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Creative Problem-Solving Process Styles, Cognitive Work Demands, and Organizational Adaptability

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Abstract

In this theoretical article, organizational adaptability is modeled as a four-stage creative problem-solving process, with each stage involving a different kind of cognitive activity. Individuals have different preferences for each stage and thus are said to have different creative problem-solving process "styles." The Creative Problem Solving Profile (CPSP) assesses these styles and maps onto and interconnects directly with the four stages of this creative problem-solving process. Field research (n = 6,091) is presented in which the psychometric properties of the CPSP are established and the distribution of styles in different occupations and at different organizational levels are examined. A concrete blueprint is provided for organizational leaders to follow to (a) increase organizational adaptability, (b) simplify and facilitate change management, and (c) address important organizational effectiveness issues at the individual, team, and organizational levels. Real-world application examples are shared and future research opportunities to expand the CPSP's usefulness are suggested.

Keywords

creative problem solving, cognitive work demands, efficiency and adaptability, organizational adaptability, problem-solving process

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Introduction

In recent times, the goal of improving the effectiveness of organizations has become much more complex and challenging. Rapidly accelerating change and frequent major discontinuities and interruptions now dominate the world in which we live and work. Many organizations that prospered during more stable times—times that rewarded routinized efficiency—now find themselves poorly adapted to today's new economic and social realities. Around the globe, researchers and practitioners are attempting to help organizations struggling to gain a competitive advantage in the face of intensifying competition and globalization of markets (e.g., Amagoh, 2008).

Mott (1972) presented evidence that effective organizations display two characteristics simultaneously: efficiency and adaptability. The efficient organization follows well-structured, stable routines to deliver its products or services in high quantities with high quality and at low cost. In a stable world, efficient organizations may be successful. But in a changing world, organizations also need adaptability. Although efficiency implies mastering routine, adaptability means mastering the process of deliberately changing routine. Adaptability is a proactive process: it allows the organization to deliberately and continually change and create. It entails deliberate discontent—proactively looking for new problems to solve, finding new things to do, and adopting new technologies and methods ahead of the competition. Dolata (2013) identified proactive adaptability as the trait differentiating companies capable of responding proactively to dynamic environments from those unable to make crucial change, whereas Short, Ketchen, Shook, and Ireland (2010) examined the emergence of opportunity discovery and creation as important concepts in creativity and entrepreneurship.

Adaptability is disruptive. It requires looking outside the organization for new opportunities, problems, trends, technologies, ideas, and methods that may dramatically improve or completely change routines or introduce completely new products and services. Adaptable organizations anticipate problems and opportunities and develop timely solutions and new routines. They deliberately and continually change routines to improve quality, raise quantities, reduce costs, and stay ahead of competitors.

Basadur and colleagues (e.g., Basadur & Gelade, 2006) proposed that adaptability can be conceptualized as a four-stage process of creative problem solving comprising generating, conceptualizing and solving important problems, and implementing valuable new solutions (see Figure 1). Each stage involves a different kind of cognitive activity. Individuals have different preferences for each stage and thus have different creative problem-solving "styles."

The purpose of this theoretical article is to present an instrument (the Creative Problem Solving Profile [CPSP]), which (1) measures these styles, (2) maps onto and interconnects directly with the four stages of this creative problem-solving process, (3) increases understanding of different cognitive creative problem-solving process demands of people in different organizational roles, (4) provides organizational leaders with a concrete blueprint to follow in order to (a) initiate and sustain permanent adaptability performance, (b) simplify and facilitate change management, and

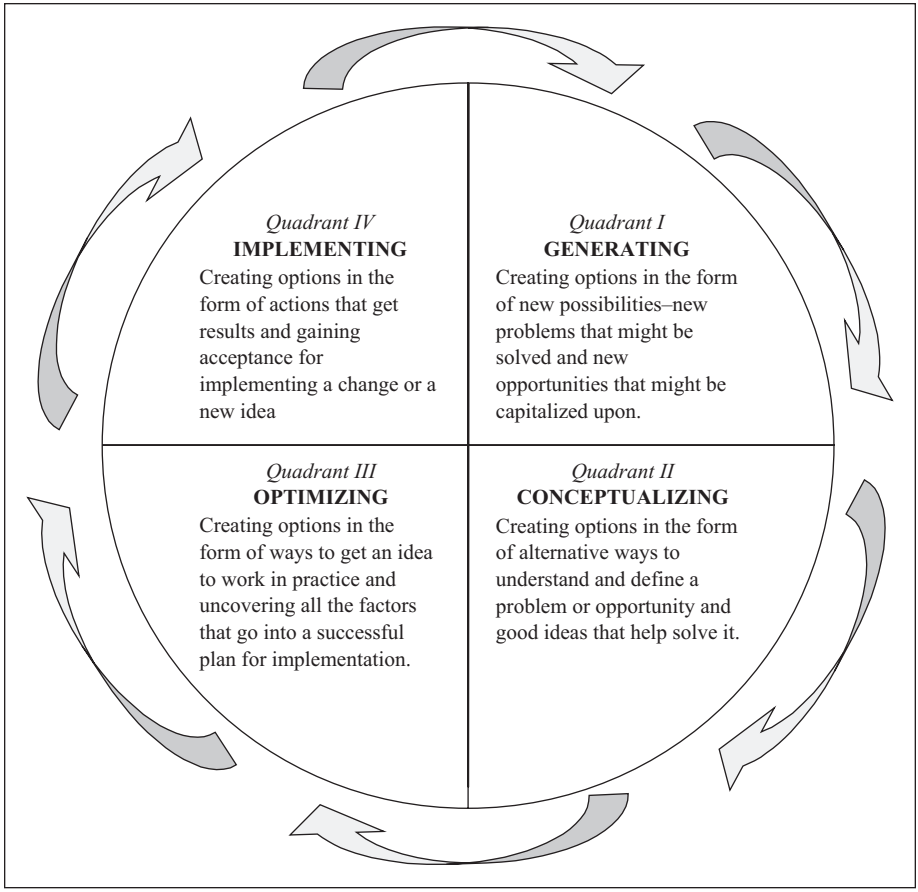

Figure 1. The four stages of the creative problem-solving process.

(c) address important long-standing specific organizational effectiveness problems and challenges. Along with introducing the theoretical basis for the CPSP, and offering examples of its application in organizations, the article describes the scientific questions we have been pursuing through field research to establish the psychometric properties of the CPSP and test propositions about the association between an individual's creative problem-solving process style and the cognitive work demands of his or her preferred organizational role. It proposes that different occupations require individuals to engage in a range of different cognitive activities and examines the distribution of creative problem-solving process styles at different organizational levels and within different occupations. Finally, the article offers an extensive discussion of implications to innovation and change management and proposes future research to expand the CPSP's usefulness.

Creative Problem Solving as a Process

The first stage of our creative problem-solving process, *Generation*, is the proactive acquisition and generation of new information and the sensing of trends, opportunities, and problems. This is what Simon (1977) called "opportunistic surveillance." Here, physical contact with, and involvement in, real-world activities alert the individual to inconsistencies and difficulties. These inconsistencies are then used to suggest new problem areas, to identify opportunities for improvement and innovation, and to propose projects that might be worth undertaking. At this stage, problems and opportunities are recognized but are not yet clearly articulated or understood.

In the second stage, *Conceptualization*, a problem or opportunity identified in the previous stage is analyzed to create a comprehensive conceptualization or model of the problem domain. Here, understanding of the problem area is gained not by direct experience but by abstract analysis. This conceptual knowledge is then used as the basis for ideation whereby one or more solutions for the problem are developed.

In the third stage, *Optimization*, the conceptualizations of the previous stage are critiqued against real-world constraints to identify practical difficulties. Alternatives are systematically examined to develop a plan for implementing an optimal solution that can be executed with existing resources. The fourth stage, *Implementation*, completes the creative process. Cognitive activity in this stage consists of experimenting with the new solution, evaluating the outcomes, and making adjustments if necessary to successfully implement it.

Understanding Creativity

Studying and discussing creativity can be difficult and complex, because no single, agreed-upon definition of this quality exists and because researchers have taken many different approaches to its study. Many researchers have addressed the topic through an *identification* approach (Guilford, 1967; MacKinnon, 1962, 1977; Nassif & Quevillon, 2008; Torrance, 1974; Urban, 2005), resulting in the development of a number of cognitive, aptitude, and personality tests to identify more or less creative people. More recently, Chavez-Eakle, Lara, and Cruz (2006) explored the bridge between creativity and personality.

Others have studied personal characteristics related to creativity. For example, Kirton (1976, 2003) differentiated between people with more "adaptive" styles of creativity and people with more "innovative" styles of creativity in the context of diversity and change, whereas Myers (1962) addressed the relationship between personality and creative behavior. Others have studied *organizational or environmental factors* that are likely to inhibit or nurture creative performance. These include the impact of factors such as leadership influences, behaviors, expectations (e.g., Carmeli & Schaubroeck, 2007; Liu, Liao, & Loi, 2012), and motivation (e.g., Amabile, Hill, Hennessy, & Tighe, 1994; Grant & Berry, 2011; Shalley & Zhou, 2008; Zhou & Shalley, 2003). The significance of climate was studied by Hunter, Bedell, and Mumford (2007) and Ivancevich, Konopaske, and Matteson (2005), whereas the

impact of strategy has been widely studied (e.g., Ettlie, Bridges, & O'Keefe, 1984; Mumford, Scott, Gaddis, & Strange, 2002; Styhre, 2002). Researchers have also looked at the relationship between creative performance and goals, incentives, and freedom from time pressure (e.g., Amabile & Gryskiewicz, 1989; Baker, Winkofsky, Langmeyer, & Sweeney, 1976; Cooper, Eisenberger, & Aselage, 2008; Eisenberger & Aselage, 2009; Shalley, Zhou, & Oldham, 2004).

Another approach to studying creativity considers *deliberate improvement*: can we train individuals and teams to make them "more creative" or better able to use their innate creativity? (e.g., Basadur, Runco, & Vega, 2000; Kim, 2011; Parnes, Noller, & Biondi, 1977; Puccio & Cabra, 2012; Puccio, Firestien, Coyle, & Masucci, 2006; Thompson, 2003). In addition, some researchers have focused on assessing the *product* of creative efforts (e.g., Baer & McKool, 2009; Besemer, 2006; Dailey & Mumford, 2006; Horn & Salvendey, 2006; O'Quin & Besemer, 1989; Thompson, 2008). Finally, for a number of decades, many researchers and practitioners have devoted their efforts to testing creative thinking *tools* such as "brainstorming" for generating ideas to presented problems (Basadur, 1994; Belliveau, Griffin, & Somermeyer, 2004; De Bono, 2008; Michaldo, 2006; Skilton & Dooley, 2010; Sternberg, O'Hara, & Lubart, 1997; VanGundy, 1992).

Our approach is different and attempts to understand and model creativity as a *process*, with stages or steps. This approach emphasizes the importance of information processing activities (Runco, 2003; Stigliani & Ravasi, 2012). We like Kabanoff and Rossiter's (1994) definition of "applied creativity" as a *process* occurring in a real-world, industrial, organizational, or social context; pertaining to the finding or solving of complex problems; and having an actual behavioral creative product or plan as the final result.

The evolution of cognitive models of multistage processes of creative thinking and problem solving began with Wallas's (1926) four linear stages: preparation, incubation, illumination, and verification. Osborn (1963) and Parnes et al. (1977) evolved a linear five-step creative problem-solving model: fact finding, problem defining, idea finding, solution finding, and acceptance finding. Amabile (1988) identified five stages of problem solving: presentation, preparation, generation, validation, and assessment. Mumford and his colleagues (e.g., Mumford, Mobley, Uhlman, Reiter-Palmon, & Doares, 1991; Reiter-Palmon & Robinson, 2009) identified eight individual core processes commonly used in creative problem solving, beginning with problem formulation and ending with planning and monitoring. Finke and colleagues (Finke, 1990; Finke, Ward, & Smith, 1992; Ward, Smith, & Finke, 1999) proposed that, in general, creativity consists of a cycle of generation and exploration to meet specific goals or task demands. Runco and Chand (1995) provided a two-tier model in which primary processes (e.g., ideation and evaluation) interact with secondary processes (e.g., motivation and knowledge) to produce novel products.

Again, our approach is different from the above creativity process models. All the process models described above tend to presuppose that a problem, task, or goal requiring creativity already exists or has been presented and that a creative process is subsequently applied. We offer a different, more comprehensive process of creative

behavior, which begins *before* a problem is available to be identified or formulated and continues until the action required to implement a solution is taken (Basadur, Graen, & Green, 1982).

This approach, which models adaptability directly, is more consistent with what goes on in real-world situations. It directly reflects the results of field research (Basadur, 1992), which showed how innovative Japanese companies engage their employees in continuous problem finding, defining, solving, and solution as part of regular work. (A surprising finding was that the main objective of this procedure was to increase motivation and commitment.) These organizations deliberately create a culture in which problems are regarded as "golden eggs." Employees are encouraged to disrupt the status quo and seek out problems for solving within their own job areas and across the company's products and services. In addition, new scientists and engineers hired into research and development departments begin their careers in the sales department so they can experientially learn that innovation begins with problem finding. By discovering the problems that customers have, including the ones they are not even aware they have, the new R&D hires see that finding solutions to these problems leads to the development of new products. These organizations do not want the new scientists and engineers thinking that they are going to be given problems to solve, but want them to discover how problems are to be found. Basadur (1995) describes how several corporations such as Frito-Lay and Kimball International have engaged their employees in deliberate generation, conceptualization, optimization, and implementation process activity for measurable and strategic gains in profitability and adaptability.

A field experiment (Basadur et al., 1982) demonstrated that training in this method of creative problem solving is effective in increasing problem-finding behavior and performance. Effective organizations recognize they must establish adaptability as an ongoing process and do not expect it to be achieved accidentally. For example, to create a positive climate toward problems as opportunities for disruptive change, 3M encourages employees to experiment with ideas ("just try and see what happens"), and has a standing policy that each division must generate 25% of its annual revenue from products developed in the last 5 years (Nayak & Ketteringham, 1997).

The process is continuous and begins with an initial stage of deliberate seeking out (*generating*) of new problems and opportunities as an everyday activity. The second stage involves *conceptualizing*, that is, formulating, defining, and constructing a newly generated problem, and is followed by the emergence of a solution in the third stage. Following the implementation of the solution, the process begins anew, as the implementation of the new solution sparks new opportunities to be discovered and also permits further development of the implemented solution. Thus, the process is dynamic and continuous. Every implemented solution (action) results in the opportunity to discover (generate) new problems and opportunities to trigger the process to begin anew.

Emphasizing that continuous creativity begins with problem generation, this process serves as a model for organizational adaptability. Adaptable organizations continually and intentionally scan the environment to anticipate new opportunities and problems and to proactively find new products, services, and procedures to implement, thus leapfrogging over their competitors. Each implemented solution leads to new problems to be discovered.

Creative Problem-Solving Style and Organizational Roles

This approach goes beyond modeling creativity as a cognitive multistage problem-solving process. It also suggests that individuals like to contribute in different ways to the process because they have individual preferences for each of the four different stages of the cognitive problem-solving process of Figure 1. People generally prefer some stages relatively more than others. These preferences are called *styles*, with the four cognitive styles tied directly to the four stages of the process.

This approach differs from other approaches to studying cognitive style characteristics that are not related to any process. For example, Armstrong, Allinson, and Hayes (2004) studied the effects of cognitive styles on research supervision, whereas Backhaus and Liff (2007) studied cognitive styles as approaches to management education. Other earlier examples include the following: Zhang and Sternberg's (2005) intellectual styles; Cooper and Miller's (1991) cognitive style discongruencies; Grigorenko and Sternberg's (1995) thinking styles as the interaction of intelligence and personality; Cacioppo, Petty, and Kao's (1984) need for cognition; and Messick's (1984) educational learning styles as differentiated from intellective abilities.

Our approach is consistent with and expands the simplifying models of creativity of Amabile (1983) and Parnes et al. (1977), which suggest that creativity is a function of knowledge and creativity relevant skills. Parnes et al. (1977) and Osborn (1963) more specifically identified ideation and evaluation as the requisite skills. The differences in individuals' preferences for both how the knowledge is apprehended and how the knowledge is used are added to these models to create the notion of style.

The CPSP Instrument

Creative problem-solving styles are measured using the CPSP inventory, which was first published by Basadur, Graen, and Wakabayashi (1990) and subsequently further developed through research and application experience. (The Complete CPSP Technical Manual, 2012, is available from the senior author.)

As shown in Figure 2, the CPSP measures two bipolar, orthogonal, dimensions of cognitive activity underlying the creative problem-solving process. The first dimension, shown on the vertical axis, represents the *apprehension* of knowledge and measures two opposing ways of apprehending knowledge (Experiencing vs. Thinking). Experiencing is a more open, nonrational, experiential, and divergent form of gaining understanding. It is learning by doing, or by "physical processing." In contrast, thinking is more closed, rational, theoretical, and convergent. It is a method of gaining knowledge through detached, abstract thinking (pondering), or by "mental processing." All individuals and organizations gain knowledge in both ways but the relative amounts (ratios) differ from those of others.

There is a long history of study into these different types of knowledge acquisition, dating back at least as far as Kant (1798/1978), who distinguished between sensory and intellectual cognition. This distinction was recognized by Thorndike (1931; learning by trial and error vs. learning by ideas) as well as by later authors (e.g., Mintzberg,

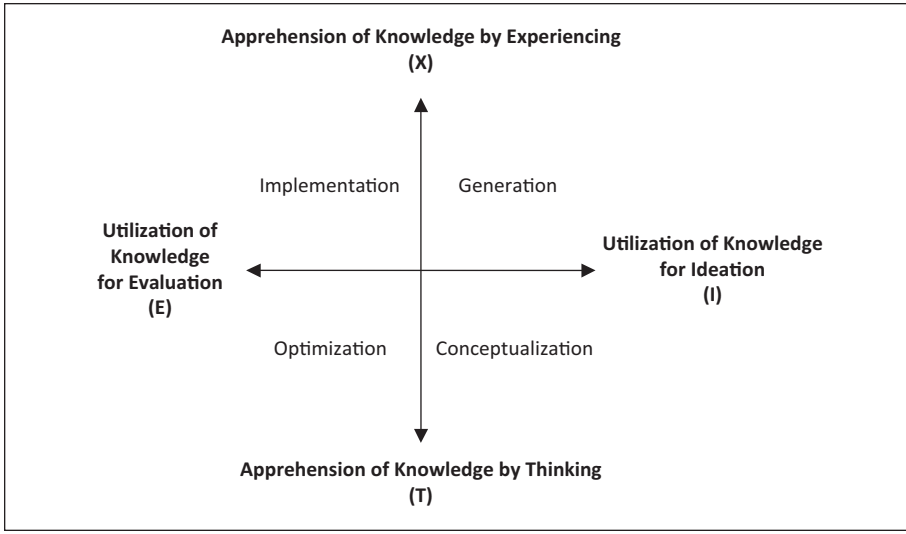

Figure 2. Cognitive activities in the four stages of the creative problem-solving process.

1989; Wonder & Blake, 1992). Guilford (1967) differentiated the mental operation of cognition (gaining knowledge by experiencing) from the mental operation of convergent production (converting given information into the "correct" answer; this is what Sternberg, 1996, defined as theoretical, analytical intelligence). Kolb (1976) emphasized the importance of using hands on experiential learning to complement abstract theoretical learning.

The second dimension, shown on the horizontal axis, represents the *utilization* of knowledge and measures two opposing ways of using knowledge (Ideation vs. Evaluation). Ideation is nonjudgmentally creating new information to increase the variety of options. Evaluation is judgmentally reaching decisions about new information to reduce the variety of options. One way to use knowledge is to *create* options (such as alternative opportunities to pursue, possible solutions to investigate, etc.). The contrasting way to use knowledge is for *evaluating* options. These two methods of applying understanding correspond respectively to Guilford's (1967) mental operations of divergent production (creating options from information) and evaluation (evaluating options). Again, all individuals and organizations use their knowledge in both ways but the relative amounts (ratios) differ from those of others.

Other researchers have also examined the relationship and complementary nature of ideation and evaluation. Acar and Runco (2012) provide a comprehensive examination of research on ideational and evaluational abilities, including how evaluational ability may promote and synthesize with ideational ability. Bipolarized option-producing and option-judging thinking processes are discussed in a variety of contexts by Joyner and Tunstall (1970); Maier (1967); Simon (1977); Simon, Newell, and Shaw (1962); and Parnes et al. (1977).

Basadur et al. (1982) identified a separated, sequenced, two-step thinking process called "ideation-evaluation." They defined ideation as the generation of options without judgment and evaluation as the application of judgment to those options. During ideation, all judgmental, rational, convergent thinking is deliberately deferred in favor of nonjudgmental, nonrational divergent thinking during which options are entertained. During evaluation, the reverse takes place. The two-step ideation-evaluation thinking process is used in each of the four stages of our creative problem-solving process. Basadur and Finkbeiner (1985) identified and created measures for attitudinal factors related to one's preferences for nonjudgmental (diverging) and judgmental (evaluating) modes of knowledge Utilization.

The CPSP questionnaire, as detailed below, determines an individual's creative problem-solving process style by providing scores on these two bipolar dimensions of cognitive activity. High scores on Experiencing and Ideation are characteristic of the *Generator* style. High scores on Thinking and Ideation are characteristic of the *Conceptualizer* style. *Optimizers* have high scores on Thinking and Evaluation, whereas *Implementers* have high scores on Experiencing and Evaluation. Individuals have their own unique blends of preferred styles and most people have one dominant most preferred style.

The Questionnaire

Designed to evaluate an individual's preference for different cognitive creative problem-solving activities, the CPSP questionnaire consists of 12 sets of four words. Respondents are instructed to rank the words within each set from 1 to 4, where 1 represents the word "least characteristic of me as a problem-solver" and 4 represents the word "most characteristic of me as a problem-solver." The four words in each set represent, respectively, Experiencing (X), Thinking (T), Ideation (I), and Evaluation (E). Six four-word distractor sets are embedded within the questionnaire to prevent respondents from identifying patterns and responding stereotypically.

The measures of Apprehension and Utilization are constructed from the item rankings. One measure (XT) is constructed by subtracting the T-item score in a word set from the X-item score in the same set, and the other (IE) by subtracting the E-item score from the I-item score. The 12 XT scores constitute a bipolar scale of Apprehension, which represents the preference for Experiencing over Thinking; the 12 IE scores constitute a bipolar scale of Utilization representing the preference for Ideation over Evaluation. For each four-item word set, XT and IE can take values of ±3, ±2, or ±1. An individual's Apprehension and Utilization scores are respectively the sum of his or her 12 XT and 12 IE scores. The theoretical range for both scales is −36 to +36, with an expected mean of zero. The psychometric properties of the CPSP, which we report below, are based on the Apprehension and Utilization scales. It should be noted that although the raw responses are ranked, these scales are normative and statistically independent and therefore can be analyzed by standard statistical methods. Although the instrument presents the respondent with a forced choice task, the scoring of the instrument produces two normative scales.

Examples of the Application of the CPSP

The CPSP has assisted many organizations to diagnose style imbalances impacting on problem solving and innovation success. Following are some real-world examples of how organizations have applied the CPSP to diagnose problems and improve adaptability performance.

A new managing director of a stagnant medium-sized European manufacturing company had been hired specifically to develop a breakthrough product and bring it to market. He had assembled a team that, in very little time, developed an exciting new product concept. However, the team had subsequently ground to a standstill. Members failed to attend meetings regularly and several felt that there was nothing important remaining to be done. The CPSP was administered to all team members. Analysis showed that all the team members whom the managing director had intuitively selected were either generators or conceptualizers, resulting in a team that was strongly biased toward using knowledge for ideation. The managing director realized that to bring the new product concept to market, he needed to bring optimizers and implementers onto the team, to strengthen the team's orientation toward using knowledge for evaluation.

A large global engineering company serving the airline, airplane, and aerospace industries was not having success in implementing an aggressive new growth strategy that depended on developing new products and entering new markets. The CPSP was administered to a large number of employees, and most managers and professionals were found to be very strongly oriented toward the optimization and implementation styles. This finding accurately reflected a strong organizational culture that favored analysis of, and quick fixes to, short-term efficiency problems. The company instituted an extensive training program to develop awareness of and skills in generation and conceptualization. It also created a corporate program that provided significant financial incentives for all business units to propose new projects for developing new products and markets.

A large bank in a very competitive environment formed teams to develop a range of new financial products, but a high percentage of the new products were failing in the market. CPSP profiles indicated that the teams contained a high proportion of implementers. Further discussion revealed that the teams often developed new products by rushing directly from an initial suggestion into implementation. By getting the implementers to be more patient and help their teammates devote more time to conceptualization, the teams would likely have developed better designed products. And with more time in optimization, the teams would have ensured that products were thoroughly developed and tested before final versions reached the market.

The organizational development team of a large health insurance company was experiencing difficulty finishing its task, which was to recommend a new strategy to senior management. Each time the team was about to forward a recommendation, one or more of the members would insist on revisions to take into account new information or to make the strategy more comprehensive. The team members were unable to agree on a final recommendation and were in a state of "paralysis by analysis." Administration of the CPSP revealed that the team was entirely made up of conceptualizers. (Only

their administrative assistant was an implementer.) The team was advised to diversify its membership by adding people with a preference for optimization and implementation to help them select and deliver an acceptable strategy to management rather than try to attain perfect understanding.

CPSP Field Research

The CPSP instrument, as described earlier, measures creative problem-solving styles and maps them directly onto the four stages of an established creative problem-solving adaptability process. Use of both the process and the instrument will provide managers with a clear roadmap for understanding, implementing, and sustaining adaptability and managing change within their organizations.

Ongoing CPSP research has examined the impact of the instrument on various areas of individual, team, and organizational adaptability. The remainder of this article examines the distribution of styles in 38 different occupations, and at five organizational levels. It reports the collection and analysis of data used to establish the psychometric properties of the CPSP and explores the relationship between the creative problem-solving process and cognitive work environment demands. This is a theoretical article drawing extensively on our empirical work developing and applying the CPSP over several years. The instrument introduces a new arena for scholarly research, as well as a variety of possible practical applications. A full section outlining the implications to innovation and change management, and providing future research opportunities to expand the usefulness of the CPSP completes the article.

Propositions to Be Tested

The four creative problem-solving styles in the CPSP model reflect a preference for different cognitive activities required throughout the stages of the problem-solving process. With the recognition that different occupations and work environments also require individuals to engage in a range of different cognitive activities, we sought to determine whether there is an association between an individual's creative problem-solving style and his or her preferred organizational role. Specifically, we examined the distribution of creative problem-solving styles at different organizational levels and within different occupations.

Understanding such relationships could assist organizations to place employees in appropriate roles and thus increase their effectiveness, job satisfaction, and motivation. According to Holland's (1959, 1985) theory of vocational personalities and work environments, people and work environments can be meaningfully classified into different types, and "people search for [work] environments that will allow them to exercise their skills and abilities, express their attitudes and values, and take on agreeable problems and roles" (Holland, 1985). The occupation that a person will find most satisfactory, and the one in which they will be most successful, is the one that maximizes the congruence between the demands of the work environment and their vocational personality.

Previous research (Basadur, 1995) found an association between different fields of work and the ideation-evaluation (I-E) preference ratios of employees doing those jobs. Individuals in positions requiring more problem generation and conceptualization expressed higher I-E preferences than those in work requiring more solution optimization and implementation. Given that evidence, we predicted a similar correspondence between work demands and CPSP style preferences. We expected individuals in jobs requiring achievement of short-term results, such as sales, production, administrative assistant, and information technology (IT) operations, would favor the Implementer style. Those in positions requiring precise solutions, such as IT systems development, engineering, and finance, would favor the optimizer style. People working in jobs in which understanding and problem definition are vital, such as market research, strategic planning, research and development, and organizational development, would be expected to favor the conceptualizer style. People engaged in initiating new projects or exploring new areas of inquiry, changes, and possibilities for improvement and future growth, such as marketing, academia, design, and artistic endeavors (writers, musicians and artists), would be expected to favor the Generator style.

In a similar vein, correspondence was also anticipated between CPSP style preferences and organizational level. The reasoning is that different levels of responsibility in an organization place different cognitive creative problem-solving process demands on an individual. Increasingly more responsible positions typically involve fewer day-to-day operational tasks and a shift toward the creation of vision and policy, strategic thinking, conceptualization of the "big picture," and the definition of goals for others to achieve (Sternberg, 1997). This suggests that individuals working at higher organizational levels may prefer conceptualizing, whereas individuals at lower levels of responsibility may prefer implementation. For instance, a salesman who enjoys his everyday interactions with customers might be less satisfied with a sales manager role that requires more planning and strategic thinking.

Data Collection and Analysis

Over several years, a total of 6,091 CPSP questionnaires were administered to a wide cross-section of participants in training and application workshops, either inside organizations or in public seminars. The vast majority of respondents were either in full-time employment or were MBA students who completed the CPSP as an element of course work. The inventories were completed as part of the training or application workshops and were not primarily for the purpose of this research. All inventories were completed using pencil and paper. All respondents received feedback on their styles and learned about the interconnection with the application of our creative problem-solving process in the workshop. The organizations included consumer goods and pharmaceutical companies, banks, manufacturers of car parts, airplane components, textiles and other materials, chemical companies, government ministries, telecommunications and technology companies, health care institutions, educational administrators and faculty, municipal and nonprofit organizations, and consulting and advertising organizations.

Respondents were given the option of reporting their name, job title, department, and employing organization or of completing the inventory anonymously. Job title, department, and employing organization were used to classify each respondent where possible by occupation and organizational level. Of all respondents in employment, 3,942 could be categorized into one of 38 occupations (minimum *n* per occupation = 27), and 3,783 into one of five organizational levels. The first four organizational levels (nonmanager, supervisor/team leader, middle manager, upper manager) represented increasing levels of organizational responsibility and, hypothetically, increasing demand for strategic thinking. The fifth category comprised specialist technical and professional jobs.

Apprehension (XT) and Utilization (IE) scores were calculated for each respondent. Overall, there was a slight preference for X over T (mean XT = +3.2) and a slight preference for E over I (IE = −1.0). To express the XT and IE scores on comparable scales, scores were converted to T-scores (mean = 50, standard deviation = 10). Respondents were then assigned to one of four CPSP style quadrants according to their XT and IE T-scores. Thus, if XT was greater than 50 and IE was greater than 50 the individual was assigned to the Generator quadrant; if XT was less than 50 and IE was greater than 50 the individual was assigned to the Conceptualizer quadrant; if XT was less than 50 and IE was less than 50 the individual was assigned to the Optimizer quadrant; and if XT was greater than 50 and IE was less than 50 the individual was assigned to the Implementer quadrant.

Field Research Results

Creative Problem-Solving Profile Psychometric Testing

Principal components analysis of the Apprehension and Utilization scores (with Varimax rotation) was conducted on the full data set ($N = 6{,}091$). The Velicer Map test for factor extraction quantity (Velicer, 1976) indicated a two-component structure, as did a Scree plot of the eigenvalues (Cattell, 1966). Cronbach alpha reliabilities for the Apprehension and Utilization scales were satisfactory (.71 and .75, respectively). The correlation between the scores on the two scales was low (−.19), supporting the orthogonality of the two dimensions. Test–retest correlations for the two scales (tests were administered 1 week apart) were .78 and .79, respectively.

These results are summarized in Table 1. Overall, they demonstrate satisfactory psychometric properties in terms of consistency, scale reliability, and scale discrimination.

CPSP Styles and Organizational Levels

The CPSP styles associated with different organizational levels are shown in Table 2. For each level, Table 2 reports the mean XT and IE scores and their standard errors and the percentage of individuals in each CPSP quadrant.

Analysis of variance shows that both the XT and the IE scale scores vary significantly by organizational level (XT, $F = 17.8$, $df = 4$, $p < .001$; IE, $F = 29.2$, $df = 4$, $p < .001$). Linear contrast tests show that the XT scale scores decrease ($t = -7.04$, $p < .001$)

Table 1. Psychometric Properties of the CPSP.

Standardized item alpha (*N* = 6,091)	
Apprehension (XT)	.71
Utilization (IE)	.75
Correlation between XT and IE	−.19
Principal components analysis (*N* = 6,091)	
% Variance explained	
Component 1	16.6%
Component 2	10.6%
First five eigenvalues	4.00
	2.53
	1.58
	1.30
	.99
Test–retest correlations (*N* = 80)	
Apprehension (XT)	.78***
Utilization (IE)	.79***

***$p \leq .001$.

Table 2. CPSP Scale *t* Scores and Mix of Styles by Organizational Level.

Organizational level	*N*	Apprehension (XT)		Utilization (IE)		Percentage of			
		M	*SE*	*M*	*SE*	Generators	Conceptualizers	Optimizers	Implementers
Non-manager	449	51.6	0.45	47.6	0.40	19.4	16.9	22.3	41.4
Supervisor/ team leader	1073	51.9	0.29	47.8	0.26	19.9	17.3	21.8	40.9
Middle manager	843	50.3	0.34	49.7	0.34	19.5	24.4	22.3	33.8
Upper manager	357	48.7	0.55	51.6	0.52	17.9	35.9	17.4	28.9
Technical/ professional	1061	48.7	0.32	51.6	0.33	22.8	30.2	23.3	23.8

and the IE scale scores increase ($t = 9.57$, $p < .001$) with increasing organizational levels, indicating an increased preference for Thinking (as opposed to Experiencing) and for Ideation (as opposed to Evaluation) at higher organizational levels.

The results shown in Table 2 and visually displayed in Figure 3 indicate that the percentage of Conceptualizers increases ($\chi^2 = 87.5$, $df = 4$, $p < .001$) from 16.9% (lowest level, non-manager) to 35.9% (upper-level manager) and the percentage of Implementers decreases ($\chi^2 = 88.0$, $df = 4$, $p < .001$) from 41.4% to 28.9% with increasing organizational levels. The percentages of Generators and Optimizers, on the other hand, are relatively stable across organizational level (Generators, $\chi^2 = 6.03$, $df = 4$, *ns*; Optimizers, $\chi^2 = 5.6$, $df = 4$, *ns*). In the technical/professional jobs category, Conceptualizers represent the highest percentage (30.2%) with the other three styles

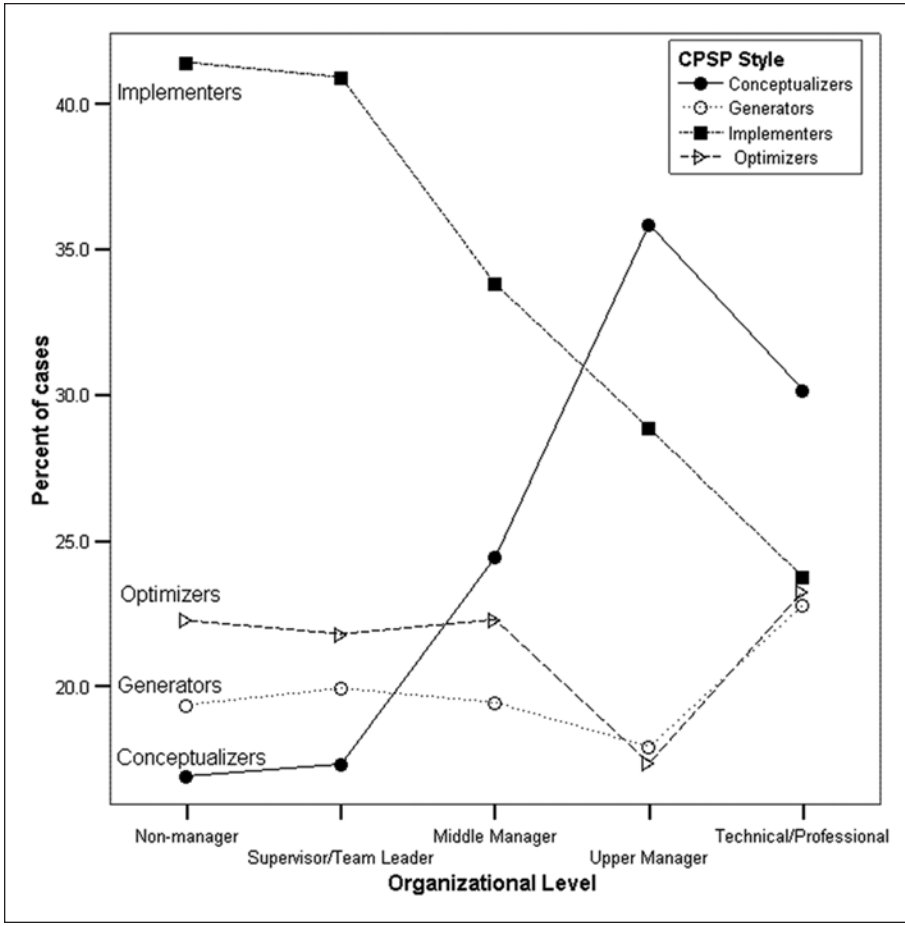

Figure 3. Mix of CPSP styles by organizational level.

all about the same at approximately 23%. Generators were the smallest percentage at every organizational level except non-managerial, where they were second smallest percentage.

CPSP Styles and Occupation

Table 3 shows the mean scale scores and their standard errors for individuals in various occupations and the percentages of individuals in each CPSP quadrant.

Analysis of variance shows that both XT scores ($F = 8.2$, $df = 37$, $p < .001$) and IE scores ($F = 18.5$, $df = 37$, $p < .001$) vary significantly by occupation. Maximum likelihood estimates of variance show that occupation and job level together account for 6.2% of the variance in XT scores and 18.2% of the variance in IE scores.

Table 3. CPSP Scale T-Scores and Mix of CPSP Styles by Occupation.

Occupation	*n*	Apprehension (XT)		Utilization (IE)		Percentage of			
		M	*SE*	*M*	*SE*	Generators	Conceptualizers	Optimizers	Implementers
School teacher	27	51.9	2.1	60.4	2.1	55.6	22.2	11.1	11.1
Academic	58	47.9	1.6	58.5	1.6	37.9	39.7	10.3	12.1
Artistic	32	47.4	2.0	60.9	1.7	34.4	46.9	12.5	6.3
Nonprofit/university admin.	89	51.5	1.0	53.1	1.1	32.6	28.1	13.5	25.8
Training	240	49.2	0.7	55.6	0.7	32.5	32.5	17.9	17.1
Marketing	172	49.0	0.8	53.6	0.7	30.2	33.7	19.8	16.3
Design	73	47.6	1.0	57.3	1.0	30.1	47.9	12.3	9.6
Health mgmt. exec.	37	50.4	1.6	52.0	1.5	29.7	21.6	21.6	27.0
Advertising mgr.	68	50.2	1.0	50.9	1.2	26.5	30.9	17.6	25.0
Tech. customer support	46	51.5	1.5	46.9	1.3	23.9	10.9	28.3	37.0
Sales	379	53.8	0.4	47.9	0.4	23.7	14.0	15.6	46.7
Logistics	94	53.1	0.9	47.1	0.8	22.3	12.8	22.3	42.6
Product dev.	45	48.9	1.7	55.5	1.7	22.2	44.4	8.9	24.4
Personnel/HR	144	50.1	0.8	50.2	0.8	21.5	28.5	20.1	29.9
Business consultant	63	50.0	1.2	50.9	1.2	20.6	28.6	20.6	30.2
Mfg prodn.	386	52.1	0.4	48.0	0.4	20.2	18.4	17.1	44.3
Fund raising/PR	37	51.0	1.4	51.1	1.5	18.9	32.4	18.9	29.7
R&D	95	45.1	1.1	55.1	1.2	17.9	47.4	18.9	15.8
Organization dev.	81	44.9	1.1	59.6	1.2	17.3	60.5	12.3	9.9
Qual. assurance	87	50.3	1.1	49.1	1.1	17.2	21.8	24.1	36.8
Mfg. maintenance	54	49.7	1.3	48.0	1.0	16.7	24.1	22.2	37.0
Project mgr.	78	53.3	1.1	45.7	0.9	16.7	12.8	21.8	48.7

(continued)

Table 3. (continued)

Occupation	*n*	Apprehension (XT)		Utilization (IE)		Percentage of			
		M	*SE*	*M*	*SE*	Generators	Conceptualizers	Optimizers	Implementers
Operations	45	52.7	1.5	46.9	1.2	15.6	20.0	22.2	42.2
Gen. mgmt-small co./div.	84	52.0	1.1	48.0	1.0	15.5	21.4	21.4	41.7
IT prog./analyst	194	49.7	0.7	46.9	0.6	15.5	17.5	31.4	35.6
Secretarial/admin	159	52.6	0.8	45.7	0.7	14.5	13.2	22.0	50.3
Accounting	105	48.9	0.9	47.7	0.8	13.3	22.9	30.5	33.3
Market research	23	45.1	2.3	52.0	2.5	13.0	52.2	17.4	17.4
Purchasing	69	51.3	1.0	46.6	1.1	13.0	15.9	24.6	46.4
Customer relations	65	52.2	1.2	46.3	1.1	12.3	15.4	21.5	50.8
Social/health services	131	48.9	0.9	48.1	0.8	12.2	24.4	28.2	35.1
IT operations	117	53.9	0.8	44.6	0.7	12.0	6.8	17.1	64.1
IT sr. consultant	85	45.3	1.2	50.2	1.2	10.6	40.0	27.1	22.4
Finance	110	46.9	0.9	47.1	0.8	10.0	26.4	36.4	27.3
IT systems developer	199	46.7	0.7	48.7	0.7	9.5	31.2	36.2	23.1
Mfg engineering	32	45.4	1.8	46.9	1.4	9.4	34.4	37.5	18.8
Strategic planning	46	42.8	1.4	53.8	1.6	8.7	56.5	28.3	6.5
Engineering/eng. design	93	47.7	0.9	46.4	0.8	7.5	21.5	43.0	28.0

For convenience, the data in Table 3 are organized by placing all occupational percentages in descending order in Column 1 (Generators) and then placing the corresponding occupational percentages in the corresponding rows of Columns 2 (Conceptualizers), 3 (Optimizers), and 4 (Implementers). Table 3 shows that in the Generator style (Column 1), the highest percentages of jobs were school teacher (55.6%), academic (37.9%), and artistic (34.4%) and the lowest percentages were engineering/engineering design (7.5%), strategic planning (8.7%), and manufacturing engineering (9.4%). In the Conceptualizer style (Column 2), the highest percentages were organizational development (60.5%), strategic planning (56.5%), and market research (52.2%), and the lowest percentages were information technology (IT) operations (6.8%), technical customer support (10.9%), and project manager (12.8%). In the Optimizer style (Column 3), the highest percentages were engineering/engineering design (43.0%), manufacturing engineering (37.5%), and finance (36.4%), and the lowest percentages were product development (8.9%), academic (10.3%), and school teacher (11.1%). In the Implementer style, the highest percentages were IT operations (64.1%), customer relations (50.8%), and secretarial administrative support (50.3%). The lowest percentages were artistic (6.3%), strategic planning (6.5%), and design (9.6%).

Table 4 ranks occupations by CPSP style.

In the four columns of Table 4, occupations are ranked (in descending order in each column) by the percentages of styles in each. In the first column, occupations are ranked by the percentages of Generators. The occupation with the highest proportion of Generators is School Teacher, followed by Academic, Artistic, Nonprofit/University Administrator, and Training. In the second column, occupations are ranked by the percentage of Conceptualizers. The occupations that contain the five highest proportions of Conceptualizers are Organization Development, Strategic Planning, Market Research, Design, and Research and Development (R&D). In the last two columns, occupations are ranked by the percentages of Optimizers and Implementers, respectively. The occupations that contain the most Optimizers are Engineering/Engineering Design, Manufacturing Engineering, Finance, IT Systems Developer, and IT Programmer/Analyst. The occupations that contain the most Implementers are IT Operations, Customer Relations Secretarial/Administrative Support, Project Manager, and Sales.

Discussion of Results

These results support the general hypothesis of compatibility between an individual's occupation and his or her preferred creative problem-solving style. The prediction was that people's CPSP style preferences would correspond to the different creative problem-solving demands of their work. The test results provide evidence that individuals working in positions that require achievement of short-term results favor the Implementer style. The highest ranking Implementer style jobs included IT Operations, Customer Relations, Secretarial/Administrative Support, Project Manager, and Sales. From the handling of customer complaints to the need to minimize IT downtime, these positions all demand short-term problem solving activities and quick delivery of results.

Table 4. Occupations Ranked by Occurrence of CPSP Style.

Rank	Generators	Conceptualizers	Optimizers	Implementers
1	School Teacher	Organization Dev.	Engineering/Eng. Design	IT Operations
2	Academic	Strategic Planning	Mfg Engineering	Customer Relations
3	Artistic	Market Research	Finance	Secretarial/Admin
4	Non-Profit/ University Admin.	Design	IT Systems Developer	Project Mgr.
5	Training	R&D	IT Prog/Analyst	Sales
6	Marketing	Artistic	Accounting	Purchasing
7	Design	Product Dev.	Strategic Planning	Mfg Prodn.
8	Health Mgmt. Exec.	IT Sr. Consultant	Tech. Customer Support	Logistics
9	Advertising Mgr.	Academic	Social/Health Services	Operations
10	Tech. Customer Support	Mfg Engineering	IT Sr. Consultant	Gen. Mgmt-Small Co./Div.
11	Sales	Marketing	Purchasing	Tech. Customer Support
12	Logistics	Training	Qual. Assurance	Mfg. Maintenance
13	Product Dev.	Fund Raising/PR	Logistics	Qual. Assurance
14	Personnel/HR	IT Systems Developer	Mfg. Maintenance	IT Prog/Analyst
15	Business Consultant	Advertising Mgr.	Operations	Social/Health Services
16	Mfg Prodn.	Business Consultant	Secretarial/Admin	Accounting
17	Fund Raising/PR	Personnel/HR	Project Mgr.	Business Consultant
18	R&D	Non-Profit/ University Admin.	Health Mgmt. Exec.	Personnel/HR
19	Organization Dev.	Finance	Customer Relations	Fund Raising/PR
20	Qual. Assurance	Social/Health Services	Gen. Mgmt-Small Co./Div.	Engineering/Eng. Design
21	Mfg. Maintenance	Mfg. Maintenance	Business Consultant	Finance
22	Project Mgr.	Accounting	Personnel/HR	Health Mgmt. Exec.
23	Operations	School Teacher	Marketing	Non-Profit/University Admin.
24	Gen. Mgmt-Small Co./Div.	Qual. Assurance	R&D	Advertising Mgr.
25	IT Prog/Analyst	Health Mgmt. Exec.	Fund Raising/PR	Product Dev.
26	Secretarial/Admin	Engineering/Eng. Design	Training	IT Systems Developer
27	Accounting	Gen. Mgmt-Small Co./Div.	Advertising Mgr.	IT Sr. Consultant
28	Market Research	Operations	Market Research	Mfg Engineering
29	Purchasing	Mfg Prodn.	Mfg Prodn.	Market Research
30	Customer Relations	IT Prog/Analyst	IT Operations	Training
31	Social/Health Services	Purchasing	Sales	Marketing
32	IT Operations	Customer Relations	Non-Profit/University Admin.	R&D
33	IT Sr. Consultant	Sales	Artistic	Academic
34	Finance	Secretarial/Admin	Organization Dev.	School Teacher
35	IT Systems Developer	Logistics	Design	Organization Dev.
36	Mfg Engineering	Project Mgr.	School Teacher	Design
37	Strategic Planning	Tech. Customer Support	Academic	Strategic Planning
38	Engineering/Eng. Design	IT Operations	Product Dev.	Artistic

Note. Occupations ranked 1 contain the highest percentages of the relevant style.

The highest ranking Optimizer style jobs were Engineering/Engineering Design, Manufacturing Engineering, Finance, IT Systems Developer, and IT Programmer/Analyst. In each of these positions, practical, precise, and detail-oriented plans, processes, and solutions are sought.

The occupations that contain the five highest proportions of Conceptualizers are Organization Development, Strategic Planning, Market Research, Design, and Research and Development. These are all jobs in which understanding and problem definition are vital. Organizational, employee, and customer needs must be defined so that new products, services, structures, and strategies for future growth can be designed.

The occupations that contain the five highest proportions of Generators are School Teacher, Academic, Artistic, Nonprofit/University Administrator, and Training. First, it must be noted that none of these have significant representation within industrial organizations, except possibly training. Second, for each of these jobs, a case could be made that they are compatible with Generator activities such as exploring new areas of inquiry, initiating new projects, seeking change and imagining possibilities for improvement, innovation, and future growth in terms of students, music, art, writing, academic programs, and research possibilities. These compatibilities might be more evident in some cases than others. A clear case could certainly be made for Marketing, Design, and Advertising jobs, which were ranked sixth, seventh, and ninth. Marketing and Advertising are centered on initiating new projects and finding new ways to build interest among customers and capitalize on new trends and opportunities sensed in the environment. Designers initiate change by offering imaginative ways to communicate and stimulate interest in new ideas.

It was also proposed that employees at higher organizational hierarchical levels (and therefore with greater responsibilities for strategic thinking rather than implementation of everyday operational tasks) would have stronger preferences for the conceptualization style than the implementer style. The results shown in Table 2 and visually displayed in Figure 3 support this proposition. The percentage of Conceptualizers increases and the percentage of Implementers decreases with increasing levels of responsibility. There may be many reasons for this. However, an important reason may be that the cognitive demands of the different levels of responsibility are correspondingly different, especially in terms of the creative problem-solving process demands on them. Senior management people have responsibility for understanding the organization's strengths and weaknesses, defining the opportunities and threats facing it now and in the future, and creating strategic plans, including efficiency and adaptability goals and objectives. This is problem definition (Conceptualization) work. People with lower level jobs are typically tasked with executing assigned tasks (Implementation work) to achieve the more strategic goals and objectives.

Limitations

We recognize certain limitations to our research, particularly as it relates to the results of the random administration of the Creative Problem Solving Process on the

subsequent data collection. Some of the occupations cited within our study had a small sample size. For example, school teachers ($n = 27$), market researchers ($n = 23$), artistic ($n = 32$), manufacturing engineering ($n = 32$). Larger bases sizes would sharpen our findings and give greater confidence in their accuracy. Larger base sizes would also allow us to split out "subbases," such as different types of artistic, training, or project management occupations, and look for style differences among them. It may be that the style for some jobs is domain specific. For example, a physics teacher might be stylistically different from an art teacher. It might be that a physics teacher is somewhat like an engineer, whereas an art teacher is rather more like an artist.

A second limitation to our research arises from the impact of secondary preferred styles. We did not evaluate or assess the impact of blends of styles. For example, the role fit for an individual with a preference for the generation style but a strong secondary preference for implementation might be quite dissimilar from that of an individual with a preference for the generation style and a strong secondary preference for the conceptualizer style.

There are numerous other factors that we did not investigate, including age and gender, which may have an impact on style preference or role fit. For example, do older people or women have a different style distribution than younger people or men?

Finally, our categorization of occupation and job title was limited by our reliance on participants' self-reporting. We could have been more precise by providing a menu of carefully crafted descriptions of selected occupations, job titles, and organizational levels for participants to select from. As suggested in our first limitation, domain areas for certain jobs (i.e., training, teaching, university lecturer, etc.) may also have been helpful. Improved precision would have helped further standardize our data, and is clearly important given the growing variety of organizations with unique varieties of job titles and descriptions.

Implications for Managing Innovation and Change

A discussion about the implications of the preceding sections is organized under three subheadings covering individual, team, and organizational implications. These implications will overlap considerably.

Implications for Organizations

The distribution of respondents by preferred creative problem-solving process stage is very much worth examining from the standpoint of managing organizational innovation and change. It is interesting to note that only about 20% of individuals were found to prefer the Generator style. Not only are they the smallest group, they are also predominantly found in nonindustrial occupations; few business and industrial occupations had a high proportion of Generators. Furthermore, Generators were no more likely to be found among senior managers than at other levels of the organizational hierarchy. These findings are perhaps the most provocative for business and industry, whose most perplexing challenge today is how to be more innovative in the face of

accelerating change, increased competition, and pressure for revenue growth. Although many corporations recognize the need to innovate, they also find it difficult to do. Perhaps one reason for this is the lack of employees with a preference for the Generator style of thinking; generator activity is the first stage of the innovative thinking process, and the essential trigger for subsequent change.

If organizational success depends so critically on innovative change, and if Holland's theory of vocational choice is correct, why are employees with Generator characteristics apparently underrepresented in business organizations? Perhaps many companies have yet to learn how to retain and motivate individuals who prefer the Generator style. Generators are the farthest away from work that is visibly measurable. In contrast to people in sales and manufacturing, for example, Generators do not produce tangible and measurable results such as sales completed or goods produced. Rather, they initiate work that others carry forward and complete. It is therefore perhaps more difficult for organizations to recognize their contributions and to reward the kind of work that they do.

However, one could argue that it may be overly simplistic to speculate that the difficulty with innovating in organizations is the lack of employees who prefer the generator style of thinking. For example, a single Generator might initiate enough work for 10 Implementers. A more productive approach might be to raise broader questions and hypotheses about the appropriate mixes or ratios of the four quadrant preferences within various organizational departments and functions, or within an organization as a whole. From an *intra*-organizational perspective, different ratios of the four quadrants might be appropriate within, say, manufacturing or service organizations, or within the particular departments of a given organization, such as R&D, sales, IT, or finance. The optimal mix for a top management team might differ from that for a lower-level team. Previous research (Basadur, 1994) has suggested that a business unit's optimal ratio may depend on the typical proportion of work oriented toward problem generation.

It is also worth considering the impact creative problem-solving process profiles can have on an organization's culture. Individual organizations have their own creative problem-solving process profiles, which are reflective of factors such as the type of people they hire, their values, and their reward systems. For example, if an organization focuses almost entirely on short-term results, it may be overloaded with Implementers and have few Conceptualizers or Generators. The organization will show strengths in processes that deliver its current products and services efficiently. But it will show weaknesses in long-term planning and product development that might help it to stay ahead of change. Rushing to solve problems, this organization will continually find itself reworking failed solutions without pausing to conduct adequate fact finding and problem definition. In contrast, an organization with many Generators or Conceptualizers and few Implementers will continually find good problems to solve and great ideas for products and processes to develop but may never carry them to their conclusion.

From the standpoint of managing organizational innovation and change, the CPSP may offer organizational leaders insight into how to increase effectiveness in the face

of accelerating change, increased competition, and pressure for revenue growth. Although many corporations recognize the need to innovate, they also find it difficult to do. Regardless of the current popularity of creativity and innovation in the media and business publications, most organizations—when given a choice—overwhelmingly favor established routine solutions over unproven novel solutions (Ford & Sullivan, 2005; Staw, 1995).

There is an opportunity for organizational leaders to model and use the four-stage process as a *blueprint* for getting the organization to cycle through of all four stages as a consistent organization-wide business innovation process just as they have standardized other business processes. One of the most discussed impediments to innovation in organizations is the so-called "silo effect." Currently, most organizations lack the ability to move projects horizontally across the different departments from beginning to implementation (Basadur, Potworowski, Pollice, & Fedorwicz, 2001), partly because they lack a *process* for doing so. Perhaps organizational members can learn and build skills in synchronizing the different preferences for the stages of the process of various departments and influence members from different parts of the organization to work more efficiently and collaboratively through the process from generation to successful implementation of valuable changes. This would include individuals on teams learning to recognize their own preferred styles and to understand their preferred part of the process as representing only a portion of a complete change process, and skillfully integrating their styles with others across the organization to allow the four-stage process to be implemented successfully and efficiently.

We suggest the following additional propositions as sample starting points into future research in these fields:

Proposition 1: Organizations trained to understand and appreciate CPSP style differences will report increased interdepartmental collaboration compared with untrained organizations.

Proposition 2: Organizations trained to understand and appreciate CPSP style differences will more speedily and efficiently develop and implement higher quality creative solutions across departments compared with untrained organizations.

Proposition 3: Organizations trained in cognitive creative problem-solving process style diversity will report higher member job satisfaction.

Proposition 4: Members of organizations who are trained to understand the four styles of the creative problem-solving process represented by the CPSP will value diversity within their organization more than will members of untrained organizations.

The creative problem-solving process and the CPSP could also be used to engage employees in adaptability as a deliberate means for motivation. Field research (Basadur, 1992) provides evidence that establishing adaptability as a daily and continuous process increases employee motivation and commitment. Permitted to engage in finding and solving problems, people become intrinsically motivated and desire even more participation in creative activity. They also work harder at perfecting their

routine jobs to increase quality and quantity and reduce costs, thus increasing organizational efficiency and short-term organizational effectiveness.

Creative activity also stimulates team building as people help each other to solve problems. This connection between creative activity and employee motivation is supported by motivational literature in industrial and organization psychology. For example, two important motivational need sets—the need for competence and the need for curiosity and activity—provide the most direct explanations of how creativity motivates people (Berlyne, 1967; White, 1959). When people face new, challenging situations, their need for competence can be satisfied by performing creatively. Many people find that exercising their curiosity and exploring new things is intrinsically motivating. Hertzberg, Mausner, and Snyderman's (1959) research also suggested that the way to truly motivate people at work was "job enrichment" or redesigning jobs to require creativity. More recently, the research of Amabile (1993), Deci and Ryan (1985), and Hackman and Oldham (1980) has supported the link between creative work and motivation.

Proposition 5: Organizations that train employees in the creative problem-solving process, and administer the CPSP to encourage understanding, and model continuous adaptability, will report higher member motivation.

These data also suggest several interesting intraorganizational and interorganizational questions that might be approached through the framework presented in this article. For example, the effectiveness of organizations, departments, or functions—and relationships among organizations, advisers, customers, suppliers, and strategic partners—may depend partly on the ability to exploit diverse thinking styles and on how well the mix of available styles matches the cognitive creative problem-solving work.

Similar considerations might, in principle at least, be extended to the dynamics of creativity and change at higher (supra-organizational) levels. Dealing effectively and creatively with change is a challenge not just for organizations but for entire economic systems, industries, and societies. Our experience of innovation at this level has generally been painful. The charismatic and visionary "generator" with a remedy for society's ills is a well-known archetype. But even the best-intentioned of these is likely to cause more harm than good if the thinking stops at this stage. Continued inertia and excessive conservatism are likely either to cause atrophy and decay or build irresistible pressures, leading to an uncontrolled and destructive catharsis. A better understanding of the dynamics of the creative problem-solving process, and the diversity of thinking processes needed to navigate change at the micro level, might contribute to a better understanding of how to avoid such difficulties at the macro level.

Implications for Teams

Teams (and entire organizations) also have unique creative problem-solving process profiles. Teamwork can be unproductive if members are unaware of variations in their

individual problem-solving styles and fail to synchronize these differences. Without a creative problem-solving process to follow, they often jump into "solving the problem" without first considering what the real problem is, and subsequently flounder. Interfunctional teams become stalled arguing about territorial issues because they do not have a common creative problem-solving process to guide them toward agreement on project definition and the selection of solutions that are best for the organization as a whole. Similarly, without a guiding process, meeting leaders steer toward their own points of view rather than facilitating the group to work open-mindedly and cohesively. As suggested through several examples presented earlier in this article, the CPSP can be applied to head off or diagnose such problems and improve creativity and innovation performance.

Interdisciplinary teamwork is an important topic in the change management literature, especially as it concerns innovation, continuous improvement, employee engagement, and complex problem solving (e.g., Hauschildt, 2001). Often teamwork is frustrating and even dysfunctional. First, if teams are not created with an appropriate mix of styles, their performance may suffer. Basadur and Head (2001) reported an experiment in which teams with a mix of styles significantly out-performed teams whose members all had the same style in innovative work. In the former case, all cognitive problem-solving stages of the creative process were readily available within the team, but in the latter case, certain stages of the process were underrepresented. Second, lack of awareness and understanding of the different problem-solving cognitive styles among team members may be a significant source of this difficulty. If team members understand their own creative problem-solving styles and thus their personal preferences for different stages of a multistage process of creative problem solving, this can increase their sensitivity to, patience for, and appreciation of the value of their teammates' different styles, and improve the quality of their interactions and their team problem-solving performance (e.g., Basadur, 1995). Then, rather than endure frustration in working with team members' different and even opposing cognitive styles, they can build skills in synchronizing these different preferences for the stages of the problem-solving process and more efficiently and collaboratively work their way through the complete process through to successful implementation of change.

The CPSP also provides special opportunities for increasing understanding and insights into group diversity. For example, Bezrukova, Jehn, and Spell (2012) emphasize the gaps in the literature on diversity research and training programs. A relatively unexplored aspect of group diversity is group cognitive diversity. There have been many studies focusing on knowledge diversity, personality diversity, and functional and educational diversity as so-called deep-level constructs that go beyond the traditional study of race, ethnicity, and other surface-level diversity constructs (e.g., Harrison, Price, Gavin, & Florey, 2002; Ragins & Gonzalez, 2003). Recent research into group diversity and conflict has focused on creativity. For example, the conditions under which cognitive team diversity may be related to individual creativity were tested by Shin, Kim, and Bian (2012). As well, successfully managing conflict between group members is argued as enabling groups to

function more creatively (Jehn & Bendersky, 2003). Diversity, it is argued, is important to group creative performance as it means group members provide unique knowledge due to their differing backgrounds, whether this uniqueness stems from surface-level or deep-level characteristics (Milliken, Bartel, & Kurtzberg, 2003).

More research is needed to go beyond knowledge diversity into problem-solving process diversity. For example, might there be "optimal mixes" of the different CPSP styles for different kinds of problems to be solved? Might there be any moderating effects on such mixes by individuals' personality traits? To what extent might the quality of hiring or transfer decisions be improved to increase the effectiveness of a mix of people, say in a department, a team, or even a senior management team? Examples of diagnosing organizational performance problems due to suboptimal mixes of CPSP styles are provided in Basadur and Gelade (2003). Furthermore, can individuals be trained to synchronize their styles with those of others during group creative problem solving regardless of their preferred style to increase efficiency?

The CPSP may also offer a different perspective for researchers studying dysfunctional groups. A crucial distinction of the instrument is that it enables exploration of diversity and conflict from a problem-solving perspective. Often overlooked in diversity and conflict research is the reality that the groups being studied are engaged in problem solving. Diversity is most useful in helping groups solve problems creatively (Mannix & Neale, 2005; Milliken et al., 2003). In groups, problem solving is often ineffective and members are in conflict because they do not know how to efficiently mesh their differing cognitive styles of problem solving.

In terms of conflict management, Jehn (1997) identified a third kind of conflict (in addition to task and interpersonal conflict) that she labeled "process conflict." Process conflict refers not to conflict about what is being talked about (task conflict) but how things should be processed. This means assigning work to whom and by when. There is the possibility that a deeper level of such process conflict exists in the form of problem-solving style conflict. This would be the frustration and inefficiency caused by the lack of synchronization of differing problem-solving styles.

Implications for Individuals

There are several traditional approaches to understanding job satisfaction and turnover at work often grouped under the category of Person-Environment (P-E) fit. For a complete discussion see Basadur and Basadur (2011). In addition to these approaches, it is possible that understanding one's own cognitive creative problem-solving process style can help individuals adapt to their organizations and increase self-efficacy. Clearer understanding would allow individuals to better assess their cognitive fit with the prevailing culture of their organization as a whole, with their particular department or function, or with the cognitive demands of their job. It would allow them to better manage their personal development and career progression, and develop skills in working with others. If the prevailing culture favors and rewards implementation proficiency, a person whose style preference is different from implementation can adapt accordingly, by learning to cope, finding ways to increase their

value by complementing the work of others in their department, seeking a reassignment to another department whose work or culture may be more congruent with their style, or even leaving the organization.

Hiring practices that incorporate an understanding of individual problem-solving styles would help ensure good decisions with respect to cognitive fit with the job or department under consideration. Human Resources professionals can better aid individuals in managing their careers by helping them understand their styles. This can help individuals find better job fits, develop the necessary cognitive skills for upward mobility, and make informed decisions on whether to accept promotions or transfers. The following sample research proposition would make a useful future study:

> **Proposition 6:** Individuals whose CPSP style preferences are more congruent with the cognitive demands of their job, department, or organization will experience a higher level of job satisfaction than those who have lower levels of such congruency.

The relationship between individuals and their preferences for stages of the creative problem-solving process gives rise to a number of interesting questions and implications. Although the CPSP instrument clearly demonstrates individual preferences, it is possible that these preferences may not be established for life. Current employment or life circumstances may influence or alter preferences, as may practice, maturity, training, or other factors. There is evidence in the literature that the preference for strategic thinking, the conceptualization style, can be developed with opportunities to practice it (Goldman, 2007; Goldman & Casey, 2010; Sloan, 2006) and with a corporate climate and culture that cultivates it (Day & Schoemaker, 2008).

There is also a possibility that environmental factors may have an impact on the formation of preferences. In particular, it may be that today's business and engineering schools have focused on training that steers many corporate leaders toward a preference for the optimization and implementation stages of the creative problem-solving process. Ongoing practice and training, emphasizing the importance of analytical thinking, may increase comfort and confidence in the optimization and implementation stages to the detriment of generation and conceptualization. Not surprisingly, Mintzberg (1973) documented that many managers operate primarily as short-term implementation doers. The research outlined earlier in this article supports this finding, as only higher management levels preferred conceptualization as much as implementation, whereas the majority of managers at the entry level preferred implementation. To increase organizational adaptability, human resources departments might focus on developing or attracting talent with a preference for conceptualization, to supplement existing preferences for optimization and implementation within organizations.

Increasing individual employee understanding of the creative problem-solving process as a continuous cycle of finding and defining important organizational problems, solving those problems, and implementing the solutions can play an important role in improving organizational adaptability. By using the creative problem-solving process

underlying the CPSP as a blueprint, organizational leaders can engage individuals in adaptability, much as the leaders have done in the world-class organizations described in Basadur (1992).

Future Research

The preceding sections have highlighted specific areas of research that could benefit from studies using the CPSP, including human resource management such as person–organization fit, organizational innovation performance, and group performance. Published research in both the group diversity and group conflict fields of study argue that increased group creative performance is an outcome affected by these constructs (Jehn & Bendersky, 2003; Milliken et al., 2003). We suggest, however, that much of the current research exploring the relationships between group diversity and group conflict with group creativity has failed to sufficiently emphasize the importance of the fact that the groups being studied are really engaged in creative problem-solving activity. Doing so would enable researchers to more accurately frame their studies in a realistic work context. Examining the cognitive problem-solving styles of the individual group members may well offer valuable insights into the dynamics of group diversity and group conflict beyond that which has been revealed thus far in the respective literatures. Specific propositions have been offered as examples for future research through the application of the CPSP in these fields.

It must be remembered in any future application or research that CPSP is a measure of preference, not skill; simply because a person prefers a certain kind of task does not necessarily imply that they are skilled at it. A style is a way of thinking and should not be confused with ability. Ability refers to how well someone can do something, whereas style refers to how someone prefers to do something (Kirton, 2003; Sternberg, 1997). The relationship between creative problem-solving style and competence has yet to be explored. However, it may be possible that preferences are predictors of competence. This question has obvious implications for team composition, selection, and promotion.

As well, the question could be asked to what extent an individual's creative problem-solving style is a disposition or a changeable state. This probably varies between individuals and definitely merits further study. Kohn and Schooler (1982) and Schooler (1984) found that individuals' intellectual functioning can change over time due to the demands of their work environments. This suggests that individuals' cognitive problem-solving styles may naturally change over time due to the continued exposure to their work's dominant problem-solving style.

For example, if individuals are placed in work that demands generator problem-solving skills, we might expect over time for them to develop increased generator problem-solving styles. ("Try it, you might like it!") This possibility is reminiscent of Bem's (1967, 1970) theory that, contrary to the belief that changes in attitude lead to changes in behavior, it is equally probable that changes in behavior lead to changes in attitude. And thus, for some people, changes in behavior (work demands) might lead to changes in preferred style. This line of exploration would extend to questions about

the effects on style of major changes in occupation. For example, if a school teacher with a prevalent generator style changed careers and became an insurance agent for a big corporation, would he/she be likely to undergo a shift in style? What factors might mediate this kind of a shift? Would personality be a moderator?

Finally, no single quadrant or style is to be considered any more "creative" than any other. All four stages of the process require creativity of different kinds and contribute uniquely to the overall innovative process and innovative results. An individual's unique creative problem-solving profile shows only their preferred activities within the creative process. Most people enjoy some stages more than others. A particular style reflects relative preferences for each of the stages of the process: generating, conceptualizing, optimizing, and implementing. A person's thinking processes cannot be pigeonholed into any single quadrant. Rather, they are a combination or blend of quadrants. A person will likely prefer one quadrant in particular, but may also have secondary preferences for one or two adjacent quadrants. Skills are needed to execute *all* stages. Everyone has a different valuable creative contribution to make to the innovation process as a whole. One goal is to capitalize on an individual's preferred orientation, thus making his or her work more satisfying and pinpointing development opportunities. Another goal is to tap resources in all four quadrants to help the individual, team, or organization cycle skillfully through the complete innovation process.

We are also currently undertaking research into the role of creative problem-solving process style in advice network formation and subsequent creative performance. Basadur and Basadur (2010) presented a conference paper suggesting that an individual's degree of preference for each CPSP stage, that is, his or her *style*, is an important antecedent to that person's formation of an advice partner network. How CPSP style affects both the number of weak ties in one's advice network and the selections of strong tie network advice partners and how both contribute to one's creative performance are modeled and propositions, possible avenues for future research, and implications for leaders and managers are provided.

We are also studying regulatory fit as an explanation for how individuals progress through the stages of the creative problem-solving process. Basadur, Beuk, and Monllor (2010) presented a conference paper using regulatory fit theory to explain how the degree of fit between one's regulatory mode orientation and the task requirements of each stage of the creative problem-solving process modeled by the CPSP determines how one progresses through the four stages. The paper proposes that, based on self-determination theory, the relationship between intrinsic and extrinsic motivation and creativity is not "either-or" but rather a blend of both if individuals are to perform optimally in all four of the process stages.

Summary

We have modeled organizational adaptability as a dynamic creative problem-solving process continuously cycling through four stages: generation, conceptualization, optimization, and implementation. Each stage involves a different kind of cognitive

activity. Individuals have different preferences for each stage and thus are said to have different creative problem-solving process "styles." We have presented a psychological instrument called the CPSP that measures an individual's relative preferences for the four different stages of the process. The CPSP maps onto and interconnects directly with the four stages of this creative problem-solving process. Real-world examples of the application of the CPSP to diagnose organizational problems are shared. Field research ($n = 6{,}091$) is presented in which the psychometric properties of the CPSP are established and the distribution of CPSP styles in different occupations, and at different organizational levels are examined to increase understanding of different cognitive creative problem-solving process demands of people in different organizational roles. As expected, senior-level managers were found to have a stronger preference for conceptualization than lower-level employees who have a stronger preference for implementation. Also, as expected, differences in creative problem-solving process style were discovered among occupations. The implications of these findings are discussed at the individual, team, and organizational levels. We suggest that this creative problem-solving process and the CPSP provide a concrete blueprint for organizational leaders to follow to increase adaptability, simplify and facilitate innovation and change management, and address important long-standing specific organizational effectiveness issues. Current research underway to expand the CPSP's usefulness has been reviewed and future research opportunities have been suggested.

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