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Testing the Predictive Validity of the Basadur Profile Innovation Assessment

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We update and deepen understanding of the Basadur Innovation Profile and particularly its capability as an innovation assessment tool for individuals, teams and organizations. We report a study (Basadur, Gelade, Basadur & Skorokard, 2009) in which the Profile accurately predicts the preferred problem solving activities of people with the four different cognitive innovation styles which it measures: Generators, Conceptualizers, Optimizers and Implementers. Twenty-four response categories were significantly associated with the four style typology. We show how the four styles directly connect to a proven four stage innovation process, and integrate additional evidence of validity and psychometric reliability, provide testable future research propositions and instructive supporting real world applications.

INTRODUCTION: THE NEED FOR INNOVATION ASSESSMENT

Because rapidly accelerating change and frequent major discontinuities and interruptions now dominate the world in which we live and work, the goal of improving and increasing the survival of organizations has become increasingly more complex. Many organizations that prospered during more stable times – times that rewarded routinized efficiency – now find themselves poorly aligned with today's new economic and social realities of accelerating change, uncertainty, globalization, increased competition, and pressure for revenue growth. The most perplexing challenge now facing business and industry organizations is how to be more innovative. Researchers and practitioners are trying to help organizations as they struggle to innovate in an attempt to gain competitive advantage in the face of intensifying competition and globalization of markets.

While many organizations recognize the need to innovate, they also find it difficult to do. Indeed, many leading management consultants exhort corporations to "begin their revolutions" – to expand their thinking and do things differently through a process of deliberate change. Rather than defend old markets, corporations are advised to explore new ones. But while organizations often find this an appealing strategy, most struggle to get a "toe hold" on exactly how to approach innovation.

The study reported here may offer that "toe hold". In our experience, the secret to innovation is through a fundamental change in cognitive thinking and behavior. The

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Profile provides a simple "thin edge of the wedge" instrument related to a concrete innovation *process* to be mastered. Not only does the Profile help professionals foster and increase the innovative performance of their organizations, it is proving to be a valuable educational instrument for professors and instructors in the broad field of organizational behavior (e.g. Basadur & Basadur, 2011; Basadur, Gelade, Basadur & Perez, 2016; Basadur & Goldsby, 2016). The Profile helps individuals and teams understand their unique approach to innovative thinking, and is frequently used to diagnose organizational-level preferences and improvement opportunities (Basadur & Gelade, 2003). We hope to highlight the high leverage value of the Profile to the field of innovation.

Innovation is not Tools or Techniques

A plethora of tools and techniques have been employed through the years to help organizations become more innovative. Basadur, Gelade and Basadur (2014) provide an extensive list, including identification of more creative people through cognitive, aptitude and personality tests; differentiating people with more "adaptive" styles of creativity from people with more "innovative" styles of creativity (Kirton, 2003); identifying organizational and environmental factors that might inhibit or nurture innovative performance such as leadership, motivation, climate, goals, incentives, and freedom from time pressure; training individuals and teams how to use their imagination and judgment to better solve problems; assessing the degrees of innovativeness of an outcome; providing creative thinking tools include "brainstorming" and "design thinking" to address specific needs; locating accessible innovation think tanks and idea accelerators; installing operations based continuous process improvement methodologies such as Six Sigma and Lean and idea optimizing and "go to market" planning methods such as Stage Gate. Such techniques (and many others) have not had a meaningful impact on significant or breakthrough innovation. Most have ended up as "flavors of the month" while organizational obsolescence has remained rampant. Think of Kodak, Polaroid and Blackberry. And new start- ups fail almost 70 percent of the time. (Griffith, 2017).

Innovation is a Process

Mott's landmark research (1972) defined organizational effectiveness as a combination of efficiency and adaptability. 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 innovation comprised of generating, conceptualizing and solving important problems and implementing valuable new solutions (see Figure 1 on the next page).

The first stage of our innovation 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 alerts 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

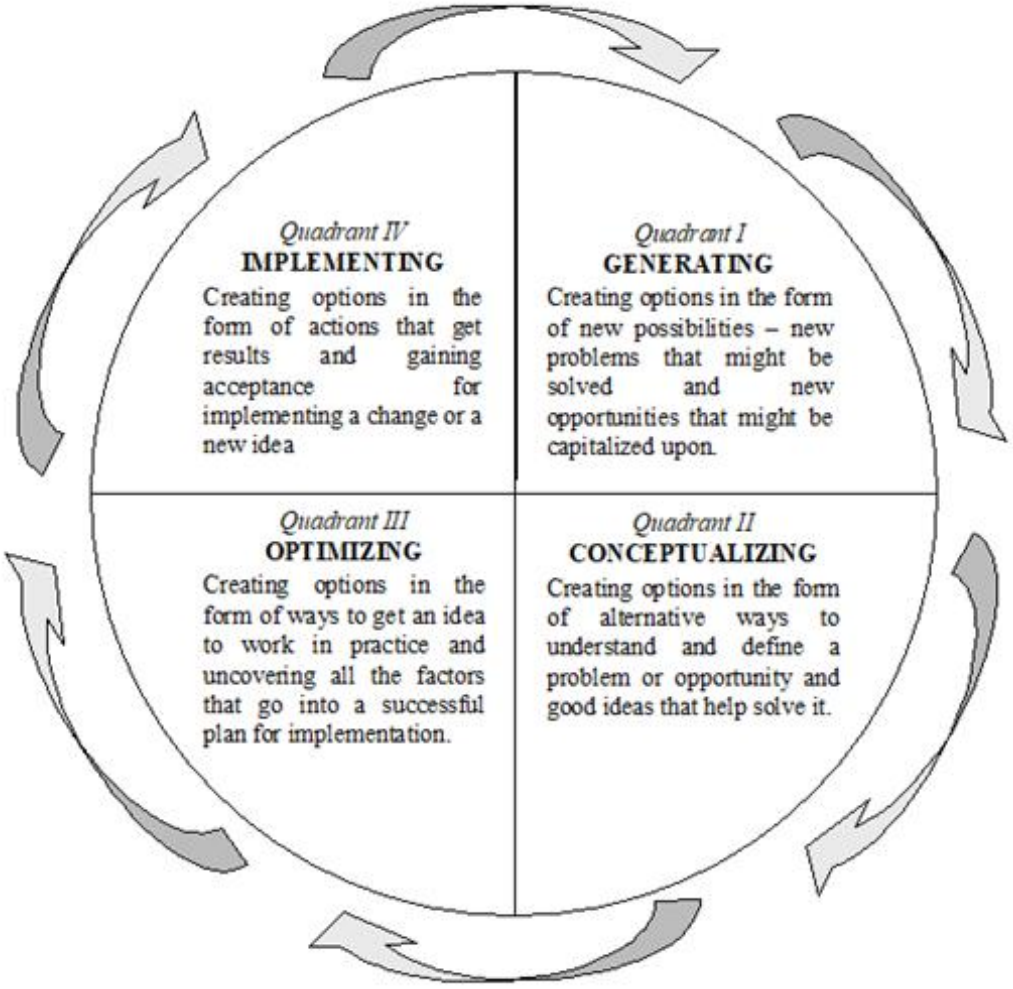

Figure 1. The Four Stages of the Innovative Thinking Process

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 in order to identify practical difficulties. Alternatives are systematically examined in order 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.

Each stage involves a different kind of cognitive activity. Individuals have different preferences for each stage and thus have different innovation "styles".

The Innovation Profile

Innovation styles are measured using the Basadur Profile. As shown in Figure 2 (below), it measures two bipolar, orthogonal, dimensions of cognitive activity underlying the innovation 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, non-rational, 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.

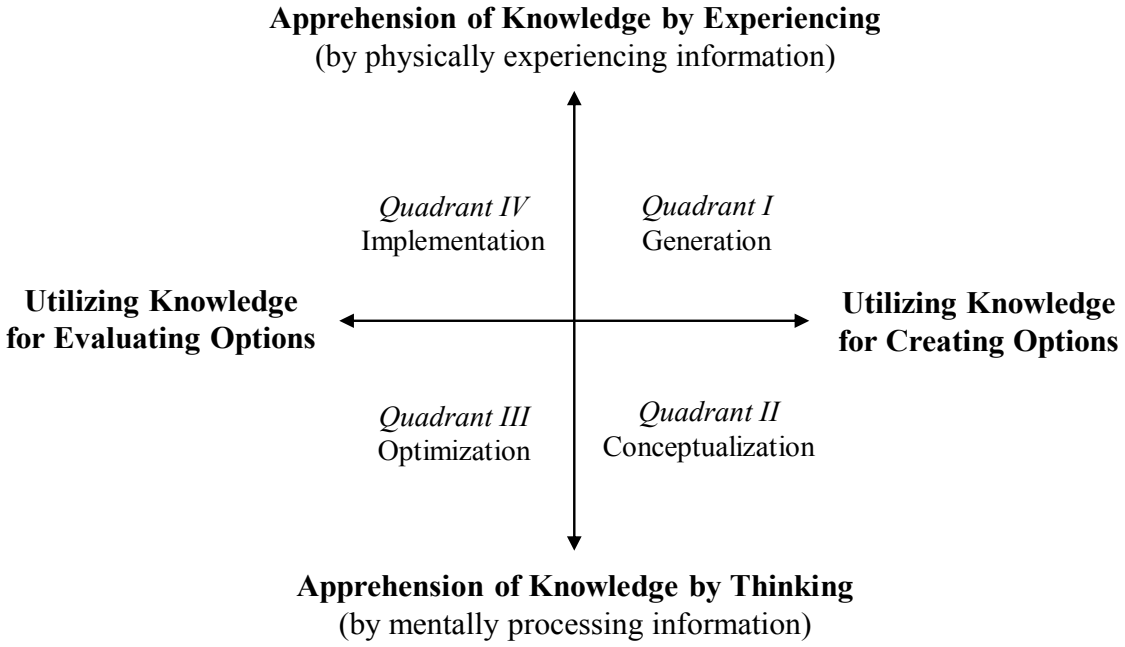

Figure 2. Cognitive Activities in the Four Stages of the Innovation Process

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, 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 utilizing knowledge (Ideation vs. Evaluation). Ideation is non-judgmentally 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.

Reliability and Validity

Basadur, Gelade and Basadur (2014) provided evidence that the Profile assessment instrument enjoys satisfactory internal consistency, scale reliability and scale discrimination and large scale (n= 6091) field research identified the distribution of preferred styles among various occupations and different organizational levels with differing cognitive demands. Real world examples of the application of the Profile assessment to diagnose organizational problems were provided, as well as suggestions for future research investigating the role of cognitive innovation styles in the fields of collaboration, diversity and group conflict. Basadur et al. (2016) reported a program of significant continuous improvement of the psychometric properties of the Profile since it was first introduced and provided real world team assessment case studies.

Basadur and Head (2001) demonstrated that heterogeneous teams (with all four styles present) achieved more innovative results than homogeneous teams (missing three styles) and semi-homogeneous teams (missing two styles). In a field study investigating the problem solving of managers, Runco and Basadur (1993) found evidence that Profile style can influence the effectiveness of training and that specific effects of training may be predicted from pre-training individual differences in process style.

The purpose of this paper is now to document the *predictive validity* of the Profile, testing how well participants' actual real world innovation styles match those predicted by the assessment.

Individual Styles, Preferences and Hypotheses

Individuals have varying preferences for the quadrants or stages in the innovation process because they have varying preferences for the bipolar modes of apprehension and utilization. These are not seen as permanent unchangeable personality traits, but rather as flexible, changeable cognitive "states" which are related to environmental factors. Following are the style descriptions Basadur and Basadur (2011), Basadur and Gelade (2005), and related hypotheses:

Generators, or those who prefer the first quadrant style, like initiating the innovation process, imagining possibilities, questioning, sensing new problems and opportunities, viewing situations from different perspectives, and gathering information through direct experience. People strong in this style are more inclined to come up with options, or diverge, than to evaluate and select, or converge. They see relevance in almost everything, and can think of good and bad angles to almost any fact, idea, or issue. They enjoy ambiguity and are hard to pin down. Every solution they explore suggests several new problems to be solved (Basadur & Basadur, 2011, Basadur & Gelade, 2005).

> Hypothesis 1: Quadrant 1 groups, Generators, use words and terms that reflect their innovation process style such as "challenge the status quo", "seek out options", "diverge", and "get things started" with significantly

greater frequency than the Conceptualizer, Optimizer and Implementer groups.

Conceptualizers, or those who prefer the second quadrant style, like putting new ideas together, discovering insights that help define problems, and creating theoretical models to explain things. People with strong conceptualizing skills enjoy taking diverse, often disconnected, information emerging from the generator stage and making sense of it. Conceptualizers need to "understand." To them, a theory or explanation must be logically sound and precise. They prefer to proceed only when they have a clear grasp of a situation or when the problem or idea is well-defined. They dislike having to choose a single option if it means discarding others, preferring to incorporate as many ideas as possible into a single conceptual scheme, which for them provides closure. They like to play with ideas and are not overly concerned with moving to action.

Hypothesis 2: Conceptualizers (quadrant 2), mention terms that reflect their innovation process style like "abstract thinking", "big picture", "conceptualize" and "ideas" significantly more frequently than the other three quadrant styles.

People who prefer the third quadrant style, Optimizers, would rather gain knowledge through abstract thinking, and like to use their knowledge to converge (evaluate options) rather than diverge (create options). Optimizers are most comfortable developing practical solutions and plans from abstract ideas and alternatives. They rely on mentally testing ideas rather than trying things, and like to create optimal solutions. Given a well-defined problem, they are able to sort through large amounts of information to pinpoint the critical factors. They are usually confident in their ability to make a sound, logical evaluation and to select the best option or solution to a problem. They often lack patience with ambiguity, and are unwilling to consider more than one problem at a time. They see little value in "dreaming" about overly radical ideas. Once they have decided they know what a problem is, they are eager to drive towards the solution as quickly as possible. Thinking in this stage focuses on idea evaluation and selection, and planning for implementation.

Hypothesis 3: Quadrant 3 groups, Optimizers, mention terms that reflect their innovation process solving style like "judgmental", "evaluate", "analysis" and "plan" significantly more frequently than the other three quadrant styles.

Finally, Implementers, or those who prefer the fourth quadrant style, favor gaining knowledge through direct experience and using knowledge to converge. They rely on trying things out rather than mentally testing them; they like to get things done and they excel in situations in which they must somehow make things work. They do not need complete understanding in order to proceed, and adapt quickly to changing circumstances. When a theory does not appear to fit the facts, they will readily discard it. Some perceive them as enthusiastic about getting the job done, but others see them as impatient or even pushy. As they seek to turn plans and ideas into action, implementers will try as many different approaches as necessary. They will try to bring others on board, and will follow up or "bird dog" as needed to ensure that a new procedure will stick.

Hypothesis 4: Implementers (quadrant 4) have a significantly higher frequency of terms like "action", lead" and "implement" in their stated

innovation process preferences than Generators, Conceptualizers and Optimizers groups.

Measuring Individual Preferences:

The Profile measures an individual's unique blend of preferences for the four stages of the innovation process in Figures 1 and 2. This produces a visual picture in which areas in the four quadrants of Figure 1 are of different unequal sizes. The largest on the graph represents the preferred or dominant style, with relative sizes of the other quadrants representing supporting orientations. The unique blend of styles is the individual's innovation profile. Figure 3 (below) shows how individual differences in orientation can yield different process styles and profiles. If the area of quadrant 1 is largest, the primary process style is generating; if quadrant 2, then conceptualizing; if quadrant 3, then optimizing; and if quadrant 4, then implementing. Each of these styles reflects the preference of an individual (or team or organization) for ways of gaining and using knowledge.

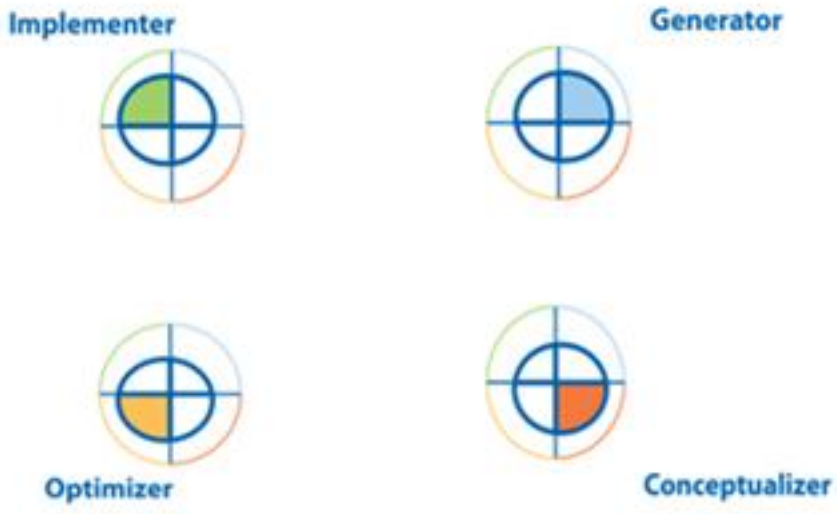

Figure 3. The Four Process Styles:
These four combinations create four different process styles

In order to measure preferences, the Profile presents participants with two lists of 12 paired words. In one list, the 12 pairs of words are descriptive of Apprehension, with one word representing Apprehension by Experiencing (denoted X), and the other representing Apprehension by Thinking (T)., for example, *trial and error vs pondering*. The second list of word pairs is descriptive of Utilization, with one word representing Utilization for Ideation (I) and the other representing Utilization for Evaluation (E), for example*, creating options vs deciding,*. Each word pair from the Apprehension list is combined with a word pair from the Utilization list. This produces 12 four-item sets of words, each set containing one word representing X, I, T and E. In addition, six four-word distracter sets are embedded within the 12 four-item sets of words. These distracters contain unrelated words and are intended to prevent respondents from identifying patterns and responding stereotypically. Respondents are instructed to rank the words within each four-item set from "most characteristic of me as a problem-solver" to "least characteristic of me as a problem-solver".

METHOD

The data used in this study were collected over a five year period from 444 groups of participants who shared similar profiles (the same dominant quadrant) from 111 training events. The events were mostly professional training workshops, but also included some university students. The age range is about 20-60 years of age. Students were enrolled in either undergraduate or graduate level business programs, while the participating professionals came from a wide variety of private and public sector organizations in a number of different industries, including financial, engineering, IT, healthcare, home furnishings, manufacturing, logistics and telecommunications. Participation was 100% due to the integral nature of the Profile exercise in the curriculum, and the exercises and training the participants completed were the same, whether in classes or workshops, and delivered by the same experienced trainer in all 111 events. At each event, the focus was on understanding and developing the individual skills of all participants in the innovation process (Figure 1, p. 6), with the Profile serving as one method of introducing participants to the process. While the Profile exercises were not presented as being part of a research study, participants were told that completed Profile inventories would be collected for ongoing Profile research purposes.

Completion of the Profile provided participants with their dominant quadrants, identified only as quadrant 1, 2, 3 or 4. Participants were then grouped together by dominant quadrant. While most participants had one dominant quadrant, occasionally a participant would have two equally dominant quadrants, and more rarely - but possible - a participant could have equal preference for all four quadrant styles. In these instances the participants were placed with the dominant quadrant group that had the fewest participants, to bolster numbers and increase interaction between participants.

Once grouped by quadrant, each group was assigned to work together to make two lists. One list identified all of the things they liked to do or did well when solving problems, while the second list identified all of the things they did not like to do or felt that they did not do well when solving problems. Following that, the groups were instructed to select the three items on each list that they agreed best represented them as a group. No further instruction was provided, to avoid interfering with the experiential learning nature of the exercise or influencing the thinking of the group members.

The Profile exercise was designed to give the participants roughly 20 minutes to both diverge and converge on their lists, with the timeframe applied relatively uniformly across all training sessions. Groups then shared their lists, discussed the processes they used to work through the exercise, and any learning that resulted. Subsequently, handouts were distributed to explain the titles and the descriptions of the different quadrants. The final step of the exercise allowed for questions and comments, before moving on to the next part of the training session. At this point, the group flipchart pages containing the lists were collected and identified by quadrant number, session group (organization or class code) and date.

For the purposes of this research, the three selected items on the “Like to Do/Do Well" and "Don’t Like to Do/Don’t Do So Well” lists were collected for content analysis. Responses were itemized as "most like us" and "least like us", and the frequency of each response was calculated. Responses were categorized into 50 distinct groups of tasks/activities. Each response given by a quadrant group was assigned to one of the 50 categories, and the frequencies were recorded. On judgment, similar responses

such as "action" and "take action" were assigned to the same category. The final result was a spreadsheet with calculated frequencies of "Like/Do well" and "Don't like/Do well" responses for each of the 50 activities, by quadrants (see table 1 in the Appendices).

ANALYSES

To analyze the collected non-parametric data, chi-square was chosen as the method of analysis. To determine whether or not problem solving preferences and quadrant profiles are associated with each other, the chi-square test of independence, also called the chi-square test of association, was employed. Given that we were looking for the frequency of cases found in one variable (e.g., like/dislike/didn't mention) within more than two categories of another variable (quadrants), we ran chi-square tests for two or more unrelated samples.

The chi-square test for two or more unrelated samples "is only available as part of the SPSS procedure for generating tables which show the distribution of two or more variables" (Bryman & Cramer, 2001). Therefore, we had to use the chi-square option in the 'Crosstabs' procedure to generate necessary results.

The data were set up so that the quadrants were entered in the first column, responses in the second, and all the listed activity types were entered in the following columns. Each activity/preference is a variable, frequencies for which must be entered "in a single column of the Data Editor, with grouping variables in separate columns" (Corston & Colman, 2000), to show which quadrant each frequency refers to, and whether the response was "Like", "Don't Like", or a variable was not mentioned at all. Each quadrant group (Generator, Conceptualizer, Optimizer, and Generator) was entered repeatedly in three rows, so that in Response column three types of responses were entered against each quadrant group: Like, Don't Like, and Didn't Mention. The "Didn't Mention" category was entered into the matrix to account for the groups that did not include a particular activity in either the "Like" or "Don't Like" categories. This way, the total responses for each activity type added up to 444 in the end, or 111 for each quadrant.

A total of 50 different types of problem solving activities was generated during the categorization process, and a chi square test was performed separately for each of these variables. Before running each chi square analysis in SPSS, the cases were weighted by the variable under consideration (activity type, e.g., Organizing, Analyzing, Planning, etc.) This was a way of telling SPSS which column contained the frequency scores. Once the cases were weighted, a chi square test was performed for a matrix consisting of quadrants in rows and response types in columns.

The Exact chi square test enabled us to analyze the data even for cases where the expected values were less than five. We ran the Exact chi square test for all variables but one. For "details", the computer was unable to run the Exact chi square test, returning a message of "insufficient memory to perform task". Since for this particular variable, there were no cells with expected values less than five, we ran the usual chi square, and obtained the significance level that way.

The results of chi square analysis enable us to conclude whether or not there are significant differences among quadrant types as to what they like and don't like to do when solving problems. The null hypothesis for each of the tests is that there are no differences among quadrants as to whether they like or do not like a particular task – i.e., the actual data would be close to expected counts – and so responses would be equally distributed among Generators, Conceptualizers, Optimizers, and Implementers.

Table 1
Categorized Profile Group Data

ACTIVITY	GENERATORS		CONCEPTUALIZERS		OPTIMZERS		IMPLEMENTERS		
	LIKE	DO NOT LIKE	LIKE	DO NOT LIKE	LIKE	DO NOT LIKE	LIKE	DO NOT LIKE	
organize / rganization	9	5	7	3	21	1	25	1	72
analyze / analysis	8	3	18	4	44	4	29	2	112
Lead	11	0	6	0	8	3	21	0	49
research	5	5	11	3	15	8	6	3	56
hands-on	18	1	3	3	2	3	26	0	56
take action	16	3	4	1	6	1	33	2	66
have fun	15	0	10	0	4	0	8	0	37
creative thinking	11	1	12	1	4	3	4	7	43
trial and error	4	2	2	4	0	7	7	3	29
start / initiate	7	0	2	1	1	3	4	0	18
realistic	1	1	0	1	2	0	4	0	9
brainstorming	27	1	28	0	15	7	9	8	95
talking	1	1	1	0	1	2	0	2	8
details	6	30	9	42	9	21	13	16	146
implement	5	4	1	10	9	5	24	3	61
conceptualize	1	0	13	0	3	1	0	0	18
see big picture	14	0	24	0	20	0	2	2	62
reading	1	9	3	3	4	3	3	8	34
writing	1	0	0	4	2	3	0	3	13
procrastinate	4	5	3	5	3	7	3	16	46
converging	3	7	2	2	7	2	6	0	29
diverging	3	0	2	0	0	6	1	11	23
work in groups	1	1	3	5	6	1	1	4	22
abstract things	0	1	5	0	0	4	0	9	19
provide alternatives	18	1	25	1	17	2	10	3	77
fact finding	4	2	5	2	3	0	5	2	23
evaluate	8	3	9	3	20	0	19	2	64
identify problems	2	0	2	0	5	0	6	0	15
criticize	0	2	0	1	4	3	1	2	13
accepting criticism	0	4	0	1	0	1	0	8	14
consolidate	0	0	2	1	1	0	1	0	5
compromise	0	1	0	0	0	4	1	3	9
planning	13	2	12	4	15	4	11	6	67
being logical	0	2	4	1	8	1	8	0	24
confrontation	0	3	1	4	0	5	1	9	23
quick decisions	11	1	4	3	3	10	13	0	45
visualize	11	0	9	0	2	2	3	1	28
get background info	0	0	0	0	4	0	1	0	5
theory	0	8	2	1	1	1	1	11	25
different perspectives	6	0	4	0	1	0	1	0	12
challenges	15	0	6	0	2	0	3	1	27
listening	10	6	11	4	7	7	12	8	65
red tape / bureaucracy	0	10	0	10	0	5	0	10	35
deadlines	0	6	0	6	0	9	2	4	27
making lists	1	0	3	4	6	0	4	0	18
efficiency	0	0	1	0	3	0	7	0	11
positive approach	18	0	5	0	0	0	3	0	26
consensus	5	0	4	1	3	1	4	3	21
crazy ideas	0	0	2	0	0	1	0	0	3
find root cause	3	0	2	0	7	0	3	0	15

Every time that a significant and high Pearson chi square is found for an activity/task, we conclude that there are differences among quadrants, and they do not all like/dislike a particular activity to the same extent. Because the sample size is large, the Pearson chi-square value and Likelihood Ratio in the output section are close to equal, and as they get larger "the likelihood that the two variables are not independent also increases" (George & Mallery, 2005).

However, a chi square statistic does not enable us to conclude which quadrants have a stronger or weaker preference for each particular activity. We need to go back to the data to make conclusions about the likes and dislikes of the quadrant groups compared to others.

RESULTS

We generated output for all 50 chi-square tests, one for each innovation activity identified by our participants, and found that nearly half (twenty-four) of the chi-square values were statistically significant at .05 alpha level, with the majority significant at .01 level. This means that twenty-four activities/task categories are significantly associated with the quadrant predictions.

The statistically significant chi-square values and their significance levels are presented in Table 1 (see Appendices). Overall, chi-square statistics are high, ranging from 9.736 for "Accepting Criticism" to 43.326 for "Taking Action", and indicate a strong association between quadrant types and problem solving activity preferences.

The pattern of responses in the four quadrants is significantly different for the listed activity types (see Table 2 in the Appendices).

Table 2
Significant Chi-square Values

Variable/Task	Chi-square	Variable/Task	Chi-square
Take action	43.326**	Organize/Organization	21.282**
Hands-on	40.788**	Details	21.163**
Analyze/Analysis	38.568**	Challenges	20.101**
Implement	38.379**	Theory	17.237**
Positive approach	30.886**	Creative thinking	15.530*
Abstract things	29.308**	Making lists	15.911**
Conceptualize	29.104**	Converging	13.724*
Quick decisions	27.322**	Visualize	13.432*
See the big picture	26.777**	Evaluating	12.577*
Brainstorm	26.573**	Efficiency	10.720*
Diverging	23.852**	Start/Initiate	12.085*
Lead	21.768**	Accepting criticism	9.736*

*$p<.05$ **$p<.01$

Twenty-six types of responses were not statistically significant. The activities/tasks not found to be significantly associated with the quadrant typology are listed in Table 3 in the Appendices.

The pattern of responses for each of the above categories was identical in various quadrants. Some of these results were surprising, and will be discussed below, in the section to follow. The output did not include Yate's Continuity Correction of chi-square because its usefulness and accuracy is controversial, and it is only calculated for 2 x 2 tables, which is not what we have. The Likelihood Ratio for our sample was very close to Pearson chi-square, which is explained by the large sample size.

In terms of support for the hypotheses, first, the data provide the most support for Hypothesis 4. This hypothesis proposed that groups of Implementers would list terms like action, lead and implement, terms that fit with a style focused on learning through direct experience and focused on evaluation, and the analysis bears this out. The words and phrases most strongly associated with the Implementers are: "Take Action" (43.3), "Hands-on" (40.8), "Implement" (38.4), "Quick Decisions" (27.3), "Lead" (21.8), "Organize" (21.3), and "Efficiency" (10.7). Each of these terms is action-oriented and associated with 'getting the job done', rather than 'reflecting upon possible courses of action'.

Table 3
Non-significant Variables

Research	Consolidating
Have fun	Compromising
Trial and error	Planning
	Being logical
Being realistic	Confrontation
Talking	Getting background information
Reading	Different perspectives
Writing	Listening
Procrastinating	Red tape/bureaucracy
Working in groups	Deadlines
Providing alternatives	Consensus
Finding facts	Crazy ideas
Identifying problems	Finding root cause
Criticizing	

Second, the data support Hypothesis 2, that Conceptualizers would favor terms reflecting a preference for gaining knowledge through abstract thinking processes and using knowledge to generate (diverge) options as opposed to evaluate them. Analysis revealed the highest association with the conceptualizing style were the terms "Abstract Things" (29.3), "Conceptualize" (29.1), "See the Big Picture" (26.8), "Brainstorm" (26.6), and "Creative Thinking" (15.5). All of these terms reflect thinking by understanding abstractly and idea creating, rather than with action-oriented terms.

Third, there is substantial evidence in support of Hypothesis 1, which proposed that Generators would choose words reflecting their predicted preferences with greater

frequency than the other three quadrant styles. The Generators prefer to gain knowledge through direct experience and use their knowledge to generate options. Terms associated most strongly are "Positive Approach" (30.9), "Diverging" (23.8), "Challenges" (20.1) and "Start/Initiate" (12.1). According to the theory, Generators are problem finders who constantly scan the environment for new potential threats and opportunities (described as "opportunistic surveillance" by Simon, 1960, 1977). They are comfortable with ambiguity and can see the good and the bad in any situation (Basadur & Basadur, 2011; Basadur et al., 2014), and this description is reflected in the results.

Lastly, the data also support Hypothesis 3, suggesting significant associations between the predictions and the output of the Optimizer groups in the sample. The most significant terms are "Analyze/Analysis" (38.5), "Making Lists" (15.9), "Converging" (13.7), and "Evaluate" (12.6). Analyze, evaluate and converge are certainly terms one would associate with people whose preferences are for gaining knowledge through abstract thinking and using their knowledge for evaluation. "Making lists" makes sense for Optimizers due to their predicted desire for making order out of chaos, which often is aided by simply making a list and keeping track of concepts and options.

DISCUSSION

The main purpose of this study was to test the predictive validity of the Profile instrument as to its accuracy in predicting the innovation preferences of people identified as having Generator, Conceptualizer, Optimizer or Implementer styles. Specifically, we posed the question, "Are the Profile predictions accurate?" and the ATE evidence suggests that answer is yes. In terms of the four hypotheses, the strongest evidence is in support of Hypothesis 4 and Hypothesis 2, concerning Implementer preferences and Conceptualizer preferences, respectively. There also is significant evidence supporting Hypotheses 1 and 3 although the results are somewhat weaker. Overall, the study adds to the validity, and therefore the trustworthiness, of the Profile as a valuable instrument for describing how individuals and groups relate to the innovation process.

Interestingly, all of the quadrant groups mentioned not liking details more than liking details. However, Conceptualizers mentioned the term negatively much more frequently than did the other groups. The term "Organize/Organization", was expected to be associated most strongly with Optimizers but was found equally significant with Implementers. Based on the steps in the process associated with the Optimization stage – evaluation and selection and implementation planning – it would seem to be an obvious fit for organization in style three. Upon reflection, the association with Implementers may fit very well. Implementers are the final stage of the process and are focused on getting plans implemented and problems solved through action, and any lack of organization might impede their progress. Perhaps Implementers recognize and value organization for its benefits to their efforts.

The term "Accepting Criticism" was also found to be a significant variable after the chi-square analysis. It was not expected to be significant, as typically all of the groups express (to some degree) that they do not like being criticized and do not accept criticism very well. However, it was surprising to see that one group, the Implementers, mentioned it much more often than the other groups. This may be because Implementers are, by nature, required to tangibly show their thought processes and decision making skills as they execute plans and get things done. Of the four Profile styles, Implementers are

often the only ones you can actually see *doing* anything, so possibly they are more reactive and defensive than the other styles.

"Start/Initiate" was significant, but bears discussion. It seemed an obvious fit for the Generator quadrant before the chi-square analysis, and had a p-value of .051. The frequency of mention by any of the quadrant groups was relatively low (mentioned only seven times at most by any one group the Generators), and the small difference in frequency between Generators (7 of 111) and Implementers (4 of 111) made it difficult to assign it to either group. It is clear that the variable has greater significance for these two groups (possibly due to their preference for acquiring new knowledge through direct experience) than for Conceptualizers and Optimizers who prefer to learn through more abstract means and may be less concerned with initiating things. Action is implied for both Generators (get things started) and for Implementers (get things finished). On judgment, we assigned it to the Generator style.

"Trial and Error" was not significant (p-value 0.60) and appeared initially to likely fall into either the Generator or Implementer quadrants because it seemed to be the way people who prefer to gain new knowledge by direct experience would likely proceed. But the raw data made clear that the groups in these quadrants were noticeably split in their opinions. After viewing the chi-square results and the raw data, it became apparent that the low significance level may be attributed to the aversion Optimizers (7 dislike, 0 like) expressed for the item. This seems to make sense in terms of the Profile's predictions, as Optimizers, who prefer to learn through abstract thinking and use their logic for evaluation, would likely abhor the concept of simply trying out different approaches without thinking things through to determine the right course of action. That opinion would be similar for Conceptualizers (4 dislike, 2 like).

Limitations of the Study and Future Research Suggestions

Both a strength and limitation of the current study is that the participants were asked open-ended questions, and therefore could include any variable they could think of. While this strengthened the study by allowing us to compile a comprehensive list of possible activities and ways of solving problems, it was also a weakness because it created a broad range of variables that were sometimes difficult to analyze, and stretched the range of possible answers. The study is also weakened by the fact that participants were never asked to specifically define what they meant by terms that were written either vaguely or otherwise unclearly when completing the exercise. Groups did not always specify in detail what they meant by a particular verb. As well, different groups might use the same word/descriptor to mean different activities. With responses then combined into categories, there is a danger that data, and subsequently results, could be unclear or even contaminated. This also makes conclusive analysis difficult. Given this, future researchers might consider using the variables used in this study to develop a survey instrument that forces participants to be more specific and accurate when recording their thinking.

A second weakness was touched upon in the methods section of the paper. It is possible for a person to have two equally dominant quadrant preferences (and although rare, even to be equally dominant in all four quadrants). In the sessions that make up the sample of this study, such participants were asked to join one homogeneous group or another depending on group size. While perfectly suited to the designs of the workshop session, this sort of inclusion negatively impacts the research effort, by somewhat contaminating the homogenous groups. The more active the person with multi-quadrant preferences

is in the exercise, the less the data purely represents that homogeneous group's point of view. In the future, the simplest way of handling this problem might be to eliminate these groups from the sample. Alternatively, these "contaminated" groups might be a source of further research into the styles and preferences of the different quadrant groups by comparing the output of these groups with those of "pure" homogeneous groups.

A third weakness, for which there may not be a solution, is the fact that each person is a blend of the four quadrant styles and so participants in each group, while sharing one dominant style, may have different secondary preferences that are quite pronounced. This tends to slow down group work as they try to select activities that most represent the whole group.

Finally, some people are less capable than others of identifying exactly what they like and don't like to do, and what they are good at and not so good at, when asked open-ended questions. This can lead to poorer quality or less clear answers, as well as the possibility of group selections being biased by the dominance of more capable members. Providing groups with prepared lists of activities, including a brief explanation of each activity, might result in more specific and accurate responses and reduce the possibility that different words mean different things among individuals or groups.

Future Research

Future research could consider the impact of providing groups with a list of activities to select from, and the result that has on their responses. In particular, would many of the variables that ended up in the non-significant group in the current study, reach the significance level of .05 if they were presented as a list of possible answers? It would be interesting to study how the chi-square test results would change depending on whether the answer options consisted of all fifty categories, or only of the twenty-six categories that were found non-significant.

Another avenue for future research would be to analyze the data used in this study with different, and preferably more sophisticated, statistical methods. It has already been suggested to the authors – too late for our purposes, unfortunately – that an analysis using correspondence analysis, a tool typically used in marketing, might be of value in establishing the relationships between the variables and perhaps would add a different dimension to our understanding of the significant and non-significant variables.

It is almost certain that a forced choice among the twenty-six presently non-significant categories would produce a great change in significance levels of the given categories. However, a more interesting study would be, how many, and which, of the currently not significant variables would be mentioned more often if presented as an answer option. This might be a difficult study to implement. A list of fifty activity categories is a long list, and a researcher would have to find a way to ensure the respondents stay motivated to select their "true" top picks, rather than just randomly marking their answers trying to finish the assignment as soon as possible.

Yet another avenue for potential future research is to look into whether there is evidence of discriminant validity in the frequency and type of responses to the terms (Like or Do not like) by groups from the diametrically opposite Profile quadrants. According to the theory of the Profile, the quadrants diametrically opposite from one another are most likely to conflict with each other. For example, Implementers prefer leaping into action regardless of why, whereas Conceptualizers prefer not to do anything until they understand exactly why (and what action might be appropriate). It may be a very interesting area of research to study whether the "Dislikes-Does not Do Well" of

one quadrant correlate to the "Likes-Does Well" of the opposite. For example, one might predict that Generators will not like analysis and that Optimizers will.

Practical Implications

The study reported here offers further evidence of the validity of the Profile as an instrument that accurately describes individual problem solving preferences as they relate to a complete innovation process. Innovation and creativity are now important topics in industry and business schools. There are very few instruments with the accuracy and pedigree of the Profile, so it may prove to be a valuable instrument for professors and instructors in the field of organizational behavior, as well as professionals responsible for fostering and increasing the innovative performance of their organizations (e.g. Basadur & Basadur, 2011; Basadur, Gelade et al., 2016; Basadur & Goldsby, 2016). The Profile has long been used to help individuals and teams understand their approach to innovative thinking, and is frequently used to diagnose organizational-level preferences and improvement opportunities (Basadur & Gelade, 2003). The results of this study should serve to highlight the value of the Profile to the field of innovation.

REFERENCES

Basadur, M.S. (2014). Navigating the world of innovation. In. M. Grace & G. Graen (Eds.), *Millennial spring: Designing the future of organizations.* Charlotte, NC: Information Age Publishing.

Basadur, M.S., & Basadur, T.M. (2011). Where are the generators? *Psychology of Aesthetics, Creativity and the Arts, 5*(1), 29–42.

Basadur, M.S., & Gelade, G. (2006). The role of knowledge management in the innovation process. *Creativity and Innovation Management, 15*(1), 45–62.

Basadur, M.S., Gelade, G., & Basadur, T.M. (2014). Creative problem solving process styles, cognitive work demands and organizational adaptability. *Journal of Applied Behavioral Science, 50*(1), 80–115.

Basadur, M.S., Gelade, G., Basadur, T.M., & Skorokhod, T. (2009). Testing the predictive validity of the Basadur creative problem solving profile (CPSP). *Proceedings of the Southwest Academy of Management,* USA.

Basadur, M.S., & Gelade, G.A. (2003). Using the creative problem solving profile (CPSP) for diagnosing and solving real-world problems. *Emergence Journal of Complexity Issues in Organizations and Management*, *5*(3), 22–47.

Basadur, M.S., & Gelade, G.A. (2005). Modelling applied creativity as a cognitive process: Theoretical foundations. *The International Journal of Thinking and Problem Solving, 15*, 13–42.

Basadur, M.S., Gelade, G.A, Basadur, T.M., & Perez, R. (2016). Improved reliability and research applications of the Basadur creative problem solving profile (CPSP). *Kindai Management Review*, *4*, 101–112.

Basadur, M.S., & Goldsby, M. (2016). *Design-centered entrepreneurship: A creative process for concept development* (pp. 9–18). New York, NY: Routledge/Taylor & Francis Group.

Basadur, M.S., & Head, M. (2001). Team performance and satisfaction: A link to cognitive style within a process framework. *Journal of Creative Behavior*, *35*, 1- 22.

Bryman, A., & Cramer, D. (2001). *Quantitative data analysis with SPSS release 10 for Windows* (pp. 122). New York, NY: Routledge.

Corston, R., & Colman, A. (2000). *A crash course in SPSS for Windows* (pp.41). Oxford, UK: Blackwell Publishers.

George, D., & Mallory, P. (2005). *SPSS for Windows step by step: A simple guide and reference. 12.0 Update* (pp. 113). Boston, MA: Pearson Education.

Griffith, E. (2017, July). On message, off target. *Fortune Magazine*.

Guilford, J.P. (1967). *The nature of human intelligence*. New York: McGraw-Hill.

Kirton, M.J. (2003). *Adaptation-Innovation in the Context of Diversity and Change.* New York, Routledge.

Kolb, D.A. (1976). *Learning style inventory technical manual*. Boston, MA: McBer.

Mintzberg, H. (1989). *Mintzberg on management: Inside our strange world of organizations*.

Mott, P.E. (1972). *The characteristics of effective organizations*. New York, Harper and Row.

Runco, M.A., & Basadur, M.S. (1993). Assessing ideational and evaluative skills and creative styles and attitudes. *Creativity and Innovation Management, 2*(3), 166–173.

Simon, H.A. (1960). *The new science of management decision.* Englewood Cliffs, NJ: Prentice- Hall.

Simon, H.A. (1977). *The new science of management decision* (Rev. ed.). Englewood Cliffs, NJ: Prentice- Hall.

Sternberg, R.J. (1996). *Successful intelligence: How practical and creative intelligence determine success in life*. New York: Simon & Schuster.

Wonder, I., and Blake, J. (1992). Creativity East and West: Intuition vs. logic? *Journal of Creative Behavior.* Vol. 25, 172-188.

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