1986 *The Emotions*. New York: Cambridge University Press.
1993 "Moods, emotion episodes and emotions." In M. Lewis and J. M. Haviland (eds.), *Handbook of Emotions*: 381-403. New York: Guilford Press.
- Fridja, N., and B. Mesquita**
1994 "The social roles and functions of emotions." In S. Kitayama and H. R. Markus (eds.), *Emotion and Culture: Empirical Studies of Mutual Influence*: 51-87. Washington, DC: American Psychological Association.
- Gaab, N., M. Paetzold, M. Becker, M. P. Walker, and G. Schlaug**
2004 "The influence of sleep on auditory learning: A behavioral study." *Neuroreport*, 15: 731-734.
- George, J. M.**
1990 "Personality, affect, and behavior in groups." *Journal of Applied Psychology*, 75: 107-116.
- 1991 "State or trait: Effects of positive mood on prosocial behaviors at work." *Journal of Applied Psychology*, 76: 229-307.
- George, J. M., and J. Zhou**
2002 "Understanding when bad moods foster creativity and good ones don't: The role of context and clarity of feelings." *Journal of Applied Psychology*, 87: 687-697.
- Grawitch, M. J., D. C. Munz, and T. J. Kramer**
2003 "Effects of member mood states on creative performance in temporary workgroups." *Group Dynamics: Theory, Research and Practice*, 7: 41-54.
- Gruber, H.E.**
1995 "Insight and affect in the history of science." In R. J. Sternber and J. E. Davidson (eds.), *The Nature of Insight*: 397-431. Cambridge, MA: MIT Press.
- Gulliksen, H.**
1987 *Theory of Mental Tests*. Hillsdale, NJ: Lawrence Erlbaum.
- Hatfield, E., J. T. Cacioppo, and R. L. Rapson**
1994 *Emotional Contagion*. Paris: Cambridge University Press.
- Hirt, E. R., G. M. Levine, H. E. McDonald, R. J. Melton, and L. L. Martin**
1997 "The role of mood in quantitative and qualitative aspects of performance: Single or multiple mechanisms?" *Journal of Experimental Social Psychology*, 33: 602-629.
- Hirt, E. R., R. J. Melton, H. E. McDonald, and J. M. Harackiewicz**
1996 "Processing goals, task interest, and the mood-performance relationship: A mediational analysis." *Journal of Personality and Social Psychology*, 71: 245-261.
- Isen, A.**
1999a "On the relationship between affect and creative problem solving." In S. W. Russ (ed.), *Affect, Creative Experience and Psychological Adjustment*: 3-18. Philadelphia: Brunner/Mazel.
1999b "Positive affect." In T. Dagleish and M. Power (eds.), *Handbook of Cognition and Emotion*: 521-539. New York: Wiley.

- Isen, A., P. Niedenthal, and N. Cantor
1992 "The influence of positive affect on social categorization." *Motivation and Emotion*, 16: 65-78.
- Isen, A. M., and K. A. Daubman
1984 "The influence of affect on categorization." *Journal of Personality and Social Psychology*, 47: 1206-1217.
- Isen, A. M., K. A. Daubman, and G. P. Nowicki
1987 "Positive affect facilitates creative problem solving." *Journal of Personality and Social Psychology*, 52: 1122-1131.
- Isen, A. M., M. S. Johnson, E. Mertz, and G. F. Robinson
1985 "The influence of positive affect on the unusualness of word associations." *Journal of Personality and Social Psychology*, 48: 1413-1426.
- James, K., M. Brodersen, and J. Eisenberg
2004 "Workplace affect and workplace creativity: A review and preliminary model." *Human Performance*, 17: 169-194.
- Jamison, K. R.
1989 "Mood disorders and patterns of creativity in British writers and artists." *Psychiatry*, 52: 125-134.
1993 *Touched with Fire: Manic-depressive illness and the Artistic Temperament*. New York: Free Press.
1995 "Manic-depressive illness and creativity." *Scientific American*, 272: 62.
- Jausovec, N.
1989 "Affect in analogical transfer." *Creativity Research Journal*, 2: 255-266.
- Judge, T. A., and R. Ilies
2004 "Affect and job satisfaction: A study of their relationship at work and at home." *Journal of Applied Psychology*, 89: 661-673.
- Kahneman, D., A. B. Krueger, D. A. Schkade, N. Schwarz, and A. A. Stone
2004 "A survey method for characterizing daily life experience: The day reconstruction method." *Science Magazine*, 306: 1776-1780.
- Karni, A., D. Tanne, B. S. Rubenstein, J. J. Ashkanasy, and D. Sagi
1994 "Dependence on REM sleep of overnight improvement of a perceptual skill." *Science*, 265: 679-682.
- Kaufmann, G.
2003 "Expanding the mood-creativity equation." *Creativity Research Journal*, 15: 131-135.
- Kaufmann, G., and S. K. Vosburg
1997 "Paradoxical effects of mood on creative problem solving." *Cognition and Emotion*, 11: 151-170.
- Kelly, J. R., and S. G. Barsade
2001 "Mood and emotions in small groups and work teams." *Organizational Behavior and Human Decision Processes*, 86: 99-130.
- Langley, P., and R. Jones
1988 "A computational model of scientific insight." In R. J. Sternberg (ed.), *The Nature of Creativity: Contemporary Psychological Perspectives*: 171-201. Cambridge: Cambridge University Press.
- Larsen, R. J., and E. Diener
1992 "Promises and problems with the circumplex model of emotion." In M. S. Clark (ed.), *Emotion: Review of Personality and Social Psychology*: 25-59. Thousand Oaks, CA: Sage.
- Larsen, R. J., E. Diener, and R. A. Emmons
1986 "Affective intensity and reactions to daily life events." *Journal of Personality and Social Psychology*, 41: 803-814.
- Lazarus, R. S.
1991 *Emotion and Adaptation*. Oxford: Oxford University Press.
- Lazarus, R. S., and Y. Cohen-Charash
2001 "Discrete emotions in organizational life." In R. Payne and C. L. Cooper (eds.), *Emotions in Organizations*: 48-81. Chichester, UK: Wiley.
- Ludwig, A. M.
1992 "Creative achievement and psychopathology: Comparison among professions." *American Journal of Psychotherapy*, 46: 330-356.
- Madjar, N., G. R. Oldham, and M. G. Pratt
2002 "There's no place like home? The contributions of work and nonwork creativity support to employees' creative performance." *Academy of Management Journal*, 45: 757-767.
- Maquet, P., S. Laureys, P. Peigneux, S. Fuchs, C. Petiau, C. Phillips, J. Aerts, G. Del Fiore, C. Dagueldre, T. Meulemans, F. Luxen, C. Der Linden, M. Smith, and A. Cleeremans
2000 "Experience-dependent changes in cerebral activation during human REM sleep." *Nature Neuroscience*, 3: 831-836.
- Maquet, P., and P. Ruby
2004 "Insight and the sleep committee." *Nature*, 427: 304-305.
- Martin, L. L., D. W. Ward, J. W. Achée, and R. S. Wyer
1993 "Mood as input: People have to interpret the motivational implications of their moods." *Journal of Personality and Social Psychology*, 64: 317-326.
- Martindale, C.
1999 "Biological basis of creativity." In R. J. Sternberg (ed.), *Handbook of Creativity*: 137-152. Cambridge: Cambridge University Press.
- Mazzarello, P.
2000 "What dreams may come?" *Nature*, 408: 523.
- McCrae, R. R.
1987 "Creativity, divergent thinking, and openness to experience." *Journal of Personality and Social Psychology*, 52: 1258-1265.
- Mikulincer, M., and E. Sheffi
2000 "Adult attachment style and cognitive reactions to positive affect: A test of mental categorization and creative problem solving." *Motivation and Emotion*, 24: 149-174.
- Murphy, S. T.
2001 "Feeling without thinking: Affective primacy and the nonconscious processing of emotion." In J. A. Bargh and K. K. Apsley (eds.), *Unraveling the Complexities of Social Life: A Festschrift in Honor of Robert B. Zajonc*: 39-53. Washington, DC: American Psychological Association.
- Murray, N., H. Sujan, E. R. Hirt, and M. Sujan
1990 "The influence of mood on categorization: A cognitive flexibility interpretation." *Journal of Personality and Social Psychology*, 59: 411-425.

- Nisbett, R. E., and T. Wilson**
1977 "Telling more than we can know: Verbal reports on mental processes." *Psychological Review*, 84: 231–259.
- Oatley, D., and J. M. Jenkins**
1996 *Understanding Emotions*. Cambridge, MA: Blackwell.
- Oldham, G. R., and A. Cummings**
1996 "Employee creativity: Personal and contextual factors at work." *Academy of Management Journal*, 39: 607–634.
- Poincare, H.**
1921 *The Foundations of Science: Science and Hypothesis, the Value of Science, and Science and Method*. New York: Science Press.
- Post, F.**
1996 "Verbal creativity, depression and alcoholism: An investigation of one hundred American and British writers." *British Journal of Psychiatry*, 168: 545–555.
- Prentky, R.**
1989 "Creativity and psychopathology: Gambling at the seat of madness." In J. A. Glover et al. (eds.), *Handbook of Creativity: Perspectives on Individual Differences*: 243–269. New York: Plenum Press.
- Puccio, G. H., and M. C. Murdock**
1999 *Creativity Assessment: Readings and Resources*. Buffalo, NY: Creative Education Foundation.
- Richards, R.**
1994 "Creativity and bipolar mood swings: Why the association?" In M. P. Shaw and M. A. Runco (eds.), *Creativity and Affect*: 127–146. Norwood, NJ: Ablex.
- Rothenberg, A.**
1990 *Creativity and Madness: New Findings and Old Stereotypes*. Baltimore, MD: Johns Hopkins University Press.
- Russell, J. A.**
1980 "A circumplex model of affect." *Journal of Personality and Social Psychology*, 39: 1161–1178.
- Russell, J. A., and L. F. Barrett**
1999 "Core affect, prototypical emotional episodes, and other things called emotion: Dissecting the elephant." *Journal of Personality and Social Psychology*, 76: 805–819.
- Sandelands, L. E.**
1988 "The concept of work feeling." *Journal for the Theory of Social Behavior*, 18: 437–457.
- Shaver, P., J. Schwartz, D. Kirson, and C. O'Connor**
1987 "Emotion knowledge: Further exploration of a prototype approach." *Journal of Personality and Social Psychology*, 52: 1061–1086.
- Shaw, E. D., J. Mann, P. E. Stokes, and A. Manevitz**
1986 "Effect of lithium carbonate on associative productivity and idiosyncrasy in bipolar outpatients." *American Journal of Psychiatry*, 143: 1166–1169.
- Shaw, M. P.**
1999 "On the role of affect in scientific discovery." In S. W. Russ (ed.), *Affect, Creative Experience, and Psychological Adjustment*: 147–164. Philadelphia: Brunner/Mazel.
- Simonton, D. K.**
1988 *Scientific Genius: A Psychology of Science*. Cambridge: Cambridge University Press.
1999 *Origins of Genius: Darwinian Perspectives on Creativity*. New York: Oxford University Press.
2003 "Scientific creativity as constrained stochastic behavior: The integration of product, person, and process perspectives." *Psychological Bulletin*, 129: 475–494.
- Singer, J. D.**
1998 "Using SAS PROC MIXED to fit multilevel models, hierarchical models, and individual growth models." *Journal of Educational and Behavioral Statistics*, 23: 323–355.
- Singleton, R. A., and B. C. Straits**
1999 *Approaches to Social Research*, 3rd ed. New York: Oxford University Press.
- Staw, B. M., and S. G. Barsade**
1993 "Affect and managerial performance: A test of the sadder-but-wiser vs. happier-and-smarter hypotheses." *Administrative Science Quarterly*, 38: 304–331.
- Staw, B. M., L. E. Sandelands, and J. E. Dutton**
1981 "Threat-rigidity effects in organizational behavior: A multilevel analysis." *Administrative Science Quarterly*, 26: 501–524.
- Staw, B. M., R. I. Sutton, and L. H. Pelled**
1994 "Employee positive emotion and favorable outcomes at the workplace." *Organization Science*, 5: 51–71.
- Sternberg, R. J.**
1988a *The Nature of Creativity: Contemporary Psychological Perspectives*. Cambridge: Cambridge University Press.
1988b "A three-facet model of creativity." In R. J. Sternberg (ed.), *The Nature of Creativity: Contemporary Psychological Perspectives*: 125–147. Cambridge: Cambridge University Press.
- Stickgold, R., L. James, and A. J. Hobson**
2000 "Visual discrimination learning requires sleep after training." *Nature Neuroscience*, 3: 1237–1238.
- Stickgold, R., L. Scott, C. Rittenhouse, and J. Hobson**
1999 "Sleep-induced changes in associative memory." *Journal of Cognitive Neuroscience*, 11: 182–193.
- Stickgold, R., and M. Walker**
2004 "To sleep, perchance to gain creative insight?" *Trends in Cognitive Sciences*, 8: 191–192.
- Stone, A. A., and J. M. Neale**
1982 "Development of a methodology for assessing daily experiences." In A. Baum and J. Singer (eds.), *Advances in Environmental Psychology*, vol. 4: Environment and Health: 49–83. Mahwah, NJ: Lawrence Erlbaum.
- Talarico, J. M., K. S. LaBar, and D. C. Rubin**
2004 "Emotional intensity predicts autobiographical memory experience." *Memory and Cognition*, 32: 1118–1132.
- Toplyn, G., and W. Maguire**
1991 "The differential effect of noise on creative task performance." *Creativity Research Journal*, 4: 337–347.
- Totterdell, P.**
2000 "Catching moods and hitting runs: Mood linkage and subjective performance in professional sport teams." *Journal of Applied Psychology*, 85: 848–859.
- Vernon, P. E.**
1970 *Creativity*. Middlesex, UK: Penguin Books.

- Vosburg, S. K.**
1998 "The effects of positive and negative mood on divergent thinking performance." *Creativity Research Journal*, 11: 165-172.
- Waddell, C.**
1998 "Creativity and mental illness: Is there a link?" *Canadian Journal of Psychiatry*, 43: 166-172.
- Wagner, U., S. Gais, H. Haider, R. Verleger, and J. Born**
2004 "Sleep inspires insight." *Nature*, 427: 352-355.
- Walker, M. P., T. Brakefield, J. Seidman, A. Morgan, J. Hobson, and R. Stickgold**
2003 "Sleep and the time course of motor skill learning." *Learning and Memory*, 10: 275-284.
- Wallas, G.**
1926 *The Art of Thought*. New York: Harcourt, Brace.
- Watson, D.**
2000 *Mood and Temperament*. New York: Guilford Press.
- Watson, D., L. A. Clark, and A. Tellegen**
1988 "Development and validation of brief measures of positive and negative affect: The PANAS scales." *Journal of Abnormal and Social Psychology*, 54: 1063-1070.
- Watson, D., and L. M. Walker**
1996 "The long term stability and predictive validity of trait measures of affect." *Journal of Personality and Social Psychology*, 70: 567-577.
- Weisberg, R. W.**
1988 "Problem solving and creativity." In R. J. Sternberg (ed.), *The Nature of Creativity: Contemporary Psychological Perspectives*: 148-176. Cambridge: Cambridge University Press.
- Weiss, H. M., and R. Cropanzano**
1996 "Affective events theory: A theoretical discussion of the structure, causes and consequences of affective experiences at work." In B. M. Staw and L. L. Cummings (eds.), *Research in Organizational Behavior*, 18: 1-74. Greenwich, CT: JAI Press.
- Wilson, T. D., D. B. Centerbar, D. A. Kramer, and D. T. Gilbert**
2005 "The pleasures of uncertainty: Prolonging positive moods in ways people do not anticipate." *Journal of Personality and Social Psychology*, 88: 5-21.
- Woodman, R. W., J. W. Sawyer, and R. W. Griffin**
1993 "Toward a theory of organizational creativity." *Academy of Management Review*, 18: 293-321.
- Wright, T. A., and B. M. Staw**
1999 "Affect and favorable work outcomes: Two longitudinal tests of the happy-productive worker thesis." *Journal of Organizational Behavior*, 20: 1-23.
- Yerkes, R. M., and J. D. Dodson**
1908 "The relation of strength of stimulus to rapidity of habit-formation." *Journal of Comparative Neurology and Psychology*, 18: 459-482.
- Zajonc, R. G.**
1980 "Feeling and thinking: Preferences need no inferences." *American Psychologist*, 35: 151-175.