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TAKING THE GOOD WITH THE BAD: THE IMPACT OF FORECASTING TIMING AND VALENCE ON IDEA EVALUATION AND CREATIVITY

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TAKING THE GOOD WITH THE BAD: THE IMPACT OF FORECASTING TIMING AND VALENCE ON IDEA EVALUATION AND CREATIVITY

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF PSYCHOLOGY

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I graciously dedicate this dissertation to my mom, Marsha. Thank you for your unwavering support, encouragement, and love. What a journey it's been. I love you.

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Abstract

Forecasting is an integral component to idea evaluation and has been shown to positively impact creative performance. However, less is known about what set of conditions, namely forecasting timing and valence, maximizes the impact that forecasting has on creative performance. Along related lines, much is unknown about how quality and originality standards applied in idea evaluation interact with forecasting approaches to impact forecasting performance, idea evaluation, and creativity. In the present study, undergraduates were asked to take on the role of a restaurant development consultant and to develop a plan for a new restaurant concept. Participant forecast quality and extensiveness, idea evaluation quality, depth and range, and final plan quality, originality, and elegance were evaluated. Before formulating final plans, participants were asked to forecast either positive, negative, or both positive and negative outcomes of their generated ideas either as each individual idea was generated or after the final list of potential ideas had been generated. Then, participants evaluated each of their ideas with respect to quality or originality standards. It was found that forecasting both positive and negative outcomes during idea generation improves forecasting performance, idea evaluation, and plan elegance. The implications of these findings for understanding forecasting and creative problem solving are discussed.

Introduction

Creative achievement depends not only on the ideas that are generated but also, and perhaps more centrally, on the evaluation of these ideas (Baer, 2003; Basadur, 1995; Licuanan, Dailey, & Mumford, 2006; Runco & Smith, 1992). Moreover, the process of evaluating ideas may be one which requires reshaping and reformulating ideas to ensure successful implementation (Frankwick, Walker, & Ward, 1994; Lonergan, Scott, and Mumford, 2004). Despite the criticality of idea evaluation to creative performance, far less is known about idea evaluation and other late-stage creative processes compared to their early-stage creative process counterparts (Mumford & Gustafson, 1988; Runco & Chand, 1994).

An integral component of idea evaluation is forecasting, or the mental stimulation of future outcomes of ideas (Mumford, Lonergan, & Scott, 2002). Forecasting has been shown to spur further creative thought because a wider range of consequences is considered during the evaluation and revision process (Byrne, Shipman, & Mumford, 2010). While the extensiveness of forecasting has been shown to contribute to solving complex, novel, and ill-defined problems (Lonergan et al., 2004; Lubart, 2001; Mumford, Schultz, & VanDoorn, 2001), little is known about the specifics of this extensiveness. More specifically, little is known about how forecasting approaches, such as timing and valence, impact forecasting extensiveness and overall forecast quality. Furthermore, past studies have demonstrated that idea evaluation standards impact creative performance (Blair & Mumford, 2007; Mumford et al., 2002), yet it is unknown exactly how these standards interact with various forecasting

approaches. Thus, the intent of the present effort is to investigate how forecasting and idea evaluation influence the refinement of creative ideas and creative problem solving.

Forecasting Characteristics

Forecasting is a cognitive activity used during the idea evaluation process that contributes to the production of creative solutions characterized by quality, originality, and elegance (Byrne, Shipman, & Mumford, 2010). Specifically, forecasting involves the mental simulation of future actions and envisioning the outcomes of these actions (Byrne et al., 2010; Doerner & Schaub, 1994). Past work suggests that the extensiveness and quality of forecasts contribute to idea evaluation and creative problem solving (Lonergan et al., 2004; Byrne et al., 2010). This is likely because considering a wider range of situations and outcomes during forecasting will result in a wider range of implications being taken into account when revising potentially viable ideas.

The findings of Byrne, Shipman, and Mumford (2010) indicate that more extensive forecasts result in more robust plans. In their study, participants were asked to formulate advertising campaigns for a new product. Before developing these campaigns, participants forecasted the implications of their ideas and the effects of a plan for implementing their best idea. Results showed that the extensiveness of forecasts of both ideas and plans were strongly related to the creativity of the proposed advertising campaigns. Forecasting extensiveness not only allows people to identify the contingencies, resources, and restrictions bearing on the viability of an idea, but it also allows for potential problems to be taken into account when revising an idea. Furthermore, the extensiveness of forecasting allows for the development of backup

plans (Patalano & Seifert, 1997; Xiao, Migram, & Doyle, 1997) that allow people to work around potential barriers to implementation.

Other studies examining performance of a managerial consulting task (Marta, Leritz, & Mumford, 2005) and performance in planning an experimental secondary school (Osburn & Mumford, 2006) have also suggested that both the quality and extensiveness of forecasting is strongly related to creative problem solving performance. Based on these findings, forecasting provides value to performance on tasks requiring complex problem solving. While some prior research has demonstrated the importance of forecasting to creative performance, only a limited number of studies examining a limited number of contexts have examined this relationship. Hence, hypothesis one:

Hypothesis 1: Characteristics of forecasting, namely extensiveness and quality, will improve creative performance.

Forecasting Approaches

Forecasting Valence. Beyond acknowledging the impact that forecasting has on creative performance, the question remains as to what set of conditions maximize the impact that forecasting has on creative performance. Assuming that forecasting characteristics, such as extensiveness and quality, influence creative performance, manipulating the way people think about and engage in forecasting may further contribute to creative performance. Thus, whereas forecasting characteristics involve the outcomes of forecasting (e.g., more extensive forecasts), forecasting approaches involve how people think about and engage in forecasting (e.g., more positive forecasts). When the characteristics of forecasting are difficult to control, the approach

people take when forecasting may be more readily directed. One such condition, forecasting valence, may prove of value to forecasting performance, idea evaluation, and creative problem solving. People tend to generate too few or too simple of outcomes when forecasting (Doerner & Schaub, 1994), so interventions intended to encourage more elaborate and directed forecasts may contribute to better performance.

Forecasting positive and negative outcomes may uniquely contribute to a range of considerations when evaluating and revising ideas. However, a mixed set of findings has been found with respect to the valence of forecasts. Specifically, considering the positive outcomes of an idea results in engagement and active analysis of the idea, allowing people to generate more accurate appraisals of outcomes (Dailey & Mumford, 2006). Put differently, positive forecasting helps people approach ideas in an open fashion and consider the value of ideas, even ideas that may initially seem extreme. As a function of being more willing to work with ideas, people may be more likely to identify potential problems inherent to the new idea during idea evaluation.

Blair and Mumford (2007) have provided some initial evidence for this claim. This study examined the attributes that impacted people's willingness to support new ideas. It was found that people had a tendency to prefer easily implemented, proximal ideas and to reject risky, original ideas. Therefore, it seems reasonable to suggest that positive forecasts may prevent premature rejection of novel ideas given the tendency for people to screen out highly risky and original ideas. Engaging in positive forecasting may also enhance the tendency for people to accept and work with ideas that can be easily implemented (Blair & Mumford, 2007).

Forecasting negative outcomes may also prove of value. People have a tendency to overestimate the likelihood of success of positively-valenced outcomes (Schwenk & Thomas, 1983). By placing too much focus on positive outcomes, failure to consider obstacles may result. Self-enhancing tendencies exist when evaluating the likelihood of success of one's own ideas, which may result in less accurate and lower quality forecasts, lead people to fail to revise their ideas (Dailey & Mumford, 2006). By forecasting negative outcomes, premature discounting of barriers to success may be avoided. Furthermore, projecting negative outcomes may stimulate a wider range of ideas and facilitate the revision of deficient ideas. Given the benefits of both positive and negative forecasts, the question remains as to whether or not simultaneously engaging in both positive and negative forecasting or exclusively engaging in only negative or positive forecasting will prove more beneficial to forecasting performance, idea evaluation, and creative problem solving.

Forecasting Timing. Another condition of forecasting, timing, may increase performance on forecasting, idea evaluation, and creative problem solving. Because forecasting is a cognitively demanding and resource intensive process (Mumford, Steele, McIntosh, & Mulhearn, 2015), the timing in which forecasting occurs during the generative and evaluative stages of the creative process may reduce these demands, thereby improving creative performance (Mumford, Mobley, Uhlman, Reiter-Palmon, & Doares, 1991). Because idea generation and evaluation are iterative processes (Basadur, Runco, & Vega, 2000), incorporating forecasting activities during different time points may differentially impact forecasting performance itself, in addition to idea evaluation and creative performance.

Forecasting during idea generation as each individual idea is generated or forecasting after idea generation once the entire pool of ideas has been generated may have different implications for the way in which these ideas are evaluated and revised. For instance, considering a wider range of information and contingencies as each idea is generated may facilitate greater depth of processing of each idea. Put differently, considering the complex contingencies of each idea once an entire pool of ideas has been generated may be too resource intensive and result in cognitive errors (Doerner & Schaub, 1994). Being able to build off of the forecasts of a previously generated idea may stimulate the production of higher quality and more original subsequent generated ideas. However, no research to date has examined the impact that the timing of forecasting has on idea evaluation and creative performance. Hence, the research questions:

Research Question 1: Do forecasting approaches, namely timing and valence, influence forecasting performance?

Research Question 2: Do forecasting approaches, namely timing and valence, influence the nature of idea evaluations?

Research Question 3: Do forecasting approaches, namely timing and valence, influence creative performance?

Idea Evaluation Approaches

Evaluation Standards. During the idea evaluation process, ideas are evaluated with respect to a set of certain standards, and revisions are made to these ideas based on these standards (Mumford, Lonergan, & Scott, 2002). Idea evaluation supports creative problem solving by fostering the exploration of information and idea refinement

(Licuanan, Dailey, & Mumford, 2006; Mumford et al., 2002). Contextual reappraisal allows for the reshaping of ideas to more accurately and appropriately fit to the context of the problem at hand (Csikszentmihalyi, 1999). Some initial evidence for this claim has been provided by Lonergan, Scott, and Mumford (2004). In their study, participants were asked to appraise a set of proposal ideas for a new advertising campaign that varied in terms of quality and originality of ideas. Results from this study showed that stronger plans were obtained when participants applied originality standards to ideas with high quality and when participants applied quality standards to ideas with high originality. This suggests that, when ideas are evaluated to a set of standards, revisions are made to these ideas which enhances the effectiveness of creative problem solving.

When discussing standards to be applied to idea evaluation, quality and originality standards come to fore. Quality standards are those characterized by appropriateness and practicality, whereas originality standards are those characterized by novelty and risk. Ideas tend to be initially appraised with respect to appropriateness and subsequently on originality (Bink & Marsh, 2000; Runco, Okuda, & Thurstone, 1987). Evidence by Lonergan and colleagues (2004) has shown that, when starting with highly original ideas, quality standards are useful in providing a compensatory basis for revision because of the expectation that these riskier ideas will be deficient.

In contrast to quality standards, originality standards are best when originality is underestimated because the information bearing on originality is not typical or readily accessible (Estes & Ward, 2002; Scott, Lonergan, & Mumford, 2005). Furthermore, Lonergan and colleagues (2004) have also demonstrated that, when starting with less original ideas, originality standards provide a basis for compensatory revisions. Put

differently, people may undervalue the originality of highly novel ideas, and active analysis of the implications of these highly original ideas may prompt people to recognize the emergent implications of these ideas (Licuanan, et al., 2007). Thus, getting people to think about and work with atypical ideas may serve to enhance creative performance. While the benefits of imposing quality or originality standards have been shown to improve performance on idea evaluation, examining these standards in tandem with various forecasting approaches has not been studied in the literature. Hence, the research question:

Research Question 4: Do idea evaluation standards influence creative performance?

Method

Sample

The sample used to answer these research questions consisted of 275 undergraduates attending a large southwestern university. The 179 women and 93 men, 3 gender unreported, who agreed to participate in this study were recruited from undergraduate psychology classes providing credit for participation in experimental studies. Those interested in the course credit reviewed a website where a brief description of available studies was provided. They then selected the study, or studies, in which they wished to participate. The average age of those who agreed to participate in the present study was 19. The average ACT score was 25.73, and the average overall grade point average (GPA) was 3.43, suggesting above average academic ability for freshmen entering four-year institutions.

General Procedures

Participants were recruited to participate in a study of restaurant development. Upon entering the classroom where the study took place, participants were assigned to one of 12 experimental conditions (i.e., 2x3x2 design) with pre-prepared packets of study materials, including paper and pencils. Trained undergraduate research assistants administered study materials and were blind to the details of experimental conditions. During the first part of this study, after completing a consent form, participants were asked to complete a set of timed covariate measures examining relevant cognitive abilities. Next, participants were asked to complete the experimental task that involved developing a proposal for a new restaurant. Then, participants were asked to complete a demographic form and a set of untimed covariate control measures and were then debriefed.

Covariates

Merrifield, Guilford, Christensen, and Frick's (1962) consequences test was used to assess creative capacity. In this timed measure of divergent thinking, participants were presented with five unique scenarios, such as "what would happen if people lost the ability to read and write?" or "what would happen if gravity were cut in half?". For each scenario, participants were asked to list as many consequences that they could think of in two minutes. Participant responses were coded for fluency and flexibility, where fluency was operationalized as the average number of consequences produced in response to each question and where flexibility was operationalized as the average number of categories of ideas. The measure yields an internal consistency coefficient of .70. Merrifield et al., (1962) and Mumford, Marks, Connelly, Zaccaro,

and Johnson (1988) have provided evidence for the construct and criterion-related validity of this measure.

Intelligence was measured as a control variable because creativity is an activity that requires significant cognitive effort and prior research has demonstrated evidence of a moderate positive between creative performance and intelligence (Mumford & Gustafson, 1988). As a measure of intelligence, participants were asked to complete Ruch and Ruch's (1980) Employee Aptitude Survey (EAS) of verbal reasoning. This intelligence measure consists of 30 items that presents four to five factual statements. Participants were asked to indicate whether or not the statement conclusions were true or false. This measure produces retest reliabilities above .80. Evidence for the construct validity of this measure has been provided by Ruch and Ruch (1980) and Grimsley, Ruch, Warren, & Ford (1985).

Cacioppo, Petty, and Kao's (1984) need for cognition scale was used to assess the extent to which participants were intrinsically motivated to solve complex problems. This scale consists of 18 statements (e.g., "I would prefer complex to simple problems") in which participants indicate their level of agreement on a five-point scale. The measure yields an internal consistency coefficient of .90. Evidence of the measure's construct validity has been provided by Cacioppo, Petty, Feinstein, and Jarvis (1996) and Watts, Steele, and Song (2016).

Gill and Hodgkinson's (2007) Big Five measure was intended to provide a global assessment of personality – openness, neuroticism, conscientiousness, agreeableness, and extraversion. Personality was assessed because a number of these personality traits have been shown to significantly predict creative performance (Feist,

2010). To measure these constructs, participants were presented with 80 adjectives (e.g., bold, picky, critical) and were asked to rate on a nine-point scale how accurate each adjective described themselves. The scales for measuring these five personality traits produced internal consistency coefficients above .80. Construct validity of these scales as a measure of these personality characteristics have been provided by Gill and Hodgkinson (2007).

Because task-relevant expertise is essential to creative performance (Hershey, Walsh, Read, Chulef, 1990), expertise was measured using a background data measure intended to assess restaurant expertise (Gibson & Mumford, 2013; Medeiros, Steele, Watts, & Mumford, 2017). Abstracted from Gibson & Mumford (2013) and modified to fit the restaurant domain, participants responded to six questions using a five-item response scale. Examples of questions asked include, "How confident are you that you know the issues and concepts used by restaurant owners and operators?" and "How likely is it that you will go into the restaurant industry as a career?". The resulting scale yields internal consistency coefficients of .70. Evidence for the construct validity of this scale as a measure of restaurant expertise has been provided by Medeiros et al. (2017).

Experimental Task

The experimental task was adapted from the restaurant development scenario used by Medeiros and colleagues (2017). Participants were asked to take on the role of a newly hired New Product Development Manager working in the Research and Development Department of a Restaurant Development Firm, O'Toole Restaurant Consultants, Inc. They were tasked with developing a new restaurant concept that O'Toole Restaurant Consulting would develop and manage. Participants began the task

by reading through relevant background information about their role and the company. After reviewing this information, participants were asked to generate a list of up to eight distinct restaurant concept ideas for the new restaurant. For the first manipulation, participants were asked to write about the forecasts, or outcomes, that could result from their ideas either once all ideas were generated or as each individual idea was generated. The second manipulation was embedded in the same set of instructions and directed participants to focus on positive outcomes, negative outcomes, or both positive and negative outcomes. Next, participants were asked to evaluate each of their ideas with respect to either quality or originality—the third, and final, manipulation. Participants were then asked to review their list of initial ideas, forecasted outcomes, and evaluations and then formulate one final restaurant plan. Ratings of forecasted ideas, idea evaluations, and final restaurant development proposals formed the basis of the dependent variables assessed in the study.

Manipulations

Timing of forecasting. After participants had read the description of their role and the organization, they were presented with an "email" that asked them to generate multiple, distinct restaurant concept ideas for the new restaurant. The timing of forecasting was manipulated by presenting participants with another "email" asking them to write about what they think would be the outcomes that could result from each of generated idea. This second "email" was either presented in tandem with the "email" about generating restaurant concept ideas or after participants generated restaurant concept ideas. Participants who engaged in forecasting during idea generation were given instructions and space on a sheet of paper to write down their idea and

subsequently write down the forecasted outcomes of this idea. Put differently, participants forecasted the outcomes of each idea as it was individually generated. Participants who engaged in forecasting after idea generation were given instructions and a sheet of paper to write down their generated ideas and an additional, separate set of instructions and sheet of paper to write down the forecasted outcomes of their ideas after all ideas had already been generated.

Valence of forecasting. The valence of forecasting was manipulated by presenting participants with an "email" asking them to focus on positive outcomes, negative outcomes, or both positive and negative outcomes when thinking about the forecasts for each idea. To facilitate understanding of how to predict outcomes of an idea, participants were presented with an example of an unrelated topic that listed potential solutions and predicted outcomes related to those solutions prior to coming up with their own idea forecasts. Participants were provided with space in their packet to write down their anticipated outcomes of each restaurant concept.

Evaluation standards. The final manipulation was intended to induce certain standards in idea evaluation. In this manipulation, participants were presented with another "email" that asked them to critically evaluate their generated ideas with respect to either quality or originality. Specifically, participants who evaluated their ideas with respect to quality were instructed to think about the practicality and feasibility of the ideas when critiquing them. Participants who evaluated their ideas with respect to originality were instructed to think about the novelty and uniqueness of the ideas when critiquing them. To ensure that participants understood how to adequately evaluate an idea with respect to quality or originality, they were presented with an example of an

unrelated topic that listed a problem, potential solutions, and evaluations of those solutions that aligned with either quality or originality evaluation standards. Participants were provided with a separate sheet of paper in their study packet to write down the evaluations for each of their generated restaurant concept ideas.

Dependent Variables

Three trained judges, blind to the study's experimental conditions and research questions, coded participants' forecasts, idea evaluations, and final restaurant proposals. Forecasts were rated for 1) quality and 2) extensiveness. Idea evaluations were coded for 1) quality, 2) range, and 3) depth. The two-to-three-page final restaurant proposals were coded for 1) quality, 2) originality, and 3) elegance. Benchmark rating scales have been shown to result in more reliable and valid ratings when trained judges are asked to appraise complex subject matter (Redmond, Mumford, & Teach, 1993). To develop benchmark rating scales for all variables, three judges, doctoral students familiar with the creativity literature, were asked to rate a set of thirty sample proposals on a five-point scale, using the below definitions. These ratings were used to identify restaurant proposals near the high, medium, and low scale points that evidenced cross-rater agreement. These restaurant proposals were abstracted and used to form scale anchors.

Three raters familiar with the creativity literature, were asked to apply these rating scales in evaluating the forecasts, idea evaluations, and final restaurant proposals. Prior to making these ratings, judges were required to complete a twenty-hour training program. In this training program, judges were familiarized with benchmark rating scales and operational definitions for all variables. Judges practiced applying these scales to sample participant responses and subsequently met to resolve any

discrepancies and discuss their ratings. Benchmark rating scales and example responses are presented in Table 1. The dependent variables were rated on a five-point Likert scale, with a rating of 1 indicating minimal to no presence of the variable and a rating of 5 indicating strong or extensive presence of the variable.

Insert Table 1 about here

Forecast quality. Forecast quality was defined as the extent to which the participant's forecasted outcomes displayed detail, relevance to the scenario, considered critical aspects of the scenario, and were realistic. The interrater agreement estimate was acceptable at .75.

Forecast extensiveness. Forecast extensiveness reflects the degree that the participant's forecasted outcomes considered a wide range of potential situations and outcomes. The estimate of interrater agreement was acceptable at .82.

Quality of evaluations. Quality of idea evaluations was defined as the extent to which the participant's idea evaluations were realistic and focused on practical issues. The interrater agreement estimate was acceptable at .82.

Range of evaluations. The range of idea evaluation was defined as the extent to which the participant's idea evaluations covered a large number of factors (e.g., personal, situational) and elements (e.g., people, tasks, groups). The interrater agreement estimate was acceptable at .86.

Depth of evaluations. The depth of idea evaluations was defined as the extent to which the participant's idea evaluations were thorough, insightful, and thoughtful. The interrater agreement estimate was acceptable at .80.

Plan quality. Quality was defined as the extent to which the participant's restaurant proposal was comprehensive, coherent, and feasible. The interrater agreement estimate was acceptable at .79.

Plan originality. Originality was defined as the extent to which the participant's final restaurant proposal was novel, unexpected, and clever. The interrater agreement estimate was acceptable at .70.

Plan elegance. Elegance was defined as the extent to which the participant's final restaurant proposal was articulately arranged in a succinct, flowing fashion (Dailey & Mumford, 2006; Scott, Lonergan, & Mumford, 2005). The interrater agreement estimate was acceptable at .74.

Results

Manipulation Checks

A significant difference in forecast positivity ($F(2,263) = 350.15$, $p \leq .00$) was found, such that participants who were asked to forecast positive outcomes ($M = 3.84$, $SE = .07$) did produce more positive forecasts compared to participants who were asked to forecast negative outcomes ($M = 1.44$ $SE = .06$) or both positive and negative outcomes ($M = 2.94$, $SE = .06$). Similarly a significant difference in forecast negativity ($F(2,260) = 350.15$, $p \leq .00$) was found, such that those who were asked to forecast negative outcomes ($M = 3.94$, $SE = .06$) did produce more negative forecasts compared to participants who were asked to forecast positive outcomes ($M = 1.42$, $SE = .06$) or

both positive and negative outcomes ($M = 2.80$, $SE = .06$). This suggests that participants were able to follow the instructions set forth by the forecasting valence manipulation.

A significant difference in idea evaluation focus ($F(1,263) = 350.15$, $p \leq .00$) was found, such that participants who were asked to evaluate ideas with respect to originality ($M = 2.24$, $SE = .07$) produced evaluations that were more focused on developing original ideas, compared to participants who were asked to evaluate ideas with respect to quality ($M = 1.70$, $SE = .07$). This suggests that participants understood and were able to follow the instructions intended by the idea evaluation standards manipulation.

Analyses

A series of analysis of covariance (ANCOVA) tests were used to assess the effects of the three manipulations (forecasting timing, forecasting valence, idea evaluation standards) on the quality and extensiveness of forecasts, the range, depth, and quality of idea evaluations, and the quality, originality, and elegance of final plans. Hierarchical regression analyses were conducted to help determine what covariates to include in the ANCOVAs. It should be noted that a covariate was included in any given analysis only if it proved significant at the $p = .05$ level. The quality of initial generated ideas was also included as a covariate in subsequent ANCOVAs to control for the influence on any dependent variables. Main effects and interactions from the one-way ANCOVAs were interpreted as statistically significant if they evidenced a p-value $\leq .05$ and near significant if they evidenced a p-value between .05 and .10. Separate

ANCOVAs were conducted for each of the eight dependent variables. Table 2 presents descriptive statistics, reliability estimates, and correlations.

Insert Table 2 about here

Forecasting, Idea Evaluation, and Creativity

First, as can be seen from Table 2, correlations suggest that forecasting extensiveness significantly influenced the quality ($r = .41$, $p < .01$), originality ($r = .33$, $p < .01$), and elegance ($r = .44$, $p < .01$) of final restaurant development plans. Similarly, correlations suggest that forecasting quality significantly influenced the quality ($r = .38$, $p < .01$), originality ($r = .34$, $p < .01$), and elegance ($r = .42$, $p < .01$) of these plans. This finding supports prior research suggesting that characteristics of forecasting, such as extensiveness and quality, influence creative performance (Shipman, Byrne, & Mumford, 2010). These correlations also clearly point to the construct validity of the criterion measures.

Table 3 presents the effects of the manipulations on the quality of participant forecasts. ACT proved to be a significant ($F(1,226) = 8.97$, $p \leq .05$) covariate being positively related to the production of quality forecasts. A significant ($F(1,226) = 15.55$, $p \leq .05$) main effect was also obtained for the forecasting valence manipulation. Inspection of cell means indicated that participants who forecasted both positive and negative outcomes evidenced higher quality forecasts ($M = 3.44$, $SE = .07$) than participants who only forecasted negative outcomes ($M = 3.03$, $SE = .07$) or positive outcomes ($M = 2.94$, $SE = .07$).

Insert Table 3 about here

Table 4 presents the results obtained in assessing the effects of the manipulations on the extensiveness of participant forecasts. The quality of initial ideas ($F(1,258) = 30.34$, $p \leq .05$), flexibility ($F(1,258) = 14.66$, $p \leq .05$), fluency ($F(1,258) = 7.65$, $p \leq .05$), and EAS ($F(1,258) = 9.49$, $p \leq .05$) proved to be significant covariates being positively related to the production of extensive forecasts. A significant ($F(1,258) = 17.18$, $p \leq .05$) main effect was found for forecasting valence. That is, participants who forecasted both positive and negative outcomes ($M = 3.39$, $SE = .06$) generated more extensive forecasts, compared with those who forecasted negative outcomes ($M = 3.04$, $SE = .06$) or positive outcomes ($M = 2.90$, $SE = .06$).

Insert Table 4 about here

Table 5 presents the effects of the manipulations on the quality of participant idea evaluations. Conscientiousness ($F(1,261) = 6.14$, $p \leq .05$) was the only significant covariate being positively related to the production of quality idea evaluations. A near significant main effect ($F(1,261) = 3.24$, $p \leq .10$) for the timing of forecasting was identified, such that participants who generated forecasts during idea generation ($M = 3.07$, $SE = .05$) evidenced greater quality idea evaluations compared to those who generated forecasts after idea generation was complete ($M = 2.95$, $SE = .05$).

Insert Table 5 about here

Table 6 presents the effects of the manipulations on the range of participant idea evaluations. The quality of initial ideas ($F(1,262) = 13.42$, $p \leq .05$) was the only significant covariate being positively related to the production of a wide range of idea evaluations. A significant main effect ($F(1,262) = 8.15$, $p \leq .05$) was found for timing of forecasting, such that participants who generated forecasts during idea generation ($M = 3.27$, $SE = .05$) evidenced a wider range of idea evaluations than participants who generated forecasts after idea generation ($M = 3.09$, $SE = .05$). Further, a significant main effect ($F(1,262) = 6.58$, $p \leq .05$) was also found for forecasting valence where participants who forecasted both positive and negative outcomes evidenced a wider range of idea evaluations ($M = 3.34$, $SE = .06$) compared to those who forecasted only negative outcomes ($M = 3.09$, $SE = .06$) or positive outcomes ($M = 3.10$, $SE = .06$).

A near significant two-way interaction between the forecasting valence and evaluation standards manipulations was also identified ($F(1,262) = 2.48$, $p \leq .10$). The idea evaluations with the greatest range were evidenced by participants who forecasted both positive and negative outcomes and who focused their idea evaluations on quality ($M = 3.36$, $SE = .08$) while the shortest range of idea evaluations was demonstrated by those forecasting positive outcomes and evaluating ideas with respect to quality standards ($M = 2.97$, $SE = .08$).

Insert Table 6 about here

Table 7 presents the effects of the manipulations on the depth of participant idea evaluations. Again, quality of initial ideas proved to be a significant ($F(1,262) = 5.83$, $p \leq .05$) covariate being positively related to the production of idea evaluations with great depth. A significant ($F(1,262) = 5.43$, $p \leq .05$) main effect was obtained for the forecasting timing manipulation. Evaluations of greater depth were obtained when participants forecasted during idea generation ($M = 3.09$, $SE = .05$) as opposed to after idea generation ($M = 2.93$, $SE = .05$). Another significant ($F(2,262) = 3.28$, $p \leq .05$) main effect was obtained for the forecasting valence manipulation. That is, participants who forecasted both positive and negative outcomes evidenced idea evaluations of greater depth ($M = 3.13$, $SE = .06$) than those who forecasted just negative outcomes ($M = 2.97$, $SE = .06$) or positive outcomes ($M = 2.92$, $SE = .06$).

Insert Table 7 about here

Table 8 presents the effects of the manipulations on the quality of the final proposal. ACT ($F(1,225) = 14.88$, $p \leq .05$), flexibility ($F(1,225) = 5.18$, $p \leq .05$), and the quality of initial ideas ($F(1,225) = 19.77$, $p \leq .05$) were all found to be significant covariates proving to be positively related to the production of greater quality plans. No significant main effects or interactions were found for final plan quality.

Insert Table 8 about here

Table 9 presents the effects of the manipulations on the originality of the final proposal. Flexibility ($F(1,259) = 8.68$, $p \leq .05$), quality of initial ideas ($F(1,259) = 49.18$, $p \leq .05$), and agreeableness ($F(1,259) = 7.78$, $p \leq .05$) were all found to be significant covariates that were positively related to the production of more original plans. A near significant main effect ($F(1,259) = 19.77$, $p \leq .10$) was found for evaluation standards, such that participants whose idea evaluations focused on originality standards evidenced final plans of greater originality ($M = 2.91$, $SE = .07$) than those whose idea evaluations focused on quality standards ($M = 2.73$, $SE = .07$).

A near significant interaction ($F(2,259) = 2.55$, $p \leq .10$) emerged between the forecasting timing and valence manipulations. Inspection of the cell means indicated that plans of the greatest originality emerged when participants were asked to forecast both positive and negative outcomes after idea generation ($M = 3.00$, $SE = .12$) and when participants were asked to forecast negative outcomes during idea generation ($M = 2.98$, $SE = .12$). The lowest originality was demonstrated by those who forecasted both positive and negative outcomes during idea generation ($M = 2.64$, $SE = .12$).

Insert Table 9 about here

Table 10 presents the effects of the manipulations on the elegance of the final proposal. ACT ($F(1,226) = 25.72$, $p \leq .05$) and the quality of initial ideas ($F(1,226) =$

23.16, $p \leq .05$) proved to be significant covariates being positively related to final plan elegance. A significant main effect ($F(2,226) = 3.18$, $p \leq .05$) was found for the forecasting valence manipulation, such that participants who forecasted both positive and negative outcomes evidenced plans of greater elegance ($M = 2.91$, $SE = .08$) compared to those who forecasted only negative outcomes ($M = 2.81$, $SE = .08$) or positive outcomes ($M = 2.64$, $SE = .08$).

Insert Table 10 about here

Discussion

This study investigated the influence of forecasting timing and valence and evaluation standards on forecasting performance, idea evaluation, and creativity. Overall, the variables examined in the present effort, particularly forecasting timing and valence, demonstrated significant influence at various points throughout the creative process. This study contributes to the creativity literature by suggesting that two approaches to forecasting—timing and valence—work to influence the effectiveness of idea evaluation processes, which have received limited attention in the literature in comparison to early-stage creative processes pertaining to idea generation. Although idea evaluation standards and forecasting valence has been studied previously, this is the first study to empirically investigate how forecasting both positive and negative outcomes simultaneously and how the timing of forecasting activities influence multiple stages of the creative problem-solving process.

Both forecasting extensiveness and quality were shown to be strongly significantly related to creative performance. These findings align well with studies by Shipman, Byrne, and Mumford (2010) and Strange and Mumford (2005) where participants were asked to assume the role of a principal of a secondary school and to provide a plan for leading this school. In these studies, it was found that the extensiveness of forecasts was positively related to the quality, originality, and elegance of participant plans. Findings from the present effort also provide some additional support for the conclusion that forecasting provides value when solving problems requiring creativity (Byrne et al., 2010; Marta, Leritz, & Mumford, 2005; Osburn & Mumford, 2006). Thus, forecasting appears to be a particularly impactful variable shaping creative performance, providing support for our first hypothesis.

Perhaps the most noteworthy findings occurred when participants forecasted both positive and negative outcomes as each individual idea was generated, as evidenced by a consistent pattern of main effects for forecasting, idea evaluation, and creative performance. That is, participants produced the highest quality and most extensive forecasts when they forecasted both positive and negative outcomes. Participants also produced idea evaluations of greater quality, range, and depth when they forecasted both positive and negative outcomes during idea generation, such that forecasts were generated for every individual idea as each idea was generated. Participants also produced the most elegant plans when they were asked to forecast both positive and negative outcomes. In contrast, participants who forecasted either positive or negative outcomes, and participants who engaged in forecasting after all idea generation had occurred, performed worse.

It was also found that imposing originality standards on idea evaluation also enhanced the originality of final plans. However, imposing quality standards on idea evaluation showed no significant effect on final plan quality. In addition, although the quality of initial generated ideas was a significant covariate in the present study, it was beyond the scope of the present effort to investigate the relationships between initial idea quality, evaluation standards, and forecasting approaches. Future research should investigate how and why initial idea quality and originality might interact with quality and originality idea evaluation standards.

Limitations

Prior to turning to the broader implications of the present effort, a number of limitations should be noted. The present effort was based on a low fidelity experimental paradigm where undergraduates took on the role of a restaurant development manager for a restaurant consulting company. Although this creative task is appropriate and engaging for undergraduate students because of their experience with restaurants (Medeiros et al., 2017), it remains uncertain whether or not the findings from the present effort can be extended to professionals tasked with creative work who have more expertise. Along related lines, although the restaurant scenario provided to participants was fairly realistic, an actual restaurant development effort would be a more complex undertaking.

Similarly, while a low fidelity simulation was used in this study, this paradigm provides more control over extraneous variables likely to influence forecasting performance, idea evaluation, and creative performance. Put differently, to ensure the viability of the creative exercise, the experimental manipulations needed to be presented

in a fixed order. Forecasting manipulations were introduced only during and immediately after the idea generation phase. In real-world creative efforts, forecasting may occur at multiple time points, even earlier and later on in the creative process. Moreover, the amount of time participants spent generating, forecasting, and evaluating ideas was not measured or manipulated to allow them to work through the materials at their own pace.

Lastly, the task and flow of the experiment used in this study limited the timeframe in which the creative effort took place and limited the observability of all stages of the creative process. Creative efforts oftentimes take numerous months or years to unfold, so a more longitudinal and in-depth approach to examining this study's research questions may yield more complex results.

Implications and Future Research

With these limitations in mind, we turn to the practical implications of this research. The pattern of observed effects suggests that, while the result of forecasting is important (e.g., creativity), forecasting as a process seems to also hold value for creative performance. Often times, when solving problems requiring creativity, there may be a tendency to forecast positive outcomes because this forecasting approach is encouraging (Dailey & Mumford, 2006; Schwenk & Thomas, 1983). However, avoiding forecasting negative outcomes altogether may be detrimental to creative performance. The results from the present effort suggest that forecasting both positive and negative outcomes may help avoid failure and other pitfalls while simultaneously providing the foundation needed to actively engage with ideas.

Similarly, findings suggest that those tasked with creative efforts should forecast early on and should not wait until the very end of idea generation when attempting to develop original solutions. The creativity literature has drawn upon the planning literature to propose that forecasting should occur later on in the creative process (Mumford, Schultz, & VanDoorn, 2001; Mumford et al., 2015). However, findings from the present effort suggest that forecasting should be part and parcel with idea generation. This point is critical because there is a tendency for people to forecast only once their final idea has been selected (Mumford, Mecca, & Watts, 2015; Mumford, Schutlz, & Osburn, 2002; Mumford, Schultz, & VanDoorn, 2001). Taken together, directing individuals tasked with creative problem solving efforts to forecast both positive and negative outcomes earlier on in the creative process as idea generation unfolds may prove valuable. Moreover, forecasting is a cross-cutting strategy in that it applies to multiple stages of the creative problem solving process (Mumford, Medeiros, & Partlow, 2012).

The forecasting model put forth by Mumford et al. (2015) depicts the complex activities that take place during the forecasting process. Such complexities include scanning of the environment, activating different knowledge structures, identifying key causes, analyzing cases, and situational monitoring. If each of these forecasting activities occurs at multiple points during the creative problem solving process (Mumford et al., 1991), it may be that the difficulty of creative thinking becomes magnified. Future research should examine the degree of impact that the nature of forecasting (e.g., extensiveness) has at each stage of the creative process (e.g., information gathering, conceptual combination). It may be that different attributes of

forecasting (e.g., depth, breadth) may be more or less beneficial for creativity depending on the stage of the creative process in which forecasting occurs. Alternately, all components of the forecasting model may not need to be applied at all points in which forecasting occurs.

It is unclear whether or not early cycle forecasting is a means of screening idea alternatives. Forecasting may be a key convergent process in creativity, both in terms of planning implementation and for formulating creative ideas. Future research should also further investigate whether different forecasting strategies (e.g., valence, timeframe) should be used depending on the stage of creative problem solving. It may be that the approach to forecasting may need to change depending on the point in the creative process.

It also remains unclear how standards imposed on idea evaluation interact with different forecasting strategies and approaches. Evaluation has traditionally occurred with respect to a set of fixed standards (Cropley, 2006). However, the findings from the present effort suggest that the evaluation of ideas is to forecasted standards. Furthermore, idea evaluation in and of itself may be a creative process given that forecasting provides a basis for idea evaluation. Future research should explore different types of idea evaluation standards and how these might be supported or inhibited by various forecasting approaches.

Conclusion

The present study investigated the interaction of two forecasting approaches—valence and timing—and idea evaluation standards that were found to influence multiple stages of the creative problem solving process, including forecasting, idea

evaluation, and creativity. Moreover, we have identified a set of conditions that maximize the impact forecasting has on creative performance. Our findings appear to suggest that the positive and negative outcomes of ideas should be forecasted as these ideas emerge. Perhaps then, when solving problems, we should take the good with the bad and roll with the punches.

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Table 1. Benchmark Ratings and Example Responses for Dependent Variables

Example Response 1	Example Response 2	Example Response 3
Generated ideas: • Concept idea #1: outdoor seafood restaurant on the beachfront • Concept idea #2: exclusive moving restaurant on a boat for specicl occasions • Concept idea #3: fast food sandwiches resturant • Concept idea #4: fast food chicken restaurant • Concept idea #5: fast food seafood restautant • Concept idea #6: authentic Asian food restaurant • Concept idea #7: hometown burger joint with classic 80s feel • Concept idea #8: protein factory with all the meats you can think of **Anticipated outcomes:** • Outcome for idea #1: go out of business, not enough customers due to many similar companies • Outcome for idea #2: go out of business, not enough customers too expensive • Outcome for idea #3: go out of business, to many similar companies	**Generated ideas:** • Concept idea #1: Western • Concept idea #2: Italian • Concept idea #3: Sandwhiches • Concept idea #4: Diner • Concept idea #5: • Concept idea #6: • Concept idea #7: • Concept idea #8: **Anticipated outcomes:** • Outcome for idea #1: draws in all classes of clientel, alienates vegetarian and vegan customers, red meat based menu • Outcome for idea #2: has healthier options, can be taylor made to cater to a mere upscale clientle, some will not get what they consider authentic food • Outcome for idea #3: can be custom made, good on the go, already large competition in sandwhich market, good for business professionals • Outcome for idea #4: serves American classics, Draws a family crowd, open for all meals, can have	**Generated ideas:** • Concept idea #1: Exclusive high end restaurant that sends people into orbit to dine on gourmet dried foods. • Concept idea #2: restaurant inside a roller coaster • Concept idea #3: Upside down restaurant • Concept idea #4: Mcdonalds 2: electric boogaloo • Concept idea #5: restaurant where customers are the head chefs. • Concept idea #6: restaurant at bottom of the ocean • Concept idea #7: • Concept idea #8: **Anticipated outcomes:** • Outcome for idea #1: High reservation prices. High development costs. Easy food prep. Costly staff training. • Outcome for idea #2: Nauseal/vomiting. Unique dining experience • Outcome for idea #3: High clean up cost. Possible customer injury. Unique dining experience.

• Outcome for idea #4: go out of business, to many similar companies • Outcome for idea #5: go out of business, to many similar companies • Outcome for idea #6: go out of business, to many similar companies • Outcome for idea #7: go out of business, not enough customers • Outcome for idea #8: go out of business, not enough profits **Evaluations:** • Evaluations for idea #1: not very original, many similar restaurants on beachfront, fighting for customers • Evaluations for idea #2: very original and unique, could prove to be too expensive, very limited number of potential customers • Evaluations for idea #3: not original, many similar restaurants, fight for customers • Evaluations for idea #4: not original, many similar restaurants, fight for customers	niche food it is known for, possibly alienats 18-28 crowd • Outcome for idea #5: • Outcome for idea #6: • Outcome for idea #7: • Outcome for idea #8: **Evaluations:** • Evaluations for idea #1: I believe that western would be good if prices are not to high, more of a middle of the road streakhouse. This may however only be best when done in the south. Also may take away a healthier clientel. • Evaluations for idea #2: Italian may draw the healthier crowd. However, this may not give some the authentic Italian feel that they want. may want to do this somewhere with a low Italian immigrant population • Evaluations for idea #3: sandwhiches may get the most daily traffic because it would cater to those on the go. If located in a downtown environment sandwiches could be nicer and healthier, catering to a wealthier business cliental	• Outcome for idea #4: A very large lawsuit. Nothing can come from this idea • Outcome for idea #5: No complaints about food prep. Low staff costs. • Outcome for idea #6: High restaurant prices, potential shark attacks. Unique dining experience. Low food shipment cost. • Outcome for idea #7 • Outcome for idea #8: **Evaluations:** • Evaluations for idea #1: What other restaurant sends people into low earth orbit? Would have to develop own rocket/spacecraft. Need trained astronauts as wait staff. Extremely high startup cost. Very low restaurant profits. • Evaluations for idea #2: A restaurant that's on a roller coaster track/ Unique. High risk of injury to both staff and customers. Could provide helmets and liability waivers. Must be 5 feet tall to dine. • Evaluations for idea #3: A regular ol' restaurant, except everything is on the ceiling. Would need lots of velcro. Wouldn't be able to serve

• Evaluations for idea #5: not original, many similar restaurants, fight for customers • Evaluations for idea #6: not original, many similar restaurants, fight for customers • Evaluations for idea #7: somewhat original, specific target customers, limited revenues • Evaluations for idea #8: original, could be too expensive, must have a lot of customers **Final plan:** We could create the very first ever moving restaurant that is on a large boat. It would move very slow and would provide a very unique feel to it. It would be expensive to finance, but would have a high financed group of customers. If starts well, could be a very big hit in the wealthier community looking for unique eating experiences with a limited amount of customers food would have to be great to be able to have positive spread of word of mouth. It would only be a dinner restaurant which would limit revenues as well as expenses.	• Evaluations for idea #4: diner would be great on weekends for all meals. Mainly caters to families. Looses health conscious cliental. • Evaluations for idea #5: • Evaluations for idea #6: • Evaluations for idea #7: • Evaluations for idea #8: **Final plan:** The restaurant plan I would propose is the western concept. I believe that if placed in the right part of the country that it can attract all sorts of classes of buiseness. With reasonably priced entrees with larger portions this will make it somewhere people can go on a regular basis. This also would be a family friendly environement allowing parents to bring children with a similar menu to the adult menu. The downside of this though is that it looses a healthy clientel due to the largely red meat and potatoes based menu. It may also loose some of the more wealthy clientel due to it being lowerend quality.	soup in a bowl. Net stretched across floor to catch falling patrons. Waivers good idea too. • Evaluations for idea #4: Exactly like Mcdonalds, but we stick a big neon "2" at the end of the sign. Would need an extensive legal team to avoid lawsuits. Fast dining experience. Cheap food. • Evaluations for idea #5: A 5 Michellan star restaurant, where the customers make their own food. Could hire celebrity chefs as consultants. Charge per ingredient. Reservation only. • Evaluations for idea #6: A restaurant under the ocean. High R&D cost. Needs either a pressurized elevator or routine submarine ferrying. Entirely seafood menu. Could have built-in traps. Advertised as freshest seafood restaurant on the planet. • Evaluations for idea #7: • Evaluations for idea #8: **Final plan:** Underwater restaurant. 1/3 of space for dining, 1/3 for food prep and 1/3 for the passive fishing system. Fish caught to order. At 3,000 feet below

		the surface. Pressurized elevator to carry you down and routine yacht taxiing customers to and from the mainland. Entirely pressurized and controlled. Placed right in middle of coral reef for incredible views. Glass walls and ceiling. Swimming area also, who wouldn't want to go swimming under the ocean? Sound engineered to reduce echoing and maximize stability. Triple reinforced safety glass to prevent a tragedy. Escape submarine pods as a backup, each table functions as a life preserver. Move the wreckage of the titanic into view for historical significance. Wait staff/kitchen staff paid less than minimum wage because restaurant would be located in international waters. Torpedo proof.
<u>Ratings</u>	<u>Ratings</u>	<u>Ratings</u>
Quality of forecast = 1.67	Quality of forecast = 3.33	Quality of forecast = 3.33
Extensiveness of forecast = 1.67	Extensiveness of forecast = 3.33	Extensiveness of forecast = 4.00
Range of evaluations = 2.00	Range of evaluations = 3.00	Range of evaluations = 3.33
Depth of evaluations = 2.00	Depth of evaluations = 3.33	Depth of evaluations = 3.67
Quality of evaluations = 2.67	Quality of evaluations = 3.00	Quality of evaluations = 2.00
Quality = 3.00	Quality = 3.00	Quality = 3.33
Originality = 3.33	Originality = 2.33	Originality = 4.67
Elegance = 3.00	Elegance = 2.33	Elegance = 3.33

Table 2. Correlation Matrix for All Covariates and Dependent Variables

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Agreeableness	7.12	0.92	—															
2. Conscientiousness	5.99	0.89	.10	—														
3. Intelligence (EAS)	25.67	6.38	-.11	-.25**	—													
4. Fluency	5.78	1.73	-.01	-.03	.10	—												
5. Flexibility	4.05	1.00	-.01	-.04	.06	.80**	—											
6. Need for Cognition	3.31	0.67	.07	.12*	.02	.00	.07	—										
7. ACT	25.73	3.84	-.20**	-.08	.34**	.05	.07	.29**	—									
8. Initial Idea Quality	3.05	0.69	.13*	-.10	.06	-.01	.04	.21**	.14*	(0.89)								
9. Forecast Quality	3.12	0.67	-.02	-.09	.17**	-.02	.13*	.19**	.22**	.34**	(0.75)							
10. Forecast Extensiveness	3.11	0.67	-.02	-.13*	.20**	.03	.17**	.18**	.24**	.29**	.88**	(0.82)						
11. Quality of Evaluations	3.01	0.55	-.01	-.14*	.09	-.03	.06	.05	.08	.10	.33**	.28**	(0.82)					
12. Depth of Evaluations	3.01	0.58	.00	-.04	.03	.02	.15*	.12*	.10	.13*	.44**	.43**	.73**	(0.80)				
13. Range of Evaluations	3.18	0.56	.04	-.08	.08	.02	.14*	.11	.08	.20**	.48**	.51**	.64**	.77**	(0.86)			
14. Quality	3.07	0.72	-.06	-.09	.14*	.06	.18**	.14*	.29**	.31**	.38**	.41**	.25**	.33**	.33**	(0.79)		
15. Originality	2.81	0.89	-.13*	-.07	.13*	.08	.18**	.11	.17*	.37**	.34**	.33**	-.02	.09	.13*	.55**	(0.70)	
16. Elegance	2.79	0.76	-.02	-.08	.13*	.04	.16**	.17**	.35**	.32**	.42**	.44**	.19**	.29**	.29**	.85**	.58**	(0.74)

Note. ** Correlation significant at $p = .01$ level, * Correlation significant at $p = .05$ level. Dependent variables and significant covariates included. Agreement coefficients included on the diagonal in parentheses.

Table 3. ANCOVA Results for Quality of Forecast

	SS	*df*	*MS*	*F*	*p*	Partial η^2
Significant Covariates						
ACT	3.25	1.00	3.25	8.97	0.00	0.04
Quality of Initial Ideas	10.21	1.00	10.21	28.21	0.00	0.11
Main Effects						
Timing of Forecasting	0.90	1.00	0.90	2.49	0.12	0.01
Valence of Forecasting	11.26	2.00	5.63	15.55	0.00	0.12
Evaluation Standards	0.00	1.00	0.00	0.00	0.98	0.00
Interactions						
Timing*Valence	0.47	2.00	0.23	0.64	0.53	0.01
Timing*Standard	0.05	1.00	0.05	0.13	0.72	0.00
Valence*Standard	0.13	2.00	0.06	0.17	0.84	0.00

Note: *SS* = Type III Sum of Squares, *df* = degrees of freedom, *MS* = Mean Square, *F* = F-ratio, *p* = significance level, Partial η^2 = effect size estimate. There were no significant three-way interactions.

Table 4. ANCOVA Results for Extensiveness of Forecast

	SS	*df*	*MS*	*F*	*p*	Partial η^2
Significant Covariates						
Quality of Initial Ideas	10.30	1.00	10.30	30.34	0.00	0.11
Flexibility	4.98	1.00	4.98	14.66	0.00	0.05
Fluency	2.60	1.00	2.60	7.65	0.01	0.03
EAS	3.22	1.00	3.22	9.49	0.00	0.04
Main Effects						
Timing of Forecasting	0.31	1.00	0.31	0.92	0.34	0.00
Valence of Forecasting	11.67	2.00	5.83	17.18	0.00	0.12
Evaluation Standards	0.00	1.00	0.00	0.00	0.99	0.00
Interactions						
Timing*Valence	0.41	2.00	0.20	0.60	0.55	0.00
Timing*Standard	0.01	1.00	0.01	0.02	0.88	0.00
Valence*Standard	0.53	2.00	0.27	0.78	0.46	0.01

Note: *SS* = Type III Sum of Squares, *df* = degrees of freedom, *MS* = Mean Square, *F* = F-ratio, *p* = significance level, Partial η^2 = effect size estimate. There were no significant three-way interactions.

Table 5. ANCOVA Results for Quality of Evaluations

	SS	*df*	*MS*	*F*	*p*	Partial η^2
Significant Covariates						
Conscientiousness	1.85	1.00	1.85	6.14	0.01	0.02
Main Effects						
Timing of Forecasting	0.98	1.00	0.98	3.24	0.07	0.01
Valence of Forecasting	0.19	2.00	0.10	0.32	0.73	0.00
Evaluation Standards	0.00	1.00	0.00	0.01	0.93	0.00
Interactions						
Timing*Valence	0.01	2.00	0.00	0.01	0.99	0.00
Timing*Standard	0.06	1.00	0.06	0.19	0.67	0.00
Valence*Standard	1.06	2.00	0.53	1.76	0.17	0.01

Note: *SS* = Type III Sum of Squares, *df* = degrees of freedom, *MS* = Mean Square, *F* = F-ratio, *p* = significance level, Partial η^2 = effect size estimate. There were no significant three-way interactions.

Table 6. ANCOVA Results for Range of Evaluations

	SS	*df*	*MS*	*F*	*p*	Partial η^2
Significant Covariates						
Quality of Initial Ideas	3.85	1.00	3.85	13.42	0.00	0.05
Main Effects						
Timing of Forecasting	2.34	1.00	2.34	8.15	0.00	0.03
Valence of Forecasting	3.77	2.00	1.89	6.58	0.00	0.05
Evaluation Standards	0.20	1.00	0.20	0.71	0.40	0.00
Interactions						
Timing*Valence	0.04	2.00	0.02	0.06	0.94	0.00
Timing*Standard	0.08	1.00	0.08	0.29	0.59	0.00
Valence*Standard	1.42	2.00	0.71	2.48	0.09	0.02

Note: *SS* = Type III Sum of Squares, *df* = degrees of freedom, *MS* = Mean Square, *F* = F-ratio, *p* = significance level, Partial η^2 = effect size estimate. There were no significant three-way interactions.

Table 7. ANCOVA Results for Depth of Evaluation

	SS	*df*	*MS*	*F*	*p*	Partial η^2
Significant Covariates						
Quality of Initial Ideas	1.92	1.00	1.92	5.83	0.02	0.02
Main Effects						
Timing of Forecasting	1.79	1.00	1.79	5.43	0.02	0.02
Valence of Forecasting	2.17	2.00	1.08	3.28	0.04	0.02
Evaluation Standards	0.14	1.00	0.14	0.41	0.52	0.00
Interactions						
Timing*Valence	0.02	2.00	0.01	0.03	0.97	0.00
Timing*Standard	0.10	1.00	0.10	0.32	0.57	0.00
Valence*Standard	1.18	2.00	0.59	1.80	0.17	0.01

Note: *SS* = Type III Sum of Squares, *df* = degrees of freedom, *MS* = Mean Square, *F* = F-ratio, *p* = significance level, Partial η^2 = effect size estimate. There were no significant three-way interactions.

Table 8. ANCOVA Results for Quality – Final Plan

	SS	*df*	*MS*	*F*	*p*	Partial η^2
Significant Covariates						
ACT	6.71	1.00	6.71	14.88	0.00	0.06
Flexibility	2.33	1.00	2.33	5.18	0.02	0.02
Quality of Initial Ideas	8.92	1.00	8.92	19.77	0.00	0.08
Main Effects						
Timing of Forecasting	0.54	1.00	0.54	1.19	0.28	0.01
Valence of Forecasting	0.45	2.00	0.22	0.50	0.61	0.00
Evaluation Standards	0.07	1.00	0.07	0.15	0.70	0.00
Interactions						
Timing*Valence	0.18	2.00	0.09	0.20	0.82	0.00
Timing*Standard	0.01	1.00	0.01	0.03	0.86	0.00
Valence*Standard	1.04	2.00	0.52	1.15	0.32	0.01

Note: *SS* = Type III Sum of Squares, *df* = degrees of freedom, *MS* = Mean Square, *F* = F-ratio, *p* = significance level, Partial η^2 = effect size estimate. There were no significant three-way interactions.

Table 9. ANCOVA Results for Originality – Final Plan

	SS	*df*	*MS*	*F*	*p*	Partial η^2
Significant Covariates						
Flexibility	5.48	1.00	5.48	8.68	0.00	0.03
Quality of Initial Ideas	31.04	1.00	31.04	49.18	0.00	0.16
Agreeableness	4.91	1.00	4.91	7.78	0.01	0.03
Main Effects						
Timing of Forecasting	0.18	1.00	0.18	0.28	0.60	0.00
Valence of Forecasting	1.80	2.00	0.90	1.42	0.24	0.01
Evaluation Standards	2.15	1.00	2.15	3.40	0.07	0.01
Interactions						
Timing*Valence	3.22	2.00	1.61	2.55	0.08	0.02
Timing*Standard	0.03	1.00	0.03	0.04	0.83	0.00
Valence*Standard	2.00	2.00	1.00	1.59	0.21	0.01

Note: *SS* = Type III Sum of Squares, *df* = degrees of freedom, *MS* = Mean Square, *F* = F-ratio, *p* = significance level, Partial η^2 = effect size estimate. There were no significant three-way interactions.

Table 10. ANCOVA Results for Elegance – Final Plan

	SS	*df*	*MS*	*F*	*p*	Partial η^2
Significant Covariates						
ACT	12.47	1.00	12.47	25.72	.00	.10
Quality of Initial Ideas	11.23	1.00	11.23	23.16	.00	.09
Main Effects						
Timing of Forecasting	.08	1.00	.08	.16	.69	.00
Valence of Forecasting	3.08	2.00	1.54	3.18	.04	.03
Evaluation Standards	.60	1.00	.60	1.25	.27	.01
Interactions						
Timing*Valence	.23	2.00	.12	.24	.79	.00
Timing*Standard	.03	1.00	.03	.07	.79	.00
Valence*Standard	1.28	2.00	.64	1.32	.27	.01

Note: *SS* = Type III Sum of Squares, *df* = degrees of freedom, *MS* = Mean Square, *F* = F-ratio, *p* = significance level, Partial η^2 = effect size estimate. There were no significant three-way interactions.