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**THE FIELD OF COGNITIVE STYLES:
FROM A THEORETICAL REVIEW TO THE CONSTRUCTION
OF THE COGNITIVE STYLE INVENTORY**

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ABSTRACT

Cognitive styles gained prominence in organizational behavior and management literature during the last decades. Researchers studied cognitive styles in relationship to various concepts and from various points of view. Different authors developed their own instruments of assessment to identify differences in cognitive styles. However, this theoretical and empirical pluralism makes the field of cognitive styles rather confusing and leads to inconsistent measurement results. Several authors try to create order in the diverse field by integration of the different theories. With this state of affairs in mind, the purpose of this article is twofold. Firstly, we attempt to demarcate and define succinctly the field of cognitive style research. Secondly, we want to present our research on cognitive styles, which led to the development of the Cognitive Style Inventory (CoSI). We are currently finalising the validation and cross-validation of our self-report questionnaire. The theoretical background of the questionnaire is presented. Because of the usefulness of the cognitive style concept for organizations, clarification of the research field and the development of a useful questionnaire to measure individual differences in cognitive styles are necessary.

INTRODUCTION

Cognitive styles are considered in a lot of organizational behavior literature (e.g., Allinson & Hayes, 1996; Hayes & Allinson, 1994; Kirton & McCarthy, 1988; Sadler-Smith & Badger, 1998). Researchers use it as a basis for studying decision-making behavior, conflict handling, strategy development, and group processes (Leonard, Scholl, & Kowalski, 1999). Cognitive styles have been investigated in relationship to various concepts, such as personality (e.g., Gryskiewicz & Tullar, 1995; Kirton & De Ciantis, 1986), motivation (e.g., Martinsen, 1994), occupation (e.g., Allinson, Chell, & Hayes, 2000), organizational climate (e.g., Kirton & McCarthy, 1988), creativity (e.g., Al-Sabaty & Davis, 1989), and problem solving (e.g., Hammerschmidt, 1996). Research shows that individual differences in cognitive styles influence perception, learning, decision-making, communicating, and information processing in important ways (e.g., Carlson & Levy, 1973; Kirton, 1989; Messick, 1984; Schmeck, 1988; Witkin & Goodenough, 1981). Management researchers found out that people with different cognitive styles prefer different types of organizations (e.g., Kilmann & Mitroff, 1976) and different kinds of offices (e.g., Williams, Armstrong, & Malcolm, 1985).

The large theoretical and empirical interest reveals some major advantages and implications of cognitive styles for practice. Kirton and McCarthy (1988) state that cognitive styles are increasingly seen as a critical intervening variable in work performance. They conclude that this has useful implications for the practitioner who wants to build effective teams by identifying a cognitive climate within the organization. The challenge is to create the right balance and to foster tolerance between team members with varying cognitive styles. Talbot (1989) states that differences in cognitive styles significantly affect one-on-one and team interactions in the workplace. According to that study, identifying and understanding each employee's unique cognitive style provides an excellent opportunity to enhance individual and team performance and productivity. Hayes and Allinson (1994) argue that cognitive style may be used to inform and improve the quality of decision-making in relation to personnel selection and placement, task and learning performance, internal communication, career guidance and counselling, fit with the organization climate, task design, team composition, conflict management, team building, management style, and training and development. Sadler-Smith and Badger (1998) also investigate human resource implications of cognitive style. They conclude that human resource practitioners have a crucial role in fostering individual versatility and in facilitating innovation through the effective management of differences in cognitive

style. A cognitive style is a fundamental determinant of individual and organizational behavior which manifests itself in individual workplace actions and in organizational systems, processes, and routines (Sadler-Smith & Badger, 1998). Streufert and Nogami (1989) argue that cognitive style may be one of the variables that determine whether or not people are able to respond appropriately across a variety of situations. In other words, knowing employees' cognitive styles implies that they can be placed in jobs they like and in which they are likely to succeed. It can explain why people with the same abilities, knowledge, and skills perform different in the organization. Leonard and Straus (1997) report that people effectively tend to choose professions that reward their own style. People have different mental processes and different mental preferences and this affects their choice of work and activities. Knowing cognitive styles will also improve respect for diversity. People better understand each other when they know their own and others' cognitive style and they will be able to build on their strengths and to balance their weaknesses (Edgley, 1992). An important element in understanding differences in style is recognizing that no one style is inherently better than another, they are just different. It is, however, important to be careful not to use the knowledge of each others cognitive style to stereotype people.

Given the usefulness of the cognitive style concept for the organization and the potential to make an important contribution to management practice, it is rather strange that it has been a relatively neglected concept within the area of industrial and organizational psychology (Hayes & Allinson, 1994). Cognitive styles are already extensively studied in domains like education or experimental psychology (Grigorenko & Sternberg, 1995; Riding, 1997). However, our research focuses on the organizational context and work-related aspects of cognitive styles. Understanding cognitive styles is nowadays particularly important for organizations due to the ever-increasing pace of change that demands individuals to quickly develop the ability to work together (Leonard & Straus, 1997).

DEFINING COGNITIVE STYLES

It is obvious from the introduction that there is a large theoretical and empirical interest in cognitive styles. As a consequence, a lot of conceptualizations and terms are introduced in theory and research. Some authors call it learning styles (e.g., Honey & Mumford, 1982; Kolb, 1976; Schmeck, 1988), others speak of cognitive styles (e.g., Allinson & Hayes, 1996; Riding &

Cheema, 1991), thinking styles (e.g., Al-Sabaty & Davis, 1989; Grigorenko & Sternberg, 1995; Leonard & Straus, 1997), or styles of thought (e.g., Sternberg, 1988). As a consequence, several researchers call for clarification in ‘style’ terminology (e.g., Rayner & Riding, 1997). The terms cognitive style and learning style both have been used much. However, what they mean still depends very much on the author (Riding & Cheema, 1991). Some researchers (e.g., Entwistle, 1981) believe the two terms mean the same and use the terms interchangeable, others (e.g., Das, 1988) consider them to be different terms and attempt to define them as separate concepts. Some authors regard a learning style as a subcategory of cognitive style (e.g., Hayes & Allinson, 1994, 1998). According to Hayes and Allinson (1998) a learning style, like a cognitive style, “reflects the way in which individuals process information when interpreting situations, assess the consequences of actions in those situations, and use this understanding to refine (or redefine) their theories-in-use” (p. 850). A main difference between cognitive and learning styles is according to Riding and Cheema (1991) the number of style elements that is considered: a cognitive style is usually a bipolar dimension, while a learning style entails many elements which are usually not ‘either-or’ extremes.

The focus in this article is on the cognitive style concept. Regardless of the specific definition, the term ‘style’ usually refers to an habitual pattern or preferred way of doing something. Cognitive psychologists who did research on problem solving and perceptual and sensory functions developed the term cognitive style (Grigorenko & Sternberg, 1995). Allport (1937) was probably the first researcher who deliberately used the style construct in association with cognition (Grigorenko & Sternberg, 1995; Riding & Cheema, 1991). Witkin, Moore, Goodenough, and Cox (1977) define cognitive styles as individual differences in the way people perceive, think, solve problems, learn, and relate to others. Messick (1984) defines cognitive styles as consistent individual differences in ways of organizing and processing information and experience. Tennant (1988) defines a cognitive style as an individual’s characteristic and consistent approach to organizing and processing information. Cognitive style is defined by Hunt, Krzystofiak, Meindl, and Yousry (1989) as the way in which people process and organize information, and arrive at judgments or conclusions based on their observations. Sadler-Smith and Badger (1998) state that a style may be thought of as a qualitatively different way of organizing and processing information, with the ‘best’ style being determined by the demands of each particular task, problem, or situation. In the light of these definitions, we define a cognitive style as the way an individual perceives environmental stimuli, and organizes and uses information. A cognitive style influences how people look at

their environment for information, how they organize and interpret this information, and how they use these interpretations for guiding their actions (Hayes & Allinson, 1998).

A recurrent distinction in literature on cognitive styles is the one between style and ability. This distinction is important and fundamental, because both style and ability may affect performance on a given task. Riding (2000) refers to style and ability as being the two major aspects that are studied with regard to individual variation in cognitive processing. Several distinguishing characteristics can be found in the literature. Guilford (1980) states that ability focuses on the level of performance, while style is more concerned with the manner of performance. Witkin et al. (1977) also propose that cognitive style is concerned with the form rather than the content of activity. Messick (1984) describes abilities as being unipolar constructs (i.e., more of it is 'better'), while styles are typically considered to be bipolar (i.e., both poles may be equally valued, but in different situations). This means that having more or less of an ability can be related to possible levels of achievement in a certain area. Cognitive styles on the contrary range from one extreme to a contrasting extreme and each pole of the dimension has different implications for cognitive functioning. Research supports the idea that cognitive style may be thought of as describing different, rather than better, ways of thinking (e.g., Kirton, 1989; Riding & Pearson, 1994; Sadler-Smith, 1997; Tinajero & Paramo, 1997). Related to this characteristic is the finding that abilities are considered to be value directional (i.e., having more of an ability is better than having less), whereas cognitive styles are considered to be value differentiated. Witkin et al. (1977) state that each pole of a cognitive style has adaptive value under specified circumstances and in this sense may be judged positively in relation to those circumstances. So, the basic distinction between style and ability is according to Riding (2000) that performance on all tasks will improve as ability increases, whereas the effect of style on individual performance will either be positive or negative depending on the nature of the task.

Hayes and Allinson (1998) conclude from their research on cognitive styles that "this suggests the possibility that people will learn and perform best in those situations where the information-processing requirements of the situation match their cognitive style or preferred approach to processing information" (p. 851). On the other hand, researchers found out that it is possible for individuals to process information and behave in ways that are not consistent with their habitual approach (Streufert & Nogami, 1989). This brings us to the discussion whether cognitive styles can change over situations and time or not. Riding and Cheema (1991) refer in this regard to three views concerning cognitive styles. Cognitive style can be viewed as

a structure (content), as a process, or as both. If cognitive style is viewed as a structure, the focus is on its stability over time. However, if cognitive style is viewed as a process, then the focus is on how it changes. In this view, style is seen as dynamic and not fixed forever. Finally, cognitive style can be viewed as both process and structure. This means it may be relatively stable, but at the same time always on the move. In this view, style structure is continually adapted as new events influence it. Most definitions of cognitive style suggest that it is pervasive and necessarily consistent across areas of cognitive functioning. Hayes and Allinson (1998), however, recognize the possibility that cognitive style may be malleable, especially over the longer term. Leonard and Straus (1997) also recognize that cognitive styles are not rigid and can be influenced by life experiences. “We often stretch outside the borders of our preferred operating modes if the conditions are right and the stakes are high enough” (Leonard & Straus, 1997, p. 112). On the other hand, they also refer to studies that found out that cognitive styles tend to be relatively stable. Research suggests that “people retain their dominant preferences throughout a variety of work and social circumstances” (Leonard & Straus, 1997, p. 121). A solution for this apparent contradicting findings is the distinction that is made between style and strategy or coping behavior (Hayes & Allinson, 1994; Kirton, 1989; Riding & Cheema, 1991; Sadler-Smith & Badger, 1998). A style is referred to as a fairly fixed characteristic of an individual, while strategies are considered as ways that may be used to cope with situations and tasks. Strategies can change from time to time and may be learned and developed, while styles are more static and are relatively in-built features of the individual. “While styles may produce consistent behavior across a variety of situations over the short and medium term, strategies are much more specific and essentially represent the result of the conscious decisions an individual makes to cope with immediate cognitive tasks” (Hayes & Allinson, 1998, p. 853). Hayes and Allinson (1994) suggest that cognitive styles may not be easily modified through training or experience, whereas strategies have a rather inherent malleability. Witkin (1976) also suggests that many of the behaviors stemming from cognitive styles might be more malleable, while cognitive style may be stable over time. According to Sadler-Smith and Badger (1998) a style can be considered as largely a function of the individual (and more specifically the personality), whereas a strategy rather is a function of the interaction of the individual and the situation. Kogan (1980) and Robertson (1985) also suggest that cognitive styles produce consistent behaviors across varying situations, while strategies are more specific and represent the conscious decisions people make in coping with cognitive tasks. Both concepts might be confused in research which leads to seemingly contrasting conclusions concerning the

malleability versus stability of cognitive style. Cognitive style, the concept of interest in this article, tends according to us towards stability across time and situations (e.g., Goldstein & Blackman, 1978; Messick et al., 1976) and consequently remain largely unresponsive to specific training (Kagan & Kogan, 1970).

PLURALISM IN THE FIELD OF COGNITIVE STYLES

Although there is the belief that cognitive styles are very useful for individuals and organizations, the literature on cognitive styles is very large and often confusing (Hayes & Allinson, 1994) which undermines its practical relevance. Our attempt to demarcate and define cognitive styles in the previous section reveals clearly that cognitive styles are not easy to conceptually or operationally define (Hayes & Allinson, 1994; Leonard et al., 1999; Riding & Cheema, 1991). “A proliferation of models, terms, and meaning in the field of learning style seems to increase with each period of new interest and research activity” (Rayner & Riding, 1997, p. 21). Cognitive styles have been studied from various points of view. Different authors worked in their own contexts, in isolation from one another, developing their own assessment instruments and giving their own labels to the style they were studying with little reference to the work of others (Shipman & Shipman, 1985). As a result, different theorists have been working with different concepts and have referred to them as cognitive/learning style. Not surprisingly, this led to the development of a large variety of style dimensions (Riding & Cheema, 1991). Kogan (1980) states that it had become clear that, with the proliferation of cognitive style research, the research field contains constructs that differ considerably. On the other hand, there is also evidence that some constructs are quite similar. Lewis (1976) remarked that: “Different groups of researchers seem determined to pursue their own pet distinctions in cheerful disregard of one another... There is the impulsive versus reflective dimension, which seems to indicate something about the tempo of learning. There is the field dependent versus field independent distinction, the serialist and the holist, and a lot more...” (p. 304-305). According to Hayes and Allinson (1994) “this wide array of cognitive style dimensions and the proliferation of empirical studies using different measures of cognitive style have resulted in a complex and confusing field of study” (p. 56).

Accordingly, several authors attempt to create order in this diverse field by integration of different theories (Grigorenko & Sternberg, 1995; Hayes & Allinson, 1994; Miller, 1991;

Rayner & Riding, 1997; Sadler-Smith & Badger, 1998). Jones (1997) states: “In spite of what some may have appraised as a dying area, there have been some energetic attempts to integrate conceptually the vast body of empirical research from a number of different theoretical perspectives” (p. 66).

A frequently used categorization is the distinction of three different approaches towards cognitive styles according to their focus of study (Grigorenko & Sternberg, 1995; Rayner & Riding, 1997). The cognition-centred approach is doing research on cognitive processes and on the relation between cognition and style (e.g., the research of Allinson and Hayes (1996), Kirton (1976), and Riding and Cheema (1991)). Research within the cognition-centred approach focuses particularly on cognitive and perceptual functioning, which resulted in the development and definition of several abilities, styles, and dimensions of cognitive processing. The origin of this approach, and particularly of the interest in styles, lies within the disappointment of cognitive psychologists with the traditional psychometric research on abilities and intelligence which failed to uncover the processes generating individual differences (Grigorenko & Sternberg, 1995). Secondly, the personality-centred approach is investigating style in relation to other personality characteristics. Researchers in this approach focus on personality styles related to cognition. Styles are not seen as personality traits but as “deep-seated individual differences exercising a wide, but somewhat loose control over the domains of cognitive function, interest, values, and personality development” (Ross, 1962, p. 76). The most famous example of this approach is the Myers-Briggs theory of psychological types (Briggs-Myers, 1990). Finally, the activity-centred approach focuses on style in relation to various activities, settings, and environments. The first activity-centred theories of styles were developed in the early 1970s when the style concept became popular among educators. They searched for psychological instruments to deal with individual differences within schools and classrooms. An example here are theories on learning and teaching styles (e.g., Entwistle, 1981; Kolb, 1984; Schmeck, 1988). For a more extensive overview of the origins, advantages, and limitations of each of these approaches, we refer to the work of Grigorenko and Sternberg (1995). Sternberg (1988) proposes a theory of mental self-government that integrates the cognition-centred, personality-centred, and activity-centred approach. His theory addresses the question of how intelligence is organized, which leads to 13 thinking styles or stylistic ways of approaching the world. Because the focus of our research lies within the cognition-centred approach, we do not elaborate further on his theory.

Another categorization to integrate the field of cognitive styles is the one of Hayes and Allinson (1994). They distinguish three approaches to the classification of cognitive style. The first approach of classification suggests that there is a superordinate structure which offers an analytical-holistic categorization of styles (e.g., Allinson & Hayes, 1996; Entwistle, 1981; Miller, 1987). Some theories using this approach are connecting this dimension with neurological and brain activity and link it to differences in hemispheric functioning (e.g., Allinson & Hayes, 1996; Entwistle, 1981). The second approach relates cognitive style to processes. In addition to using a vertical classification of styles (first approach), Miller (1987) also proposes a horizontal classification according to the major cognitive processes of perception, memory, and thought. For instance, cognitive style constructs such as field dependence-field independence are according to Miller (1987) primarily concerned with patterns of recognition and selective attention, while other constructs such as cognitive complexity-simplicity primarily reflect different ways in which knowledge is structured in memory. The third approach focuses on the earlier mentioned distinction between style and ability (e.g., Messick, 1984). According to Hayes and Allinson (1994), these classifications are very useful to identify possible aspects that undermine the utility of a theory of cognitive style because the measures used to operationalize it are measures of level (ability) rather than style. Our research fits into the first mentioned approach of Hayes and Allinson (1994).

MEASURING COGNITIVE STYLES

As mentioned before, the large and increasing interest in cognitive styles led to the origin of a lot of theories. To empirically study and identify differences in cognitive styles many diagnostic tools and questionnaires have been developed. According to Riding and Cheema (1991) measures of cognitive styles can be situated between aptitude measures and personality measures. As a consequence, “their status has been unclear and this lack of clarity has meant that regular attempts to distinguish them from aptitude and personality measures have been made (Kagan & Kogan, 1970; Kogan, 1980), successfully or unsuccessfully” (Riding & Cheema, 1991, p. 194). There are problems with some existing questionnaires that measure cognitive style, such as matters of validity, reliability, administration (e.g., the time needed to complete the questionnaire, and the need for trained raters), and interpretation (Allinson & Hayes, 1996; Streufert & Nogami, 1989). Allinson and Hayes (1996) raise the issue that there seems to be

little or no published independent evaluation of several self-reporting instruments developed as management training tools. This applies, for instance, to the Cognitive Style Instrument (Whetten & Cameron, 1984), the BrainMap measure (Brain Technologies Corporation, 1989), the Herrmann Brain Dominance Instrument (Herrmann, 1994), and the Benziger Thinking Styles Assessment (Benziger & Sohn, 1993). A number of questionnaires also have been criticized on psychometric grounds—for example, Kolb’s Learning Style Inventory (Kolb, 1976), Kirton’s Adaption Innovation Inventory (Kirton, 1976), and McCarthy’s Hemispheric Mode Indicator (McCarthy, 1993). Several authors state that the successive versions of the Learning Style Inventory (Kolb, 1976) have only moderate internal reliability and temporal stability (e.g., Atkinson, 1988; Freedman & Stumpf, 1978). Leonard et al. (1999) state that evidence of the reliability and validity of the Learning Style Inventory has been mixed. Taylor (1989) questions the orthogonality of subscales of Kirton’s Adaption Innovation Inventory (Kirton, 1976). Hartman, Hylton, and Sanders (1997) state that information on the reliability and validity of the Hemispheric Mode Indicator (McCarthy, 1993) is limited.

Moreover, there is a lack of established measures of cognitive style that can be applied in large-scale organizational studies (Allinson & Hayes, 1996). As an example of the common problems with measures of cognitive styles, we take the field dependence-independence construct, which is among the most widely studied constructs of the range of style dimensions appearing in the literature. Measures of field dependence are impractical for use in organizations—for example, the Rod and Frame Test of Oltman (1968) or the Embedded Figures Test of Witkin, Oltman, Raskin, and Karp (1971). In addition, Streufert and Nogami (1989) summarize work that questions the validity and reliability of the Embedded Figures Test. Some measures of other dimensions, besides the field dependence-field independence construct, are just as inconvenient for use in organizations—for example, methods to assess impulsiveness versus reflection, or cognitive simplicity versus complexity. They are typically time consuming and expensive, and require trained raters to code and score the written text of the subjects. The same can be said of methods inferring style from physiological state, and methods based on the direct observation of behavior.

COGNITIVE STYLE INVENTORY

Theoretical background of the Cognitive Style Inventory

Cognitive style has been studied from various points of view. Different authors developed their own instruments of assessment, providing unique labels to the cognitive style under investigation. Messick (1984) distinguished 19 separate labels in his review of the literature. More recently, Hayes and Allinson (1994) have extended the list to 29. Several authors, however, are suggesting that the various cognitive styles are different conceptions of the same dimension (Riding, 1997). Miller (1987, 1991), who confirms this, 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” (p. 201). “Many observers have since noted that the degree to which behavior is global or differentiated and analytic, is a key ingredient in psychological development and in differences between individuals” (Jones, 1997, p. 67). According to Miller (1991) the most suitable cognitive style dimension almost selects itself and he refers to Brand (1984) who notes: “A serious possibility is that there are omnipresent differences between people in whether they attend narrowly to (self-)selected aspects of reality or whether they are more broadly attentive” (Brand, 1984, p. 195). This distinction between cognitive narrowness and broadness is not new. It recurred over the centuries and also continues to play a major role in the way that cognitive differences are depicted in the current research (Coan, 1979). In sum, two qualitatively different cognitive styles are common among many studies. The first cognitive style is commonly described as analytic, 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). We call this central dimension analytic-holistic, but other conceptualisations also exist to refer to the same dimension (e.g., analytic-nonanalytic (Kemler-Nelson, 1984), analysis-intuition (Allinson & Hayes, 1996), analytic-wholistic (Riding & Cheema, 1991)).

Like other authors (e.g., Grigorenko & Sternberg, 1995; Hayes & Allinson, 1994; Miller, 1991; Rayner & Riding, 1997; Riding & Cheema, 1991; Sadler-Smith & Badger, 1998), we can put different theories that were used as a basis for our dimension analytic-holistic in a table (Table 1). For a more extensive elaboration of these theories and other initial theories on

cognitive styles, we refer to their works. There is a considerable agreement between the different researchers who attempt to categorize different cognitive style theories according to one central dimension (Hayes & Allinson, 1994; Sadler-Smith & Badger, 1998).

Insert Table 1 About Here

On the base of a literature review, we describe the two poles of the dimension we call analytic-holistic (Table 2). Integrating different theories in the description of this dimension fits in the appeal of Lewis (1976), who states the following: “In my opinion, the right thing to do is to focus ... on the search for individual differences which are basic, in the sense that they underlie (and to that extent, explain), a whole range of more readily observable differences” (p. 305).

Insert Table 2 About Here

As noted already, some theories connect this dimension with neurological and brain activity and link it to differences in hemispheric functioning (‘hemispheric preference’ theory) (Allinson & Hayes, 1996; Hayes & Allinson, 1994), although this is also widely criticized (see further). According to Leonard and Straus (1997), the distinction between left-brained and right-brained ways of thinking is the most widely recognised cognitive distinction. The basic assumption is that left and right hemispheres have different cognitive functions while processing information (Prevedi & Carli, 1987; Riding, Glass, & Douglas, 1993). Left-brained thinking reflects analytic processing, while right-brained thinking reflects holistic processing (Beyler & Schmeck, 1992). The left hemisphere involves rational, convergent, realistic, objective, and critical thinking. The right hemisphere involves holistic, synthetic, intuitive, analogical, divergent, and creative thinking. The left hemisphere has an analytic, logical, linear, and sequential approach to problem framing and solving, while the right hemisphere uses an intuitive, value-based, and non-linear approach (Al-Sabaty & Davis, 1989; Entwistle, 1981; Leonard & Straus, 1997; Prevedi & Carli, 1987).

Although the 'hemispheric preference' theory has been criticized (e.g., Hines, 1987; Levy, 1985), there is evidence for the validity of the theoretical constructs underlying this dimension (Beyler & Schmeck, 1992). Hartman et al. (1997), for instance, agree that people can be characterized informatively as analytic or holistic according to the strengths of their skills in those areas. However, the extent to which identifiable clusters of such traits in individuals are a consequence of hemispheric lateralization is, according to these studies, a separate question. As stated by Leonard and Straus (1997) the categorization in left- and right-brained thinking is more powerful metaphorically than it is accurate physiologically. Not all assumed left-brained functions are actually located on the left, and the same is true for assumed right-brained functions. In Hines's (1987) view, the brain is a very complex organ, and it is wrong to think of any higher cognitive function as being localized in any one area. However, evidence is found for the two radically different ways of thinking (Entwistle, 1981; Hayes & Allinson, 1994; Miller, 1987, 1991).

Some authors do not identify one central dimension of cognitive style ('unidimensional' models), but investigate several dimensions ('multidimensional' models). The earlier mentioned theory of mental self-government (Sternberg, 1988), for instance, contains 13 different cognitive styles. Taggart and Valenzi (1990) developed a human information processing metaphor, which includes six information-processing modes. After reviewing of the literature on cognitive styles, Riding and Cheema (1991) concluded that the various existing models of cognitive style can be grouped into two basic dimensions. The 'analytic-wholist' dimension describes the habitual way in which an individual processes information: some individuals process information into its component parts ('analytics'), while others retain a global or overall view of information ('wholists'). The second dimension, the 'verbal-imagery', concerns an individual's preferred mode of representing information: whether he or she is inclined to represent information during thinking verbally ('verbalizers') or in mental pictures ('imagers'). Riding (1997) found further support for this model.

Rowe and Mason (1987) also developed a model of cognitive styles. They identified two dimensions: cognitive complexity and individual values. Cognitive complexity deals with the issue of tolerance for ambiguity: individuals have a high or a low tolerance for ambiguity (i.e., a low or a high need for structure). Values refer to human and social concerns or to task and technical concerns. These two dimensions are combined to produce four cognitive styles (i.e., the directive style, the analytic style, the behavioral style, and the conceptual style). Directive individuals have a low tolerance for ambiguity and are oriented to tasks and technical concerns.

They have a strong need for structure and tend to consider facts, rules, and procedures in their decision-making process. Analytic individuals have a high tolerance for ambiguity and are oriented to task and technical concerns. They are very logical, consider every aspect of a given problem, and acquire information by careful analysis and the collection of large amounts of data. Behavioral individuals have a low tolerance for ambiguity and a concern for people and their needs. These individuals focus on people and social aspects of the work situations and consider the feelings and the well-being of other. Conceptual individuals are characterized by a high tolerance for ambiguity and are oriented to people and social concerns. They tend to enjoy exploring new options, forming new strategies, being creative, and taking risks. Rowe and Boulgarides (1992) further elaborated the model.

Herrmann's (1994) 'brain dominance theory' also distinguished two dimensions of cognitive style. The left-brain/right-brain theory ('hemispheric preference' theory) reflects the first dimension of his model on cognitive styles. A second dimension is deduced from MacLean's (1955, 1958) 'triune brain theory'. In this theory, the cerebral cortex responds to information in the external world, and seeks novelty. The cerebral cortex employs cognitive programming, which is easily subject to change: we learn new facts, we perceive, generate and modify information. By contrast, the limbic system is the seat of the emotions, and is a powerful force with respect to interpersonal relationships and sexuality. It is the seat of our sense of family, our feeling of connectedness with others (Gorovitz, 1982; Springer, 1981; Taggart & Valenzi, 1990). A combination of both dimensions results in four separate and distinct quadrants (i.e., cerebral left, cerebral right, limbic left, and limbic right). On the cerebral cortex level, the left hemisphere is the seat of logic and verbal language. It is concerned with reading, writing, organization, and time relationships. The left hemisphere is always checking for correctness and is good at performing logical, analytical, and mathematical tasks (in which linear and sequential processing are involved). The right hemisphere is the seat of space relationships, holistic thinking, creativity, and imaging. The right hemisphere is better at non-verbal ideation, intuition, synthesizing activities and tasks (especially those involving spatial, visual, and simultaneous processing) (Gorovitz, 1982; Herrmann, 1994; Springer, 1981). On the level of the limbic system, the left limbic influences our planning and organizing activities, and the degree of structure and control that emanates from the left side of the brains. The right limbic on the other hand is the source of emotional activity. The appropriateness of the emotional response can also be influenced by the left limbic system (Gorovitz, 1982; Herrmann, 1994; Springer, 1981).

Traditionally, the research on cognitive styles focuses mainly on the analytic-holistic dimension. It can be concluded from the work of Riding and Cheema (1991), Rowe and Mason (1987), and Herrmann (1994) that a second dimension can be identified in the field of cognitive styles. Leonard et al. (1999) also concluded from their study on the interrelationship among four measures of cognitive styles that cognitive style is a complex variable with multiple dimensions. We describe this second dimension as conceptual versus experiential thinking, a conceptualization we also find in the work of Leonard and Straus (1997). We now focus on the Cognitive Style Inventory (CoSI).

Cognitive Style Inventory

Although several authors identified two dimensions of cognitive style and created their own measurement instruments, we developed the Cognitive Style Inventory (CoSI) for several reasons. Herrmann (1994) created the Herrmann Brain Dominance Instrument (HBDI), but there is a lack of independent validation of this instrument (Allinson & Hayes, 1996; Hines, 1987). The Herrmann Brain Dominance Instrument contains 120 items which is rather long to be used in an organizational context. Moreover, administrating the HBDI requires a trained rater for scoring and interpreting the results. Riding (1991) developed the Cognitive Styles Analysis (CSA) to measure his model of cognitive styles. According to Sadler-Smith and Badger (1998), the relevance to workplace behaviors of the verbal-imagery style dimension of Riding and Cheema (1991) is unclear. Rowe and Mason (1987) developed the Decision Style Inventory (DSI) to measure their cognitive styles model. We did not use their instrument because of the different way in which the central dimensions are defined in that inventory.

The metaphorical concept underlying the Cognitive Style Inventory (CoSI) consists of two fundamental cognitive style dimensions: analytic versus holistic thinking, and conceptual versus experiential thinking (Leonard & Straus, 1997). According to the first dimension, an individual can be either an analytic thinker (rational, logical, critical, tending to retain facts and details) or a holistic thinker (intuitive, synthetic, creative, open to experience, able to integrate several simultaneous inputs). The second dimension differentiates between conceptual thinkers, who like to think on a more abstract and conceptual level, and experiential thinkers, who like to think on a more pragmatic and experiential level. Combining these two dimensions yields four cognitive styles: the knowing style, the planning style, the creating style, and the cooperating style. These four styles build up the framework of the CoSI.

Individuals who utilize analytic and conceptual thinking (knowing style) look for facts and data. They want to know exactly how 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. Individuals who utilize analytical and experiential thinking (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 to reach their objectives. They tend to be risk averse. They strongly want other people to respect rules and agreements. The creating style, by contrast, is characterized by holistic and conceptual thinking. Individuals who utilize this style tend to be creative and to like experimentation. They see problems as opportunities and challenges. They do not like rules and procedures. They like uncertainty and freedom. They prefer to think on a conceptual level and are less interested in the practical implementation of ideas. They are ambitious and achievement oriented. Individuals who utilize holistic and experiential thinking (cooperating style) attach great importance to communication and interpersonal relations. They prefer to think on a pragmatic and experiential level. They take people into account whenever they make decisions. They assemble information by sensing, listening, and interacting with others. They like teamwork and they attach great importance to team spirit and good cooperation.

We are currently in the final stage of validating and cross-validating the Cognitive Style Inventory. Several successive studies were conducted to develop and further refine the self-report questionnaire. The final version of the Cognitive Style Inventory contains 27 questions, measured on 5-point Likert scales.

CONCLUSION

In this article, we attempted to provide a clear and concise overview of the field of cognitive style research on the one hand and to present the theoretical model underlying the self-report questionnaire Cognitive Style Inventory (CoSI) on the other hand. We can conclude that the field of cognitive style research is very large and extensive. This theoretical and empirical diversity can be seen as an enrichment on the one hand, but leads to confusion on the other hand. Nevertheless, the cognitive style concept really has a potential for use in organizations. Allinson and Hayes (1996) also state that there can be no doubt concerning the potential value of cognitive style in the study of organizational behavior and the understanding

of management problems. Cognitive style surely can be an additional concept to explain and understand individual differences in the workplace. To increase the practical relevance of cognitive styles, some further work needs to be done. Riding (2000) also states that “cognitive style research offers a number of interesting challenges and has reached the stage where it requires a focus on specific issues to carry it forward” (p. 8). He formulates some inter-related critical issues that are necessary for the further successful development of the notion of cognitive style. This article can be seen as an attempt to meet two of these requirements. Firstly, Riding (2000) calls for reducing “the number of style labels by collapsing them into similar groups to identify the fundamental dimensions” (p. 8). He refers to the desirability for future cognitive style research to recognize and confirm the fundamental cognitive style dimensions within the large and extensive body of style labels that exists. In this way, a framework and clear foundation will be provided for subsequent research. Our model with two dimensions and four cognitive styles attempts to provide a clear foundation for further research. Secondly, Riding (2000) calls for the “development of simple valid direct measures of assessing style suitable for world-wide use. There is the need to critically consider the issues in the valid assessment of style and the rejection of doubtful methods” (p. 8). Given the usefulness of cognitive styles for organizations and the shortage of valid questionnaires for use in organizations, we worked on the development of the Cognitive Style Inventory (CoSI). Several scholars integrate the field of cognitive styles into one central analytic-holistic dimension. Our research, however, also identified a second useful dimension to distinguish between different cognitive styles. However, further research to validate our model and questionnaire is necessary.

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TABLE 1**Theories underlying the analytic-holistic dimension**

Analytic	Holistic	Source
Analysis	Intuition	(Allinson & Hayes, 1996)
Analytic	Holistic	(Miller, 1987)
Adaptor	Innovator	(Kirton, 1976)
Assimilator	Explorer	(Kaufmann, 1979)
Analytic	Wholist	(Riding & Cheema, 1991)
Field independence	Field dependence	(Witkin, 1962)
Reflection	Impulsivity	(Kagan, 1965)
Serialist	Holist	(Pask, 1976)
Sharpener	Leveller	(Holzman & Klein, 1954)
Converger	Diverger	(Hudson, 1966)
Left-brain	Right-brain	(Entwistle, 1981)

TABLE 2**Description of the analytic – holistic dimension**

Analytic side	Holistic side
Convergence ⁶	Divergence ⁶
Sequential, structured ^{1,4,6}	More randomly, less orderly ^{1,4}
Facts, details ^{1,2,5}	Possibilities, meanings, ideas ⁵
More interested in parts than in wholes ⁶	More interested in the whole than in the component parts ⁶
Logical ⁴ , reflective ^{1,6}	Intuitive ⁴ , impulsive ⁶ , active ¹
Conservative ² , conventional, conformity ³	Openness to experience ¹ , taking risks ² , subversive ³
Planned, organised, systematic ^{1,2,5}	Flexible, spontaneous, open-ended ^{1,2,5}
Utility ⁵	Novelty ^{3,5}
Objective, impersonal ^{2,5}	Subjective, (inter)personal, expressive ^{2,5}
Rational, intellectual ^{2,5}	Emotional, sensitive ^{2,5}
Verbal ^{1,2,6}	Visual ^{1,2,6}
Precision, methodicalness ⁵	Inventive, creative ⁵
Routine ^{1,3,5}	Variety ⁵

Note. 1 = (Allinson & Hayes, 1996) 2 = (Herrmann, 1994) 3 = (Kirton, 1976)

4 = (Miller, 1987) 5 = (Briggs-Myers, 1990) 6 = (Riding & Cheema, 1991)