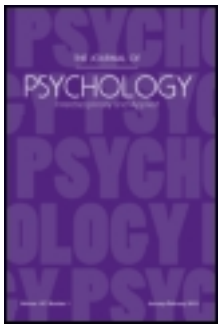

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Development and Validation of the Cognitive Style Indicator

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ABSTRACT. The authors describe the development and validation of the Cognitive Style Indicator (CoSI) using 3 diverse samples (N = 5,924; N = 1,580; and N = 635). Reliability, item, and factor analyses demonstrated the internal consistency and homogeneity of 3 cognitive styles: knowing, planning, and creating. The authors also found substantial support for the instrument's convergent and discriminant validity by including other cognitive style instruments and personality and academic performance measures in the validation process. Criterion-related validity was confirmed by examination of the relation between these cognitive styles and work-related characteristics. The main contributions of this study are (a) the further refinement of the analytic–intuitive cognitive style dimension by splitting the analytic pole in a knowing and a planning style and (b) the development of a valid and reliable cognitive style instrument for use in organizations.

Keywords: Cognitive Style Indicator, cognitive styles, measurement

COGNITIVE STYLES ARE INDIVIDUAL PREFERENCES in perceiving and processing information, and they are extensively studied in domains such as education and experimental psychology (Grigorenko & Sternberg, 1995; Rayner & Riding, 1997). Given the increased attention for cognitive approaches in industrial, work, and organizational psychology (Hodgkinson, 2003), cognitive styles have gained prominence in the organizational behavior and management literature (Hayes & Allinson, 1994; Hodgkinson & Sadler-Smith, 2003; Sadler-Smith & Badger, 1998). Researchers have found that individual differences in cognitive styles influence perception, learning, problem solving, decision making, communication, and creativity in important ways (Hayes & Allinson, 1994; Kirton, 2003). Researchers have identified various cognitive style models (Hodgkinson & Sadler-Smith). Different authors have also developed their own instruments for assessment, providing unique labels to the cognitive styles under investiga-

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tion (Shipman & Shipman, 1985). Although there is widespread belief that cognitive styles are useful for organizations, the myriad cognitive style models and the growing number of cognitive style measures have resulted in a complex and confusing field of study (Grigorenko & Sternberg; Hayes & Allinson; Rayner & Riding) that undermines the viability of the concept for academics and practitioners (Hodgkinson & Sadler-Smith).

We had two goals in this research. First, given the recent debate about unidimensional cognitive style models, we wanted to examine whether reducing the large field of cognitive style theories to one bipolar cognitive style dimension is still warranted. We wanted to contribute to further clarity in the cognitive style field. Second, we wanted to develop a reliable, valid, and convenient instrument, the Cognitive Style Indicator (CoSI), to measure the three-dimensional cognitive style model we identified in the literature. In this article, we examine the field of cognitive styles and the model we identified, and we explain the methodology of our validation studies. We continue with the results, focusing on the scale development and scale evaluation phase, and conclude by discussing the scientific implications of the study.

Theoretical and Empirical Interest in Cognitive Styles

Defining Cognitive Styles

Regardless of a specific approach or theory, the term *style* usually refers to a habitual pattern or preferred way of doing something (Grigorenko & Sternberg, 1995). *Cognitive style* was defined by Witkin, Moore, Goodenough, and Cox (1977) as the individual way a person perceives, thinks, learns, solves problems, and relates to others. Hunt, Krzystofiak, Meindl, and Yousry (1989) defined *cognitive style* as the way people process and organize information and arrive at judgments or conclusions on the basis of their observations. In an early attempt to bring clarity to the diverse field of cognitive style research, Messick (1984) concluded that the different conceptions all imply that cognitive styles are consistent individual differences in ways of organizing and processing information and experience. Building further on this stream of conceptualizations, we define a *cognitive style* as the way people perceive stimuli and how they use this information to guide their behavior (i.e., thinking, feeling, actions).

Researchers have investigated cognitive styles in relation to various concepts, such as personality (e.g., Goldsmith, 1984; Gryskiewicz & Tullar, 1995), ability (e.g., Riding & Agrell, 1997; Tinajero & Paramo, 1998), cognitive strategies (e.g., Sadler-Smith & Badger, 1998), and affect (e.g., Tullet & Davies, 1997). Riding and Rayner (1998) described cognitive styles as the missing link between personality and cognition. Cognitive styles are considered to be independent of, but to interact with, personality (Riding, 2000a). Early researchers

in the cognitive style field referred to a *personality space,* a conceptual space in which key bridging components of personality and cognitive style are situated (Kirton & de Ciantis, 1986). This definition implies that not all personality aspects will be related to cognitive styles; only some key elements that constitute the personality space will be. Whether cognitive styles and ability are related has been the subject of continuous debate among researchers in the cognitive style domain (Armstrong, 2000; Furnham, 1995). Several theorists argued that cognitive style and intellectual abilities are different in multiple and important ways (Kirton, 2003; Mudd, 1996; Riding & Rayner; Tullet, 1997). Other researchers found relations between cognitive styles and ability (e.g., Allinson & Hayes, 1996; Federico & Landis, 1984; Isaksen & Puccio, 1988; Tiedemann, 1989). Furthermore, cognitive styles are considered conceptually different from affect (Kirton, 1994; Tullett & Davies).

Relevance of Cognitive Styles

Kirton and de Ciantis (1994) argued that cognitive style is increasingly seen as a critical intervening variable in work performance. According to Hayes and Allinson (1994), cognitive styles can be used in organizations in the context of recruitment, task and learning performance, internal communication, career guidance and counseling, team composition and team building, conflict management, and training and development. Sadler-Smith and Badger (1998) also investigated the human resource implications of cognitive styles. They concluded that human resource practitioners play a crucial role in fostering individual versatility and in facilitating innovation through the effective management of cognitive style differences. Identifying and understanding each employee's cognitive style can allow managers to enhance individual and team performance and productivity (Volkema & Gorman, 1998). Thus, gaining insight into cognitive styles is a significant task for organizations. In particular, the turbulent business environment characterized by an ever-increasing pace of change and adaptation (Burke & Trahant, 2000; Cascio, 1995; Conner, 1992) requires the ability and flexibility of organizational members to work together (Armstrong & Priola, 2001; Jarzabkowski & Searle, 2004). Moreover, attention for cognitive style differences is relevant in the context of decision making (Leonard, Scholl, & Kowalski, 1999); people prefer decision-making processes that are compatible with their cognitive style (Gardner & Martinko, 1996; Hunt et al., 1989). In a wider context, cognitive styles influence not only information processing and strategic decision making (Gallén, 1997; Hough & Ogilvie, 2005; Kirton, 2003) but also *person–organization fit* (Chan, 1996), or selection and turnover of employees (Sadler-Smith, 1998). Cognitive styles are also an excellent indicator of entrepreneurial attitudes (Allinson, Chell, & Hayes, 2000; Bouckenooghe, Cools, Vanderheyden, & Van den Broeck, 2005; Sadler-Smith, 2004).

Pluralism in the Field of Cognitive Styles

Several researchers have attempted to create order in the cognitive style field by integrating and categorizing different theories (e.g., Cassidy, 2004; Coffield, Moseley, Hall, & Ecclestone, 2004; Desmedt & Valcke, 2004). Some authors suggested that various cognitive styles are different conceptualizations of the same underlying dimension (Allinson & Hayes, 1996; Riding, 1997; Sadler-Smith & Badger, 1998). Two qualitatively different cognitive styles are evident among many studies (Nickerson, Perkins, & Smith, 1985). The first cognitive style is commonly described by the terms *analytical, deductive, rigorous, constrained, convergent, formal,* and *critical.* The second cognitive style is commonly described as *synthetic, inductive, expansive, unconstrained, divergent, informal, diffuse,* and *creative.* Allinson and Hayes called this the *analysis–intuition dimension.* Similar conceptualizations refer to the same dimension, such as analytic–nonanalytic (Kemler-Nelson, 1984), analytic–holistic (Beyler & Schmeck, 1992), and logical–nonlogical (Barnard, 1938). This distinction between cognitive narrowness and broadness, or rational and intuitive thinking, continues to dominate research on cognitive differences (Hodgkinson & Sadler-Smith, 2003).

However, continuous debate exists about whether bipolar unidimensional cognitive style models are better served by treating the two poles as separate unipolar scales. Taylor (1989) called for further research to refine the Kirton Adaption–Innovation methodology using orthogonal scales, treating the subscales of this instrument as separate dimensions. In contrast, Foxall and Hackett (1992) and Mudd (1996) defended the unidimensionality of Kirton's theory. Recent researchers discussed the unidimensional nature of Allinson and Hayes' theory: Hodgkinson and Sadler-Smith (2003) and Coffield et al. (2004) proposed that analysis and intuition are better conceived as separate dimensions. Hayes, Allinson, Hudson, and Keasey (2003) defended the unitarist conception of their theory. Moreover, although bipolar, unidimensional models are considered to form a continuum—indicating that people can vary in the extent to which they show certain cognitive styles—the two poles of the continuum are often treated as a dichotomy. This bipolarity excludes the possibility that people can simultaneously show a strong or weak preference for both poles of the dimension (Sadler-Smith, 2004).

Researchers have addressed these concerns by providing alternative multidimensional cognitive style models (e.g., Riding & Cheema, 1991; Sternberg, 1997). Hodgkinson and Sadler-Smith (2003) wrote that multidimensional theories "undoubtedly made a major contribution to the fields of management and organizational behavior (and beyond) by enriching understanding of the nature and significance of individual differences in the processing of information" (p. 245).

Differences in conceptualization and operationalization are apparent in the myriad bipolar unidimensional models. Leonard et al. (1999) did not find simple, strong interrelations between different cognitive style measures, although many

of the measures seem to overlap conceptually. In an early review of the cognitive style field, Shipman and Shipman (1985) concluded that diverse cognitive style dimensions lack a common definition. However, the departure from different theoretical perspectives in defining bipolar cognitive style models suggests the existence of more than one style on each of the poles of the analytic–intuitive dimension. Several theorists have developed their own instruments to measure their bipolar cognitive style dimension.

In sum, (a) the debate about the bipolarity of unidimensional cognitive style models, (b) the existence of valuable multidimensional cognitive style models, and (c) different conceptualizations of the bipolar analytic–intuitive cognitive style dimension inspired us to further examine the analytic–intuitive cognitive style dimension. We combined an inductive and deductive approach.

Model and Hypotheses

On the basis of an extensive literature review of the cognitive style field and our experience as organizational behavior scholars working with people with different cognitive styles, and taking into account the debate about unidimensional cognitive style models, we identified a three-dimension model (see Table 1). We labeled our styles *knowing style, planning style,* and *creating style.* People with a knowing style look for facts and data. They want to know exactly the way things are and tend to retain many facts and details. They like complex problems if they can find a clear and rational solution. People with a planning style are character-

TABLE 1. Description of the Three-Dimensional Cognitive Style Model

Style	Characteristics
Knowing	Facts, details[a, b]
	Logical[c], reflective[a, d]
	Objective, impersonal, rational[b]
	Precision, methodical[b]
Planning	Sequential, structured[a, c, d]
	Conventional, conformity[e]
	Planned, organized, systematic[a, b]
	Routine[a, b, e]
Creating	Possibilities, meanings, ideas[b]
	Impulsive[e], flexible, open-ended[a, b]
	Novelty[b, e]
	Subjective[b]
	Inventive, creative[b]

[a]C. W. Allinson & J. Hayes, 1996. [b]I. B. Myers, M. H. McCaulley, N. L. Quenk, & A. L. Hammer, 2003. [c]A. Miller, 1987. [d]R. Riding & I. Cheema, 1991. [e]M. J. Kirton, 1994.

ized by a need for structure. Planners like to organize and control and prefer a well-structured work environment. They attach importance to preparation and planning to reach their objectives. People with a creating style tend to be creative and like experimentation. They see problems as opportunities and challenges, and they like uncertainty and freedom.

To examine the construct validity of this cognitive style model, we described the relationship with conceptually similar and dissimilar constructs to define a *nomological network* (Cronbach & Meehl, 1955). On the basis of previous research that links cognitive styles with personality, cognition, and affect, we formulated a range of hypotheses, using the terminology of the measures we used to test them (see Table 2).

The resulting hypothesized relationships are grouped into three categories. The first category contains scales we expected to be strongly related to the CoSI subscales. As shown in Table 2, we grouped two dimensions of personality type theory in Category 1. Previous researchers studying cognitive styles and personality types concluded that the dimensions sensing–intuiting and judging–perceiving are cognition-oriented dimensions of the Myers-Briggs Type Indicator (MBTI; I. B. Myers, McCaulley, Quenk, & Hammer, 2003), whereas thinking–feeling is an affect-oriented dimension (i.e., taking an impersonal or a personal approach when making judgments; Jacobson, 1993; Tullet & Davies, 1997). We expected the personality-related scales in the second category to have weaker, less significant correlations with the CoSI subscales. The third group comprises scales that previous researchers found to be statistically uncorrelated with cognitive styles (i.e., affect-related scales and ability). Because this is a new cognitive style model, we developed the CoSI questionnaire to measure the three styles we identified. In the remainder of this article, we describe the development and validation of the CoSI.

Method

Item Generation and Pilot Study

The process of item generation combined an inductive and deductive phase. In the inductive phase, we used the critical incidents methodology to capture existing cognitive style differences. We invited 133 master of business administration (MBA) students to write a paper about how they typically process information and make decisions. In the deductive phase, we consulted other cognitive style instruments and extensively reviewed the cognitive style literature. On the basis of our literature review, existing cognitive style measures, and content analysis of the student papers, we initially constructed 97 items about how people perceive, process, and use information. To ensure content validity, we involved other people in the judging (Haynes, Richard, & Kubany, 1995; Most & Zeidner, 1995). Three cognitive style experts judged the content and rel-

TABLE 2. Hypothesized Relations Between Cognitive Style Indicator (CoSI) Subscales and Personality and Academic Performance Measures

Measure	Knowing style	Planning style	Creating style
Strongly related			
Overall score KAI	−	−	+
Rationality REI	+	+	−
Sensing MBTI	+	+	−
Intuiting MBTI	−	−	+
Judging MBTI	+	+	−
Perceiving MBTI	−	−	+
Less strongly and significantly correlated			
Thinking MBTI	+	+	−
Extraversion MBTI	−	−	+
Introversion MBTI	+	+	−
Extraversion SIMP	−	−	+
Agreeableness SIMP	−	−	+
Conscientiousness SIMP	+	+	−
Openness SIMP	−	−	+
Independent of cognitive style			
Experientiality REI	None	None	None
Feeling MBTI	None	None	None
Emotional stability SIMP	None	None	None
Academic performance[a]	None	None	None

Note. + = significant positive correlation expected. − = significant negative correlation expected. None = no significant correlation expected. KAI = Kirton Adaptor-Innovator. Inventory (M. J. Kirton, 1994, 2003). REI = Rational-Experiential Inventory (J. A. Edwards, K. Lanning, & K. Hooker, 2002; S. Epstein, R. Pacini, V. Denes-Rai, & H. Heier, 1996; R. Pacini & S. Epstein, 1999). MBTI = Myers-Briggs Type Indicator (J. Beyler & R. R. Schmeck, 1992; N. D. Gryskiewicz & W. L. Tullar, 1995; N. H. Leonard, R. W. Scholl, & K. B. Kowalski, 1999; S. J. Power, J. M. Kummerow, & L. L. Lundsten, 1999). SIMP = Single-Item Measures of Personality (R. E. Goldsmith, 1984; M. J. Kirton & S. M. de Ciantis, 1986; R. J. Riding & S. Wigley, 1997).

[a]R. Riding & T. Agrell, 1997; R. Riding & F. Pearson, 1994; C. Tinajero & M. F. Paramo, 1997.

evance of our initial pool of items. We retained 60 items that the experts agreed measure preferences in information processing. We presented these 60 items to organizational behavior scholars in our department for evaluation of the wording and the content.

We subsequently conducted a pilot study in which a final pool of 40 items was included in a large-scale study on values (N = 15,616). The response format was a 5-point Likert scale from 1 (*totally disagree*) to 5 (*totally agree*). Statistical analysis of these data indicated the existence of three main factors in our item

pool. The pilot study yielded 30 psychometrically sound items that we used in subsequent validation studies.

Validation Studies

We included three diverse studies in our validation project. Table 3 shows a summary of the main aspects of our research design. We used the first two studies for scale development and to assess criterion-related validity and used the third study additionally to assess convergent and discriminant validity.

TABLE 3. Research Design of the Cognitive Style Indicator (CoSI) Validation Studies

Method of analysis	Study 1 (N = 5,924)	Study 2 (N = 1,580)	Study 3 (N = 635)
	Scale Development		
Item analysis	Yes	Yes	Yes
Factor analysis	Yes	Yes	Yes
Exploratory	n = 2,970	n = 763	n = 321
Confirmatory	n = 2,954	n = 817	n = 314
	Scale Evaluation		
Convergent/discriminant validity	No[a]	No[a]	Yes[b]
KAI	—	—	n = 66
REI	—	—	n = 70
MBTI	—	—	n = 296
SIMP	—	—	n = 98
Academic performance[c]	—	—	n = 443
Criterion-related validity	Yes	Yes	Yes
Function	n = 2,013	n = 713	—
Study orientation	—	—	n = 233
University degree	—	—	n = 446

Note. KAI = Kirton Adaptor-Innovator Inventory (M. J. Kirton, 1994, 2003). REI = Rational-Experiential Inventory (J. A. Edwards, K. Lanning, & K. Hooker, 2002; S. Epstein, R. Pacini, V. Denes-Rai, & H. Heier, 1996; R. Pacini & S. Epstein, 1999). MBTI = Myers-Briggs Type Indicator (J. Beyler & R. R. Schmeck, 1992; N. D. Gryskiewicz & W. L. Tullar, 1995; N. H. Leonard, R. W. Scholl, & K. B. Kowalski, 1999; S. J. Power, J. M. Kummerow, & L. L. Lundsten, 1999). SIMP = Single-Item Measures of Personality (R. E. Goldsmith, 1984; M. J. Kirton & S. M. de Ciantis, 1986; R. J. Riding & S. Wigley, 1997).
[a]Other measures included in these studies are not relevant for construct validation purposes. [b]We presented different scales to different groups of respondents, and none of them received all scales. [c]R. Riding & T. Agrell, 1997; R. Riding & F. Pearson, 1994; C. Tinajero & M. F. Paramo, 1997.

Study 1. We used data from a large-scale Belgian career-decisions survey to conduct our first validation study. A total of 6,358 people participated in this study, yielding 5,924 useful questionnaires. Fifty-eight percent of the respondents were men, and 42% were women. The majority of the respondents were aged 26–35 years (42%) or 36–45 years (24%). Most (93%) worked full time, and 33% were managers. Respondents had a wide range of careers and educational backgrounds.

Study 2. In the second study, we used data from people who completed an Internet tool assessing the indivdual profiles of working people. After we cleaned the data set for missing values and response patterns, 1,580 useful questionnaires remained. As in the first study, respondents reported a wide variety of careers and educational backgrounds. Sixty-one percent were men, and 39% were women. Sixty-eight percent of respondents were aged 21–35 years, and 21% were aged 36–45 years.

Study 3. In the third study, 635 management and MBA students from 4 years (2002–2005) of a leading Belgian business school completed the CoSI as part of a management and organization course. Twenty-two percent of participants had several years of working experience. Their age ranged from 21–58 years (M = 24.73 years, SD = 4.39 years). Sixty-eight percent were men, and 32% were women. Twenty-three percent held an engineering degree, and 41% had a university degree with a background in economics. The remaining third of this sample had a medical background or studied social science, science, law, or art. For construct validation purposes, we included other cognitive style, personality, and academic performance measures in this study.

Measures

To be valid, a test must be related to conceptually similar measures (convergent validity) and unrelated to conceptually dissimilar constructs (discriminant validity; Campbell & Fiske, 1959). In this regard, we examined the relation of the CoSI with two existing cognitive style measures. Because the field of cognitive styles is conceptually situated on the crossroad of personality and cognition (Furnham, 1995; Sternberg & Grigorenko, 1997), we included personality and academic performance measures to check the construct validity of the CoSI.

Cognitive style measures. We used two diverse instruments that measure differences in how people preferably perceive, process, and structure information. We chose the Kirton Adaption-Innovation Inventory (KAI; Kirton, 1976; Taylor, 1989), an older measure that is used extensively, and the Rational-Experiential Inventory (REI; Epstein, Pacini, Denes-Raj, & Heier, 1996; Pacini & Epstein,

1999), a newer measure that is increasingly used in the field, to assess the convergent validity of the CoSI. The KAI is a 32-item questionnaire that measures the tendency of people to adapt or innovate when approaching a problematic situation. It was originally developed as a single dimension of cognitive style, with higher scores referring to higher innovativeness. Cronbach's alpha of the overall scale in our research was .85. The REI is a 40-item questionnaire that measures individual differences in analytical–rational and intuitive–experiential thinking styles. Twenty items constitute a Rationality scale ($\alpha = .79$). Pacini and Epstein distinguished between Rational ability ($\alpha = .73$) and Rational engagement ($\alpha = .70$). The other 20 items constitute an Experientiality scale ($\alpha = .88$), distinguished in an Experiential ability ($\alpha = .83$) and an Experiential engagement scale ($\alpha = .80$).

Personality measures. We included two personality-related measures in our study, one related to personality trait theories and one in the field of personality type theories. The Single-Item Measures of Personality (SIMP) is an instrument that measures the Big Five personality model using five bipolar single items (Woods & Hampson, 2005). Each item consists of two opposing descriptions representing the poles of one of the Big Five factors (i.e., extraversion, agreeableness, emotional stability, conscientiousness, and openness to experience). Woods and Hampson reported good psychometric qualities for the SIMP for research purposes. The MBTI measures personality on four dimensions: extraversion–introversion, sensing–intuiting, thinking–feeling, and judging–perceiving. We administered the MBTI form M, which contains 93 forced-choice items (P. B. Myers & Myers, 1998). Gardner and Martinko (1996) concluded in a review article about the MBTI that the instrument is a reliable and valid tool for research on relations among managerial personalities, cognition, behaviors, effectiveness, and situational variables.

Academic performance. As in a study by Armstrong (2000), we used several indicators for overall academic performance as a proxy for a measurement of cognition. We determined overall academic achievement by collecting the final grades of management and MBA students from a leading Belgian business school. These scores are an accurate representation of students' overall cognition because this final grade is a weighted aggregation of scores on a wide variety of business-related subjects.

Results

Following the stages of Schwab (1980), we first report on the scale development stage (i.e., item analysis, factor analysis, and reliability) and then focus on scale evaluation (i.e., convergent/discriminant validity and criterion-related validity).

Scale Development

Item analysis. For each of the 30 selected items, we checked the mean, standard deviation, item–scale and item–total correlations, average interitem correlations, and Cronbach's alpha coefficients (DeVellis, 1991). We retained items with an item–total correlation of more than .30 and a reasonably high variance in response ($SD > .40$) in the final questionnaire. On the basis of these criteria, we discarded 12 items from further analyses. Tables 4 and 5 show the item means, standard deviations, average interitem correlations, and corrected item–total correlations for Studies 1, 2, and 3.

Factor analysis and reliability. We conducted a two-stage factor analysis to examine the factor structure of the CoSI (Gerbing & Hamilton, 1996; Hurley et al., 1997). We randomly split each sample into equal halves. We used one half for exploratory factor analysis (EFA) using principal axis factoring with oblique (direct oblimen) rotation (Kim & Mueller, 1978). We used the other half for cross-validation with confirmatory factor analysis (CFA) using maximum likelihood estimation (Byrne, 2001).

In EFA, we combined various rules of thumb to decide on the number of factors to retain (Kerlinger & Lee, 2000; Zwick & Vellicer, 1982, 1986). We based the extraction and retention of factors on (a) examination of the scree plot (Cattell, 1966) and (b) the eigenvalues-greater-than-one criterion (Kaiser, 1960). The preliminary findings of the pilot study were confirmed. In each study, 3 factors were retained, accounting for 50% of the variance in Study 1, 53% in Study 2, and 49% in Study 3. An additional examination of the interitem correlation matrixes also suggests a 3-factor solution. The average interitem correlations for the scales were all greater than .30 (Robinson, Shaver, & Wrightsman, 1991). Tables 4 and 5 show factor loadings for the CoSI items. Items needed to have a primary factor loading of at least .40 and no secondary loadings of more than .30 (Ford, MacCallum, & Tait, 1986). Although item 7 for the creating style (C7) in Table 5 loads only .36 on Factor 2, we decided to keep this item in the questionnaire because it met all other psychometric criteria. Factor 1 represents the planning style, Factor 2 represents the creating style, and Factor 3 represents the knowing style.

In a second stage, we performed CFA. Many fit indexes and criteria for determining good fit are available (MacCallum & Austin, 2000; Medsker, Williams, & Holohan, 1994). Table 6 shows several fit indexes for the three studies. A consensus on the acceptability of a model should be formed on the basis of examination of the results of all fit indexes (Hair, Anderson, Tatham, & Black, 1998). As sample size might affect fit indexes used in CFA (Guadagnoli & Velicer, 1988; Marsh, Balla, & McDonald, 1988), root mean square residual (RMSR), root mean square error of approximation (RMSEA), the Tucker-Lewis index (NNFI), and the normed fit index (NFI) are the most appropriate fit indexes for our research (Hair et al.; Kline,

TABLE 4. Means, Standard Deviations, Average Interitem Correlations, Item–Total Correlations, and Factor Loadings for the Cognitive Style Indicator, Study 1

Item	*M*	*SD*	Item total	Factor 1	Factor 2	Factor 3
Knowing Style	3.89	0.65	(.41)			
K1. I want to have a full understanding of all problems.	3.92	0.82	.52	.11	.01	**–.58**
K2. I like to analyze problems.	4.23	0.73	.53	–.07	.12	**–.66**
K3. I make detailed analyses.	3.44	0.92	.49	.13	–.04	**–.57**
K4. I study each problem until I understand the underlying logic.	3.97	0.73	.56	–.01	–.01	**–.68**
Planning Style	3.78	0.77	(.39)			
P1. Developing a clear plan is very important to me.	3.87	0.83	.65	**.71**	.02	–.04
P2. I always want to know what should be done when.	3.55	1.00	.52	**.63**	–.07	.04
P3. I like detailed action plans.	3.58	0.86	.64	**.69**	–.01	–.07

P4. I prefer clear structures to do my job.	3.83	0.82	.57	**.67**	−.12	.002
P5. I prefer well-prepared meetings with a clear agenda and strict time management.	3.70	0.98	.48	**.56**	.07	.05
P6. I make definite engagements, and I follow up meticulously.	3.93	0.79	.47	**.44**	.09	−.15
P7. A good task is a well-prepared task.	4.00	0.83	.55	**.59**	.10	−.02
Creating Style	4.01	0.60	(.35)			
C1. I like to contribute to innovative solutions.	4.17	0.70	.52	.08	**.52**	−.11
C2. I prefer to look for creative solutions.	3.94	0.77	.45	.003	**.46**	−.12
C3. I am motivated by ongoing innovation.	3.99	0.85	.55	−.08	**.63**	−.06
C4. I like much variety in my life.	3.98	0.84	.51	.01	**.66**	.19
C5. New ideas attract me more than existing solutions.	4.09	0.70	.63	.01	**.72**	−.03
C6. I like to extend boundaries.	4.22	0.73	.59	.04	**.67**	−.02
C7. I try to avoid routine.	3.68	0.81	.39	.000	**.44**	−.03

Note. We performed exploratory factor analysis on a random half of the total sample. Average interitem correlations of scales are in parentheses. Factor loadings of the corresponding items within the scale are in bold type.

TABLE 5. Means, Standard Deviations, Average Interitem Correlations, Item–Total Correlations, and Factor Loadings for the Cognitive Style Indicator, Studies 2 and 3

	Study 2				
Item	*M*	*SD*	Item–total	Factor 1	Factor 2
Knowing style	4.06	0.96	(.45)		
K1. I want to have a full understanding of all problems.	4.11	1.03	.50	.03	.01
K2. I like to analyze problems.	4.15	0.93	.65	−.10	−.01
K3. I make detailed analyses.	3.74	1.07	.53	.14	−.04
K4. I study each problem until I understand the underlying logic.	4.26	0.88	.58	−.01	.09
Planning style	3.81	1.16	(.40)		
P1. Developing a clear plan is very important to me.	4.17	0.94	.60	**.70**	.10
P2. I always want to know what should be done when.	3.38	1.25	.47	**.54**	−.09
P3. I like detailed action plans.	3.67	1.11	.67	**.77**	−.02
P4. I prefer clear structures to do my job.	3.82	1.03	.59	**.67**	−.03
P5. I prefer well-prepared meetings with a clear agenda and strict time management.	3.74	1.17	.53	**.64**	.03
P6. I make definite engagements, and I follow up meticulously.	3.93	0.97	.53	**.62**	.06
P7. A good task is a well-prepared task.	3.92	1.02	.55	**.65**	−.02
Creating style	4.16	0.80	(.36)		
C1. I like to contribute to innovative solutions.	4.37	0.80	.48	.12	**.53**
C2. I prefer to look for creative solutions.	3.95	0.99	.47	−.03	**.52**
C3. I am motivated by ongoing innovation.	4.13	0.93	.58	.02	**.69**
C4. I like much variety in my life.	4.29	0.89	.49	−.02	**.62**
C5. New ideas attract me more than existing solutions.	4.33	0.78	.66	.04	**.81**
C6. I like to extend boundaries.	4.34	0.79	.60	.01	**.70**
C7. I try to avoid routine.	3.72	1.04	.42	−.07	**.50**

Note. We performed exploratory factor analysis on a random half of the total sample. Average interitem correlations of the scales are in parentheses. Factor loadings of items within the scale are in bold type.

1998; MacCallum & Austin), but we also report other fit indexes for completeness. Our sample sizes are considerably large in the light of factor analytic procedures, which makes the chi-square statistic less appropriate for model assessment. Hu and

		Study 3					
	Factor 3	*M*	*SD*	Item–total	Factor 1	Factor 2	Factor 3
		3.79	0.79	(.45)			
	–.56	3.84	0.91	.54	–.07	.03	**–.60**
	–.90	3.87	0.84	.61	.07	–.02	**–.66**
	–.61	3.35	0.96	.54	.25	.03	**–.53**
	–.69	4.08	0.84	.56	.001	-.02	**–.63**
		3.58	0.95	(.44)			
	–.04	3.72	0.95	.73	**.70**	–.03	–.17
	.03	3.39	1.07	.56	**.59**	.03	.01
	–.04	3.31	0.96	.70	**.74**	–.01	–.03
	.03	3.54	1.01	.64	**.56**	–.19	–.08
	.06	3.97	0.93	.54	**.63**	–.001	–.04
	–.07	3.56	0.94	.53	**.44**	–.03	–.20
	–.08	3.60	0.98	.54	**.67**	–.01	.15
		4.09	0.62	(.34)			
	–.13	4.14	0.74	.47	.24	**.59**	.07
	–.08	3.87	0.87	.52	–.07	**.57**	–.003
	.04	4.08	0.76	.63	–.05	**.71**	.01
	.09	4.51	0.62	.44	–.06	**.49**	.05
	.04	4.08	0.81	.56	–.10	**.61**	–.11
	–.05	4.22	0.78	.49	–.01	**.61**	–.13
	–.02	3.72	0.91	.40	–.04	**.36**	.04

Bentler (1998, 1999) also criticized the wide use of the goodness of fit index (GFI) and adjusted goodness of fit index (AGFI) in the structural equation modeling (SEM) literature because they are heavily influenced by sample size (MacCallum

TABLE 6. AMOS Fit Indexes for Confirmatory Factor Analysis for Studies 1, 2, and 3

Fit index	Study 1[a]	Study 2[b]	Study 3[c]
Absolute fit measures			
χ^2 of estimated model	1388.62	657.19	372.64
Degrees of freedom (*df*)	132	132	132
Significance level (*p*)	.000	.000	.000
Normed chi-square (χ^2/df)	10.52	4.98	2.82
Goodness-of-fit index (GFI)	.948	.915	.880
Root mean square residual (RMSR)	.033	.069	.057
Root mean square error of approximation (RMSEA)	.057	.070	.076
p of close fit (RMSEA < 0.05)	.000	.000	.000
Incremental fit measures			
Adjusted goodness-of-fit index (AGFI)	.933	.890	.845
Tucker-Lewis index (TLI) or NNFI	.901	.888	.860
Normed fit index (NFI)	.906	.882	.826

Note. RMSR, RMSEA, NNFI, and NFI are the most appropriate fit indexes for this study.
[a]*N* = 2,954. [b]*N* = 817. [c]*N* = 314.

& Austin). Values above .90 for NNFI and NFI are usually considered indicative of a good fit, although other sources mention a criterion of .85 or above as generally acceptable (Hinkin, 1995). Table 6 shows that not all values of NNFI and NFI meet the criterion of .90, but all, with one exception, meet the criterion of .85. No real threshold level can be established for RMSR (Hair et al.), although a criterion of .05 or below is sometimes used (Patterson et al., 2005). Values of RMSEA below .08 indicate a good fit. This criterion was met in all three studies. Overall, we found a good fit for the CFA model and therefore accepted it.

We used the Cronbach's alpha coefficient (Cronbach, 1951) as a proxy for the internal consistency of our scales. Nunnally and Bernstein (1998) suggested that an alpha coefficient of .70 is a minimally acceptable threshold. The results of the reliability analysis indicated that in each of the studies, this criterion was met for the scales. We found a Cronbach's alpha of .73, .79, and .76 for the knowing style in Studies 1, 2, and 3, respectively; Cronbach's alpha of .81, .84, and .85 for the planning style; and Cronbach's alpha of .79, .82, and .78 for the creating style.

Scale Evaluation

In addition to content validity and internal consistency, new measures must demonstrate convergent and discriminant and criterion-related validity (Clark & Watson, 1995; DeVellis, 1991; Hinkin, 1995, 1998).

Convergent and discriminant validity. Table 7 shows the correlations of the CoSI subscales with the other measures we used in our validation research. We highlight the most relevant results for each of the categories from Table 2.

In the first category—scales we hypothesized were strongly related to cognitive styles—the hypotheses were mostly confirmed. The knowing ($r = –.28$, $p < .05$) and planning styles ($r = –.64$, $p < .01$) were negatively correlated with the overall KAI score, whereas the creating style ($r = .64$, $p < .01$) was positively correlated with the overall KAI. People with a creating style tend to be more innovative and to restructure the situation when solving problems and making decisions. People with a knowing and a planning style tend to stay within the

TABLE 7. Pearson Product–Moment Correlations Between Cognitive Style Indicator (CoSI) Subscales and Other Measures

Measure	Knowing style	Planning style	Creating style
Category 1: Hypothesized as strongly related			
Overall KAI	–.28*	–.64**	.64**
Rationality REI	.52**	.25**	.12
Sensing MBTI	.12*	.36**	–.43**
Intuiting MBTI	–.04	–.23**	.32**
Judging MBTI	.19**	.54**	–.38**
Perceiving MBTI	–.15**	–.55**	.36**
Category 2: Hypothesized as showing weaker and less significant correlations			
Thinking MBTI	.15*	.06	–.11
Extraversion MBTI	–.22**	–.05	.20**
Introversion MBTI	.16**	.11	–.22**
Extraversion SIMP	–.08	–.19	.24*
Agreeableness SIMP	–.25*	–.11	–.10
Conscientiousness SIMP	.19	.57**	–.36**
Openness SIMP	–.08	–.39**	.14
Category 3: Hypothesized as independent of cognitive style			
Experientiality REI	–.20	–.001	.21
Feeling MBTI	–.10	–.04	.08
Emotional stability SIMP	–.01	–.07	.17
Academic performance[a]	–.01	–.08	–.004

Note. KAI = Kirton Adaptor-Innovator Inventory (M. J. Kirton, 1994, 2003). REI = Rational-Experiential Inventory (J. A. Edwards, K. Lanning, & K. Hooker, 2002; S. Epstein, R. Pacini, V. Denes-Rai, & H. Heier, 1996; R. Pacini & S. Epstein, 1999). MBTI = Myers-Briggs Type Indicator (J. Beyler & R. R. Schmeck, 1992; N. D. Gryskiewicz & W. L. Tullar, 1995; N. H. Leonard, R. W. Scholl, & K. B. Kowalski, 1999; S. J. Power, J. M. Kummerow, & L. L. Lundsten, 1999). SIMP = Single-Item Measures of Personality (R. E. Goldsmith, 1984; M. J. Kirton & S. M. de Ciantis, 1986; R. J. Riding & S. Wigley, 1997).

[a]R. Riding & T. Agrell, 1997; R. Riding & F. Pearson, 1994; C. Tinajero & M. F. Paramo, 1997.

*$p < .05$. **$p < .01$ (two-tailed).

existing structure when solving problems. Whereas people with a creating style tend to "do things differently," people with a knowing or planning style tend to "do things better" (Kirton, 1994, p. 9). Furthermore, the knowing ($r = .52$, $p < .01$) and planning styles ($r = .25$, $p < .05$) were positively correlated with the Rationality scale of the REI. These results suggest that people who have a planning or knowing style tend to operate within the rational, analytic cognitive system. For the creating style, we did not find a significant correlation with Rationality ($r = .12$, $p = .31$). Thus, people with a creating style will not be inclined to process information primarily in an analytical mode. In the Rationality subscales, we found a notable difference between the knowing and planning styles. The knowing style correlated positively with both Rational ability ($r = .49$, $p < .01$) and Rational engagement ($r = .40$, $p < .01$). The planning style correlated positively with Rational ability ($r = .29$, $p < .05$). However, we did not find a significant correlation between the planning style and Rational engagement ($r = .14$, $p = .24$). Although people with both styles have the ability to use the rational thinking style, people with a knowing style are more likely to rely on and enjoy thinking in an analytical way.

Overall, our findings support the hypothesis that the sensing–intuiting and judging–perceiving dimensions of the MBTI are most relevant to cognitive styles; these correlations are the highest of all four MBTI dimensions. We found a low but significant positive correlaton between the knowing style ($r = .12$, $p < .05$) and the Sensing subscale of the MBTI. People with a knowing style have great respect for facts. They have an enormous capacity for details, make errors seldomly, and are good at demanding tasks. The planning style was also positively correlated with the Sensing subscale of the MBTI ($r = .36$, $p < .01$). People with a planning style like rules and regulations, step-by-step explanations, and consistent procedures. The creating style was correlated positively with the Intuiting subscale of the MBTI ($r = .32$, $p < .01$). People with a creating style prefer dynamic structures and are constantly searching for hidden possibilities and new horizons. Previous researchers studying the link between the KAI and the MBTI found a strong positive correlation between Adaption and Sensing and between Innovation and Intuiting (Gryskiewicz & Tullar, 1995; Jacobson, 1993). Beyler and Schmeck (1992) also found that high scores on Sensing related positively to measures of a proper, rule-bound attitude. In contrast, high scores on Intuiting were related to flexibility and creativity.

Last, the knowing and planning styles correlated positively with the Judging subscale of the MBTI (knowing style, $r = .19$, $p < .01$; planning style, $r = .54$, $p < .01$). People with a knowing style like to make decisions using a logical approach. They are concerned with solving rational problems. People with a planning style like to work in a planned, orderly way. They dislike ambiguity and prefer clarity and order. The creating style correlated positively with the Perceiving subscale of the MBTI ($r = .36$, $p < .01$). People with a creating style like to work in a flexible and spontaneous way. They can tolerate ambiguity and

prefer to leave options open. Judging was related to orderliness, self-control, and a proper, rule-bound attitude, whereas Perceiving was related to measures of complexity, flexibility, and imagination (Beyler & Schmeck, 1992). Gryskiewicz and Tullar (1995) found that perceiving types are more likely to be innovators, whereas judging types are more likely to be adaptors.

For the second category of hypotheses, we found less significant and weaker correlations, as we expected. Only the knowing style showed a significant correlation with the Thinking subscale of the MBTI ($r = .15$, $p < .05$). People with a knowing style prefer to judge on the basis of a logical, objective, and impersonal process. They prefer logical analysis and just decisions made on the basis of standards and policies. Furthermore, the knowing style was positively correlated with the Introversion subscale of the MBTI ($r = .16$, $p < .01$). People with a knowing style feel comfortable when they can focus their attention internally on ideas and concepts. They prefer to take their time to integrate and assimilate outside information. The creating style was positively correlated with the Extraversion subscale of the MBTI ($r = .20$, $p < .01$). People with a creating style get their energy from interactions with other people and things in their environment. They like action and want to experience the world to understand it. Jacobson (1993) also found a significant positive correlation between innovators and extraversion.

Only knowing style had a significant correlation with the Agreeableness subscale of the SIMP ($r = –.25$, $p < .05$). People with a knowing style are forthright and tend to be critical. In addition, we found a significant positive correlation between planning style and the Conscientiousness subscale of the SIMP ($r = .57$, $p < .01$). Planners are organized, self-disciplined, and reliable. We found a significant negative correlation between creating style and the Conscientiousness subscale of the SIMP ($r = –.36$, $p < .01$). People with a creating style do not necessarily stick to a schedule, and they tend to be flexible and disorganized. Only planning style had a significant correlation with Openness to Experience ($r = –.39$, $p < .01$). People with a planning style tend to be resistant to change, habit-bound, conventional, and closed to new ideas. Kirton and de Ciantis (1986) also found a strong correlation between the adaptor and a conservative trait, indicating a predisposition to stay within traditional boundaries and conform to traditions.

Last, inspection of the results for the third category of variables, which we hypothesized would be independent of cognitive style, supports the independence of the cognitive style construct from affect-related and cognition-related constructs. As hypothesized, none of the cognitive styles correlated significantly with the Experientiality subscale of the REI (knowing style, $r = –.20$, $p = .11$; planning style, $r = –.001$, $p = .99$; creating style, $r = .21$, $p = .08$). Pacini and Epstein (1999) reported a significant positive relationship between Experientiality and emotional expressivity, lending support to the idea that an experiential thinking style is related to affect and emotionality (Epstein, 1994). We did not find a significant correlation between cognitive style and the Emotional stability subscale of the SIMP (knowing style, $r = –.01$, $p = .89$; planning style, $r = –.07$,

$p = .49$; creating style, $r = .17$, $p = .11$). Tullett (1997) also found no correlation between the KAI overall score and Emotional stability. In our study, we did not find significant correlations between cognitive style and overall academic performance (knowing style, $r = –.01$, $p = .78$; planning style, $r = –.08$, $p = .10$; creating style, $r = –.004$, $p = .93$). These findings lend further support to the independence of cognitive styles and ability. However, it may be useful for future researchers to investigate the possible moderating effect of type of task on the cognitive style–cognition relation. Although people have a preferred or dominant cognitive style, their actual behavior and performance is also influenced by the demands of the situation or task (Armstrong, 2000; Spicer, 2004).

Overall, our results support the convergent and discriminant validity of the CoSI. Some of our results suggest a bipolar conceptualization of the three styles, with the knowing and the planning style on the analytic pole and the creating style on the intuitive pole of the continuum. For example, we found a positive correlation with the overall KAI score for creating style (indicating higher innovativeness) and a negative correlation for knowing and planning styles. Furthermore, knowing and planning styles correlated positively with the Judging subscale of the MBTI, whereas creating style was positively correlated with the Perceiving subscale of the MBTI. We also found a moderately high correlation between knowing and planning styles ($r = .38$, $p < .01$). However, given the different correlations of the knowing and planning styles with several other scales and their different correlation with the creating style (knowing style, $r = –.02$, $p = .62$; planning style, $r = –.23$, $p < .01$), we found it was more useful to distinguish between three cognitive styles without calculating one overall CoSI score as Allinson and Hayes (1996) and Kirton (1976) did.

Criterion-related validity. Criterion-related validity is the degree of correspondence of a measure with some other accepted measure (Carmines & Zeller, 1979). Criterion-related validity often is not assessed in organizational research because it is not always possible to find an adequate criterion with which to relate the scale (Price, 1997). In the light of the contemporary interest in person–organization fit (Kristof, 1996), we looked at the relation between cognitive style and work-related characteristics. If the CoSI has criterion-related validity, it should be capable of distinguishing between groups that differ in their cognitive styles (Allinson & Hayes, 1996). One possible difference is the difference between several job functions in organizations. Through selective recruitment and socialization, a certain cognitive climate can arise in organizations or parts of organizations (Kirton & de Ciantis, 1994). We compared mean scores for the cognitive styles in Study 1 and 2 (see Table 8) using analysis of variance (ANOVA) and found that people with a financial job scored significantly higher on the knowing style than did people with a sales or marketing job or a personnel job, Study 1: $F(2, 2010) = 18.21$, $p < .01$; Study 2: $F(3, 709) = 2.82$, $p < .05$. Financial employees scored significantly lower on the creating style than did sales and marketing

TABLE 8. Job Function Differences of Scores on the Cognitive Style Indicator (CoSI), Studies 1 and 2

		Knowing style		Planning style		Creating style	
Job function	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*
			Study 1				
Personnel	474	3.77	.60	3.70	.62	4.01	0.47
Sales and marketing	1,160	3.85	.60	3.79	.60	4.06	0.51
Finance	379	4.02	.57	3.79	.57	3.88	.51
			Study 2				
Finance	62	4.25	.70	3.83	.73	4.09	.70
Engineering	123	4.16	.73	3.78	.84	4.22	.56
IT	302	4.11	.68	3.72	.75	4.20	.56
Sales and marketing	226	4.00	.73	3.90	.75	4.19	.59

Note. Study 1: Knowing style, $F(2, 2010) = 18.21^{**}$; Planning style, $F(2, 2010) = 4.11^{**}$; Creating style, $F(2, 2010) = 18.48^{**}$. Study 2: Knowing style, $F(3, 709) = 2.82^{*}$; Planning style, $F(3, 709) = 2.33$; Creating style, $F(3, 709) = 0.61$.
$^{*}p < .05$. $^{**}p < .01$.

employees or personnel employees, Study 1: $F(2, 2010) = 18.48$, $p < .01$. We also found that people with personnel jobs scored significantly lower on the planning style than did people with sales and marketing jobs, Study 1: $F(2, 2010) = 4.11$, $p < .05$. Our results are consistent with those of previous researchers who concluded that people tend to select professions that emphasize their preferred style (e.g., Chan, 1996; Myers et al., 2003). Agor (1985), for example, found a lower score on the Intuition subscale of the MBTI for people in financial management and a higher score for people in personnel management. Foxall (1986) found a higher score on the Innovation subscale of the KAI for marketing employees and a lower score for accounting employees, indicating an adaptive tendency.

To further study the criterion-related validity of the CoSI, we looked at the profile of management students who chose a program in financial management versus marketing management. We performed an independent samples *t* test of study orientation in Study 3 and found that the financially oriented management students ($n = 89$) scored significantly higher on the knowing style than did the marketing-oriented management students ($n = 144$), $t(231) = -4.54$, $p < .01$. We performed an ANOVA and found that students with a degree in engineering ($n = 140$) scored significantly higher on the knowing style than did students with a background in economics ($n = 249$) or social science ($n = 57$), $F(2, 443) = 3.14$, $p < .05$. We did not find significant differences for the planning or creating styles. These results for criterion-related validity are preliminary and exploratory, and further research is needed.

Discussion

Given the relevance and usefulness of the cognitive style concept for organizations, we had two objectives in this study. First, we examined whether reducing the array of cognitive style theories to one bipolar cognitive style dimension is warranted. Cognitive style researchers have traditionally focused on the distinction between analytic and intuitive thinking. However, results of empirical research on the relation between different cognitive style measures suggest that cognitive style is a complex variable with multiple dimensions (Beyler & Schmeck, 1992; Bokoros, Goldstein, & Sweeney, 1992; Bostic & Tallent-Runnels, 1991). Riding (2000b) suggested that cognitive style researchers should recognize and confirm the fundamental cognitive style dimensions within the extensive body of style labels. We identified a model with three cognitive styles on the basis of an extensive literature review of the cognitive style domain. The convergent, discriminant, and criterion-related validity analyses in our research show the relevance and usefulness of identifying three cognitive styles rather than two.

Second, we developed a psychometrically sound and convenient instrument, the CoSI, to measure our cognitive style model. This objective answers Riding's (2000b) call to develop simple, valid, and direct measures of cognitive style. Our validation process led to a reliable and valid questionnaire. Our instrument shows internal consistency, with Cronbach's alpha coefficients ranging from .73 to .85. The CoSI has a clear factor structure, as examined in a 2-stage factor analytic procedure. EFA suggested a 3-factor solution (knowing, planning, and creating styles). CFA indicated adequate fit for this 3-factor model. The questionnaire is particularly relevant for use in organizations, given its length (18 items) and the short time required to complete it (approximately 10 min). Good organizational measures not only must be valid and reliable but also need practicality (i.e., they should be easy to administer and interpret; Cooper & Schindler, 2003).

Main Findings

Reflecting on the results of the convergent and discriminant validity analyses, our three different styles can be described as follows. The knowing style is empirically related to Rationality (REI), indicating a preference for logical, analytical, and impersonal information processing. Theoretically, this style is similar to existing conceptualizations of the analytic pole, such as analysis in Allinson and Hayes' theory (1996) or Riding's (1997) analytic style. We also found a significant correlation with the Adaptiveness pole of the KAI (Kirton, 1994). With regard to personality, we found a positive correlation with introversion and a negative correlation with agreeableness.

The planning style is empirically related to the Adaptiveness pole of the KAI (Kirton, 1994). We found a significant negative correlation with the overall KAI

score. According to Kirton (1994), adaptors are characterized by the production of a relatively small number of solutions to problems, a conventional approach to the improvement of efficiency, and adherence to rules. We also found a significant positive correlation between planning style and the Sensing and Judging subscales of the MBTI. The planning style is also correlated with rationality (REI), although a significant correlation exists only with the Rational ability subscale and not with the Rational engagement subscale. With regard to personality aspects, we found a positive correlation with conscientiousness and a negative correlation with openness to experience.

The creating style is strongly correlated with the innovator of Kirton's theory (1994). Innovators proliferate ideas, seek a broader realization of efficiency by proposing radical change, and are likely to threaten or subvert the traditional and accepted framework of rules. A significant positive correlation is found between the creating style and Intuiting and Perceiving (MBTI). Theoretically, this style is related to existing conceptualizations of the intuitive pole, such as intuition in Allinson and Hayes' theory (1996) or the innovativeness pole of Kirton (1994). With regard to personality aspects, we found a positive correlation with extraversion and a negative correlation with conscientiousness.

Overall, our validation process confirms that cognitive styles are conceptually different from cognition and affect. None of the cognitive styles correlated significantly with experientiality, emotional stability, or academic performance. These results lend further support to the construct validity of our theory and measure. With regard to predictive validity, our preliminary results indicate that cognitive style differences influence people's educational and vocational choices.

Implications for Further Research

Although the CoSI may contribute to the continuation of cognitive style research, it has limitations. The CoSI is a self-report questionnaire, which implies that respondents can unduly influence the result. A self-report measurement relies on respondents' ability to introspect themselves accurately and without notions of social desirability. The true test of an instrument's validity, however, is the validation of the data against objectively observable behavior (Leonard et al., 1999). Riding (2000b) called for the establishment of clear relations between style measures and objectively observable behavior, in contrast with introspective self-report measures, to find clear and relevant applications for style. Researchers should further investigate the CoSI's predictive validity by measuring cognitive styles in team and organizational contexts, for example, on the basis of 360-degree feedback sessions. Riding (2000b) also called for future research on the relation between style and other individual difference constructs and measures that may influence behavior. To strengthen the construct validity of our cognitive style model and instrument, it will be necessary to further investigate it in relation with other theoretically similar and dissimilar concepts. In this

regard, research about the relationship of CoSI with other existing cognitive style models, learning style theories, affect-related measures, dispositional personality factors, and intelligence-related measures is highly relevant. To increase the theoretical impact and practical relevance of our cognitive style model and to take advantage of the limitations of this study, further research is necessary.

Conclusion

The CoSI is a valuable new instrument for measuring cognitive style differences. The unique contribution of our research lies in the refinement of the analytic–intuitive cognitive style dimension and the distinction between a knowing and a planning style. Overall, our findings suggest that it is worthwhile to distinguish between three different cognitive styles, which initially stem from the traditional conceptualization of the bipolar analytic–intuitive cognitive style dimension, without situating them conceptually on a single dimension. We see our cognitive styles situated on a conceptual triangle as three independent unipolar scales. Thus, we do not exclude the possibility that people might show a preference for a combination of cognitive styles.

AUTHOR NOTES

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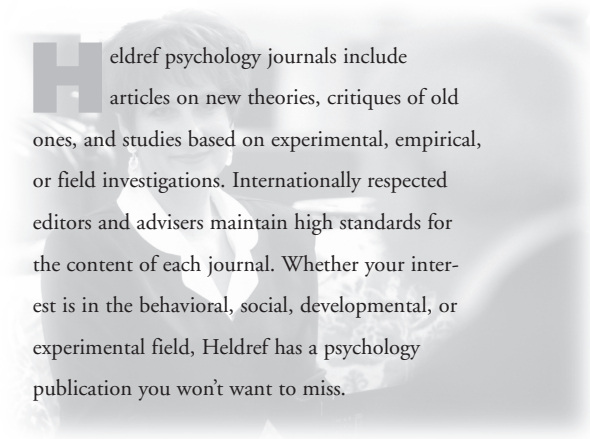

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