

THE COGNITIVE STYLE INDEX: A MEASURE OF INTUITION- ANALYSIS FOR ORGANIZATIONAL RESEARCH

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ABSTRACT

Almost 1000 adults participated in the development of the Cognitive Style Index (CSI), a new measure designed specifically for use with managerial and professional groups. The objectives of the study were, first, to produce a psychometrically sound instrument suitable for application in large-scale organizational studies, and second, through its development, to confirm empirically the generic intuition-analysis dimension of cognitive style. Findings suggest that each objective was largely fulfilled. At a time when there is a burgeoning interest in intuition as a basis for decision making and problem solving in organizations, the CSI would appear to be a notable addition to the small collection of measures appropriate for survey research.

INTRODUCTION

During the past decade, there has been an increasing interest in cognitive style among management researchers and practitioners. A major problem, however, has been the shortage of valid and reliable measures convenient for use in organizational settings. This paper reports the development and validation of the Cognitive Style Index, a new self-report questionnaire specifically designed to meet this need.

Cognitive style has been defined as 'consistent individual differences in preferred ways of organizing and processing information and experience' (Messick, 1976, p. 5). Its relevance to organizational behaviour is clear. As Schweiger (1983, p. 143) points out:

If research indicates ... that particular cognitive styles are more appropriate than others for the conduct of particular managerial activities, then normative recommendations concerning the selection and placement of individuals for these activities may be warranted. In addition, if it is found that cognitive styles are subject to modification, then the development of training programs in the industrial setting, or modifications of current business school curricula in the academic setting, may be critical.

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Findings so far have been encouraging. Hayes and Allinson (1994) cite evidence of the value of cognitive style in relation to personnel selection, careers guidance, task design, team composition, conflict management and training and development. Others have demonstrated the appropriateness of certain styles for particular management tasks. Mintzberg (1976), for example, claims that planning and management science, with their emphasis on logic and articulation, require a rational cognitive style whereas management at the policy level, which involves coping with ambiguity and complexity, requires a more intuitive approach.

Measurement

The main problem with many established measures of cognitive style is that they are too cumbersome to be applied in large-scale organizational studies. This is especially true of methods for assessing field dependence–field independence, the most heavily researched of the wide range of style dimensions appearing in the literature. The Body-adjustment Test (Witkin et al., 1962) examines orientation towards environment or field by having subjects sit in a chair suspended within a specially constructed room and adjust themselves into an upright position. The Rod and Frame Test (Oltman, 1968) measures the influence of context by seating subjects in darkness and requiring them to place a luminous rod vertically within a tilted luminous frame. Even a paper and pencil inventory, the Embedded Figures Test (EFT) (Witkin et al., 1971), is awkward to administer, with subjects being assessed according to time taken to identify figures ‘embedded’ within a series of backgrounds.

Measures of other important dimensions are just as inconvenient to use. The Matching Familiar Figures Test (Kagan et al., 1964), the commonest method of assessing impulsivity–reflection, also entails timing of response, in this case to the task of matching a standard figure with one of a number of variants. The Schematising Test (Gardner et al., 1959), the main measure of levelling–sharpening, involves subjects becoming dark-adapted before judging the size of squares of light of increasing magnitude. The content analysis method used to assess integrative complexity (Tetlock and Suedfeld, 1988) and the Paragraph Completion Test (Schroder et al., 1967), the primary measure of cognitive simplicity–complexity, both require trained raters to code and score subjects’ written text. Simulation techniques for the assessment of metacomplexity (Suedfeld et al., 1992) require six to eight hours of task participation for each subject. Other classes of measure, such as those inferring style from physiological state (e.g. electroencephalograms) and those based on observation of behaviour are equally time-consuming and expensive to apply.

Among the more straightforward questionnaire measures, a number have been criticized on psychometric grounds. For example, Schweiger (1983) claims that Keen’s (1973) test lacks construct validity in that it appears to assess cognitive ability rather than style; Widiger et al. (1980) level the same criticism at the Group Embedded Figures Test (Oltman et al., 1971), an adaptation of the original EFT for administration to a number of subjects at once; Freedman and Stumpf (1978) and Atkinson (1988) point to the moderate internal reliability and temporal stability of successive versions of Kolb’s Learning Style Inventory (Kolb, 1976; Smith and Kolb, 1986); and Taylor (1989) and Payne (1987) query,

respectively, the orthogonality of subscales and overall homogeneity of the Kirton Adaption-Innovation Inventory (Kirton, 1976) although the latter criticism has been rebutted by Kirton himself (Kirton, 1987). In addition, there appears to have been little or no published independent evaluation of several self-report measures developed as management training tools. These include the Cognitive Style Instrument (Whetten and Cameron, 1984), the BrainMap measure (Brain Technologies Corporation, 1985), Herrmann's Brain Dominance Instrument (Herrmann, 1988) and the Benziger Thinking Styles Assessment (Benziger and Sohn, 1993). Of the remainder, the Myers-Briggs Type Indicator (MBTI) (Myers, 1962), though applied extensively in clinical and small sample studies, is of questionable utility in organizational surveys owing to its length (between 94 and 166 items depending on which form is used) and the time taken to administer it.

This leaves only a few other measures which might be considered for application in large-scale organizational studies. Two of them have been developed by Taggart and his associates. First, the Human Information Processing (HIP) Survey (Taggart and Torrance, 1984) assesses preferences in rational-intuitive terms and locates individuals within a four-fold typology of information processing. Second, the Personal Style Inventory (PSI) (Taggart, 1993) differentiates respondents on six scales arranged in a spectrum from the most rational (analysis, planning and control) to the most intuitive (sharing, vision and insight). Selected questions from the HIP Survey and 12 items from the MBTI form the basis of the measure of intuitive potential used in Agor's (1984) AIM Survey, an investigation into the cognitive style preferences of over 3000 American managers. Another questionnaire specifically designed for a large organizational study is that used by Parikh et al. (1994) in their survey of 1300 upper managers in nine industrialized countries. Like Taggart's measures, this assesses respondents' orientation on a rational-intuitive scale. Finally, two potentially useful instruments have been developed by British researchers. Riding's (1991) Cognitive Style Analysis is a computer-presented test designed to measure two fundamental dimensions of cognitive style: wholist-analytic and verbal-imagery. And Furnham et al.'s (1992) Occupational Attributional Style Questionnaire assesses how a person makes causal attribution for outcomes in the work context.

Although an important step forward in the assessment of cognitive style would be further validation of the most promising measures already available, the paucity of instruments suitable for use in large sample surveys suggests the need for a variety of additional tools if the construct is to be adequately researched in organizational settings. The principal objective of the present study, therefore, was to develop a new measure which is psychometrically sound and convenient to administer. This was ultimately titled the Cognitive Style Index (CSI), and, to meet the authors' own research needs, was designed specifically for use with managers and professionals.

Complex or Unitary?

As noted above, there is a considerable array of dimensions on which cognitive style has been differentiated. A decade ago, Messick (1984) distinguished 19 separate labels in his review of the literature. More recently, Hayes and Allinson (1994) have extended the list to 29. Although it is argued by many (e.g. Globerson and Zelniker, 1989; Streufert and Nogami, 1989) that this reflects the sheer

complexity of cognition, others claim that the various styles identified are simply different conceptions of the same dimension, the extremes of which confirm 'the dual nature of human consciousness' (Robey and Taggart, 1981, p.375). The suggestion, according to Miller (1987), is that most cognitive styles are 'subordinate to, and reflect, a broad superordinate stylistic difference' (p.253), which represents a long-established distinction between contrasting modes of thought. Nickerson et al. (1985) observe that:

... the view that there are two qualitatively different types of thinking is widely shared. Among the terms used to describe one type are analytic, deductive, rigorous, constrained, convergent, formal and critical. Representative of the terms used to describe the other type are synthetic, inductive, expansive, unconstrained, divergent, informal, diffuse and creative. No doubt the partitioning of thinking into two types involves something of an oversimplification but possibly a useful one. (Nickerson et al., 1985, p.50)

Entwhistle (1981) proposes a possible connection between this universal dimension and the areas of neurological activity associated with the two halves of the human brain. Although the cerebral hemispheres have the potential to perform many functions, each tends to specialize (Doktor, 1978; Ornstein, 1977). The right hemisphere emphasizes synthesis and the simultaneous integration of many inputs at once, and is mainly responsible for spatial orientation and the comprehension of iconic visual images. The left hemisphere emphasizes a primarily linear mode of operation with information being processed sequentially, and is mainly responsible for logical thought, especially in verbal and mathematical functions.

The terms used to describe right brain and left brain thinking in the present study are 'intuition' and 'analysis', expressions favoured by a number of previous investigators (e.g. Agor, 1986; Hammond et al., 1987). Intuition, characteristic of the right brain orientation, refers to immediate judgement based on feeling and the adoption of a global perspective. Analysis, characteristic of the left brain orientation, refers to judgement based on mental reasoning and a focus on detail. These right-left patterns are not merely transient; people seem to have a rather permanent stylistic orientation to the use of one hemisphere. Intuitivists (right-brain dominant) tend to be relatively nonconformist, prefer an open-ended approach to problem solving, rely on random methods of exploration, remember spatial images most easily, and work best with ideas requiring overall assessment. Analysts (left-brain dominant) tend to be more compliant, favour a structured approach to problem solving, depend on systematic methods of investigation, recall verbal material most readily and are especially comfortable with ideas requiring step by step analysis.

Several authors, such as Kagan and Kogan (1970), Wilson (1988) and Miller (1991), have attempted an intuitive-analytical or right brain-left brain categorization of the styles most frequently encountered in the literature. It is argued that these are all essentially components or facets of the hypothesized superordinate structure. Many of them appear to overlap, and some may even be synonymous with each other.

This generic dimension of cognition has traditionally been conceptualized as a

dichotomy in human thinking. Many modern theorists, however, emphasize that it is, in fact, a continuum along which all degrees of style are possible. Hammond et al. (1987), for example, recognize a compromise form of cognitive style called quasi-rationality or 'common sense', which includes properties of both poles of the intuition-analysis dimension; Letteri (1980), in his studies of learning effectiveness, identified Type 2 learners whose cognitive style was somewhere between the extremes of analytic (Type 1) and global (Type 3); and Simon (1989), in his analysis of managerial decision-making, claims that rather than find two types of managers, one relying on intuition, the other on analysis, we are more likely to discover a continuum of decision-making styles involving an intimate combination of both kinds of skill.

Against this background, another important objective of the present study was to discover, through the development of the CSI, if the multiplicity of styles highlighted in the literature could be reduced to the hypothesized unitary dimension.

METHOD

A self-report format was adopted for the CSI. Four or five statements were written for each of the dimensions identified by Hayes and Allinson (1994) resulting in 129 items in all. A trichotomous true-uncertain-false response mode was adopted throughout. This provided a central category for subjects who wished to indicate genuine uncertainty on the grounds that the extreme categories did not apply consistently. It also overcame the problem associated with Likert scales of five or more points that some subjects tend toward the extremes while others habitually avoid them (Kline, 1993).

For item analysis, the full pool was administered to 66 managers in a large construction company (all men)^[1] and 225 undergraduate management students at a provincial university (145 men and 80 women). For subsequent validation studies, the final form was also completed by 226 managers and supervisors in a national brewing company (121 men and 105 women), 74 teachers from various primary schools (15 men and 59 women), 202 undergraduate business and economics students at the same university as the management students (134 men and 68 women), 130 miscellaneous managers from a range of organizations (89 men and 41 women) and 22 professionals participating in a human relations training workshop (9 men and 13 women). The inclusion of student samples as surrogates for work-based populations was considered justified because, in psychometric analysis, it is the *relationship* between items rather than the *level* of mean scores which is important.

In the item analysis, a score of 2 was assigned for a response of true, 1 for uncertain and 0 for false. Item selection criteria were *p* values (the proportions of subjects choosing particular responses) and item-total correlations (the correlation of each item score with the aggregate score of the remainder). Items were retained which, for *both* the construction managers and management students, had *p* values, at either scale extremity, no greater than .7 and no less than .3 (a criterion of discriminative ability), and item-total correlations of at least .3 (a criterion of test homogeneity).

RESULTS

Item Analysis

Thirty-eight items, deriving from 18 of the dimensions yielded by the literature search, survived the item analysis to form the final version of the CSI.^[2] Examples are:

'Formal plans are more of a hindrance than a help in my work'

'I am most effective when my work involves a clear sequence of tasks to be performed'

'My philosophy is that it is better to be safe than risk being sorry'

'I am inclined to scan through reports rather than read them in detail'

Twenty-one of the items were worded in such a way that a response of 'true' indicated an analysis orientation. The scoring of the remaining 17 was reversed, therefore, so that the nearer the total CSI score to the theoretical maximum of 76, the more analytical the respondent, and the nearer the total score to the theoretical minimum of zero, the more intuitive the respondent. Items were placed in random order on the final form.

Factor Analysis

If the CSI really does measure the superordinate dimension of cognitive style, its internal structure should be unifactorial. Demonstrating this through factor analysis of items is, however, difficult. As inter-item correlations tend to be low, often only around .2, with little variance (Kline, 1993), and items as single variables tend to be unstable (Nunnally, 1978), it is unlikely that a clear factor structure will emerge. In order to overcome this problem, Cattell (1973) advocates the factor analysis of groups or 'parcels' of items (four to eight in number) which are, in effect, homogeneous scales. These give a more accurately determined, unique simple structure solution (Cattell, 1974).

Cattell and Burdsal (1975) reject the creation of parcels by inspection of item content as being 'too subjective and depending on possibly half-unconscious and almost certainly insufficiently informed stereotypes of a particular experimenter' (p. 167). In the present study, therefore, the 38 items were divided into six parcels (one of eight items and five of six items) on the basis of inter-item correlations ($p < .05$). These were determined after initial item factoring had given a rough indication of groups of intercorrelating items. Although the parcels were derived initially from the management students sample data, there were significant inter-correlations between constituent items for the other samples too.

Table I shows the results of confirmatory factor analysis (maximum likelihood method). The chi-square values indicate that the hypothesized single factor solution is confirmed for five of the seven samples studied, and that this accounts for over half the variance in each case. Exploratory factor analysis (principal components method) produced a single factor solution for all seven samples.

Descriptive Statistics and Reliability

Table II summarizes descriptive statistics for the CSI, and shows that sample mean scores are generally close to the theoretical mean of 38.5. In addition to reported statistics, indices of skew (ranging from $-.01$ to $-.44$ with a mean of

Table 1. Confirmatory factor analysis of Cognitive Style Index item parcels: loadings on a single factor

<i>Parcel</i>	<i>Construction managers</i> <i>n</i> = 66	<i>Management students</i> <i>n</i> = 225	<i>Brewery managers</i> <i>n</i> = 226	<i>Teachers</i> <i>n</i> = 74	<i>Business and economics students</i> <i>n</i> = 202	<i>Miscellaneous managers</i> <i>n</i> = 130	<i>Workshop participants</i> <i>n</i> = 22
1	.81	.87	.73	.87	.78	.75	.91
2	.72	.83	.69	.76	.78	.78	.75
3	.79	.77	.77	.77	.77	.67	.91
4	.67	.71	.70	.66	.57	.72	.51
5	.80	.71	.60	.73	.52	.60	.84
6	.68	.70	.56	.62	.55	.64	.71
Eigenvalue	3.79	3.94	3.28	3.72	3.22	3.40	4.01
Variance explained	63.2	65.6	54.7	62.1	53.6	56.6	66.9
Chi-square (<i>df</i> = 9)	14.54	9.35	15.34	13.06	21.32*	27.00*	9.33

Notes

*Parcel 1 comprises eight items. All other parcels comprise six items.

**p* < .05 (i.e. reject the null hypothesis that a single factor solution is sufficient).

Table II. Descriptive statistics and internal reliability coefficients for the Cognitive Style Index

<i>Sample</i>	<i>n</i>	<i>Mean</i>	<i>Mode</i>	<i>Median</i>	<i>Standard deviation</i>	<i>Range</i>	<i>Cronbach's alpha</i>
Construction managers	66	38.98	46	40.0	14.21	8-72	.89
Management students	225	40.32	45	41.0	15.18	4-72	.91
Brewery managers	226	43.26	48	44.5	12.13	12-69	.84
Teachers	74	42.54	56	44.0	13.47	13-73	.85
Business and economics students	202	41.64	45	43.0	12.19	8-66	.86
Miscellaneous managers	130	39.48	52	41.0	7.08	5-68	.85
Workshop participants	22	46.67	42	51.0	16.13	12-72	.92

-.24) and kurtosis (ranging from -.22 to -.77 with a mean of -.39) suggest that the inventory measures a continuous variable which is approximately normal in its distribution, an interpretation supported by graphical evidence and Kolmogorov-Smirnov 'goodness of fit' tests. This, and the proximity of means to the theoretical mean, indicate the absence of response bias.

Table II also shows evidence of the internal consistency of the CSI with Cronbach's alpha coefficients ranging from .84 to .92 across the seven samples. In addition, temporal stability is suggested by a test-retest coefficient of .90 ($p < .001$) for a subgroup of the management students ($n = 30$) who completed the questionnaire on a second occasion after an interval of four weeks. Mean scores of 34.60 ($SD = 11.94$) and 35.40 ($SD = 12.10$) indicate no significant change over time ($t_{29} = 0.82$, $p > .05$).

Construct Validity

Evidence of the construct validity of the CSI is provided by support for hypothesized relationships with selected variables. Five instruments were chosen for this purpose: three personality inventories, a measure of learning styles and a test of analytical ability.

Data for the 16 Personality Factor Questionnaire (16PF) Form A (Cattell et al., 1973) were provided by the construction managers. It was predicted that CSI scores (high = analytical) would correlate positively with the expedient-conscientious, forthright-shrewd and undisciplined self-conflict-following self-image primary factors of the 16PF and negatively with the submissive-dominant primary factor and the introversion-extroversion and subduedness-independence second order factors. The validity coefficients shown in table III are consistent with these predictions.

Table III. Construct validity coefficients for the Cognitive Style Index

<i>Variable</i>	<i>Construction managers n = 64</i>	<i>Management students n = 190</i>	<i>Business and economics students n = 62† n = 201††</i>	<i>Workshop participants n = 20</i>
<i>16 PF Questionnaire</i>				
Submissive-dominant	-.34 ^{***}			
Expedient-conscientious	.39 ^{***}			
Forthright-shrewd	.30 ^{**}			
Undisciplined self conflict - following self image	.45 ^{***}			
Introversion-extroversion	-.22 [*]			
Subduedness-independence	-.31 ^{**}			
<i>Learning Styles Questionnaire</i>				
Action		-.81 ^{***}		
Analysis		.33 ^{***}		
<i>Work Environment Preference Schedule</i> [†]			.27 [*]	
<i>Critical Thinking Appraisal</i> ^{††}				
Total score			-.25 ^{***}	
Inference			-.28 ^{***}	
Recognition of assumptions			-.22 ^{**}	
Deduction			-.13 [*]	
Interpretation			-.14 [*]	
Evaluation of arguments			-.06	
<i>Myers-Briggs Type Indicator</i>				
Extroversion-introversion				.57 ^{**}
Sensing perception-intuitive perception				-.45 [*]
Feeling judgement-thinking				.57 ^{**}
Judgement-perception				-.41 [*]

Note

*** $p < .001$; ** $p < .01$; * $p < .05$

The Myers-Briggs Type Indicator Form G (Myers, 1962), was completed by the workshop participants, and the dichotomous categories deriving from the test converted to continuous scales for the purposes of correlation. In light of the results of similar studies (e.g. McKinnell Jacobson, 1993; Taggart and Valenzi, 1990), it was hypothesized that CSI scores would correlate positively with the introversion and thinking poles, and negatively with the intuitive perception and perception poles, of the four MBTI scales. Table III shows that findings confirmed these expectations with coefficients ranging from .41 to .57. Subjects scoring high on analysis appear likely, therefore, on the basis of Hirsh and Kummerow's (1989) interpretation of the MBTI, to prefer a work setting which is quiet, private and impersonal, oriented towards careful routines, governed by logic, and clearly structured and organized. Those scoring high on intuition will

prefer a setting which is activity oriented, offers new experiences, provides opportunities for relationships and is flexible and open to change.

The Work Environment Preference Schedule (WEPS) (Gordon, 1973), a measure of the bureaucratic orientation personality trait, was administered to a subgroup of the business and economics students ($n = 62$). In line with previous research findings (Wooten et al., 1994), it was predicted that the higher the analysis orientation, the greater the individual's predilection for a structured, ordered and relatively impersonal work environment. The positive correlation between CSI and WEPS scores shown in table III supports this idea. The implication is that analysts will subscribe to the bureaucratic norm and thus prefer specific guidelines to follow, favour formal work relationships, value the security of organizational identification and be prepared to accept authority while intuitivists will prefer freedom from rules and regulations, favour personalized relationships, avoid close commitment to the organization and be prepared to question authority.

The management students completed the Learning Styles Questionnaire (LSQ) (Honey and Mumford, 1982) which yielded scores on action (learning through immediate insight resulting from experience) and analysis (learning through reflection and reason), the two underlying dimensions identified by Allinson and Hayes (1988). It was anticipated that an analysis orientation on the CSI would correlate negatively with action, and positively with analysis, on the LSQ. Correlations of $-.81$ and $.33$ respectively (see table III) support this view.

Finally, all the business and economics students answered the Watson–Glaser Critical Thinking Analysis (CTA) Form C (Watson and Glaser, 1991), a test of reasoning ability. Bearing in mind Kirton's (1978) assertion that there is an orthogonal relationship between cognitive style and ability, it was hypothesized that the correlation between CSI and CTA scores would be close to zero. The statistically significant ($p < .05$) negative correlations between the CSI and the total CTA score and all but one of its five constituent subtests (see table III) were, therefore, contrary to expectations. The results are, nevertheless, interesting. If Kirton's theory was regarded as invalid, it might be expected that analysts would perform relatively well on the CTA, since it is purported to measure 'careful, analytical reasoning' (Watson and Glaser, 1991, p. 1), and that correlations would be positive. An explanation of the actual findings may be that the imposition of a 40-minute time limit favoured the ability of the intuitivist to apply rapidly previously developed frames of reference, and disadvantaged the more cautious and systematic analyst.

Concurrent Validity

If the CSI has concurrent validity, it should be capable of discriminating between groups which are presumed to differ in their cognitive style. One obvious area for comparison is gender. Previous studies have produced varying results, some confirming the social stereotype of 'female intuition' (e.g. Agor, 1986) and others suggesting that men may be more intuitive than women (e.g. Kirton, 1989). Table IV shows that the latter view is confirmed consistently in four of the five samples whose size and composition made gender comparison possible. In each case, women scored higher on the CSI (i.e. had more of an analysis orientation) than men.

Table IV. Sex differences in scores on the Cognitive Style Index

<i>Sample</i>	<i>Males</i>			<i>Females</i>			<i>df</i>	<i>t</i>
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>		
Management students [†]	106	36.32	15.56	109	43.84	14.02	213	-3.73***
Brewery managers	121	41.21	12.21	105	45.62	11.66	224	-2.77**
Teachers	15	35.73	10.36	59	44.27	13.69	72	-2.25*
Business and economics students	133	40.26	12.82	68	44.34	10.42	199	-2.27*
Miscellaneous managers	89	40.62	12.11	41	37.00	13.01	128	1.54

Notes[†] Reduced sample owing to missing gender values.*** $p < .001$; ** $p < .01$; * $p < .05$

Another anticipated difference is that between job levels. Mintzberg's (1976) hypothesis that intuition increases with seniority has found favour in the literature, the general view being that the uncertainty and time pressures associated with higher management positions call for a decisive, experience-based approach rather than elaborate analysis. Agor's (1986) survey of American managers provides empirical support for this, senior managers in every organization scoring higher on intuition than their subordinates. Table V reveals a similar pattern for the construction and brewing companies, the only organizations in the present study for which job level comparisons were possible, with CSI scores decreasing (i.e. becoming more intuition oriented) as status increases.

It might also be expected that, through selective recruitment or socialization, there will be differences in cognitive style between organizations or even between different job functions in the same organization. In comparing mean CSI scores for samples in the present study (see table II above), analysis of variance ($F_{940} = 2.42$, $p < .05$) and Duncan multiple-range tests indicate that the brewery managers are significantly more analytical than the management students, construction managers and miscellaneous managers, and that the workshop trainees are more analytical than the construction managers and the miscellaneous managers. With regard to job function comparisons, table VI presents CSI mean scores for five function groups within the miscellaneous managers sample. Analysis of variance ($F_{110} = 2.75$, $p < .05$) and Duncan multiple-range tests indicate that personnel managers are more intuitive than production, marketing and financial managers. This is consistent with findings reported by Kirton (1989), who concludes that personnel managers tend to have a relatively innovative (cf. intuitive) orientation, and Agor (1986) whose study revealed that those working in organizational development, a subfunction of personnel, are significantly more intuitive than financial managers. Agor argues that these func-

Table V. Job level differences in scores on the Cognitive Style Index

	<i>Construction company</i>		<i>Brewing company</i>	
	<i>Junior and middle managers</i>	<i>Senior managers and directors</i>	<i>Supervisors and junior managers</i>	<i>Middle and senior managers</i>
<i>n</i>	41	23	115	109
Mean	41.20	35.04	45.67	40.75
Standard deviation	14.06	13.90	12.27	11.59
<i>df</i>	62		222	
<i>t</i>	1.69*		3.08**	

Note

** $p < .01$; * $p < .05$ (1 - tailed)

Table VI. Mean scores on the Cognitive Style Index for five job functions (miscellaneous managers sample)

<i>Job function</i>	<i>n</i>	<i>Mean</i>	<i>Standard deviation</i>
Finance	13	45.46	13.06
Production	17	40.59	9.89
Marketing	26	40.42	12.62
Information technology	40	38.28	12.09
Personnel	15	31.07	12.49

tional variations result from different degrees of uncertainty and volatility in the associated working environments.

Concurrent validity can also be demonstrated through correlational evidence. The following predictions were substantiated in this way:

- since it is commonly held that intuition is the rapid application of principles learned through experience, there will be a negative relationship between CSI scores (i.e. higher analysis orientation) and age among members of the miscellaneous managers sample ($r = -.20$, $p < .05$, $n = 130$)
- there will be a positive relationship between scores on Hoppock's (1935) measure of global job satisfaction and CSI scores for managers at the relatively bureaucratic junior levels in the brewing company ($r = .29$, $p < .05$, $n = 56$)
- there will be a positive relationship between perceived warmth of job climate, assessed by the *Job Climate Questionnaire* (Fineman, 1975), and CSI scores of female teachers involved in relatively routine basic grade work in primary schools ($r = .35$, $p < .05$, $n = 30$).

CONCLUSIONS

This study had two fundamental objectives: first, to develop a new measure of cognitive style that is psychometrically sound and convenient to administer in large-scale organizational studies; and second, through the development of the instrument, to discover if the wide array of styles conceptualized in the literature can be reduced to the single, superordinate dimension hypothesized by many theorists. It is argued that both of these have been fulfilled.

With regard to the first objective, a substantial study of almost 1000 subjects has demonstrated the psychometric properties of the CSI. Results indicate: (a) a distribution of scores closely approximating theoretical expectations, (b) excellent reliability in terms of internal consistency and temporal stability, and (c) good initial evidence of construct and concurrent validity. In addition, the CSI has proved easy to apply in survey research. The relatively small number of items can be completed in only 5–10 minutes; it is brief enough to incorporate into a larger research questionnaire; and its simple format obviates the need for formal administration by an expert tester, thus permitting its use in postal studies. With regard to the second objective, the unifactorial structure of the instrument apparent in most of the factor analyses, combining items purported to represent an array of substyles, suggests that it may genuinely tap the hypothetical unitary dimension of cognitive style.

It is clear, however, that these findings need to be replicated and extended. More rigorous test–retest studies of larger samples over extended time periods are required, and confirmatory evidence of the factor structure is desirable. Predictive validity, in particular, must be established through correlational studies of work outcomes such as performance, absenteeism, training accomplishment, commitment and job attitudes. It is important in these analyses to adopt a contingency approach as it cannot be assumed that the exercise of a particular cognitive style will have the same effect in all situations. Effective performance or positive attitudes may result from the interaction of different styles and different work environments. Evidence that environments can be classified as, for example, intuition oriented or analysis oriented would have obvious implications for the interpretation of results.

Another area for further investigation is the relationship between CSI scores and ability. The correlations with critical thinking ability in the present study are difficult to explain in the context of the widely held belief that cognitive style and cognitive ability are unrelated. Research using a range of ability measures, including assessments of general intelligence, is called for. Similarly, gender comparisons warrant additional study. The tendency for females to be more analytical than males held for almost all samples in the present research. Kirton (1989), however, has warned that findings on sex differences may vary from one culture to another. Application of the CSI across a range of organizations and nations would, therefore, be useful in this respect.

In conclusion, there can be no doubting the potential value of cognitive style in the study of organizational behaviour and the understanding of management problems. Falling somewhere between the ability and personality domains, it provides the organizational psychologist with an additional and conceptually distinct means of explaining individual differences at the workplace. Especially

significant, in the context of the present study, is the fact that it is becoming acceptable once again to adopt the traditional distinction between analytical and non-analytical modes of thought (Beyler and Schmeck, 1992). Moreover, in the business world in particular there has been a 'crescendo of interest' (Agor, 1986, p. 3) in intuition as an approach to solving management problems:

The conventional, analytical, logical patterns of thinking are no longer sufficient either to understand or to cope with the current and emerging scenarios ... To cope with such accelerating change, one requires a sense of inner stability; to cope with complexity, one needs an anchor of simplicity; to cope with uncertainty, one has to develop a deeper level of internal support system; and to cope with conflict, one needs a special ability of synthesis, a deeper level of perception. Intuition seems to facilitate the cultivation of these qualities. (Parikh et al., 1994, p. 2)

This is not to suggest that analytical thinking is no longer relevant in modern organizational life. Rather, the need is to recognize situations in which the intuitive way of thinking is appropriate. Interest now centres on how far individuals are analytical or intuitive in their cognitive style, to what extent it is possible to integrate the two and develop a whole brain approach (Taggart et al., 1985) and whether or not this can be assisted by training or education. In order to answer these questions, the need for valid and reliable tools for the assessment of cognitive style is obvious. On the evidence of the present study, the CSI may prove a useful addition to the small collection of measures suitable for this purpose in organizational research.

NOTES

- [1] The authors wish to thank Mr Ian Campbell of Miall Campbell Associates Ltd for his assistance in obtaining data from the construction managers.
- [2] For the protection of intellectual property, the Cognitive Style Index is not reproduced in full here. Anyone wishing to use the instrument for research purposes should contact the authors.

REFERENCES

- AGOR, W. H. (1984). *Intuitive Management: Integrating Right and Left Brain Management Skills*. Englewood Cliffs, NJ: Prentice-Hall.
- AGOR, W. H. (1986). *The Logic of Intuitive Decision Making: A Research-based Approach for Top Management*. New York: Quorum Books.
- ALLINSON, C. W. and HAYES, J. (1988). 'The Learning Styles Questionnaire: an alternative to Kolb's inventory?'. *Journal of Management Studies*, **25**, 269–81.
- ATKINSON, G. (1988). 'Reliability of the Learning Style Inventory – 1985'. *Psychological Reports*, **62** 755–8.
- BENZIGER, I. K. and SOHN, A. (1993). *The Art of Using Your Whole Brain*. Rockwall, Texas: KBA Publishing.
- BEYLER, J. and SCHMECK, R. R. (1992). 'Assessment of individual differences in pre-

- ferences for holistic-analytic strategies: evaluation of some commonly available instruments'. *Educational and Psychological Measurement*, **52**, 709–19.
- BRAIN TECHNOLOGIES CORPORATION (1985). *The Brainmap*. Fort Collins, Colorado: Brain Technologies Corporation.
- CATTELL, R. B. (1973). *Personality and Mood by Questionnaire*. San Francisco: Jossey-Bass.
- CATTELL, R. B. (1974). 'Radial parcel factoring-vs-item factoring in defining personality structure in questionnaires: theory and experimental checks'. *Australian Journal of Psychology*, **26**, 103–19.
- CATTELL, R. B. and BURDSAL, C. A. (1975). 'The radial parcel double factoring design: a solution to the item-vs-parcel controversy'. *Multivariate Behavioral Research*, **10**, 165–79.
- CATTELL, R. B., EBER, H. W. and TATSOUKA, M. (1973). *Handbook of the Sixteen Personality Factor Questionnaire*. Champaign, Ill: Institute for Personality and Ability Testing.
- DOKTOR, R. H. (1978). 'Problem-solving styles of executives and management scientists'. *TIMS Studies in Management Sciences*, **8**, 123–34.
- ENTWISTLE, N. J. (1981). *Styles of Learning and Teaching*. Chichester: Wiley.
- FINEMAN, S. (1975). 'The influence of perceived job climate on the relationship between managerial achievement motivation and performance'. *Journal of Occupational Psychology*, **48**, 113–24.
- FREEDMAN, R. D. and STUMPF, A. (1978). 'What can one learn from the Learning Style Inventory?'. *Academy of Management Journal*, **21**, 275–82.
- FURNHAM, A., SADKA, V. and BREWIN, C. R. (1992). 'The development of an occupational attributional style questionnaire'. *Journal of Organizational Behavior*, **13**, 27–39.
- GARDNER, R., HOLZMAN, P., KLEIN, G., LINTON, H. and SPENCE, D. (1959). 'Cognitive control: a study of individual differences in cognitive behavior'. *Psychological Issues*, **1**, monograph 4.
- GLOBERSON, T. and ZELNIKER, T. (Eds) (1989). *Cognitive Style and Cognitive Development*. Norwood, NJ: Ablex.
- HAMMOND, K. R., HAMM, R. M., GRASSIA, J. and PEARSON, T. (1987). 'Direct comparison of the efficacy of intuitive and analytical cognition in expert judgement'. *IEEE Transactions on Systems, Man and Cybernetics*, **17**, 753–70.
- HAYES, J. and ALLINSON, C. W. (1994). 'Cognitive style and its relevance for management practice'. *British Journal of Management*, **5**, 53–71.
- HERRMANN, N. (1988). *The Creative Brain*. Lake Lure, North Carolina: Brain Books.
- HIRSH, S. and KUMMEROW, J. (1989). *Life Types*. New York: Warner.
- HONEY, P. and MUMFORD, A. (1982). *The Manual of Learning Styles*. Maidenhead: Honey.
- HOPPOCK, R. (1935). *Job Satisfaction*. New York: Harper.
- KAGAN, J. and KOGAN, N. (1970). 'Individual variation in cognitive processes'. In Mussen, P. H. (Ed.), *Carmichael's Manual of Child Psychology*, 3rd edn. New York: Wiley, 1273–365.
- KAGAN, J. and ROSMAN, B. L., DAY, D., ALBERT, J. and PHILIPS, W. (1964). 'Information processing in the child: significance of analytic and reflective attitudes'. *Psychological Monographs*, **78** (whole issue).
- KEEN, P.G. (1973). 'The implications of cognitive style for individual decision making'. Unpublished doctoral dissertation, School of Business Administration, Harvard University.
- KIRTON, M. J. (1976). 'Adaptors and innovators: a description and measure'. *Journal of Applied Psychology*, **61**, 622–9.
- KIRTON, M. J. (1978). 'Have adaptors and innovators equal levels of creativity?'. *Psychological Reports*, **42**, 695–8.
- KIRTON, M. J. (1987). 'M. J. Kirton's reply to R. L. Payne's article: individual differences and performance among R & D personnel'. *R & D Management*, **17**, 163–6.
- KIRTON, M. J. (1989). 'Adaptors and innovators at work'. In Kirton, M. J. (Ed.), *Adaptors and Innovators: Styles of Creativity and Problem Solving*. London: Routledge, 56–78.

- KLINE, P. (1993). *The Handbook of Psychological Testing*. London, Routledge.
- KOLB, D. A. (1976). *Learning Style Inventory: Technical Manual*. Boston, Mass.: McBer.
- LETTERI, C. A. (1980). 'Cognitive profile: basic determinant of academic achievement'. *Journal of Educational Research*, **73**, 195-9.
- McKINNELL JACOBSON, C. (1993). 'Cognitive styles of creativity: relations of scores on the Kirton Adaption-Innovation Inventory and the Myers-Briggs Type Indicator among managers in USA'. *Psychological Reports*, **72**, 1131-8.
- MESSICK, S. (1976). 'Personality consistencies in cognition and creativity'. In Messick, S. and associates (Eds), *Individuality in Learning*. San Francisco, Cal.: Jossey-Bass, 4-22.
- MESSICK, S. (1984). 'The nature of cognitive styles: problems and promise in educational practice'. *Educational Psychologist*, **19**, 59-74.
- MILLER, A. (1987). 'Cognitive styles: an integrated model'. *Educational Psychology*, **7**, 251-68.
- MILLER, A. (1991). 'Personality types, learning styles and educational goals'. *Educational Psychology*, **11**, 217-38.
- MINTZBERG, H. (1976). 'Planning on the left side and managing on the right'. *Harvard Business Review*, July-August, 49-58.
- MYERS, I. B. (1962). *The Myers-Briggs Type Indicator*. Palo Alto, Cal.: Consulting Psychologists Press.
- NICKERSON, R., PERKINS, D. and SMITH, E. (1985). *The Teaching of Thinking*. Hillsdale, NJ: Erlbaum.
- NUNNALLY, J. (1978). *Psychometric Theory*. New York: McGraw-Hill.
- OLTMAN, P. K. (1968). 'A portable rod-and-frame apparatus'. *Perceptual and Motor Skills*, **26**, 503-6.
- OLTMAN, P. K., RASKIN, E. and WITKIN, H. A. (1971). *Group Embedded Figures Test*. Palo Alto, Cal.: Consulting Psychologists Press.
- ORNSTEIN, R. E. (1977). *The Psychology of Consciousness*. New York: Harcourt Brace Jovanovich.
- PARIKH, J., NEUBAUER, F. and LANK, A. G. (1994). *Intuition: The New Frontier of Management*. Oxford: Blackwell.
- PAYNE, R. L. (1987). 'Individual differences and performance among R&D personnel: some implications for management development'. *R&D Management*, **17**, 153-61.
- RIDING, R. J. (1991). *Cognitive Styles Analysis*. Birmingham: Learning and Training Technology.
- ROBEY, D. and TAGGART, W. (1981). 'Measuring managers' minds: the assessment of style in human information processing'. *Academy of Management Review*, **6**, 375-83.
- SCHRODER, H. M., DRIVER, M. J. and STREUFERT, S. (1967). *Human Information Processing*. New York: Holt, Rhinehart & Winston.
- SCHWEIGER, D. M. (1983). 'Measuring managers' minds: a critical reply to Robey and Taggart'. *Academy of Management Review*, **8**, 143-51.
- SIMON, H. A. (1989). 'Making management decisions: the role of intuition and emotion'. In Agor, W. H. (Ed.), *Intuition in Organizations*. Newbury Park, Cal.: Sage, 23-39.
- SMITH, D. M. and KOLB, D. A. (1986). *Learning Style Inventory: User's Guide*. Boston, Mass.: McBer.
- STREUFERT, S. and NOGAMI, G. Y. (1989). 'Cognitive style and complexity: implications for I/O psychology'. In Cooper, C. L. and Robertson, I. (Eds), *International Review of Industrial and Organizational Psychology*. Chichester, Wiley, 93-143.
- SUEDFELD, P., TETLOCK, P. E. and STREUFERT, S. (1992). 'Conceptual/integrative complexity'. In Smith, C. P. (Ed.), *Motivation and Personality: Handbook of Thematic Content Analysis*. Cambridge: Cambridge University Press, 393-400.
- TAGGART, W. (1993). *Trainer's Manual for the Personal Style Inventory*. Odessa, Florida: Psychological Assessment Resources.

- TAGGART, W. and TORRANCE, E. P. (1984). *Human Information Processing Survey*. Bensenville, Ill.: Scholastic Testing Service.
- TAGGART, W. and VALENZI, E. (1990). 'Assessing rational and intuitive styles: a human information processing metaphor'. *Journal of Management Studies*, **27**, 149–72.
- TAGGART, W., ROBEY, D. and KROECK, G. (1985). 'Managerial decisions styles and cerebral dominance: an empirical study'. *Journal of Management Studies*, **22**, 175–92.
- TAYLOR, W. G. K. (1989). 'The Kirton Adaption-Innovation Inventory: a re-examination of the factor structure'. *Journal of Organizational Behavior*, **10**, 297–307.
- TETLOCK, P. E. and SUEDELD, P. (1988). 'Integrative complexity: coding of verbal behavior'. In Antaki, C. (Ed.), *Analysing Everyday Explanation: A Casebook of Methods*. London: Sage, 43–59.
- WATSON, G. and GLASER, E. M. (1991). *Watson–Glaser Critical Thinking Appraisal: British Manual*. Sidcup: The Psychological Corporation.
- WHETTEN, D. and CAMERON, K. (1984). *Developing Management Skills*. London: Scott Foresman.
- WIDIGER, T., KNUDSON, R. and PORTER, L. (1980). 'Convergent and discriminant validity of a measure of cognitive styles and abilities'. *Journal of Personality and Social Psychology*, **39**, 116–29.
- WILSON, D. K. (1988). 'Management learning: a grounded study of the written reflections of managers on their approach to real time work problems'. Unpublished Ph.D. thesis, University of Lancaster, England.
- WITKIN, H. A., DYK, R. B., FATERSON, H. F. and KARP, S. A. (1962). *Psychological Differentiation*. New York: Wiley.
- WITKIN, H. A., OLTMAN, P. K., RUSKIN, E. and KARP, S. A. (1971). *A Manual for the Embedded Figures Test*. Palo Alto, Cal.: Consulting Psychologists Press.
- WOOTEN, K. C., BARNER, B. O. and SILVER, N. C. (1994). 'The influence of cognitive style upon work environment preferences'. *Perceptual and Motor Skills*, **79**, 307–14.