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THE COGNITIVE STYLE INDICATOR:

DEVELOPMENT OF A NEW MEASUREMENT INSTRUMENT

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ABSTRACT

This paper describes the development and validation of a cognitive style measure, the Cognitive Style Indicator (CoSI). Three studies were conducted to validate the CoSI. The first study consisted of 5924 employees who took part in a large-scale research with regard to career decisions. In the second study, 1580 people completed the CoSI as part of a 'Competence Indicator' tool on the Internet. Finally, the third study comprised 635 MBA students who completed the CoSI in the context of a 'Management and Organization' course. Reliability, item, and factor analyses demonstrated the internal consistency and homogeneity of three cognitive styles (knowing, planning, and creating style). In addition, substantial support was found for the instrument's construct validity by including other cognitive style instruments, and personality and ability measures in the validation process. Criterion-related validity was confirmed by examination of the relationship between these cognitive styles and work-related characteristics. The main contributions of our research lie in (a) the development of a valid and reliable cognitive style instrument for use in organizations, and in (b) the further refinement of the analytic–intuitive cognitive style dimension by splitting the analytic pole in a knowing and a planning style.

INTRODUCTION

Cognitive styles have been extensively studied in diverse research domains (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 organizational behavior (OB) and management literature (Hayes & Allinson, 1994; Hodgkinson & Sadler-Smith, 2003; Sadler-Smith & Badger, 1998). However, there is a lack of established measures of cognitive style that can be used in organizational settings (Allinson & Hayes, 1996). Therefore, our aim was to develop a psychometrically sound instrument for use in organizations.

Cognitive style is defined by Witkin, Moore, Goodenough, and Cox (1977) as the individual way in which a person perceives, thinks, learns, solves problems, and relates to others. Hunt, Krzystofiak, Meindl, and Yousry (1989) define cognitive style as the way in which people process and organize information, and arrive at judgments or conclusions based on their observations. In an early attempt to bring clarity in the diverse field of cognitive style research, Messick (1984) concludes that all these different conceptions one way or another 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 in which people perceive environmental stimuli, and how they organize and use this information for guiding their actions.

Theoretical and empirical interest in cognitive styles

Kirton and De Ciantis (1994) argue that people's 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 provides an excellent opportunity to enhance individual and team performance and productivity (Volkema & Gorman, 1998). Consequently, gaining insight into cognitive styles is of high significance 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 highly relevant in the context of decision making (Leonard, Scholl, & Kowalski, 1999), as 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 do not only influence information processing and strategic decision making (Gallen, 1997; Hough & ogilvie, 2005; Kirton, 2003), but also person–organization fit (Chan, 1996), or selection and turnover of employees (Sadler-Smith, 1998). Furthermore, people's cognitive styles are claimed to be an excellent indicator for entrepreneurial attitudes (Allinson, Chell, & Hayes, 2000; Bouckenooghe, Cools, Vanderheyden, & Van den Broeck, 2005; Sadler-Smith, 2004).

Pluralism in the field of cognitive styles

Over the years, a large variety of cognitive style dimensions has been identified by researchers (Hodgkinson & Sadler-Smith, 2003), ranging from the well-known 'field dependent' versus 'field independent' (Witkin, 1962), and 'serialist' versus 'holist' constructs (Pask & Scott, 1972), through 'levellers' versus 'sharpeners' (Gardner, Holzman, Klein, Linton, & Spence, 1959), and 'reflection' versus 'impulsivity' (Kagan, 1965) to 'convergers' versus 'divergers (Guilford, 1967), and 'adaptors' versus 'innovators' (Kirton, 1976). Additionally, many diagnostic tools and questionnaires have been developed to identify cognitive style differences. Allinson and Hayes (1996) made an extensive summary of problems with existing cognitive style measures for use in organizations. Besides the dissatisfaction with psychometric unsoundness (validity and

reliability issues), other points of critique on current instruments concern the time-consuming character pertaining the administration in organizations, and the need for well-trained raters to interpret the results produced by these tools.

Consequently, the myriad of cognitive style dimensions and the growing number of cognitive style measures have resulted in a complex and confusing field of study (Grigorenko & Sternberg, 1995; Hayes & Allinson, 1994; Rayner & Riding, 1997), which undermines the viability of the concept for academics and practitioners (Hodgkinson & Sadler-Smith, 2003). Accordingly, several attempts have been made 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 suggest that various cognitive styles are different conceptualizations of the same underlying dimension (Allinson & Hayes, 1996; Riding, 1997; Sadler-Smith & Badger, 1998). Miller (1991, p. 201) suggests that "the idea that (cognitive) processes depend on the interaction of two opposing principles – destructive and constructive, … diversifying and unifying …, is hardly new. In one form or another, we can find this motion appearing repeatedly over many centuries in Western thought." The dual nature of human consciousness has intrigued people for hundreds of years (Taggart & Robey, 1981). Two qualitatively different cognitive styles are evident among many studies. 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 (Nickerson, Perkins, & Smith, 1985). Allinson and Hayes (1996) call this the analysis–intuition dimension. Similar conceptualizations exist to refer to the same dimension, like analytic–nonanalytic (Kemler-Nelson, 1984), analytic–holistic (Beyler & Schmeck, 1992), or logical–nonlogical (Barnard, 1938). This distinction between cognitive narrowness and broadness, or rational and intuitive thinking, continues to dominate current research on cognitive differences (Hodgkinson & Sadler-Smith, 2003). Based on an extensive literature review of the cognitive style field, we came to a description of the two poles of the so-called analytic–intuitive dimension (Table 1).

Insert Table 1 about here

However, after this comprehensive literature review, we questioned the empirical and theoretical viability of a bipolar analytic–intuitive cognitive style dimension. This concern is acknowledged by other authors as they provide alternative multidimensional cognitive style models (e.g., Herrmann, 1994; Riding & Cheema, 1991; Sternberg, 1997). Recently, Hodgkinson and Sadler-Smith (2003, p. 245) stated that these 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".

In addition, when the myriad of bipolar unidimensional models were analyzed, differences in conceptualization and operationalization became apparent. For instance, Allinson and Hayes (1996) define analysis–intuition mainly as a difference between rational and intuitive reasoning, stemming from left brain/right brain theories. Kirton (2003) defines his adaption–innovation dimension as a difference in the way people prefer to deal with cognitive structure. Since the early stage of theoretical development, Kirton put a central focus on cognitive structure (Mudd, 1995). 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, as several theorists have developed their own instrument to measure their bipolar cognitive style dimension. In an early review of the cognitive style field, Shipman and Shipman (1985) already concluded that diverse cognitive style dimensions are exceedingly heterogeneous and lack a common definition. Leonard et al. (1999) did not find simple, strong interrelationships between different cognitive style measures, although many of the measures seem to overlap conceptually.

Continuous debate also exists with regard to bipolar unidimensional cognitive style models whether they are not better served by treating the two poles as separate unipolar scales. Taylor (1989) calls for research to further refine the KAI methodology by using orthogonal scales, treating adaption and innovation as multidimensional. On the contrary, Foxall and Hackett (1992) and Mudd (1996) defend the unidimensionality of Kirton's theory. Recently, a series of articles discussed the unidimensional nature of

Allinson and Hayes' theory. Hodgkinson and Sadler-Smith (2003), and Coffield et al. (2004) propose that analysis and intuition are better conceived as separate dimensions. Hayes, Allinson, Hudson, and Keasey (2003) defend 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 like a dichotomy. This bipolarity excludes the possibility that people can simultaneously show a strong (weak) preference for both poles of the dimension (Sadler-Smith, 2004).

Furthermore, recent theoretical work of Epstein and colleagues (Denes-Raj & Epstein, 1994; Epstein, 1990; Epstein, Pacini, Denes-Raj, & Heier, 1996) asserts that the rational-analytic and the experiential-intuitive systems operate independently from each other in the processing of information. Accordingly, this theory also questions the bipolarity of the cognitive style continuum, raising the possibility that analytic and intuitive processing are served by independent cognitive systems.

Taken together, (a) the existence of valuable multidimensional cognitive style models; (b) the different conceptualizations of the bipolar analytic–intuitive cognitive style dimension; (c) the debate with regard to the bipolarity of unidimensional cognitive style models; and (d) the recent theorizing on independent cognitive systems made us dig deeper in the cognitive style field so that we could better map the underlying structure of the analytic–intuitive cognitive style dimension. We combined a two-stage inductive–deductive approach in our search for further evidence and justification of our assumptions. In summary, the aim of this project was twofold. Firstly, we wanted to develop a reliable, valid, and convenient instrument, labeled the Cognitive Style Indicator (CoSI), to measure cognitive styles in organizations. Secondly, through the development of the CoSI, we wanted to find out whether reducing the large field of cognitive style theories to one bipolar cognitive style dimension is still warranted.

METHOD

Item generation process and pilot study

The process of item generation combined an inductive and a deductive phase. In the inductive phase, the critical incidents methodology was used to capture existing cognitive style differences. A group of 133 MBA students was invited to write a paper on how they typically process information and make decisions. They were given a list of concrete and open questions with regard to their organizational behavior, performance, and skills. In the deductive phase, we consulted other cognitive style instruments and extensively reviewed the cognitive style field. Based on our literature review, existing cognitive style measures, and content analysis of the student papers, 97 items were constructed initially on how people perceive, process, and use information. To ensure content validity, other people were involved in the judgmental process (Haynes, Richard, & Kubany, 1995; Most & Zeidner, 1995). Our initial pool of items was judged with regard to content and relevance by three experts in the cognitive style domain. Additionally, they were asked to categorize the items in different cognitive style clusters. Sixty items were retained on which these experts agreed they are part of the cognitive style field and that were categorized as belonging to the same cognitive style cluster. Next, the remaining 60 items were presented to the OB scholars at our department for the evaluation of the wording and the content of these items. Subsequently, we conducted a pilot study. A final pool of 40 items was included in a large-scale study on values (N = 15616). The response format used was a 5-point Likert scale of totally disagree, rather disagree, neutral, rather agree, and 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, which are used in subsequent validation studies.

Validation studies

Three diverse studies were included in our validation project.

Study 1. Data from a large-scale career decisions survey were used to conduct our first validation study. A total of 6358 people participated in this study, yielding 5924 useful questionnaires. Fifty-eight per cent of the respondents were men, and 42 per cent were women. The majority of the respondents were aged between 26 and 35 years (42 per cent) and between 36 and 45 years (24 per cent). Ninety-three per cent worked full time, and 33 per cent had a management job. Respondents had a wide range of careers and educational backgrounds.

Study 2. In the second study, which aimed to assess the competences of working people, 4 batches (from 4 different time periods) of 400 respondents were randomly selected from the total database. After cleaning the dataset for missing values and response patterns, 1580 useful questionnaires remained. As in the first study, respondents displayed a wide variety of careers and educational backgrounds. Sixty-one per cent were men, and 39 per cent were women. Sixty-eight per cent of respondents were aged between 21 and 35 years, and 21 per cent between 36 and 45 years.

Study 3. In the third study, 635 MBA students (from 4 successive years, starting in 2002 till 2005) of a leading Belgian business school completed the CoSI as part of a ‘Management and Organization’ course. Twenty-two per cent had several years of working experience. Their age ranged from 21 to 58 years, with a mean age of 24.73 (SD = 4.39). Sixty-eight per cent were men, and 32 per cent were women. Twenty-three per cent held an engineering degree, while 41 per cent had a university degree with a background in economics. The remaining third of this sample had a medical background or studied social sciences, exact sciences, law, or arts. For construct validation purposes, we included other cognitive style, several personality, and ability measures in this study.

Table 2 summarizes the main aspects of our research design. We used the first two studies mainly for scale development and criterion-related validity, while the third study was additionally used for convergent and discriminant validation purposes.

Insert Table 2 about here

Measures

To be valid, a test has to be related to conceptually similar measures (convergent validity) and unrelated to conceptually dissimilar constructs (discriminant validity) (Campbell & Fiske, 1959). In this regard, the relationship with two existing cognitive style measures was examined. The field of cognitive styles is conceptually situated on the crossroad of personality and cognition (Furnham, 1995; Sternberg & Grigorenko, 1997). Hence, the inclusion of personality and ability measures seemed to be a reasonable choice to further check the construct validity of the CoSI.

Cognitive style measures

Two diverse instruments were used that measure differences in how people perceive, process, and structure information. We chose Kirton's questionnaire (KAI) and the questionnaire based on Epstein's work (REI) to assess the construct validity of the CoSI.

Kirton Adaption-Innovation Inventory (KAI). KAI is a 32-item questionnaire, which gauges the tendency of people to adapt or innovate when approaching a problem situation (Kirton, 1976). KAI 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 is 0.85. Sometimes, three subscales are derived from KAI subscores.

Rational-Experiential Inventory (REI). REI is a 40-item questionnaire that purports to measure individual differences with regard to analytical-rational and intuitive-experiential thinking styles (Epstein et al., 1996; Pacini & Epstein, 1999). Twenty items constitute a Rationality scale (α = 0.79). Pacini and Epstein (1999) distinguish between Rational Ability (α = 0.73) and Rational Engagement (α = 0.70). The other 20 items constitute an Experientiality scale (α = 0.88), distinguished in an Experiential Ability (α = 0.83) and an Experiential Engagement scale (α = 0.80).

Personality measures

Three personality-related measures were included in our study: one measure of a dispositional personality factor (i.e., optimism (LOT-R)), one related to personality trait theories (SIMP), and one situated in the field of personality type theories (MBTI).

Revised Life Orientation Test (LOT-R). LOT-R is a 10-item scale developed to measure dispositional optimism, defined as the extent to which individuals possess favorable expectations regarding life outcomes (Scheier & Carver, 1985; Scheier, Carver, & Bridges, 1994). Four items are filler items and are not used for scoring. Cronbach's alpha for this scale is 0.64.

Single-Item Measures of Personality (SIMP). SIMP is a new instrument to measure the Big Five personality model, using five bipolar single items (Woods & Hampson, 2005). Each item consists of two opposing descriptions, each representing the poles of one of the Big Five factors (i.e., Extraversion, Agreeableness, Emotional Stability, Conscientiousness, and Openness to Experience). Woods and Hampson (2005) report acceptable psychometric qualities for the SIMP for research purposes.

Myers-Briggs Type Indicator (MBTI). MBTI measures personality on four dimensions: Extraversion–Introversion, Sensing–Intuiting, Thinking–Feeling, and Judging–Perceiving. We administered MBTI form M, containing 93 forced-choice items (Myers & Myers, 1998). Gardner and Martinko (1996) conclude from their review article on the MBTI that the instrument is a reliable and valid tool for research into relationships among managerial personalities, cognition, behaviors, effectiveness, and situational variables.

Ability measures

Academic performance. Several indicators for overall academic performance were used to measure ability. Overall academic achievement was determined by collecting the final, overall grades of MBA students from a leading Belgian business school. This was considered to be an accurate representation of students' overall ability as this final grade is a weighted aggregation of scores on a wide variety of business-related subjects. Additionally, for each student the results on the admission procedure were extracted from the business school's database. This final grade is a weighted aggregation of scores on an analytical, knowledge, and motivation test, and a calculated score based on previous university results.

RESULTS AND DISCUSSION

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 the scale evaluation stage (i.e., construct validity and criterion-related validity).

Scale development

Item analysis

The selected pool of 30 items was subjected to an initial process of item analysis. As suggested by DeVellis (1991), we checked for each item the mean, standard deviation, item-scale and item-total correlations, the average inter-item correlations, and Cronbach alpha coefficients. Those items with an item–total correlation of more than 0.30 and a reasonably high variance in response (standard deviation of more than 0.40) were retained in the final questionnaire. Based upon these criteria, a total of 12 items were discarded for further analyses.

In Table 3 and 4, item means, standard deviations, average inter-item correlations, and corrected item-total correlations are reported for Study 1, 2, and 3.

Insert Table 3 & 4 about here

Factor analysis and reliability

In order to examine the factor structure of our items, the different studies were subjected to a factor analytic procedure. Following the suggestion by Gerbing and Hamilton (1996), a two-stage factor analysis was conducted (see Hurley et al., 1997). Each sample was randomly split into two equal halves. One half was used for exploratory factor analysis, using principal axis factoring with oblique (direct oblimen) rotation (Kim & Mueller, 1978). The other half was used for cross-validation with confirmatory factor analysis (AMOS) (Byrne, 2001). Factor parameters were estimated using the maximum likelihood procedure. All constructs were allowed to correlate with each other.

Exploratory factor analysis (EFA). As suggested by several authors, various rules-of-thumb were combined to decide on the number of factors that should be retained (Kerlinger & Lee, 2000; Zwick & Vellicer, 1982, 1986). The extraction and retention of factors in EFA was simultaneously based on examination of the scree plot (Cattell, 1966) and the eigenvalues-greater-than-one criterion (Kaiser, 1960). The preliminary findings of the pilot study were confirmed. In each study, three factors were retained, accounting for 50 per cent of the variance in Study 1, 53 per cent in Study 2, and 49 per cent in Study 3. An additional examination of the inter-item correlation matrices also suggests a three-factor-solution. The average inter-item correlations for the different scales are all higher than 0.30 (Robinson, Shaver, & Wrightsman, 1991). In Table 3 and 4, factor loadings for the items of the CoSI are reported. Items needed to have a primary factor loading of at least 0.40 and no secondary loadings of more than 0.30 (Ford, MacCallum, & Tait, 1986). Although item C7 in Table 4 loads only 0.36 on Factor 2, we decided to keep this item in the questionnaire as it meets all other psychometric criteria. Factor 1 was labeled as the planning style, Factor 2 as the creating style, and Factor 3 as the knowing style. People

with a planning style are characterized by a need for structure. Planners like to organize and control, and prefer a well-structured work environment. They attach great importance to preparation and planning in order to reach their objectives. They strongly want other people to respect rules and agreements. People with a creating style tend to be creative and like experimentation. They see problems as opportunities and challenges. They like uncertainty and freedom. They prefer to think on a conceptual level and are less interested in the practical implementation of ideas. 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 are task-oriented and accurate, and like complex problems if they can find a clear and rational solution.

Confirmatory factor analysis (CFA). The purpose of CFA in scale development is to confirm that prior analyses have been conducted thoroughly and appropriately. This means assessing the quality of the factor structure by statistically testing the significance of the overall model and of item loadings on factors (Hinkin, 1998). A myriad of fit indices and as many criteria for determining good fit are at the researcher's disposal to choose from (MacCallum & Austin, 2000; Medsker, Williams, & Holohan, 1994). In Table 5, several fit indices are reported for the three studies: chi-square and normed chi-square statistics (Jöreskog, 1969), goodness-of-fit index (GFI; Jöreskog & Sörbom, 1989), root mean square residual (RMSR; Bollen, 1989), root mean square error of approximation (RMSEA; Browne & Cudeck, 1993), adjusted goodness-of-fit index (AGFI; Jöreskog & Sörbom, 1989), non-normed fit index (NNFI; Tucker & Lewis, 1973), and normed fit index (NFI; Bentler & Bonnett, 1980). A consensus on the acceptability of a model should be based on examination of the results of all fit indices (Hair, Anderson, Tatham, & Black, 1998). As sample size might affect fit indices used in CFA (Guadagnoli & Velicer, 1988; Marsh, Balla, & McDonald, 1988), RMSR, RMSEA, NNFI, and NFI are considered to be the most appropriate fit indices for our research (Hair et al., 1998; Kline, 1998; MacCallum & Austin, 2000). Our sample sizes are considerably large in the light of factor analytic procedures, which makes the chi-square statistics less appropriate for model assessment (although we do report them for completeness). Hu and Bentler (1998, 1999) also criticize the wide use of GFI and AGFI in the structural equation modeling (SEM) literature, because they have been shown to be

heavily influenced by sample size (MacCallum & Austin, 2000). Although the evaluation of fit indices is rather subjective and somewhat arbitrary, higher values often indicate a better fit. Values above 0.90 for NNFI and NFI are usually considered indicative of a good fit, although other sources mention a criterion of 0.85 or above as generally acceptable (Hinkin, 1995). Table 5 reveals that not all values of NNFI and NFI meet the criterion of 0.90, but all of them (with one exception) meet the criterion of 0.85. No real threshold level can be established for RMSR (Hair et al., 1998), although a criterion of 0.05 or below is sometimes used (Patterson et al., 2005). Researchers need to evaluate the value of RMSR in the light of their research objectives and the observed or actual covariances or correlations. Values of RMSEA ranging from 0.05 to 0.08 indicate a good fit. This criterion is met in all studies. Overall, we find a good fit for the CFA model and therefore accept it.

Insert Table 5 about here

Reliability. The Cronbach alpha coefficient (Cronbach, 1951) was used as a proxy for the internal consistency of our scales. Nunnally and Bernstein (1998) suggest that an alpha coefficient of 0.70 is a minimally acceptable threshold. The results of the reliability analysis indicate that in each of the studies this criterion is met for the different scales. A Cronbach alpha coefficient of 0.73, 0.76, and 0.76 for the knowing style in Study 1, 2, and 3 respectively was found. Cronbach alpha coefficients in the different studies are 0.81, 0.82, and 0.85 for the planning style and 0.79, 0.79, and 0.78 for the creating style.

Scale evaluation

Besides content validity and internal consistency, new measures need to demonstrate construct and criterion-related validity (Clark & Watson, 1995; DeVellis, 1991; Hinkin, 1995, 1998).

Construct validity

To examine the construct validity of our theory and its related measure, it is important to describe the relationship with conceptually similar and dissimilar constructs to define a so-called 'nomological network' (Cronbach & Meehl, 1955). Cognitive styles have been described as the 'missing link' between personality and cognition (Riding & Rayner, 1998). Based on previous research that links cognitive styles with aforementioned personality and cognition measures, we formulated a range of hypotheses (Table 6).

Insert Table 6 about here

The resulting hypothesized relationships are grouped in three categories. The first category contains those scales that are expected to be strongly related to the CoSI subscales, being other cognitive style measures. As can be seen in Table 6, two dimensions of the personality type theory are grouped in category 1. Previous research with regard to cognitive styles and personality types concluded that the dimensions Sensing–Intuiting and Judging–Perceiving are cognition oriented dimensions of the MBTI, while Thinking–Feeling is considered to be an affect oriented dimension (i.e., taking an impersonal or a personal approach when judging) (Jacobson, 1993; Tullet & Davies, 1997). The scales in the second category, being personality-related scales, are expected to show less significant and weaker correlations with the CoSI subscales. Cognitive styles are generally considered to be independent of, but interacting with personality (Riding, 2000a). The third group comprises scales that in previous research are found to be statistically not correlated with cognitive styles (i.e., affect-related scales and ability).

Table 7 shows the correlations of the CoSI subscales with the other measures used in our validation research. We highlight the most relevant results for each of the categories from Table 6.

Insert Table 7 about here

Category 1. With regard to the first category, the hypothesized relationships are to a large extent confirmed. The knowing ($r = –0.28$, $p < 0.05$) and the planning style ($r = –0.64$, $p < 0.01$) were negatively correlated with the overall KAI score, while the creating style ($r = 0.64$, $p < 0.01$) was positively correlated. People with a creating style tend to be more innovation oriented and to restructure the situation while solving problems and making decisions. People with a knowing and a planning style have a tendency to stay within the existing structure when solving problems. While people with a creating style tend to 'do things differently', people with a knowing and a planning style tend to 'do things better' (Kirton, 1994). Furthermore, the knowing ($r = 0.52$, $p < 0.01$) and the planning style ($r = 0.25$, $p < 0.05$) were positively correlated with the Rationality scale. These results suggest that both the planning and the knowing style tend to operate within the rational, analytic cognitive system. For the creating style, no significant correlation was found with Rationality ($r = 0.12$, $p = 0.31$). Consequently, people with a creating style will not be inclined to process information primarily in an analytical mode. With regard to the Rationality subscales, we found a remarkable difference between the knowing and the planning style. The knowing style correlated positively with both Rational Ability ($r = 0.49$, $p < 0.01$) and Rational Engagement ($r = 0.40$, $p < 0.01$). The planning style correlated positively with Rational Ability ($r = 0.29$, $p < 0.05$). However, no significant correlation was found between the planning style and Rational Engagement ($r = 0.14$, $p = 0.24$). This means that, although both styles have the ability to use the rational thinking style, people with a knowing style will actually engage in this process.

Overall, our findings support the reasoning that the Sensing–Intuiting and the Judging–Perceiving dimension of the MBTI are most relevant with regard to cognitive styles, as these correlations are the highest of all four MBTI dimensions. A low, but significant positive correlation was found between the knowing style ($r = 0.12$, $p < 0.05$) and Sensing. 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 positively correlated with Sensing ($r = 0.36$, $p < 0.01$) and

negatively with Intuiting ($r = –0.23$, $p < 0.01$). People with a planning style like rules and regulations, step-by-step explanations, and doing things the way they always have done. The creating style was negatively correlated with Sensing ($r = –0.43$, $p < 0.01$) and positively with Intuiting ($r = 0.32$, $p < 0.01$). People with a creating style prefer dynamic structures and are constantly searching for hidden possibilities and new horizons. Previous research on the link between KAI and MBTI found a strong positive correlation between adaption and sensing on the one hand, and between innovation and intuiting on the other hand (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. On the contrary, high scores on intuiting related to flexibility and creativity. Finally, the knowing and the planning style correlated positively with Judging (knowing style, $r = 0.19$, $p < 0.01$; planning style, $r = 0.54$, $p < 0.01$) and negatively with Perceiving (knowing style, $r = –0.15$, $p < 0.01$; planning style, $r = –0.55$, $p < 0.01$). People with a knowing style like to make decisions using a structured 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 negatively with Judging ($r = –0.38$, $p < 0.01$) and positively with Perceiving ($r = 0.36$, $p < 0.01$). 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 found to be related to orderliness, self-control, and a proper, rule-bound attitude, while 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, while judging types are more likely to be adaptors.

Category 2. Examination of the results of the second category of hypothesized relationships reveals less significant and weaker correlations, as expected. Overall, these results confirm the idea that cognitive styles and personality are independent, but related constructs. Early works within the cognitive style field refer to a ‘personality space’, which is a conceptual space in which key bridging components of personality and cognitive style are situated (Kirton & De Ciantis, 1986). This implies that not all personality aspects will be related to cognitive styles, but only some key elements that

constitute the personality space. Only the knowing style showed a significant correlation with Thinking ($r = 0.15$, $p < 0.05$). People with a knowing style prefer to judge based on a logical, objective, and impersonal process. They prefer logical analysis and just decisions based on standards and policies. Furthermore, the knowing style was positively correlated with Introversion ($r = 0.16$, $p < 0.01$) and negatively with Extraversion ($r = –0.22$, $p < 0.01$). People with a knowing style feel comfortable when they can focus their attention internally, to ideas and concepts. They prefer to take their time to integrate and assimilate outside information. The creating style was positively correlated with Extraversion ($r = 0.20$, $p < 0.01$) and negatively with Introversion ($r = –0.22$, $p < 0.01$). People with a creating style get their energy from their environment, from interacting with other people and things. 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 the knowing style showed a significant correlation with Agreeableness ($r = –0.25$, $p < 0.05$). People with a knowing style are forthright and tend to be critical. In addition, a significant positive correlation was found between the planning style ($r = 0.57$, $p < 0.01$) and Conscientiousness. Planners are organized, self-disciplined, and reliable. A significant negative correlation was found between the creating style ($r = –0.36$, $p < 0.01$) and Conscientiousness. People with a creating style do not necessarily stick to a schedule and tend to be flexible and disorganized. Furthermore, only the planning style showed a significant correlation with Openness to Experience ($r = –0.39$, $p < 0.01$). 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 conforming to past traditions and practices. Finally, a significant positive correlation was found between the creating style ($r = 0.19$, $p < 0.01$) and Optimism. A significant negative correlation was found between the planning style ($r = –0.22$, $p < 0.01$) and Optimism. People with a creating style see problems as challenges or opportunities. They like uncertainty and believe in the positive outcome of their ideas. Planners, on the other hand, have difficulty with unexpected changes, are self-critical, and are inclined to think in terms of worst case scenarios.

Category 3. Finally, inspection of the results for the third category of hypothesized relationships lends support to the independence of the cognitive style construct from affect-related constructs and ability-related constructs.

Cognitive styles are considered to be conceptually different from affect (Kirton, 1994; Tullett & Davies, 1997). As hypothesized, none of the cognitive styles correlated significantly with the Experientiality scale (knowing style, $r = –0.20$, $p = 0.11$; planning style, $r = –0.001$, $p = 0.99$; creating style, $r = 0.21$, $p = 0.08$). Pacini and Epstein (1999) report a significant positive relationship between Experientiality and emotional expressivity, lending support to the reasoning that an experiential thinking style is related to affect and emotionality (Epstein, 1994). In addition, no significant correlations were found between any of the cognitive styles and Feeling (knowing style, $r = –0.10$, $p = 0.10$; planning style, $r = –0.04$, $p = 0.52$; creating style, $r = 0.08$, $p = 0.18$). Furthermore, no significant correlation is found between people's cognitive style and Emotional Stability (knowing style, $r = –0.01$, $p = 0.89$; planning style, $r = –0.07$, $p = 0.49$; creating style, $r = 0.17$, $p = 0.11$). Tullett (1997) also refers to zero correlations between the KAI overall score and emotional stability.

Whether cognitive styles and ability are related or not has been the subject of continuous debate between researchers in the cognitive style domain (Armstrong, 2000; Furnham, 1995). Several theorists argue that cognitive style and intellectual abilities are different in multiple and important ways (Kirton, 2003; Mudd, 1996; Riding & Rayner, 1998; Tullet, 1997). Other research did find relationships between cognitive styles and ability (e.g., Allinson & Hayes, 1996; Federico & Landis, 1984; Isaksen & Puccio, 1988; Tiedemann, 1989). However, Armstrong (2000) asserts that these studies did not carefully consider the nature of the task that is used to measure ability, as some tasks might favor one cognitive style over the other. In our study, no significant correlations were found between people's cognitive style and their overall academic performance (knowing style, $r = –0.01$, $p = 0.78$; planning style, $r = –0.08$, $p = 0.10$; creating style, $r = –0.004$, $p = 0.93$). Additionally, no significant correlations were found between people's cognitive style and their overall result on the business school's admission test (knowing style, $r = 0.08$, $p = 0.07$; planning style, $r = 0.02$, $p = 0.65$; creating style, $r = 0.07$, $p = 0.10$). These findings lend further support to the independence of cognitive styles and

ability. However, it might be useful for future research to investigate the possible moderating effect of type of task on the cognitive style–cognition relationship. 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).

Conclusion. Overall, our results lend strong support for the construct validity of the CoSI. When examining our findings, some results seem to 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. We found, for instance, a positive correlation with the overall KAI score for the creating style (indicating higher innovativeness) and a negative correlation for the knowing and the planning style. Furthermore, the knowing and planning style correlated positively with Judging and negatively with Perceiving. The creating style, however, showed a positive correlation with Perceiving and a negative one with Judging. In addition, we found a moderately high correlation between the knowing and the planning style ($r = 0.38$, $p < 0.01$). However, given the different correlations of the knowing and the planning style with several of the other scales in our research and their different correlation with the creating style (knowing style, $r = –0.02$, $p = 0.62$; planning style, $r = –0.23$, $p < 0.01$), we find it more useful to distinguish between three cognitive styles, without calculating one overall CoSI score like Allinson and Hayes (1996) or Kirton (1976).

Criterion-related validity

Criterion-related validity refers to the degree of correspondence of a measure with some other accepted measure, being the criterion (Carmines & Zeller, 1979). Criterion-related validity is not often assessed in organizational research, as it is not always possible to find an adequate criterion to relate the scale with (Price, 1997). In the light of the contemporary interest in person–organization fit (Kristof, 1996), we chose to look at the relationship between people's cognitive styles and some work-related characteristics.

If the CoSI has criterion-related validity, it should be capable of distinguishing between groups that are considered to differ in their cognitive styles.

Hierarchical level. One possible difference is that between hierarchical levels. Continuous debate in management literature has existed whether effective management is better served by a rational, analytical approach or an intuitive, creative approach (Sadler-Smith, 2004). Nowadays, intuition seems to be increasingly considered as an important aspect of effective decision-making (Andersen, 2000; Khatri & Ng, 2000). Additionally, a considerable number of scholars have stressed the necessity of integrating analytical and intuitive cognitive styles in managerial work (e.g., Foxall & Hackett, 1994; Mintzberg, 1994; Sinclair, Ashkanasy, Chattopadhyay, & Boyle, 2002). According to Hodgkinson and Sparrow (2002), a combination of both styles is required to process information, if individuals and organizations are to prosper and minimize the dangers of cognitive biases identified by behavioral decision researchers. However, empirical evidence for this assertion is scarce. Foxall (1986) found a rather intermediate position for general management functions on the adaption–innovation continuum, indicating that they are composed of both adaptive and innovative task subsets. Analysis of variance (with post hoc Scheffé-test) in Study 1 (Table 8) revealed that people with a management function score significantly higher on the knowing style ($F_{2,5882} = 28.66$, $p < 0.01$) and on the creating style ($F_{2,5882} = 34.33$, $p < 0.01$) than clerical staff. This finding suggests that contemporary managers use both a knowing and a creating style when processing information and making decisions. Interestingly, no significant difference was found between people on a management level and professionals for both the knowing and the creating style. No significant difference was found between any of the hierarchical levels with regard to the planning style.

Insert Table 8 about here

Industry and sector of employment. We did not find any significant differences between industry of employment and cognitive styles in our research. This is probably due to the fact that in each industry different types of functions and tasks need to be performed, indicating there are several kinds of cognitive styles needed. Moreover, Kirton (1980) emphasizes the importance of making a difference between internally oriented and externally oriented jobs (even within the same functional specialization). However, when we make a distinction between the profit and the non-profit sector in Study 1, we found a significant higher score for the planning style in the non-profit sector than in the profit sector ($t_{3682} = -2.79$, $p < 0.01$). The non-profit sector is often government regulated, leading to more administrative requirements and regulations. Apparently, this attracts more people with a planning style. No significant difference was found for the knowing and the creating style in this regard.

Job and study choices. Another possible difference is that 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). In comparing mean scores for the different cognitive styles in Study 1 and 2 (Table 9), analysis of variance (with post hoc Scheffé-test) showed that people with a financial function score significantly higher on the knowing style than people with a function in sales and marketing, or personnel (Study 1, $F_{2,2010} = 18.21$, $p < 0.01$; Study 2, $F_{3,709} = 2.82$, $p < 0.05$). Financial employees scored significantly lower on the creating style than sales and marketing, or personnel employees (Study 1, $F_{2,2010} = 18.48$, $p < 0.01$). Interestingly, we also found that people with a function in personnel scored significantly lower on the planning style than people in a sales and marketing function (Study 1, $F_{2,2010} = 4.11$, $p < 0.05$). Our results are consistent with previous research that concluded that people tend to select those professions that emphasize their preferred style (e.g., Chan, 1996; Myers, McCaulley, Quenk, & Hammer, 2003). Agor (1985), for instance, found a lower score on intuition for people in financial management and a higher score for people in personnel management. Foxall (1986) found a higher score on innovativeness for people in a marketing function and a lower score for people in an accounting and financial function, indicating a more adaptive tendency. In this regard, we looked at the profile of MBA students choosing an MBA focused on financial

management versus the ones choosing an MBA focused on marketing management aspects. An independent samples T-test of study orientation in Study 3 indicated that the financially oriented MBA students (N = 89) scored significantly higher on the knowing style ($t_{231} = -4.54$, $p < 0.01$) than the marketing oriented MBA students (N = 144). Additionally, analysis of variance (with post hoc Scheffé-test) indicated that students with a previous degree in engineering (N = 140) scored significantly higher on the knowing style than students with a background in economics (N = 249) and social sciences (N = 57) ($F_{2,443} = 3.14$, $p < 0.05$). No significant differences were found for the planning and the creating style.

Insert Table 9 about here

CONCLUSION

Given the relevance and usefulness of the cognitive style concept for organizations, the objectives of this study were twofold. The first was to develop a psychometrically sound instrument to measure cognitive styles in organizations. This objective fits very well the call of Riding (2000b) to develop simple, valid, and direct measures of cognitive style. Our validation process led to a reliable and valid questionnaire. Our instrument is highly reliable, with Cronbach alpha coefficients ranging from 0.73 to 0.85. CoSI has a clear factor structure, as examined in a two-stage factor analytic procedure. Exploratory factor analysis suggested a three-factor solution (knowing, planning, and creating style). Confirmatory factor analysis indicated adequate fit for this three-factor model. Moreover, the questionnaire is particularly relevant for use in organizations, given its length (18 items) and the short time required to complete it (approximately 10 minutes). Good organizational measures not only have to be valid and reliable, but also need practicality, this means being easy to administer and to interpret (Cooper & Schindler, 2003).

Secondly, we wanted to find out whether reducing the large field of cognitive styles theories to one bipolar cognitive style dimension is still warranted. Traditionally, cognitive style research has focused mainly on the distinction between analytic and intuitive thinking. However, empirical research on the relationship between different cognitive style measures found that cognitive style is a complex variable with multiple dimensions (Beyler & Schmeck, 1992; Bokoros & Goldstein, 1992; Bostic & Tallent-Runnels, 1991). Therefore, Riding (2000b) refers to the desirability for cognitive style research of recognizing and confirming the fundamental cognitive style dimensions within the existing extensive body of style labels. The convergent, discriminant, and predictive validity analyses in our research clearly indicate the relevance and usefulness of identifying three cognitive styles rather than two. Overall, our findings support the reasoning that it might be a valuable endeavor to distinguish between three different cognitive styles, which initially stem from the traditional conceptualization of the bipolar analytic–intuitive cognitive style dimension, however, without further situating them conceptually on a single dimension. We rather see our three cognitive styles situated on a conceptual triangle, as three independent unipolar scales. This way, we do not exclude the possibility that people might show a preference for a combination of cognitive styles.

Reflecting on the results of the construct validity analysis, our three different styles can be described as follows. The knowing style is empirically related with Rationality (REI) and Thinking (MBTI), indicating a preference for logical, analytical, and impersonal information processing. Theoretically, this style is rather similar to existing conceptualizations of the analytic pole, like analysis in Allinson and Hayes' theory (1996) or Riding's (1991) analytic style. A significant correlation with the adaptiveness pole of Kirton's theory (1994) was also found. With regard to personality, knowing types are introverts and tend to be rather critical and forthright. The planning style is empirically related with the adaptiveness pole of Kirton (1994). A significant negative correlation was established 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. Additionally, a significant positive correlation was reported between the planning style and Sensing and Judging (MBTI). The planning style is also correlated

with Rationality (REI), although there is only a significant correlation with the Rational Ability subscale and not with the Rational Engagement subscale. With regard to personality aspects, planners are found to be very conscious people, who are rather pessimistic, and not very open to experience. The creating style shows a strong correlation 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, like intuition in Allinson and Hayes' theory (1996) or the innovativeness pole of Kirton (1994). With regard to personality aspects, creating people are extraverts, tend to be optimists, flexible, and rather disorganized.

Overall, our validation process indicates that cognitive styles are conceptually different from ability and affect, and independent of, but interacting with personality. None of the cognitive styles correlated significantly with Experientiality, Feeling, Emotional Stability, and academic performance. These results lend strong support for the construct validity of our theory and measure. The CoSI is found to be a valuable new instrument to measure 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.

With regard to predictive validity, our results indicate that cognitive style differences might influence people's study and job choice, and work-related behavior. Significant differences in cognitive style profile are found for employees on different hierarchical levels and in different functions. In addition, people's sector of employment also counts for differences in cognitive styles, as well as previous study choices.

Although the CoSI clearly has potential and may contribute to the continuation of cognitive style research, some limitations of this research should be noted. The CoSI is a self-reporting 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, will be to validate the data against objectively observable behavior

(Leonard et al., 1999). Riding (2000b) calls for establishing clear relationships between style measures and real, objectively observable behavior, in contrast to introspective self-report measures, to find clear and relevant applications for style. In this regard, the instrument's predictive validity can be further investigated by measuring people's cognitive styles in team and organizational contexts, for instance on the basis of 360° feedback sessions. Furthermore, Riding (2000b) calls for future research on the relationship between style and other individual difference constructs and measures that may influence people's 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 on 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. Additionally, the link between cognitive styles and work-related attitudes (e.g., loyalty, job satisfaction, intention to leave) and work performance has not been studied very extensively yet. To increase the theoretical impact and practical relevance of our cognitive style model and to take advantage of the limitations of this study, such further research is necessary.

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TABLE 1

Description of the analytic–intuitive dimension

Analytic pole	Intuitive pole
Convergence	Divergence
Sequential, structured	More randomly, less orderly
Facts, details	Possibilities, meanings, ideas
More interested in parts than in wholes	More interested in the whole than in the component parts
Logical, reflective	Impulsive, active
Conservative, conventional, conformity	Openness to experience, taking risks, subversive
Planned, organized, systematic	Flexible, spontaneous, open-ended
Utility	Novelty
Objective, impersonal, rational, intellectual	Subjective, (inter)personal, expressive
Verbal	Visual
Precision, methodicalness	Inventive, creative
Routine	Variety

TABLE 2

Research design of the Cognitive Style Indicator validation studies

	Study 1 N = *5924*	**Study 2** N = *1580*	**Study 3** N = *635*
Scale development			
Item analysis	Yes	Yes	Yes
Factor analysis	Yes	Yes	Yes
EFA	N = 2970	N = 763	N = 321
CFA	N = 2954	N = 817	N = 314
Scale evaluation			
Convergent and discriminant validity	No[a]	No[a]	Yes[b]
KAI			N = 66
REI			N = 70
MBTI			N = 296
SIMP			N = 98
LOT-R			N = 367
Academic performance			N = 443
Admission test			N = 583
Criterion-related validity	Yes	Yes	Yes
Hierarchical level	N = 5885		
Job function	N = 2013	N = 713	
Sector of employment	N = 3684		
Study orientation			N = 233
University degree			N = 446

Note. [a] Other measures that were included in these studies are not relevant for construct validation purposes.

[b] Different groups of respondents were presented a different set of scales and none of them received all scales.

TABLE 3

Means, standard deviations, average inter-item correlations, item–total correlations, and factor loadings for the Cognitive Style Indicator, Study 1

Item	M	SD	Item total	Factor 1[a]	Factor 2	Factor 3
Knowing style	3.89	0.65	(0.41)[b]			
(K1) I want to have a full understanding of all problems.	3.92	0.82	0.52	0.11	0.01	**-0.58**[c]
(K2) I like to analyze problems.	4.23	0.73	0.53	-0.07	0.12	**-0.66**
(K3) I make detailed analyses.	3.44	0.92	0.49	0.13	-0.04	**-0.57**
(K4) I study each problem until I have understood the underlying logic.	3.97	0.73	0.56	-0.01	-0.01	**-0.68**
Planning style	3.78	0.77	(0.39)			
(P1) Developing a clear plan is very important to me.	3.87	0.83	0.65	**0.71**	0.02	-0.04
(P2) I always want to know what should be done when.	3.55	1.00	0.52	**0.63**	-0.07	0.04
(P3) I like detailed action plans.	3.58	0.86	0.64	**0.69**	-0.01	-0.07
(P4) I prefer clear structures to do my job.	3.83	0.82	0.57	**0.67**	-0.12	0.002
(P5) I prefer well prepared meetings with a clear agenda and strict time management.	3.70	0.98	0.48	**0.56**	0.07	0.05
(P6) I make definite engagements, which I follow up meticulously.	3.93	0.79	0.47	**0.44**	0.09	-0.15
(P7) A good task is a well prepared task.	4.00	0.83	0.55	**0.59**	0.10	-0.02
Creating style	4.01	0.60	(0.35)			
(C1) I like to contribute to innovative solutions.	4.17	0.70	0.52	0.08	**0.52**	-0.11
(C2) I prefer to look for creative solutions.	3.94	0.77	0.45	0.003	**0.46**	-0.12
(C3) I am motivated by ongoing innovation.	3.99	0.85	0.55	-0.08	**0.63**	-0.06
(C4) I like much variety in my life.	3.98	0.84	0.51	0.01	**0.66**	0.19
(C5) New ideas attract me more than existing solutions.	4.09	0.70	0.63	0.01	**0.72**	-0.03
(C6) I like to extend the boundaries.	4.22	0.73	0.59	0.04	**0.67**	-0.02
(C7) I try to avoid routine.	3.68	0.81	0.39	0.000	**0.44**	-0.03

Note. [a] Exploratory factor analysis is done on random half of total sample.
[b] Average inter-item correlations of the corresponding scale are between brackets.
[c] Factor loadings of the corresponding items within the scale are in bold face.

TABLE 4

Means, standard deviations, average inter-item correlations, item–total correlations, and factor loadings for the Cognitive Style Indicator, Study 2 and 3

	Study 2						Study 3					
	M	**SD**	**Item total**	**Factor 1[a]**	**Factor 2**	**Factor 3**	**M**	**SD**	**Item total**	**Factor 1**	**Factor 2**	**Factor 3**
K[b]	4.06	0.96	(0.45)[c]				3.79	0.79	(0.45)			
K1	4.11	1.03	0.50	0.03	0.01	**-0.56**[d]	3.84	0.91	0.54	-0.07	0.03	**-0.60**
K2	4.15	0.93	0.65	-0.10	-0.01	**-0.90**	3.87	0.84	0.61	0.07	-0.02	**-0.66**
K3	3.74	1.07	0.53	0.14	-0.04	**-0.61**	3.35	0.96	0.54	0.25	0.03	**-0.53**
K4	4.26	0.88	0.58	-0.01	0.09	**-0.69**	4.08	0.84	0.56	0.001	-0.02	**-0.63**
P	3.81	1.16	(0.40)				3.58	0.95	(0.44)			
P1	4.17	0.94	0.60	**0.70**	0.10	-0.04	3.72	0.95	0.73	**0.70**	-0.03	-0.17
P2	3.38	1.25	0.47	**0.54**	-0.09	0.03	3.39	1.07	0.56	**0.59**	0.03	0.01
P3	3.67	1.11	0.67	**0.77**	-0.02	-0.04	3.31	0.96	0.70	**0.74**	-0.01	-0.03
P4	3.82	1.03	0.59	**0.67**	-0.03	0.03	3.54	1.01	0.64	**0.56**	-0.19	-0.08
P5	3.74	1.17	0.53	**0.64**	0.03	0.06	3.97	0.93	0.54	**0.63**	-0.001	-0.04
P6	3.93	0.97	0.53	**0.62**	0.06	-0.07	3.56	0.94	0.53	**0.44**	-0.03	-0.20
P7	3.92	1.02	0.55	**0.65**	-0.02	-0.08	3.60	0.98	0.54	**0.67**	-0.01	0.15
C	4.16	0.80	(0.36)				4.09	0.62	(0.34)			
C1	4.37	0.80	0.48	0.12	**0.53**	-0.13	4.14	0.74	0.47	0.24	**0.59**	0.07
C2	3.95	0.99	0.47	-0.03	**0.52**	-0.08	3.87	0.87	0.52	-0.07	**0.57**	-0.003
C3	4.13	0.93	0.58	0.02	**0.69**	0.04	4.08	0.76	0.63	-0.05	**0.71**	0.01
C4	4.29	0.89	0.49	-0.02	**0.62**	0.09	4.51	0.62	0.44	-0.06	**0.49**	0.05
C5	4.33	0.78	0.66	0.04	**0.81**	0.04	4.08	0.81	0.56	-0.10	**0.61**	-0.11
C6	4.34	0.79	0.60	0.01	**0.70**	-0.05	4.22	0.78	0.49	-0.01	**0.61**	-0.13
C7	3.72	1.04	0.42	-0.07	**0.50**	-0.02	3.72	0.91	0.40	-0.04	**0.36**	0.04

Note. [a] Exploratory factor analysis is done on random half of total sample.
[b] K = knowing style; P = planning style; C = creating style
[c] Average inter-item correlations of the corresponding scale are between brackets.
d Factor loadings of the corresponding items within the scale are in bold face.

TABLE 5

AMOS fit indices for confirmatory factor analysis, Study 1, 2, and 3

Fit indices	**Study 1** *N* = 2954	**Study 2** *N* = 817	**Study 3** *N* = 314
Absolute fit measures			
Chi-square (χ^2) of estimated model	1388.62	657.19	372.64
Degrees of freedom (df)	132	132	132
Significance level (p)	0.000	0.000	0.000
Normed chi-square (χ^2/df)	10.52	4.98	2.82
Goodness-of-fit index (GFI)	0.948	0.915	0.880
Root mean square residual (RMSR)	0.033	0.069	0.057
Root mean square error of approximation (RMSEA)	0.057	0.070	0.076
p-value of close fit (RMSEA < 0.05)	0.000	0.000	0.000
Incremental fit measures			
Adjusted goodness-of-fit index (AGFI)	0.933	0.890	0.845
Tucker-Lewis index (TLI) or NNFI	0.901	0.888	0.860
Normed fit index (NFI)	0.906	0.882	0.826

Note. RMSR, RMSEA, NNFI, and NFI are considered to be the most appropriate fit indices for our study.

TABLE 6

Expected relationships between CoSI subscales and other measures

	Knowing style	Planning style	Creating style
	Category 1: hypothesized as strongly related		
Overall score KAI[a]	–	–	+
Rationality REI[b]	+	+	–
Sensing MBTI[c]	+	+	–
Intuiting MBTI[c]	–	–	+
Judging MBTI[c]	+	+	–
Perceiving MBTI[c]	–	–	+
Category 2: hypothesized as showing weaker and less significant correlations			
Thinking MBTI[c]	+	+	–
Extraversion MBTI[c]	–	–	+
Introversion MBTI[c]	+	+	–
Extraversion SIMP[d]	–	–	+
Agreeableness SIMP[d]	–	–	+
Conscientiousness SIMP[d]	+	+	–
Openness SIMP[d]	–	–	+
Optimism LOT-R[e]	–	–	+
Category 3: hypothesized as independent of cognitive style			
Experientiality REI[b]			
Feeling MBTI[c]			
Emotional Stability SIMP[d]			
Academic Performance[f]			
Admission Test[f]			

Note.
+ significant positive correlation expected – significant negative correlation expected
[a] Based on Kirton (1994, 2003).
[b] Based on Edwards, Lanning, and Hooker (2002); Epstein et al. (1996); and Pacini and Epstein (1999).
[c] Based on Beyler and Schmeck (1992); Gryskiewicz and Tullar (1995); Leonard et al. (1999); and Power, Kummerow, and Lundsten (1999).
[d] Based on Goldsmith (1994); Kirton and De Ciantis (1986); Riding, Burton, Rees, and Sharratt (1995); and Riding and Wigley (1997).
[e] Based on Fandelova (1999) and Sarmany (1992).
[f] Based on Riding and Agrell (1997); Riding and Pearson (1994); and Tinajero and Paramo (1998).

TABLE 7

Pearson product–moment correlations between CoSI subscales and other measures

	Knowing style	Planning style	Creating style
Category 1: hypothesized as strongly related			
Overall score KAI	-0.28*	-0.64**	0.64**
Rationality REI	0.52**	0.25**	0.12
Sensing MBTI	0.12*	0.36**	-0.43**
Intuiting MBTI	-0.04	-0.23**	0.32**
Judging MBTI	0.19**	0.54**	-0.38**
Perceiving MBTI	-0.15**	-0.55**	0.36**
Category 2: hypothesized as showing weaker and less significant correlations			
Thinking MBTI	0.15*	0.06	-0.11
Extraversion MBTI	-0.22**	-0.05	0.20**
Introversion MBTI	0.16**	0.11	-0.22**
Extraversion SIMP	-0.08	-0.19	0.24*
Agreeableness SIMP	-0.25*	-0.11	-0.10
Conscientiousness SIMP	0.19	0.57**	-0.36**
Openness SIMP	-0.08	-0.39**	0.14
Optimism LOT-R	-0.04	-0.22**	0.19**
Category 3: hypothesized as independent of cognitive style			
Experientiality REI	-0.20	-0.001	0.21
Feeling MBTI	-0.10	-0.04	0.08
Emotional Stability SIMP	-0.01	-0.07	0.17
Academic Performance	-0.01	-0.08	-0.004
Admission Test	0.08	0.02	0.07

*Note. *p < 0.05; **p < 0.01; two-tailed*

TABLE 8

Hierarchical level differences of scores on the Cognitive Style Indicator, Study 1

	Clerical staff N = ***1597***	**Professional employees** N = ***2335***	**Middle and senior management/ General directors** N = ***1953***
Knowing style			
M	*3.80*	*3.93*	*3.92*
SD	*0.60*	*0.58*	*0.61*
df		*2,5882*	
F		*28.66***	
Planning style			
M	3.81	3.77	3.78
SD	0.60	0.60	0.61
df		2,5882	
F		2.15	
Creating style			
M	*3.92*	*4.03*	*4.06*
SD	*0.55*	*0.50*	*0.49*
df		*2,5882*	
F		*34.33***	

Note. *p < *0.05;* **p < *0.01*

TABLE 9

Job function differences of scores on the Cognitive Style Indicator, Study 1 and 2

		Knowing style		**Planning Style**		**Creating style**	
	N	M	SD	M	SD	M	SD
Study 1							
Personnel	*474*	*3.77*	*0.60*	*3.70*	*0.62*	*4.01*	*0.47*
Sales and marketing	*1160*	*3.85*	*0.60*	*3.79*	*0.60*	*4.06*	*0.51*
Finance	*379*	*4.02*	*0.57*	*3.79*	*0.57*	*3.88*	*0.51*
		$F_{2,2010} = 18.21^{**}$		$F_{2,2010} = 4.11^{**}$		$F_{2,2010} = 18.48^{**}$	
Study 2							
Finance	62	4.25	0.70	3.83	0.73	4.09	0.70
Engineering	123	4.16	0.73	3.78	0.84	4.22	0.56
IT	302	4.11	0.68	3.72	0.75	4.20	0.56
Sales and marketing	226	4.00	0.73	3.90	0.75	4.19	0.59
		$F_{3,709} = 2.82^{*}$		$F_{3,709} = 2.33$		$F_{3,709} = 0.61$	

Note. *p < 0.05; **p < 0.01