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An Exploration of Creative Problem-Solving through a Stylistic Lens

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Abstract

There is a growing interest in a more inclusive conception of the activity of the 'change process' (person, product, process and press) particularly the aspects of the creative sub-process concerned with person and product. The variables Cognitive style and Idea style, have a common heritage that is rooted in a dichotomy concerned at one end with 'adaption' (improvements) while at the other end with 'innovation' (novelty). These characteristics have been used to describe the 'creative concept' where to date the emphasis has been on the pole concerned with 'innovation continuum'. The pole is hence also concerned with adaption, but while the pole being a necessary and central aspect of both variables, has nevertheless received relatively little attention. In this study, the primary objective was therefore to evaluate the coherence of Kirton's 'cognitive style' measure of adaptive – innovative behavioural preferences with the measures of Idea styles. Therefore, another related objective was to evaluate the relationship between the cognitive style and 'psychological climate', consisting of ideas generated and problems identified as sub-components. The results show the 'innovative pole' of cognitive style is significantly related to both innovative idea style and the quantity of ideas generated (it is also explicitly supported by the facets of the personality variable 'openness'). However, while a negative relationship between cognitive style and the adaptive style of ideas is a central aspect of Kirton's cognitive style theory, no significant negative relationship was found. Instead, the adaptive style of ideas has a positive relationship to a factor within the measure of psychological climate or 'the opportunity to contribute to change'. These findings position Kirton's cognitive style measure as primarily in the domain of 'personality' and only partially coherent with the domain of 'idea style' the latter a carrier, rather than 'a component of style'. Furthermore, while the variables of cognitive style and psychological climate show no significant relationship, they provide differential support to the 'first two stages' of the change process.

Keywords: creativity, cognitive style, idea style, change process, innovation, adaption, radical, incremental, problem-solving

Introduction

There is a growing acceptance that a useful characterisation of the domains of creativity, leadership and culture are rooted in a 'stylistic dichotomy'. Leaning on the view of a dichotomy

as two things sharply different (rather than in assumed opposition). At one end of the dichotomy is a concern with usefulness and improvements within the existing, while at the other end there is a concern with novel extensions beyond the existing. These 'stylistic' positions have been referred to using many different descriptors some of which lack clarity and face-validity when describing different contexts (Abdulla & Cramond, 2018). This text follows the definitions proposed by Kirton (1976, 2011) and (Dewar & Dutton, 1986; Gilson & Madjar, 2010). For individual differences, Kirton uses 'adaption' for the pole concerned with 'improvements' to the existing, and 'innovation' for the pole concerned with extensions 'beyond' the existing, (both polar definitions implicate ideas). For the same polarisations Gilson uses 'incremental' and 'radical' for ideas from process outcomes. While idea style is clearly an individual difference associated with the way cognitive structure is constructed, be it permeable or fragmented (Kelly, 1963), a position also supported by the inclusion of ideas as a facet of openness within the Big 5 definition of personality. However, it is less clear whether idea style, as a process outcome, should be treated as a variable from a different domain (personality). These differences are important, particularly if the same variable (idea style) is used to describe both cognitive process outcomes and individual differences thus affecting any analysis of relationships and causality.

The central concern of this research is thus the validation of coherence between the domains of 'idea style', defined as the characteristics of cognitively construed ideas, and 'cognitive style', defined as an individual difference related to generic problem-solving (Kirton 1976, 2011). Also, of interest are the relationships of cognitive style and psychological climate (Schneider, 1975) with relevant outputs (style and quantity) from the creative sub-process.

Literature Review

The early work on creativity described it as the province of ideas from a few gifted individuals such as Albert Einstein, Sigmund Freud, Pablo Picasso and similar others. This led to the view that while creativity existed in many different domains, only a small number of people were creative problem solvers, more recently called the 'Big C' concept (Kaufman & Beghetto, 2009). In trying to uncover the nature of creativity, individual differences and the products of this gifted group were studied endlessly with little further understanding. However, in more recent times, creative ideas and their products have been described as dependent on a number of mutually supporting strands including people, products, process and press and additionally culture and knowledge (Rhodes, 1961; Beresnevičius, 2013).

Thus, creativity has become a generic concept used to describe an 'activity' that 'produces' stylised solutions (ideas) which, if implemented, offer change in different domains, such as arts and sciences (e.g., leadership, Bass & Avolio, 1994), political decision making (Tetlock, 2005; Meynhart et al., 2017), fashion and art (Hogan et al., 2018) and performing arts (Clements et al., 2018).

The dynamics of the current market-place prioritise the development of products that tend towards the more innovative outcome (novel). Indeed, it has been suggested that without such a contribution, organisational leadership, strategy and growth are affected (Gorodnichenko & Roland, 2011). These issues bring into focus the field of significant variables that surround organisational change, where culture, individual differences and creative style are particularly relevant. Here the term "style" is defined as 'a distinctive manner or technique which characterises something done or performed' (Goncalo & Staw, 2006). Thus, within this concept, creative products and individual differences while being in different domains and variables can be represented by a generic, stylistic dichotomy, where at one end is a concern for improvements to the existing, while at the other end a concern for novel extensions beyond the existing (Kelly, 1963; Kirton, 1976, 2011; Kuhn, 1970). However, in many studies only the pole concerned with novelty has been recognised, thus leading to a limited view of creativity and the style construct.

Theoretical Frameworks

The pervasive nature of the idea style dichotomy

The consideration of stylistic contrasts dates back to the Greek poet Archilochus (some 645 BC) to whom the fragment 'The fox knows many things but the hedgehog knows one big thing' is attributed. This comment has been taken further by Berlin (1953), who suggests that:

> '…the words can be made to yield a sense in which they mark one of the deepest differences which divide writers and thinkers, and, it may be, human beings in general. For there exists a great chasm between those, on the one side who relate everything to a single central vision, and, on the other side those who pursue many ends, often unrelated and even contradictory. The first kind of personality belongs to the hedgehogs, the second to the foxes.'

The same underlying dichotomy has been used by other authors to describe a number of different domains:

Kirton (2011, 1976, 1961) describes a stylistic dichotomy (from an earlier study of management behaviour) to position his adaptive-innovative continuum of cognitive style concerned with creative problem-solving. The adaptive end of the continuum relates to behaviours and ideas concerned with resolving residual problems thrown up by the 'current paradigm'. The innovative end of the continuum is concerned with behaviours and ideas that approach problems from alternative avenues of solution, cutting across existing paradigms.

> 'One way of summing up these differences is to say that the more adaptive prefer to solve the problems by the use of rules (all cognitive structures) and the more innovative do so despite the rules' (Kirton, 2011, p.4).

From a different perspective, Tomasello (1999) suggests that through the use of a 'ratchet effect' evolution has enabled the building of both social and subject-specific knowledge from the 'accumulation of ideas' and their synthesis. Separately, other novel categories and analogies will also be produced, thereby suggesting that 'these effects capture what is perhaps the most fundamental dialectical tension in human cognitive development, the tension between doing things conventionally, which has many obvious advantages, and doing things creatively (use of novelty) which has its own advantages (p. 53)'.

When investigating political decision making, Tetlock (2005) also used a cognitive style concept based on the observations detailed by Berlin (1953) that portrayed the characterising differences between the fox and the hedgehog. Tetlock operationalised the concept and described the measure as yielding a bipolar dimension. Meynhardt et al., (2017) in a re-analysis found two covarying factors representing hedgehoginess and foxiness ($r=0.20$, $p<0.01$). Psychological details of the concept describe hedgehogs as having a high need for cognitive closure, prefer clarity and favour a single organising principle, while the fox allows for ambiguity and is open to new ideas and different opinions (Meynhardt et al., 2017).

Kelly (1963) described how individuals structure their world of experiences using concepts of Modulation, a single coherent vision and Fragmentation, pursuing many ends, often unrelated and even contradictory (consistent with Berlin's use of the hedgehog and the fox as personality analogues). In defining the choice between these two concepts, Kelly hypothesised that 'a person builds their life on one or the other of the two alternatives by placing relative values on the ends of the dichotomy. 'Some of the values are transient and represent merely the convenience of the moment others more stable'. The latter represents guiding principles for the choice of direction regarding the elaboration of an individual's construct system, be it in the direction of 'definition (more certain about fewer things) or extension (aware of more things

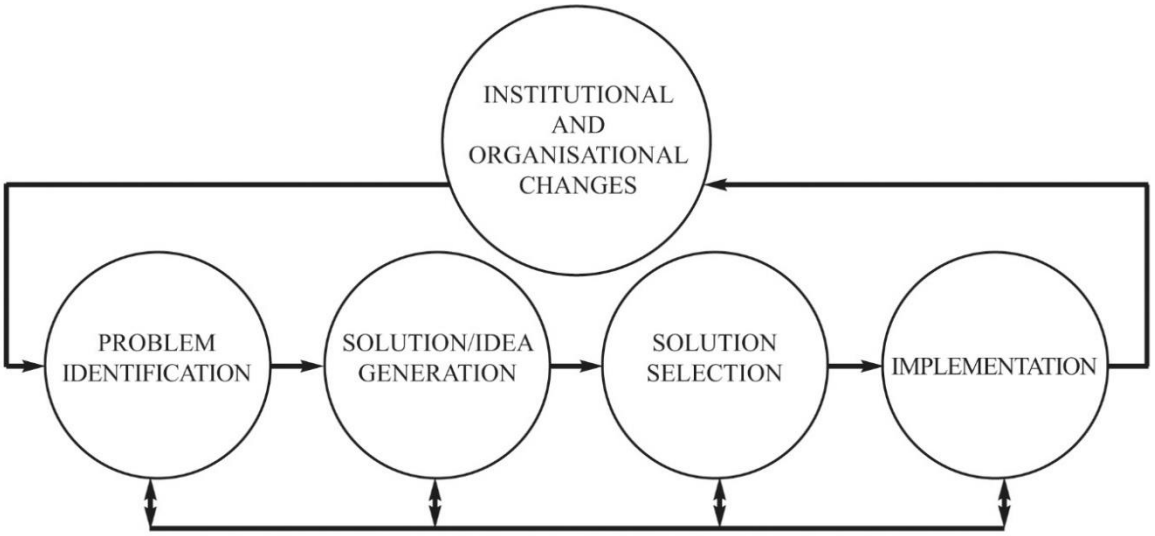
on the misty horizon) or both'. Thus, a person chooses one or other of the alternative to build their construct system, where, overtime, as the choices add up, a bias emerges that indicates a preference for one or other of the polar alternatives. So, while it has been useful to portray a 'single central vision' and 'pursuing many unrelated ends' as the two ends of a scalable bipolar dichotomy, it may be that the relationship is independent (or even covarying) rather than bipolar. In addressing these latter issues, Cacioppo et al., (1997) identified configurations of bivariate space as independence, covariance and bipolarity and noted that the relationships tend to gravitate from independence to a bipolar structure when underlying beliefs act as a guide for behaviour. So, while many descriptors have been used by the different studies for each pole of the dichotomy, the content of the style concept remains as a dichotomy where one pole is concerned with innovative or novel issues while the other pole with issues adaptive or conventional.

The Change Process

When problem-solving, (using an information processing model) a four-stage process provides a framework for the facilitation of institutional/organisational change (See Fig 1). The first two stages are often referred to more generally as the exploratory or creative process (Goncalo & Staw, 2006; Yao et al., 2012), while the last two stages, more associated with the adoption of creative ideas are generally referred to as the exploitation process.

Figure 1

The Change Process



Problem identification is the first stage of the process where the content concerns the recognition and definition of the problem. Here, problems are identified that relate to organisational shortcomings or significant personal concerns of an individual (Vernon et al., 2016). Of particular relevance is the core of the problem, the goals of the 'sponsor/owner', the environmental cues and the tensions that support or constrain the definition (Reiter-Palmon, 2009a). The congruence of the elements used in the definition of the problem, be they coherent or fragmented (Kelly, 1963), determine the information that is passed to the next stage for idea/solution generation. In this second stage, the information from the problem identification stage is used to assemble ideas as potential solutions to the problem. Early solutions may iterate around these first two stages of the process as the constraints and structural relationships of the problem definition are challenged before viable or more elegant solutions (*new* ideas) emerge. The next two stages comprise the exploitation part of the process, here, in the third stage of the process, the most acceptable solution (from the viable many) is selected for use. In the last stage, implementation of the idea introduces new ways of doing things. Within this context, knowledge that relates to the problem domain can be distinctly different from that required to generate the most suitable solution (Baer, 2015). Also, the term 'new' takes on a stylistic interpretation based on the view that ideas, (product outcomes) the lifeblood of the change process, can take two broad stylistic forms namely, adaptive or innovative (Drucker, 1969; Gabora, 2018; Kirton, 1976, 2011; Kuhn, 1970).

Organisational Problem Solving

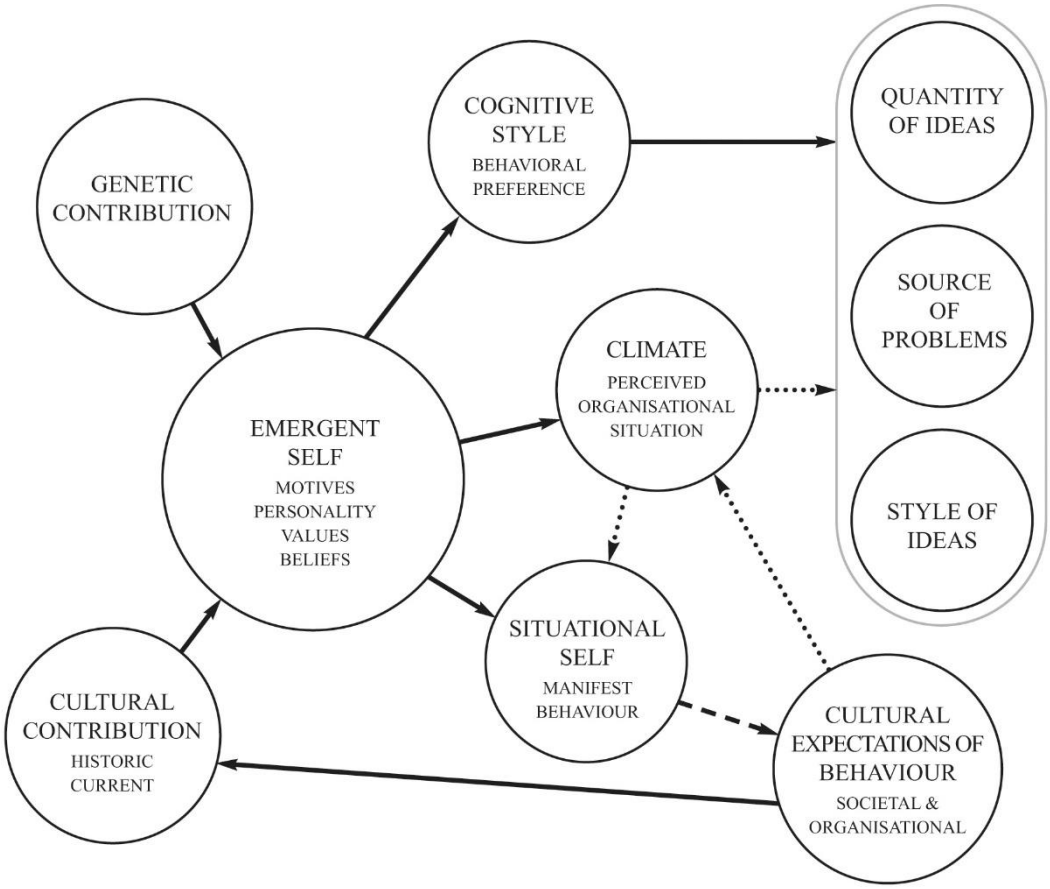
When considering organisational problem solving a number of variables play an important part when performance is of interest (Beresnevičius, 2013). Also, feedback is evident as information is fed-back from the different stages of the change process to challenge and better define the products from earlier stages. The process also operates dynamically where successive iterations over time, generate a spiral of change as optimal organisational performance is approached (Gabora, 2018; Goldratt,1990; Kirton, 2011). In the last two stages of the change process, if solutions are selected but the resources needed for implementation are not made available either due to organisational shortages or withheld for political reasons, useful ideas are lost to the organisation (Ruckthum & Clapp, 2008).

Of particular interest in this study are the variables concerned with processing the activity of the creative part of the change process, specifically the stages of problem identification and idea generation. Two variables are considered significant, one is concerned with the cognitive bias of the individual as it relates cognitive style (Kirton 1976, 2011). The other variable is concerned with the psychological climate of the individual and includes the constraints and supports from both culture (social and organisational) framed within the situational context of the problem to be solved (e.g. Safety, Zohar, 2014). These considerations lead to a complex system of relationships (see Fig 2).

Conceptual Framework

Figure 2

Complex System – the Salient Variables of the Emergent and Situational Self



Source: Author

Note: ___Connections that define the personality and cultural behavioural loop

.....Connections that define the situational behaviour loop

_ _ _ _Connections common to both loops.

Products from process outcomes: Quantity of ideas, Source of problems, Style of ideas (dependent variables). Independent Variables: Cognitive Style (Behavioural Preferences) and Psychological Climate (Situational perceptions that include culture). Following discussions explain the variables and relationships shown in the conceptual diagram above.

Cognitive Style Theory

Kirton (1961, 2011) described predictable polarised behaviours observed as part of a study of management problem-solving initiatives in the UK. These observations formed a theory concerned with problem-solving through a dichotomy of preferred behaviours. At one end of the dichotomy, 'adaption' describes reducing problems by working with maximum continuity and dependability (improvements within current boundaries), while at the other end, 'innovation' described behaviours concerned with working with multiple avenues of solution, and less concerned with (even unaware of) current boundaries. An analysis of these behaviours was described as a bipolar continuum of individual preferences that contains three significant factors: sufficiency of originality, efficiency, and rule/group conformity all seen as enduring individual differences.

For the factor of originality, genetic roots have been identified along with a relationship with 'openness' a trait within personality domain. Also, individuals with high real-world creative achievements appear to have weak cognitive flexibility and weak top-down control (Gelade, 2002; Van der Molen, 1994; Zabelina et al., 2016). The other end of the dichotomy is represented by factors efficiency and rule /group conformity and is related with the personality domain through the trait conscientiousness. Conformity is described as 'a behaviour designed to match or imitate *beliefs, expectations or behaviours* of real or imagined others' Griskevicius et al., (2006) and is described as having two factors - the first concerns *efficiency* where following others leads to more effective and accurate decisions, especially where new facts or uncertainty are present. The second factor concerns *affiliation,* where following others tends to produce effective relationships by avoiding rejection and conflict. This has led to conformity, with its concern for goals as being located in the domain of 'values' (Roccas at al., 2002; Schwartz, 1992) and concerned with both efficiency and self-preservation (Cialdini & Trost, 1998). Thus, the components of the dichotomy described by Kirton contains both traits (enduring dispositions) and values (enduring goals). Also, individuals when relating to a significant reference group believe that their values are desirable while their traits may be positively or negatively regarded or perceived.

Psychological Climate Theory

When considering culture from a psychological viewpoint, individual experiences both supports and constraints that have their origins in beliefs held in common by members of a specific grouping and result in *shared expectations* of behaviour (Cooke & Szumal, 1993). These expectations stem from different traditions, historic values, beliefs and norms which are

associated with specific geographic, social, organisational and functional boundaries and retained in individual memory. This results in culture being commonly defined as an integral of a learnt set of values and beliefs that people hold in common about nature and the society they live within. Or if more specifically focused, about the professions they represent or the organisation they work within.

Following Hofstede (1980), the dimension concerned with individualism-collectivism was found to be most important in separating societal groups particularly countries east and west (Markus & Kitayama 1991; Singelis, 1994). While initially described as a bipolar dimension empirical analysis has suggested two independent dimensions each with two factors (Cozma, 2011). In evaluating this cultural variable and its relationship with idea generation and implementation at the individual level (Yao et al., 2012) found that both individualism and collectivism related to individual idea generation with collectivism being the more significant. Here collective individuals are described as 'holding interdependence, sociability and equality in high regard…. tends to be cooperative, often considers other's feelings, all of which leads to the creation of a supportive environment' (and is similar to the description of the adaptive individual). These findings also confirm the contribution of social culture (and potentially organisational) to the generation of ideas by the individual.

Furthermore, in organisations (where individuals usually spend a large amount of time), a further set of cultural supports and constrains add to those from social culture and have been operationalised using many different constructs. Cameron & Quinn (1999) used 'competing values' to form the dimensions 'flexibility-stability' and 'integration-differentiation' where flexibility and differentiation support the more innovative change or 'doing things differently', while integration and stability support adaptive change or 'doing things better' (Drucker, 1969; Kirton, 1976, 2011).

From the perspective of an individual in an organisation, there are further constraints and supports associated with the priorities of local working situation. Here, the climate concept provides an integration of the various aspects from social and organisational culture through to local situational priorities. The use of supports and constrains (both values) as a common thread that frames 'local interactions' between relevant individuals along with resulting outcomes (Stacy, 2012. Shao et al, 2019). A key attribute of psychological climate is that it involves employee perceptions regarding the emergent properties of their overall environment, a personal 'outlook' (Kelly, 1963). The comment by Schneider (1975) that 'climates are for

something' provides a focus for the salient dimensions involved e.g., 'Safety', (Zohar, 2014). For this study the focus is on the creative part of the change process.

The Complex System in the Problem Definition Context

The problem context is also complex as the organisation operates as an adaptive system where the salient variables, their relationships and their function within the problem boundary are essential to understanding and defining the problem. The circular nature of these many relationships (See Fig 2) is described by a loop involving longer-term beliefs, (solid line connections) where individual personal preferences are emergent properties from early exposure to the complexities of social culture and personality development. The presence of openness within the individual's personality profile encourages a personal preference for originality and the production of innovative ideas (Kaufman et al., 2016). Also, a short-term loop (dotted line connections) shows individual preferences constrained or supported by situational and cultural expectations of behaviour from other individuals within the organisation (Clapp & De Ciantis, 1989).

However, large service organisations, seeking predictability, tend to support conformity, consistent with the preferences of the majority of those employed. Also, when such conforming demands are held in conflict with the preferences of the more innovative individuals the need for personal coping behaviour results (Clapp, 1993). Thus, organisational culture/climate provides supports and constraints that guide the problem context while cognitive style (behavioural preferences) provides cognitive engagement with the problem. Both variables and any interaction between them have a role in executing the functional activity of each stage of the creative sub-process and any associated outcomes. This leads to the following 5 research propositions (our hypotheses).

Hypothesis 1. As the two variables cognitive style and psychological climate are from independent domains an insignificant relationship can be expected.

Hypothesis 2. Given the view that all people can be creative then, with support from psychological climate and a suitable problem focus, all people within the sample will generate at least one idea as a possible solution. (Clapp, 1991; Kirton, 2011).

Hypothesis 3. The dichotomy of adaption-innovation, when used to characterise the behavioural preferences of the measure of cognitive style, will for idea style show a negative relationship with the adaptive style and a positive relationship with the innovative style (Kirton, 1976, 2011).

Hypothesis 4. In large organisations that are adaptive by nature, the associated psychological climate will be related to the adaptive style of ideas and quantity of ideas generated.
Hypothesis 5. Managers and supervisors with their greater overview of operational activities will provide significant support as problem identifiers.

Research Methodology

The evaluation of the relationships between the variables in a system can be separated into two aspects: the structural model and the measurement model. In the structural model (see Fig 2) the variables of interest are located within the larger system within which they exist.

The measurement model provides for the relationships between both the observed indicators and the (latent) variables of interest. In this study the objective is to evaluate the relationships between the latent variables: Cognitive Style, Psychological Climate, Quantity of ideas, Style of ideas and Source of problems where the first two variables are considered independent.

Population and Samples

The convenience sample of respondents used in this study (n=153) came from three divisions of the Administrative Services Organisation within the UK head office of a multinational oil company. The operating objectives of the organisation are concerned with efficiency and responsiveness, largely within routine processes and conventional work methods.

The study was initiated by sending to all members (n=200) of the administrative services department an outline of the study with an invitation for them to participate. Some 153 members accepted the invitation distributed n = 39, 58, 56 respectively across three independent divisions. Each of the participants was then sent a description of the study along with a questionnaire for self-reporting of the individual level data required for the study. Also, a small sub sample n=37 completed the NEO PI measure of personality (Costa & McCrea, 1992).

Research Instruments

Cognitive Style

In constructing the measure of cognitive style (Kirton, 1976), a pool of items focused on the problem-solving behaviour of individuals was examined. After analysis, 13 items were

found to represent originality, (alpha 0.83, mean=40.78, SD=8.89), 7 items represented efficiency (alpha 0.76, mean=18.82, SD=5.59) and 12 to represented rule/group conformity (alpha 0.83, mean=35.39, SD=8.56). The total of all items was then used as an additive scale (alpha 0.88, mean=95.00, SD=17.90) and described as a bipolar continuum. However, Bagozzi & Foxall (1995) suggested that this configuration is not unidimensional bipolar in a strict statistical sense, and that it represents instead three independent components of cognitive style. To score the inventory, the 19 items representing efficiency and rule/group conformity are reversed (becoming inefficiency and nonconformity) so as to align with originality.

Idea Style

The idea characteristics of interest are those consistent with the two polar descriptions of the style dichotomy. At one end are characteristics that define ideas that stem from algorithmic thinking within existing paradigmatic constrains (e.g., environmental, technical and personal) in the words of Drucker (1969), "doing things better", i.e., adaptive change. The other end of the dichotomy is concerned with ideas defined by change beyond existing paradigms: "doing things differently", i.e., innovative change.

The measure of idea style (see Appendix 1) consists of 7 items for each of the poles where the characteristics of ideas produced by an individual (as outcomes from the creative sub-process), are self-scored (Clapp, 1991). When evaluating the measure, two positively related factors representing the polar descriptors were found ($r = +0.42$, $p=0.001$) each with an alpha of 0.87. Also, Dewar & Dutton (1986), Madjar et al., (2011) and Malik et al., (2019), also found the two similar factors that were positively related. The finding of a positive relationship is consistent with the view that individuals with a more innovative cognitive style are less concerned with (even unaware of) current boundaries (Kirton, 1976) and so, in spite of their preference, may produce both styles of ideas. Furthermore, both styles of ideas have been recognised as being able to provide creative solutions that can match the problem-solving context and play an important part in the development and optimisation of societal and organisational performance (Gabora, 2018; Kirton, 2011).

Psychological Climate

In this study, for psychological climate, the perceptions of the individual are focused on the situational/cultural supports and constraints associated with processing the functional content of the first two stages of the change process (see Fig 1). To capture the effects of these

differing supports and constraints on process performance, a 30-item scale was constructed that provided a reliable measure (alpha = 0.90) of factors which evaluate a climate-supportive of organisational change. Namely, Support for Change Process, Opportunity to Contribute to Change, Dynamism, and Support for Idea Generation. All factors are substantial and relate well in descriptive terms to the change process. Each factor meets the design framework and has an alpha > 0.7, allowing the factors to be considered as subscales for further correlation analysis (Clapp, 1991; Clapp & Ruckthum, 2017).

Ideas Generation

This measure involved the participant's personal assessment of the frequency that they generate ideas that address organisational shortcomings (ideas in unit time) the response scale ranges from three months down to one week. To aggregate the responses to provide a comparative assessment between individuals the different frequencies are aggregated to a one-year period.

Organisational Problems Identification

In the context of large organisations, 'problems' can be defined as a variance between the current situation and a future goal. As such, problems have no inherent style or associated risk. It is the solution offered that provides the pathway to a reduced variance that has stylistic characteristics of either adaptive or innovative. Here, the concern is who defines the problem rather than how problems are defined. To this end a measure was designed consisting of four separate items that question the source of the problem (personal, colleague, manager or organisation)

Factors of Personality

The NEO-PI (Big 5) measure of factors of personality was used to illuminate the personality domain, and for each factor the associate facets (Costa & McCrea, 1992).

Results and Discussions

Within the change process (See Fig 1) individual preferred behaviours and cultural expectations of behaviour combine to achieve the processing objectives of each stage of the process. This determines the way that data input into each succeeding stage of the process is viewed and the style and quantity of products that emerge from the different stages as well as

outcomes from the overall process. Prior to testing the hypotheses, the demographic and occupational characteristics of the sample were valuated (see Tables 1 and 2 below).

Table 1

Sample Demographic Characteristics

Variable	**N=153**
Male	54%
Female	46%
Age Range	20-58 yrs.
Mean	40 yrs.
Education Baccalaureate	50%
Advanced	10%
Job Level: Staff	66%
Supervisors	26%
Managers	8%

Table 2

Sample Occupational Characteristics (n=153)

Occupational Variables	Cognitive Style	Psychological Climate
Age	.-.07	-.15
Education (level)	.25**	-.03
Job Training Required	.14	.21*
Time in Job	.10	-.26**
Time in Company	.10	.06
Job Level	.41***	.29**

* p<.05, **p<.01, ***p<.001 these indicators are valid throughout the text

The Job level correlation with cognitive style shows supervisors and managers as a more innovative group, supportive of change and with higher levels of education. Time in job, with its acceptance of the culture of a large organisation (adaptive by nature), is negatively related to a climate that supports change.

Hypothesis 1. Relationship between climate and cognitive style

The main objective of Hypothesis 1 is to examine the relationship between the two independent variables cognitive style and organisational climate to determine their independence and viability as predictors of the dependant variables, along with their relationships with the occupational characteristics of the sample.

For both cognitive style and psychological climate significant correlations were found for the factors of each measure indicating overall commonality. However, no significant relationship was found between the overall measures of cognitive style and psychological climate indicating independence of the two domains. This finding is at variance with the view that for large organisations cognitive style (and its relationship with personality) contributes to the situational climate, (e. g. Schneider (1987) 'people make the place'. Only when significant consolidation of any cultural, or personality variable is present may such an alignment exist typically through recruitment, or when attrition erodes individual diversity (Marsden, 2016). As no significant relationship was found between the two independent variables Hypothesis 1 is accepted.

Additionally, the measure of cognitive style was related to factors of the 'Big 5' measure of personality (Costa & McCrea, 1992), only the factor 'openness' (fantasy, ideas and values) has a significant relationship (r= 0.59 p=.000). In a study with a distinctly different sample Gelade, (2002), found the factor 'openness') was related (r= 0.44 p=.001) to cognitive style along with the personality factor 'conscientiousness' (dutifulness, achievement and deliberation) (r= - 0.50 p=.001). The latter negative relationships show Kirton's measure of cognitive style as being rooted in one or more factors traits of personality (Von Wittich & Antonakis, 2011; Gelade, 2002). For psychological climate no significant relationships were found with any of the factors of personality.

Hypothesis 2. Relationship between climate, cognitive style and ideas generated

It has been proposed that all people are creative and only the style separates individuals who create adaptive ideas from those who create innovative ideas. For this sample where organisational activities are being addressed a group of some 31% (n=41) of the respondents did not offer a single idea (Adler & Chen, 2011; Madjar et al., 2011). For this group the number of individuals in each division were n = (15, 14, 12) respectively, where half were single individuals, while the other half were groups of two or three individuals, no larger groupings were present. The remaining group 69% (n=90) offered one or more ideas.

To detect any differences between the independent variables of the two groups t-tests were used with the following results: for climate (t =.97 p=.33), for cognitive style (t=.93 p=.35). These results indicate that both groups show no significant differences in their evaluation of the characteristics of both climate and cognitive style. A similar result was found when the measures of idea style, were evaluated. Here for both groups (contributors and non-contributors) alpha of the idea style factors was greater than 0.8. Absolute values of the factors and the correlation between them showed no significant differences. Thus, while some 30% of the sample offered no ideas, they were able to reliably recognise the differences between the characteristics of the two styles of ideas. This finding shows ideas as cognitive construals are different from manifest ideas as process outcome variables.

While no significant difference between the two groups for any of the demographic variables was noted, differences in relationships between the three factors within cognitive style were significant. For the group who offered one or more ideas the factor 'sufficiency of originality' showed a significant relationship with factors efficiency and conformity. For the group who offered zero ideas, such a relationship lacked significance. The relationship between the factors efficiency and conformity maintained a significant relationship for both groups.

For the overall sample, the relationship between climate and ideas generated is significant (r=.23 p=.01), and for cognitive style and ideas generated is (r=.32 p .000). Also, an interaction exists between the standardised variables of climate and cognitive style with ideas generated (r=.25 p=.004).

For the group that generated one or more ideas the relationship between climate and ideas generated is (r=.26 p=.01), and for cognitive style (r=.39 p=.000), with a lower interaction of (r=.26 p=.01) showing little difference between the group that generated ideas and the overall sample.

In summary, for the 69% of the sample that generated at least one idea both climate and cognitive style showed significate relationships with ideas generated. With the addition of the 31% of the sample that offered no ideas to the evaluation, the relationships were diluted but not below significance. Also, while this latter group offered no ideas, they were able to reliably recognise the differences between the characteristics of the two styles of ideas. Thus, the motivational effect of other exogenous variables cannot be ignored. Typically, trust, inclusion and contextual sensemaking of the problem well as the activity of particular co-workers all have an effect (Jansen et al., 2014; Madjar et al., 2011; Zhang et al., 2018). Also, for the zero ideas

group changes to the internal structure of cognitive style were noted where the factor 'sufficiency of originality' lacked a significance relationship with factors efficiency and conformity. Thus, from the perspective of ideas as cognitive constructions hypothesis 2 is accepted.

Hypothesis 3. Relationship between climate, cognitive style and idea style

As cognitive style is described as a bipolar continuum of personal preferences (e.g., Kirton, 1976, 2011), it is expected that the measure, with its innovative focus (the adaptive pole being reverse scored) would correlate positively with the innovative idea style and negatively with the adaptive idea style. Such a relationship would be indicating complete coherence between cognitive style and idea style as described in cognitive style theory (Kirton, 2011). For climate a positive relationship between both idea styles is expected.

The relationship between cognitive style and the innovative style of ideas, controlling for the adaptive style of ideas, is significant (r=.35 p=000), while that for cognitive style and the adaptive style of ideas, controlling for the innovative style of ideas, lacks significance (r=.03 p=.68). Furthermore, there is no significant interaction between the two independent variables and the style of ideas (unlike the result for the quantity of ideas).

The relationship between climate and the innovative style of ideas, controlling for the adaptive style of ideas, lacks significance (r=.10 p=.22). However, the relationship between climate and the adaptive style of ideas, controlling for the innovative style of ideas, is significant (r=.37 p=.000).

Thus, the measure for climate is related to the adaptive style of ideas and unrelated to the innovative style of ideas, while the measure of cognitive style is related to the innovative style and–unrelated to the adaptive style of ideas. This indicates that while high scores for cognitive style (originality and non-conformity) are related to innovative ideas, low scores are not related to adaptive ideas. These relationships are at variance with cognitive style theory and question the bipolar design of the measure of cognitive style suggesting that it is unipolar, related only to the innovative style of idea. Thus hypothesis 3 is only partially accepted.

Additionally, the measures of idea style were related to factors of the 'Big 5' measure of personality (Costa & McCrea, 1992), only the factor 'openness' is related to the innovative style (r=0.44 p=.006). Also, the factor 'conscientiousness' is related negatively to the adaptive style of ideas (r= -0.36 p=0.03), when the innovative style is controlled for the relationship

boarders on insignificance (r= -0.33 p=0.05) (Reiter-Palmon et al., 2009b). Furthermore, the innovative idea style has been shown to be related to intrinsic motivation, while the adaptive style is related to extrinsic motivation (Amabile et al., 1994; Gilson et al., 2012; Malik et al., 2019).

Hypothesis 4. Relationship between idea style and number of ideas generated

Cognitive style theory describes a person who proliferates ideas as related positively to cognitive style. Thus, it is expected that the innovative style of ideas will correlate positively with the increasing number of ideas offered.

For the overall sample, while controlling for the effect of the adaptive style, no significant relationships were found between the innovative style of ideas and the number of ideas generated. However, for the group where the number of ideas generated was one or more, the variables of ideas generated and the innovative style of ideas showed a significant relationship (r=.25 p=.02). As the increasing number of ideas generated is not a characteristic of the adaptive style of ideas, no significant relationship was expected or found between these two variables. Thus, as expected, individuals who generate an increasing quantity of ideas also create a more innovative style of ideas. The presence of some 30% of individuals who did not generate any ideas dilutes this relationship to insignificance in the overall sample. Therefore, hypothesis 4 is accepted

Hypothesis 5. Relationship between climate cognitive style and source of problems identified

In the context of large organisations, 'problems' can be defined as a variance between the current situation and a future goal, and as such they have no inherent style. Here, the concern is who defines the problem (personal, colleague, manager or organisation) and their relationship with the independent variables, rather than how problems are defined.

For the overall sample, all individuals in the group (personal, colleague, manager or organisation) show a significant relationship with cognitive style and problems identified (r=.21 p=.01). This mirrors the relationship with ideas generated and suggests that cognitive style, through originality, is related to both the generation of ideas and the identification of problems. Such an individual is described by Kirton (1976, 2011) as 'a person who copes with several new ideas and problems at the same time'. For climate there is a significant positive relationship

between all who identifies problems (r=.34 p=000), thereby indicating a supporting rather than a constraining relationship for all levels of hierarchy in the organisation.

For the group who generated one or more ideas, cognitive style retained a significant relationship with problems identified (r=.26 p=.01). However, the support provided by climate is more specific and relates only to the manager as a problem identifier (r=.27 p=.01). However, job level was found to be related (r=.41 p=.001) to cognitive style indicating that the managers were more innovative than others in the sample.

In summary, for the identification of problems, the innovative aspect of cognitive style plays an important part. While climate support is provided for all individuals in the organisation, for the more adaptive individuals the manager is seen as a significant identifier of problems. Hypothesis 5 is accepted.

Summary of Hypothesis Testing Results

- As the two variables cognitive style and psychological climate are from independent domains an insignificant relationship can be expected. This hypothesis is accepted.
- Given the view that all people can be creative then, with support from psychological climate and a suitable problem focus, all people within the sample will generate at least one idea as a possible solution. (Clapp, 1991; Kirton, 2011). This hypothesis is accepted.
- The dichotomy of adaption-innovation, when used to characterise the behavioural preferences of the measure of cognitive style, will for idea style show a negative relationship with the adaptive style and a positive relationship with the innovative style (Kirton, 1976, 2011). This hypothesis is partially accepted.
- In large organisations that are adaptive by nature, the associated psychological climate will be related to the adaptive style of ideas and quantity of ideas generated. This hypothesis is accepted.
- Managers and supervisors with their greater overview of operational activities will provide significant support as problem identifiers. This hypothesis is accepted.

Conclusions and Recommendations

Conclusions

In this study, the generally accepted stage definitions of the four-stage change process are used (see Fig 1). The products from processing the content of the first two stages of the

process are considered as the creative part, while the latter two stages form the part concerned with exploitation of the creative opportunity, or more generally, outcomes that change existing arrangements. The processing of the content of the first two stages where problems are defined and solutions constructed depends largely on the constraints and supports from both cognitive style (stylistic preferences) of individuals and psychological climate (situational and cultural). However, because the content of the last two stages is concerned with the more political issues of organisational choice and resource allocation they to act as filters. Thus, for large organisations, incremental rather than the more radical solutions are favoured, the latter by default involve more risk. Issues such as supply chain disturbance, costs, profits, time-scales and other associated risks all tend to be lower for incremental idea outcomes and higher for the more radical. These constraints on the more radical ideas are not so much exercised through the suppression of ideas but through the more political process stages of solution selection and implementation. Xerox and the graphical user interface, along with IBM and the personal computer, are examples of organisations where radical opportunity was discarded in favour of continuing with the current strategy resulting in the longer-term loss of a market sector. Thus, when considering creative problem solving in large organisations, the implications of preferred style extend beyond the identification of problems and solution generation through to decision making and the allocation of resources. All are of significant importance to the strategic management of outcomes.

Administrative organisations operating as complex systems and seeking predictability by minimising risk are expected to promote a climate that reflects the adaptive end of the dichotomy (similarly research organisations promote predictability through innovation). While there is a view that ‘people make the place’ (Schneider, 1987), no significant relationship was found between the two domains of psychological climate (individual perceptions of the group) and individual cognitive style (which in sum characterise the group). This lack of such a relationship may be due to the study sample containing managers and supervisors that are more innovative (and independent) thus able to offer support to individuals for the generation of ideas. Both psychological climate and cognitive style were found to have a significate relationship with number of ideas generated as does a normalised interactive factor. While some 70% of the sample generated at least one idea, there remains some 30% (n=41) of the sample that offered zero ideas. Of this latter group of individuals, similar numbers were present in each division within the sample. While difference in the scores for psychological climate, cognitive style and idea style between the two groups (70% and 30%) lacks significance, the latter group were able

to recognise the difference between the two poles of idea style (in spite of offering zero ideas). Leading to the view of ideas as a cognitive construal different from ideas manifest as process outcomes. Furthermore, exposure to cultural differences by individuals (such as this sample) who are from an international organisation may influence the way measures are perceived. This is particularly so for Kirton's measure of cognitive style (where the adaptive pole is reverse scored to align with the innovative pole). Here, the relationships between the poles for different national samples range between +0.5 for countries in the west, to -0.5 for countries in the east (Clapp & Ruckthum, 2017). Paletz & Peng (2009) suggests that the activity of a culturally sensitive cognitive style concerned with tolerance of contradiction may account for such differences, and thus dichotomies formed in the west may not be seen as such in the east. Or even that all things seen as innovative in the west are regarded by the Chinese as adaptive (Shao et al., 2019).

For the activity of problem-solving to be considered creative, the general view is that it must involve novelty or ideas leading to original and useful solutions (Gilson & Madjar, 2010; Runco, 2004; Sternberg & Lubart, 1999; Vernon et al., 2016; Yilman, 2020). However, Kirton (1999) suggested, and Gabora (2018) confirmed that innovative solutions that contain novelty, are rarely conceived as fully efficient, and that many adaptive (useful) improvements are required to approach an optimal configuration (e.g. 70 years of improvements for the modern jet engine to emerge). Furthermore, Gabora suggests that if creative output is not just chance or intelligence, but 'idiosyncratic individual behaviour concerned with wrestling with personally meaningful issues to forge a new integrated world view'. Then, one might expect that individuals will have a distinctive characteristic style not just within domain but across domains (e.g., artistic, scientific literary etc) and across organisational functions (production, research, marketing etc). These findings support the view that within the two dichotomous forms, most people (rather than just a gifted few) can contribute creatively to problem identification, ideas and outcomes independent of specialisation or product class. Furthermore, to exclude from the concept of creativity the significant benefits, and in some cases social change from the implementation of many useful improvements is to ignore a significant creative contribution (Bunker & Alban 2006).

While the relationship between the innovative style of ideas and the cognitive style measure is significant, the adaptive style of ideas is related only to the situational support from climate and involves the factor '*opportunity* to contribute' (Clapp, 1991; Ruckthum & Clapp, 2008). This finding leans towards *inclusion* and the more inclusive climate associated with

authentic leadership (Avolio, & Gardener 2005; Boekhorst, 2015; Jansen et al., 2014) rather than the *rewards* usually associated with extrinsic motivation (Amabile et al., 1994; Higgins, 1998). This relationship leaves the adaptive end of the cognitive style measure (concerned with the factors conformity and efficiency) independent of the adaptive style of ideas. Thus, in its current form, the cognitive style measure (Kirton, 1976, 2011) is consistent with a spectrum of personality traits where it relates negatively with the factors of neuroticism, and conscientiousness and positively with extroversion and openness. These relationships address only that part of the creative activity concerned with innovative ideas which are explicitly catered for within the measures of both cognitive style and the personality trait of openness. If adaptive ideas are theorised as relating to the trait domain (e.g., Kirton 1976, 2011) then similar explicit definition for adaptive ideas will need to exist within both measures. This suggests that the facets of the trait factor openness should be reformed as bipolar so as to create a balance between the innovative and adaptive styles (e.g. as alluded to in the definition of openness (Costa, & McCrae,1992, p.15). An alternative to such a consideration is that as ideas are carriers of style they do not exist as a component or an enduring disposition, and so do not meet the definition for personality traits as describing 'what people are like'. Thus, ideas, (both styles) should be excluded from both the definition and measures of style as rooted in personality.

For the identification of problems, the innovative component of cognitive style plays an important part at the individual level, while climate supports all individuals in the organisation and as such, leans towards culture. The manager, however, is seen by some individuals as a significant identifier of problems. Thus, in the absence of the manager identifying a problem, ideas from subordinates may also be absent.

Recommendations

There is a growing acceptance that a useful conceptualisation of creative style as an individual difference is rooted in a dichotomy concerned at one end with innovation while at the other end with adaptiveness. The dichotomy has been used by Kirton to describe both a cognitive style theory and a bipolar measure where both ideas and behaviours are coherent and play a central part in the development and optimisation of societal and organisational performance. This study found such a relationship between the innovative end of the bipolar measure of cognitive style and the innovative measure of idea style, but a lack of coherence

between the adaptive end of cognitive style and the measure of adaptive idea style. Therefore, this relationship needs further studies.

In problem-solving, it has been recognised that radical outcomes are not born along with optimal efficiency and that many iterations are required from incremental improvements before such an optimum is attained. This process is described in both the spiral of change and the theory of constraints and is particularly relevant to organisational development projects. While this research has centred on the view of creativity from a western perspective, the view of creativity and personality from eastern countries may offer additional concepts that resolve the issues surrounding the integration of the concept of incremental improvements. Such view requires further critical analysis and empirical investigations into its relevance.

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