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### Abstract

This study investigated the personality facets that underpin the construct of problem solving style, particularly when approaching more creative kinds of problem solving. Cattell's Sixteen Personality Factors Questionnaire and VIEW – An Assessment of Problem Solving Style were administered to 165 students from the Norwegian Business School. We explored relationships through correlational and regression analysis. Personality profiles were derived for each of VIEW's three dimensions and were in generally expected directions.

Those with an Explorer preference were more imaginative and idea-oriented, open to change, unconventional, freethinking and flexible than Developers. Those with a Developer preference were more practical and solution oriented, more traditional, rule conscious, conservative, and respecting of traditional ideas. Those with an External preference were more group oriented, affiliative, socially bold, warm, and attentive to others than those with an Internal preference. Those with a more Task oriented preference were more impersonal, detached, utilitarian, and tough minded than those with Person oriented preference. We outlined implications and suggestions for further research.

*Keywords:* problem-solving style, creativity, personality, creative problem solving

Creativity and innovation are key imperatives for survival, remaining competitive, and growth. How individuals approach new challenges and opportunities is fundamental to team and organizational creativity and innovation. Gaining insight into how people approach novel, ambiguous, and complex problems can help set the appropriate conditions to help individuals, teams, and organizations meet their innovation challenges.

Individuals differ in how they contribute to, and what they need from, the creative problem solving process. Problem solving style is one way to understand and appreciate these differences. Yet, numerous scholars have criticized the field of cognitive and learning styles due to the lack of clear conceptual foundations and sparse empirical validation (Hodgkinson & Sadler-Smith, 2003; Peterson, Rayner, & Armstrong, 2009). Researchers have called for more research into the relationship between style constructs and personality as a way to ameliorate the confusion (Kozhevnikov, 2007). This study focused on deepening our understanding of individual differences in problem solving style by examining the extent to which certain aspects of personality underpin the concept. Problem solving style should have its deeper foundations in personality – but they should not completely overlap. More specifically, this study sought to examine the personality foundations of VIEW: An Assessment of Problem Solving Style (VIEW), and the extent to which there was empirical overlap between personality as assessed by Cattell's Sixteen Personality Factor Questionnaire (16PF) and the dimensions of VIEW.

**Problem Solving Style and Personality.** It is reasonable to expect that problem solving styles would develop in congenial or agreeable ways based on underlying personality traits (Messick, 1984; Kozhevnikov, Evans, & Kosslyn, 2014). Personality and cognition play key roles in understanding how people approach life's creative challenges and opportunities (Feist & Barron, 2003). Preferred knowledge structuring, information processing, and decision-making schemas

and strategies may provide a conceptual bridge between personality and behavior (Cantor, 1990; Messick, 1996; Sternberg, Grigorenko, & Zhang, 2008). Some researchers conceive of styles as bridging variables that embody cognition and personality simultaneously (Martinsen & Kaufmann, 1999; Messick, 1994).

Treffinger, Selby, and Isaksen (2008) defined problem-solving styles as "...consistent individual differences in the ways people prefer to plan and carry out generating and focusing activities, in order to gain clarity, produce ideas, and prepare for action" (p. 393). This definition is anchored within an individual or intrapersonal level of analysis as it encompasses a person's consistent predilection from a psychological point of view. Further, it includes both divergent (generating) and convergent (focusing) kinds of problem solving aimed at gaining clarity when facing ambiguous or ill structured situational demands, generating new ideas and alternatives, and building and developing options and plans to implement novel insights. As such, there is a strong conceptual link between problem solving styles and a creative approach to problem solving (Isaksen, Dorval, & Treffinger, 2011) or a sense making perspective of creativity (Drazin, Glynn, & Kazanjian, 1999; Maitlis & Christianson, 2014).

Selby, Treffinger, Isaksen, and Lauer (2004) formed a new model of problem solving styles based on more than 30 years of research and development aimed at understanding the relationships among the deliberate development of creativity and learning styles, psychological type, and cognitive styles (Isaksen, 2004; Treffinger, Selby, & Isaksen, 2008). The historical and conceptual basis for this new model was the linking of practical efforts to deliberately develop creativity and creative problem solving abilities (focus on process) with psychological characteristics and individual differences (focus on person). The Cognitive Styles Project was the research program

aimed at improving our understanding of these differences in learning and applying creative problem solving (Isaksen, 2004).

The Creative Studies Project (Noller & Parnes, 1972; Parnes & Noller, 1972) had demonstrated that creativity and creative problem solving skills and abilities could be deliberately developed. Yet, there were indications that those subjects who dropped out of the program demonstrated a unique personality profile (Parnes & Noller 1973). The Cognitive Styles Project aimed to better understand these individual differences related to learning and applying creative problem solving and making improvements in the instructional program.

The investigators involved in the Cognitive Styles Project studied numerous models and measures of assessing individual differences and, consistent with other researchers, discovered a fragmented proliferation of theories and approaches (Kozhevnikov, 2007; Peterson, Rayner, & Armstrong, 2009). The three major constructs approached during the project included learning style theory (Dunn & Dunn, 1978; Gregorc, 1985; Kolb, 1981), cognitive style theory (Guilford, 1986; Kirton 1976; Martinsen & Kaufmann, 1999) and psychological type and temperament theory (Jung, 1923; Myers & McCaulley, 1985; Vernon, 1973). These three constructs, and their related measures, emerged as the most salient in the developmental efforts for VIEW.

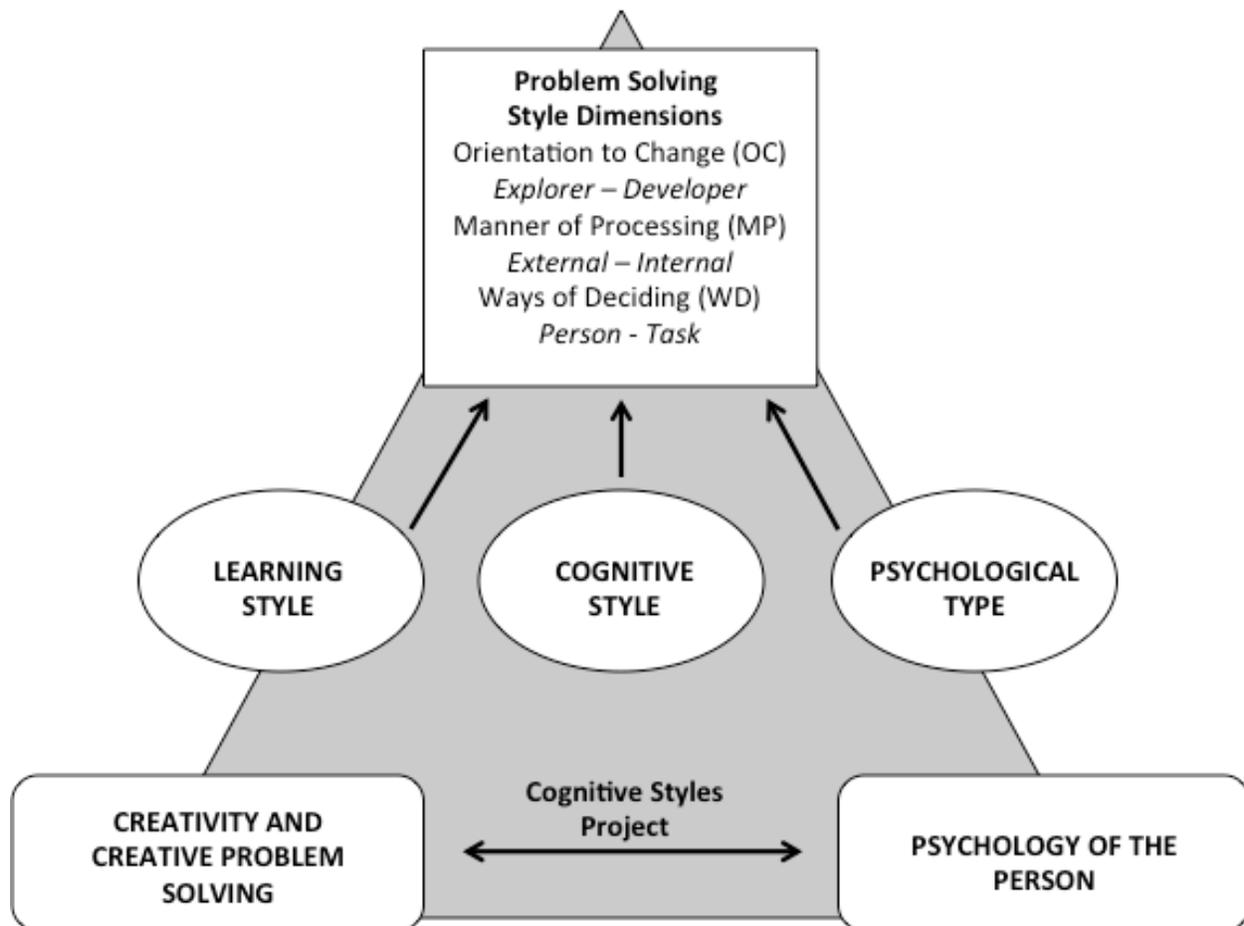
It is well beyond the scope of this study to offer clear, singular, and consensus-based definitions of these three constructs. They all shared a common focus on understanding and appreciating individual differences and provided some contribution to the Cognitive Styles Project. They differed when it came to the breadth of their application and with regard to their stability. Peterson, Rayner, and Armstrong (2009) provided support for these differences based on a survey of 94 style researchers. In general, they reported that cognitive styles were seen as stable and closely linked to underlying cognitive processing mechanisms, whereas learning styles were seen

as more variable, environmentally dependent, and focused more on effects on learning behavior. Psychological type, with foundations in Jung's work on personality, described preferences that influence individuals' behavior consistently and over a broad range of tasks.

The authors of VIEW integrated various aspects from all three constructs in order to define and delineate the problem solving style construct (Selby, Treffinger, & Isaksen, 2007a; 2014). The VIEW model and measure of problem solving style describes an individual's preference specifically in relation to dealing with complex, novel, and open-ended problems and to managing change associated with these problem spaces. The model includes three bi-polar dimensions of problem solving style. Each dimension includes a continuum with clear descriptions of styles at each end (see Figure One).

How individuals perceive and approach opportunities and challenges for change, creativity, and innovation influences their creative problem solving behavior. The Orientation to Change dimension of VIEW encompasses individual preferences for responding to and managing novelty, structure and authority, and search strategy when dealing with change or solving problems of a creative kind and is anchored by Explorer and Developer styles. Those who prefer an Explorer style seek to break new ground and venture into uncharted territory. They enjoy considering many original and unique challenges, ideas, and possibilities. Explorers are likely to feel constrained by structure and external sources of authority and prefer to search broadly for alternatives and information. The Developer style prefers to organize, synthesize, refine, and more fully settle existing or known territory. Developers feel more comfortable considering fewer familiar and accepted challenges, ideas, and alternatives. They are encouraged and enabled by dealing with structure and sources of authority and prefer to search more narrowly for ideas and information, particularly if they are useful and more traditional.

Figure 1: A Model of Problem-Solving Style



The extent to which individuals prefer reflection or interaction influences how they engage in creative collaboration. The Manner of Processing dimension focuses on preferences for how and when individuals use their inner energy and resources (and those of others or from the environment) while processing information when managing change or solving problems, and is anchored by External and Internal styles. Those who prefer External processing are energized by interaction when facing creative challenges and opportunities. They seek input openly from a variety of others and their thinking will likely be modified as more input is obtained. Externals freely share their thoughts and perspectives early with others in order to seek their opinions and

reactions so that their own thinking can be influenced. Those with Internal preferences are energized by reflection and look more to their inner thoughts when engaged in creative kinds of problem solving. Internals prefer to share their thoughts after they have had sufficient contemplation and consider their thinking finished.

Creative problem solving includes generating many, varied, and unusual alternatives; as well as focusing, deciding, and taking action aimed at implementation. The Ways of Deciding dimension of VIEW refers to dispositions of individuals in balancing concerns for tasks and interpersonal needs when focusing, making decisions, or taking action and is anchored by Person and Task styles. Those with a Person oriented preference consider the level of harmony or impact on relationships – the human impact – of their decisions and actions as a key priority. They tend to be holistic when considering alternatives – they do not tend to separate people from their ideas. As a result, they prefer to give feedback that is softer or more caring. Their preferred standards for making decisions include: likely level of agreement, feelings, and more subjective criteria. The Task oriented decider tends to give the highest priority to obtaining a high-quality outcome or result. They tend to separate people from their ideas when considering options and, as a result, they are inclined to be cooler or more critical when providing feedback. Task-oriented deciders prefer to apply reason, logic, analysis, and objective criteria as their favored standards.

The authors of VIEW also drew upon numerous personality theorists in providing the underlying rationale for all three dimensions of problem solving style (Selby, Treffinger, & Isaksen, 2007a). They specified theoretical relationships between problem solving dimensions and the work of Cattell (1988), Costa and McCrae (1995), Eysenck and Eysenck (1991), as well as Gough and Bradley (1996). Personality theorists have yet to agree on a single definition of personality but most would agree that personality is a pattern of relatively permanent traits and

unique characteristics that give both consistency and individuality to a person's behavior (Feist & Feist, 2009). For the purposes of this study, Cattell's 16PF was selected due to its focus on the normal range of personality rather than focusing on abnormalities in individuals. It provides a reasonable comparison to the widely used Big Five (Costa & McCrae, 1995), as well as a more detailed set of more specific personality factors. Further, it includes three scales (acquiescence, impression management, and infrequency of response) to assess the social desirability of responses. Table One includes a description of the facets assessed by the 16PF.

Any multidimensional assessment of problem solving style should yield differentiated personality profiles for each dimension, particularly if the dimensions have been shown to be factorially independent. Further, we expected that the correlations between personality and problem solving style should be small or moderate, illustrating a low degree of empirical overlap between the two constructs.

**Research Questions.** This study focused on examining the relationships between the three dimensions of problem solving style and the sixteen facets, and global scales, of the Cattell 16PF. We expected to find relationships between VIEW's Orientation to Change dimension such that those with a Developer preference should tend to be: more rule conscious, less abstract, and less open to change than those with an Explorer preference. Explorers would be less rule conscious, more abstract, and more open to change. We expected to find relationships between VIEW's Manner of Processing dimension such that Internals should tend to be less socially bold than Externals. Externals should be more extraverted and socially bold. We expected to find relationships between VIEW's Ways of Deciding dimension such that those with a Task oriented preference should tend to score lower on warmth and lower on sensitivity than those with a

Table 1: *Facets of the 16PF*

<b>Description of Low Range</b>	<b>FACET</b>	<b>Descriptors of High Range</b>
Reserved, impersonal, distant, cool, detached, formal, aloof	<b>Warmth</b>	Warm, outgoing, attentive to others, kindly, easy-going, participating, likes people
Concrete thinking, lower general mental capacity, less intelligent, unable to handle abstract problems	<b>Reasoning</b>	Abstract-thinking, more intelligent, bright, higher general mental capacity, fast learner
Reactive emotionally, changeable, affected by feelings, emotionally less stable, easily upset	<b>Emotional Stability</b>	Emotionally stable, adaptive, mature, faces reality calmly
Deferential, cooperative, avoids conflict, submissive, humble, obedient, easily led, docile, accommodating	<b>Dominance</b>	Dominant, forceful, assertive, aggressive, competitive, stubborn, bossy
Serious, restrained, prudent, taciturn, introspective, silent, somber, inhibited	<b>Liveliness</b>	Lively, animated, energetic, spontaneous, enthusiastic, happy go lucky, cheerful, expressive, impulsive
Expedient, nonconforming, disregards rules, self indulgent, unconventional	<b>Rule-Consciousness</b>	Rule-conscious, dutiful, conscientious, conforming, moralistic, staid, rule bound
Shy, threat-sensitive, timid, hesitant, intimidated	<b>Social Boldness</b>	Socially-bold, venturesome, thick skinned, uninhibited
Utilitarian, objective, unsentimental, tough-minded, self-reliant, no-nonsense, rough	<b>Sensitivity</b>	Sensitive, aesthetic, sentimental, tender-minded, intuitive, refined
Trusting, unsuspecting, accepting, unconditional, easy-going	<b>Vigilance</b>	Vigilant, suspicious, skeptical, distrustful, oppositional
Grounded, practical, prosaic, solution-oriented, steady, conventional	<b>Abstractedness</b>	Abstract, imaginative, absent minded, impractical, absorbed in ideas
Forthright, genuine, open, guileless, naive, unpretentious, involved	<b>Privateness</b>	Private, discreet, non-disclosing, shrewd, polished, worldly, astute, diplomatic
Self-Assured, unworried, complacent, secure, free of guilt, confident, self-satisfied, untroubled	<b>Apprehension</b>	Apprehensive, self-doubting, worried, guilt-prone, insecure, worrying, self-blaming
Traditional, attached to familiar, conservative, respecting traditional ideas	<b>Openness to Change</b>	Open to change, experimental, liberal, analytical, critical, free-thinking, flexibility
Group-oriented, affiliative, a joiner, group dependent	<b>Self-Reliance</b>	Self-reliant, solitary, resourceful, individualistic, self-sufficient
Tolerates disorder, unexacting, flexible, undisciplined, lax, self-conflict, impulsive, careless of social rules, uncontrolled	<b>Perfectionism</b>	Perfectionistic, organized, compulsive, self-disciplined, socially precise, exacting will power, control, self-sentimental
Relaxed, placid, tranquil, torpid, patient, composed, low drive	<b>Tension</b>	Tense, high-energy, impatient, driven, frustrated, over-wrought, time driven

Adapted from: Cattell, H. E. & Schueger, J. M. (2003). *Essentials of 16 PF assessment*. New York: Wiley.

Person-oriented deciding preference. Person oriented deciders should score higher on warmth and sensitivity.

These expected relationships were those specified by the VIEW authors. However, little or no previous empirical research has substantiated the personality underpinnings of problem solving style.

### **Method**

**Participants and Procedure.** One hundred and sixty-five students from the Norwegian Business School participated in this study. They were invited to complete VIEW: An Assessment of Problem Solving Style during March of 2010, and were provided feedback on their VIEW results. Those who completed VIEW were also invited to complete the 16PF as a voluntary additional exercise following the course. Students were provided feedback on their results shortly after they completed the 16PF. This sample of convenience included 102 females and 61 males (2 did not indicate gender). The participants' ages ranged from 19 to 60, with an average age of 24.12 and a standard deviation of 6.68 (3 did not indicate their age).

**Personality Facets and Global Scales.** This study applied the fifth edition of the Cattell Sixteen Personality Factor Questionnaire (16PF; Cattell, 1988). The 16PF is an established and widely used measure of personality and has demonstrated evidence of its reliability and validity (Aluja & Blanch, 2004; Cattell & Schuerger, 2003; Karol & Russell, 2009). The 16PF assesses 16 facets or factors, as well as five global traits that are higher order factors and are comparable to the Big Five personality traits (Costa & McCrae, 1995; Digman & Inouye, 1986; Rossier, de Stadelhofen, & Berthoud, 2004). The higher order factors have been replicated in cross-cultural comparisons (Aluja, Rossier, Garcia, & Verardi, 2005). The 16PF global scales (with their respective sub-factors) include: Extraversion meaning how one relates to others (warmth, liveliness, social boldness, privateness, and self reliance); Anxiety meaning how one manages pressure (emotional

stability, vigilance, apprehension, and tension); Tough-mindedness as a thinking style (warmth, sensitivity, abstractedness, openness to change); Independence meaning how one relates to influence and collaboration with others (dominance, social boldness, vigilance, and openness to change); and Self Control relating to conscientiousness, structure and rules (liveliness, rule-consciousness, abstractedness, and perfectionism).

**Problem-Solving Style.** This study applied VIEW: An Assessment of Problem Solving Style (VIEW) to assess individuals' problem-solving style preferences. VIEW is based on clear and explicit conceptual foundations and demonstrates promising evidence of reliability and validity (Selby, Treffinger, Isaksen & Lauer, 2004; Selby, Treffinger & Isaksen, 2007a&b; Schraw, 2007; Staal, 2007; Treffinger, 2013; Treffinger, Selby & Isaksen, 2008). The internal consistency of the scales was reported in Isaksen (2012) on a sample of 31,360 as .87 for Orientation to Change, .86 for Manner of Processing, and .84 for Ways of Deciding. Test-Retest stability correlations for a two-month interval are .93 for Orientation to Change, .93 for Manner of Processing, and .84 for Ways of Deciding (Selby, Treffinger, & Isaksen, 2007a). The Cronbach's Coefficient Alphas for this sample on VIEW were .83 for Orientation to Change and .87 for Manner of Processing and .79 for Ways of Deciding. Based on a recent examination of VIEW's database of 31,360 subjects (Isaksen, 2012), the correlations of VIEW's dimensions with age or gender are negligible.

VIEW includes 34 items scored on a seven point Likert-type scale yielding results on three independent dimensions. The Orientation to Change dimension includes 18 items, so the continuum ranges from 18 to 126, with higher scores indicating a Developer preference. The Manner of Processing dimension includes eight items with scores ranging from 8 to 56 with higher scores indicating an Internal preference. The Ways of Deciding dimension also includes eight items, with higher scores indicating a Task preference.

Examination of the internal structure of VIEW through a series of exploratory factor analyses has provided evidence of three independent dimensions (Costello & Houtz, 2005; Selby, Treffinger & Isaksen, 2007a; Selby, Treffinger, Isaksen, & Lauer, 2004; Treffinger, Isaksen, & Selby, 2014). Deeper examination of VIEW's internal structure has included a series of studies utilizing confirmatory factor analysis (CFA; Breen, Selby, Zusho, & Houtz, 2009; Isaksen & Aerts, 2011; Proestler & Vasquez, 2011). The results from CFA have generally indicated that a three dimensional model may not be the best fit to the various sets of data utilized, resulting in the development of three elements or subscales of the Orientation to Change dimension (Selby, Treffinger, & Isaksen, 2014). More research remains to be done on these developments.

VIEW has demonstrated relationships to other variables such as learning and teaching styles (Doheny, Houtz, & Selby, 2008; Selby, Shaw, & Houtz, 2003), other measures of learning style, cognitive style, and personality type (Selby, Treffinger, & Isaksen, 2007a; Sokolowska, 2006; Woodel-Johnson, 2010), coping styles (Maghan, 2008), and career interests (Crerar, 2010; Maghan & Houtz, 2009). VIEW has also demonstrated application potential in educational (Shaw, Selby & Houtz, 2009) business (Stead, 2008) and cross-cultural contexts (Isaksen, De Schryver, & Onkelinx, 2010).

## **Results**

The descriptive statistics for this sample are presented in Table Two. The results on the 16PF were comparable to the normed samples reported in Karol and Russell (2009). The results on VIEW showed a slight skew toward a Developer style on the Orientation to Change Dimension, an External style on the Manner of Processing Dimension, and toward a Task oriented style on Ways of Deciding. These findings were similar to other studies using student samples (Houtz, Matos, Park, Scheinholtz, & Selby, 2007; Houtz, Ponterotto, Burger, & Marino, 2010).

Since self-report measures were used for both problem solving style and personality, Harmon's Single Factor Test (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) was computed to assess the extent to which the results were affected by common method variance. The results of the principal component factor extraction yielded a single factor explaining 19.34% of the variance indicating a low likelihood of common method variance.

The 16PF includes three response style indicators. The Acquiescence scale measures the tendency to answer "true" to an item regardless of its content. The 16PF includes 103 true-false questions and a raw score of 70 or higher indicates an acquiescent response set. The results for this sample indicated that the respondents did not generally respond randomly or indecisively. Only five subjects had scores in the 70's.

The Impression Management scale is essentially a social desirability scale with high scores indicating socially desirable responses and low scores reflecting a willingness to admit to undesirable characteristics. Raw scores at 21 or higher fall above the 95<sup>th</sup> percentile on the normed sample and indicate the possibility of subjects responding in a socially desirable fashion. Only one subject obtained a score of 21 for this sample.

The Infrequency scale is designed to indicate if a respondent answers a relatively large number of responses in a way that is different from most people. Raw scores of seven or greater are at the 95<sup>th</sup> percentile and indicate a relatively uncertain response orientation. Only five participants had scores above seven.

Table 2: *Descriptive Statistics*

Variable	Range	<i>M</i>	<i>SD</i>	<i>SE</i>	<i>CI</i> Lower	<i>CI</i> Upper
<u><i>16PF Primary Scales</i></u>						
Warmth	2 - 22	15.25	3.97	.31	14.64	15.86
Reasoning	2 - 15	9.07	3.03	.24	8.60	9.53

Emotional Stability	0 - 20	14.22	4.86	.38	13.45	14.93
Dominance	2 - 20	14.07	3.86	.30	13.48	14.67
Liveliness	0 - 20	15.09	4.12	.32	14.46	15.72
Rule-Consciousness	0 - 22	12.61	4.67	.36	11.89	13.33
Social Boldness	0 - 20	13.47	5.65	.44	12.60	14.34
Sensitivity	2 - 22	11.95	4.97	.39	11.18	12.71
Vigilance	2 - 20	12.44	4.32	.34	11.77	13.10
Abstractedness	0 - 21	7.58	5.03	.39	6.80	8.35
Privateness	0 - 20	10.73	5.60	.44	9.87	11.59
Apprehension	0 - 20	11.43	4.97	.39	10.67	12.19
Open to Change	5 - 28	16.82	5.44	.42	15.98	17.65
Self-Reliance	0 - 20	5.72	4.66	.36	5.01	6.44
Perfectionism	0 - 20	10.70	4.55	.35	10.00	11.40
Tension	2 - 20	12.60	4.76	.37	11.87	13.33
<i>Response Style</i>						
Acquiescence	30 - 78	56.96	8.57	.67	55.65	58.28
Impression	0 - 21	10.05	4.66	.36	9.33	10.77
Infrequency	0 - 16	1.20	2.15	.17	.87	1.53
<i>16PF Global Scales</i>						
Extroversion	1 - 10	7.04	1.77	.14	6.76	7.31
Anxiety	1 - 10	5.35	2.20	.17	5.01	5.68
Tough-Mindedness	1 - 10	5.48	1.79	.14	5.20	5.75
Independence	1 - 9	6.14	1.67	.13	5.88	6.40
Self-Control	1 - 8	5.15	1.59	.12	4.90	5.39
<i>VIEW Dimensions</i>						
Orientation to	45 - 126	77.47	14.35	1.12	75.26	79.67
Manner of	9 - 56	26.80	9.25	.72	25.38	28.22
Ways of Deciding	15 - 56	34.39	7.84	.61	33.18	35.59

Note: Confidence Intervals are displayed for 95%

**Problem Solving Style and Personality.** Pearson correlation coefficients were computed for all 16PF facets and global scales with the three dimensions of problem-solving style. Thirty-five of the possible 75 correlations were significant (46.6%). The values of the significant coefficients ranged from .16 to .49. The pattern of correlations displayed in Table Two suggests unique personality profiles for each of the dimensions of problem-solving style.

The mean correlation between the 16 facets of personality for the Orientation to Change dimension was .19 (3.6% shared variance). The mean correlation between personality and Manner

of Processing was .18 (3.24% shared variance). The average correlation between Ways of Deciding and personality was .14 (1.96% shared variance). The mean correlation between the global scales (similar to the big five) and Orientation to Change was .31 (9.61% shared variance). For Manner of Processing the average correlation was .24 (5.76% shared variance) and for Ways of Deciding it was .21 (4.41% shared variance).

Within the Orientation to Change Dimension, we found support for those with a Developer preferred style tending toward being more rule bound and conforming ( $r = .32, p < .01$ ), being less abstract ( $r = -.40, p < .01$ ), and less open to change ( $r = -.40, p < .01$ ). Those with Explorer preferences on this dimension tended to be more non-conforming, idea oriented, and more open to change. Developers preferred to have more structure, to produce solution-oriented ideas, and to be more attached to the familiar. In addition, we found Developers tended to be focused on perfectionism – taking an organized approach to change. Explorers, on the other hand, tended to take a more flexible approach, be more spontaneous, forceful, adventuresome, and more tolerant of disorder. From the global scale perspective (second-order factors), we found that Developers tended to be more tough-minded or resolute and self controlled than Explorers. Explorers tended to be more independent, intuitive, and forthright than Developers.

Table 3: *Correlations between 16PF and VIEW*

16PF Primary Scales	VIEW: Orientation to Change	VIEW: Manner of Processing	VIEW: Ways of Deciding
Warmth	<b>-.159*</b>	<b>-.238**</b>	<b>-.380**</b>
Reasoning	-.095	-.105	.122
Emotional Stability	-.102	<b>-.245**</b>	.055
Dominance	<b>-.216**</b>	<b>-.201**</b>	.012
Liveliness	<b>-.280**</b>	<b>-.300**</b>	<b>-.255**</b>

Rule Conscious	<b>.320**</b>	-.046	<b>.182*</b>
Social-Boldness	<b>-.239**</b>	<b>-.326**</b>	.046
Sensitivity	-.087	-.050	<b>-.337**</b>
Vigilance	-.127	.112	-.023
Abstractedness	<b>-.402**</b>	.042	-.114
Privateness	.037	.083	<b>.194*</b>
Apprehension	.188	<b>.263**</b>	-.129
Openness to Change	<b>-.404**</b>	<b>-.188*</b>	-.093
Self-Reliance	.101	<b>.401**</b>	.141
Perfectionism	<b>.250**</b>	<b>.230**</b>	<b>.199*</b>
Tension	-.106	.008	.008
<i>Response Indices</i>			
Acquiescence	-.186	.032	-.046
Impression	-.002	-.077	.059
Management			
Infrequency	-.063	-.025	-.025
<i>16PF Global Scales</i>			
Extroversion	<b>-.223**</b>	<b>-.381**</b>	<b>-.313**</b>
Anxiety	-.022	<b>.207*</b>	-.071
Tough-Mindedness	<b>.447**</b>	<b>.197*</b>	<b>.361**</b>
Independence	<b>-.365**</b>	<b>-.246**</b>	-.037
Self-Control	<b>.487**</b>	<b>.190*</b>	<b>.278**</b>

Note.  $N = 165$ . \*  $p < .05$ , \*\*  $p < .01$

For Manner of Processing, Internals were found to be more self reliant and solitary ( $r = .40$ ,  $p < .01$ ), less socially bold ( $r = -.33$ ,  $p < .01$ ) and more hesitant. In addition, we found the personality profile of the Internal was less emotionally stable or reactive, more careful, more likely to be self doubting, submissive, individualistic, slightly less open to change, and tended more toward perfectionism. Externals tended to be more socially bold, more affiliative and group oriented, and outgoing. In terms of the second-order factors, we found that Internals were more introverted, socially inhibited, reserved and distant and Externals more extraverted (see Table Two for specific correlations).

For Ways of Deciding, those with a Task oriented preference were more reserved and impersonal, objective and utilitarian ( $r = -.38$ ,  $p < .01$ ), and also more utilitarian, objective, and

tough minded ( $r = .34, p < .01$ ) than those with a Person oriented preference. In addition, we found the profile for Task oriented deciders included being less attentive to others and more self-reliant. On the 16PF global scales Task oriented deciders tended to be tough-minded or impersonal ( $r = .36, p < .01$ ) when making decisions and focused more on practical and grounded solutions. They also tended to be more self-controlled ( $r = .28, p < .01$ ). Person oriented deciders tended to be more warm, attentive to others, and affiliative ( $r = .31, p < .01$ )

To further examine the ability of personality to predict problem-solving style we conducted regression analysis of the five 16PF global scales against each of the three dimensions of problem-solving style (see Table Four). Self-control ( $\beta = .37, SE = .64, p < .001$ ), tough mindedness ( $\beta = .23, SE = .61, p < .01$ ), and independence ( $\beta = -.20, SE = .63, p < .01$ ) were the optimum predictor variables for the Orientation to Change dimension. Those with a Developer preference tended to be more practical, solution-oriented and attached to the familiar. They also tended to be more rule-conscious, self-disciplined and cooperative than Explorers. The adjusted  $R^2$  for the model indicated that it accounted for 33.5% of the variance.

The global scale of extraversion was the optimum predictor variable for the Manner of Processing dimension of problem-solving style ( $\beta = -.26, SE = .45, p < .01$ ) indicating that those with an External preference were more likely to be outgoing, lively, venturesome, and group-oriented. The global scale of anxiety approached significance ( $\beta = .14, SE = .33, p < .074$ ), indicating a slight tendency for Externals to be more unsuspecting and self-assured. The adjusted  $R^2$  for the model indicated that it accounted for 16% of the variance.

Table 4: *Regression Analysis Predicting VIEW Dimensions by 16PF Global Scales*

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16PF Global Scale

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	VIEW: Orientation to Change	VIEW: Manner of Processing	VIEW: Ways of Deciding
Extroversion	.02	-.26*	-.34**
Anxiety	.11	.14	-.14
Tough-Mindedness	.23*	.05	.31**
Independence	-.20*	-.11	.24*
Self-Control	.37**	.11	.12
Model $R^2$ (adjusted)	.34	.16	.23

Note. N = 165. Standardized Beta coefficients are shown.

\*  $p < .01$ , \*\*  $p < .001$

The global scales of extraversion ( $\beta = -.34$ ,  $SE = .36$ ,  $p < .001$ ) tough-mindedness ( $\beta = .31$ ,  $SE = .36$ ,  $p < .001$ ), and independence ( $\beta = .24$ ,  $SE = .37$ ,  $p < .01$ ) were significant predictor variables for the Ways of Deciding dimension of problem-solving style. Those with a Task-oriented preference were more likely to be more objective, unsentimental, and solution-focused. They are also more likely to be forceful, assertive, and thick-skinned. The global scale of anxiety approached significance ( $\beta = -.14$ ,  $SE = .27$ ,  $p < .071$ ), indicating a slight tendency for Person oriented deciders to be more trusting, patient, and accepting. The adjusted  $R^2$  for the model indicated that it accounted for 22.7% of the variance.

## Discussion

The results from this study provided support for the research questions examined, and also produced additional insights into the personality facets that undergird problem-solving style. The personality profiles that emerged for each of the VIEW style dimensions provided preliminary support of the construct validity for problem-solving style as assessed by VIEW.

**Style and Personality.** The research questions focused on the nature and extent of the relationship between problem solving style and personality. The way people prefer to approach problem solving should have some foundations in personality. However, recent criticism of cognitive styles

has suggested that some of the style constructs are nothing more than personality (von Wittich & Antonakis, 2011). Some style constructs may be more trait-like or more strongly related to deeper aspects of personality (Allport, 1931), and others may be closer to general cognitive strategies reflecting preferred ways people think, solve problems, and relate to others (Kozhevnikov, 2007). We expected that problem solving style, assessed by VIEW, would have appropriate, but relatively small or moderate correlations with certain personality factors as measured by the 16PF. Each of VIEW's three dimensions did have personality factors reflecting an appropriate fit to their conceptual definitions. However, in terms of observed overlap between VIEW styles and personality, the correlations were relatively small and indicated a low level of empirical overlap.

Further support for the low level of overlap between personality and problem-solving style was provided by the regression results. The regression analysis using the global facets of personality to predict problem solving style provided consistent personality profiles for their respective style dimensions, but the overall amount of variance accounted for by each of the models was modest. Problem solving style may add additional value in understanding individual differences beyond personality. This is an important issue for those creativity researchers and practitioners who apply style assessments and is deserving of much more additional inquiry.

**Style and Level.** VIEW was designed to be a measure of problem solving style and, in principle, should be independent from cognitive abilities or capacity (Kirton, 2003; Martinsen & Kaufmann, 2000) or level of intellectual function. The 16PF includes fifteen items to assess verbal, numerical, and logical reasoning ability (Factor B). Cattell included this factor as a short proxy for intellectual ability and it does correlate with measures of intelligence and mental ability (Karol & Russell, 2009). This scale is not a replacement for more reliable and full-length measures of mental ability and care must be taken regarding its interpretation.

Although tangential to the main purpose of this study, we found no significant correlations between the dimensions of VIEW with Factor B, providing support for the independence of cognitive level and style. These results are consistent with earlier findings supporting the independence of problem solving style with other level measures (Houtz & Selby, 2009; Woodell-Johnson, Delcourt, & Treffinger, 2012).

**Creative Style and Process.** This study was confined to the person conceptual space within the classic four P's of creativity (person, process, place, and product). However, this raises an issue regarding the potential relationships between "person" and the creative "process," as this was the main thrust of the Cognitive Style Project (Isaksen, 2004). Indeed, one of the main reasons we see a proliferation of style assessments is the fundamental belief that they make a difference in creative behavior (Armstrong, Cools, & Sadler-Smith, 2012). One important consideration in assessing problem-solving style was the extent to which the measure should be conceptually focused not only on style, but include a specific creative process framework within its scope. We have observed that some relatively recent style measures link their assessment to a specific creative process framework (Basadur, Graen, & Wakabayashi, 1990; Basadur & Basadur, 2011; Puccio, 1999; Puccio, Wheeler, & Cassandro, 2004) implying that style should be conceptually integrated with a particular description of the creative process. The challenge with these approaches is that they may confound measurement, and there is a danger that individuals get the idea that they are only competent in one part of the creative process.

Regardless of their preferred style, problem solvers need to be able to productively approach all stages and aspects of any particular model of the creative process. Some researchers have argued that process should remain distinct from elements of style and level (De Ciantis, & Kirton, 1996; Hayes & Allison, 1998). The value of keeping these distinct is that individuals can

and do apply cognitive strategies that are less congenial to their preferred approaches (Dane, Pratt, Baer, & Oldham, 2011; Messick, 1984). This sort of coping behavior may be sustained by motivation and the perception of the importance of the task at hand. The amount of energy an individual puts into this coping behavior could be minimized by learning and applying alternative creative thinking strategies, tools, and techniques. Problem-solving style could be a useful tool for metacognitive monitoring, control, and modification of problem-solving strategies (Flavell, 1979).

Another practical implication of the style-process distinction may apply when individuals must collaborate and work together creatively and cooperatively. When working in groups and teams, it may be possible for problem solving style to play a supportive role in social metacognition (Jost, Kruglanski, & Nelson, 1998; Frith & Frith, 2012). For example, if individuals were aware of their preferences when working together on a creative problem-solving task, they could arrange their work so that the individuals with the appropriate style preferences could take the lead on the elements of the task with the most congenial fit. The potential benefit of this sort of coverage should also be the subject of further research and should be linked with the emerging concept of social metacognition.

**Limitations and Future Research Directions.** This study used a small sample of convenience, so the results will have limited generalizability and should be considered preliminary. Further research regarding the personality underpinnings of problem solving style should be conducted with larger and random samples to improve the generalizability of the findings.

Further, both measures applied in this study were self-report assessments. In order to address the issue of the relative overlap between personality and problem solving style, further research must be conducted utilizing objective and behaviorally dependent outcomes. This would

allow a more stringent assessment of predictive relationships between personality and style, and comparisons of their ability to predict creative behavior and outcomes. This type of inquiry would be required in order to illustrate that problem-solving style adds predictive value beyond personality characteristics. Future research of this sort may shed some light on how problem solving style may act as a bridge between personality and other cognitive functions related to creativity.

This study used Factor B of the 16PF to address the level-style issue. Further research is needed to more fully examine the level-style distinction, particularly because Factor B is not a replacement for more reliable and full-length measures of mental ability. Future research should apply full-length and reliable assessments of mental ability. Further, specific kinds of creative tasks and challenges may call upon certain specific styles, but the more general abilities like IQ and verbal comprehension should be conceptually and empirically distinct for measures purporting to be pure style assessments.

From a measurement perspective, work must be done to examine the manipulation effects that instructions and item construction may have that influences style's relationship to personality. For example, the KAI instructions require participants to assess "...how easy or difficult do you find it to present yourself, consistently, over a long period as..." Each item begins with the phrase "A person who..." This response set may reflect a tendency for participants to reflect deeply, and scores would likely have a stronger conceptual and empirical link to personality traits. VIEW, on the other hand, asks participants to keep in mind: "When I am solving problems, I am a person who prefers..." This response set is more likely to reflect style preferences closer to creative behavior rather than overlap strongly with personality. We need more research on how the wording of both instructions and items may influence the relationships between style and

personality. This difference in response set and item wording may also account for why von Wittich and Antonakis (2011) found that the KAI lacked incremental validity.

This study provided preliminary evidence regarding the expected kind and degree of relationships between VIEW as an assessment of problem solving style and the 16PF as a measure of personality. Individuals can benefit from understanding and appreciating their problem solving style by recognizing their preferred approach to new, unfamiliar, and complex tasks. They can apply these insights to reduce the costs associated with coping. Teams engaged in creative problem solving can apply problem-solving style to make improved use of their diversity in a value-neutral manner – aimed at productive use of differences. Problem solving style, and VIEW as its measure, has already been applied to improve our understanding of individual differences in establishing an organizational work environment that supports creativity (Isaksen & Aerts, 2011). The problem solving style construct holds promise and potential in helping us take a more inclusive approach to developing and applying creativity.

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