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Cognitive styles and performance on complex, structured tasks

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ABSTRACT

This study looks at the conditional relationship between the Assimilator–Explorer (A–E) cognitive styles and performance on complex, structured tasks. We predicted that the achievement motive should moderate the style–performance relationship. Eighty-three participants with mean age 18.5 years completed a cognitive style test, a measure of the achievement motive, and a fluid intelligence test (control variable). The dependent variable was scored on a remote association test (RAT) with items based on complex word pairs. Results showed that Explorers performed better when they scored higher on the achievement motive. Assimilators performed better when they scored lower on the achievement motive. The idea of optimal motivation was supported by the pattern of interaction.

1. Introduction

The Assimilator–Explorer styles (A–E styles) describe individual differences in cognitive strategy preferences. The A–E styles can be seen as an important moderator in research on creativity and problem solving and the purpose of the present paper is to further investigate how these styles may moderate problem solving performance. The theory posits that the strategy preferences associated with the A–E styles describe competence implications for different types of tasks along a structured–unstructured (high novelty) dimension (Kaufmann, 1979). More recent positions argue that the task competence described by the A–E styles will be moderated by the achievement motive (Martinsen, 1994). However, while previous studies have emphasized performance on complex, *unstructured* tasks, we presently focus on complex, *structured* tasks. This represents a further test of the interactive nature of the A–E styles.

The theory of the Assimilator–Explorer styles was proposed by Kaufmann (1979, 1995) and later elaborated by Martinsen (1993, 1994, 1995a,b). It has been placed in the Wholist–Analyst category of style constructs (Riding & Rayner, 1998). Assimilators are more rule-bound in problem solving behavior and inclined to interpret new events in terms of existing knowledge. Explorers seek novelty, which manifests as a search for new types of solutions and new ways of solving problems even without external pressure to do so.

The A–E style construct has been operationalized as a continuum where higher scores describe Explorers and lower scores describe Assimilators. The measure of A–E styles (Kaufmann & Martinsen, 1992) includes three correlated sub-factors that define the second-order A–E style construct. (Martinsen & Diseth, 2011). The main A–E style construct has several correlations with measures of personality, where the Explorer end of the continuum is associated with lower scores on Neuroticism, Agreeableness, and Conscientiousness, and higher scores on Extroversion and Openness compared with the Assimilator end of the continuum (Martinsen & Diseth, 2011). Moreover, the A–E continuum is not correlated with general intelligence (Martinsen & Kaufmann, 2000). In the latter study, the A–E style dimension also correlated significantly with a motivational factor. Significant differences between students have been found in different types of educational settings; art students show the highest scores (more explorative). A significant correlation between the A–E styles and scores on a creative activities checklist (Explorers having higher creativity scores) also exists, but there is only a weak, yet still significant, correlation between these styles and measures of verbal and figural fluency (Explorers have higher divergent thinking scores). Taken together, the correspondence between the A–E theory and the pattern of empirical findings hitherto is consistent with the basic definitions of cognitive style. This implies a strong relationship between personality and style, no or low correlations with abilities, and differential implications for performance (Martinsen, Kaufmann, & Furnham, 2011).

Previous studies have shown that the task-specific strategies described by the A–E styles do not necessarily lead to superior performance. The degree of compatibility between stylistic dispositions and task characteristics affect performance mainly in combination with other influences. Interactive effects between stylistic dispositions, degree of task-relevant experience (Martinsen, 1993, 1995a), cues in the situation, such as solution hints (Martinsen, Furnham, & Hærem in

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preparation), strength of the achievement motive (Martinsen, 1994), as well as positive mood (Kaufmann & Martinsen, 2006) together may influence performance. Several aspects of this dynamic interplay may be explained by a theory of optimal motivation for the task depending on task complexity (Atkinson, 1974; Yerkes & Dodson, 1908) and where also the type of task (structured vs. unstructured), position on the A–E style inventory, and the strength of the achievement motive (or other positive affect arousing conditions) together determine the quality of performance. In Atkinson's (1974) account of achievement motivation, resultant task motivation is mainly a function of perceived competence for the task and the strength of the achievement motives. The performance effect of resultant task motivation, however, is posited to be dependent on the structure or complexity of the task. On complex problem solving tasks the prediction is that performance should be impaired when task competence is high and achievement motivation is also high. In our study we use the A–E styles as a proxy for task competence and this is further outlined below.

In previous studies we have emphasized performance on unstructured tasks. Thus, in the present context, we found it important to further investigate the style–performance relationship on tasks that favor Assimilators' strategy dispositions. It seems that on complex tasks with solution cues, which were seen as influential search constraints by Kaplan and Simon (1990), Assimilators should perform better at the outset. However, according to the theory above, this style–performance relationship should also be moderated by the strength of the achievement motive.

Previous studies (Martinsen, 1994) have used classic insight problems that can be described as unstructured, ill defined and difficult because they demand restructuring. A related type of task can be constructed based on principles from the Remote Associates Test (RAT; Mednick, 1962). Such tasks have been used as insight problems in the line of research by Bowden, Jung-Beeman, Fleck, and Kounios (2005). Items in RAT present the subject with three stimuli words that are supposed to elicit one another remotely associated word. Such a task presents the individual with a large problem space, especially if one or several word associations are uncommon (remote). In such cases, the task would favor the Explorer style. However, these tasks may also be constructed so they favor the Assimilator type of strategy disposition. Using complex word pairs, rather than distantly associated words, can moderate the structure of such tasks since word pair-based tasks implicitly present the problem-solver with a rule to follow. Such a rule can be made salient through task instructions or by presenting sample items with solutions. When word pairs are used as the basis for RAT items, the task should theoretically align with Assimilators' competence rather than Explorers' competence because they include a general problem-solving rule. Thus a constraint may limit search in large problem spaces, but theory argues that people with different styles are differently inclined to utilize such constraints. Based on this, we expect that Assimilators should be more competent on the present RAT tasks, but also that strength of the achievement motive should moderate the performance of style–performance relationships. Compared with previous studies (Martinsen, 1994), we expect a reverse pattern of interaction and put forward the following hypothesis:

H1. The relationship between the A–E styles and performance on structured, complex RAT tasks should be moderated by scores on the achievement motive.

The pattern of the posited interaction should indicate that Assimilators perform better when scores on the Motive to Approach Success are in the lower range and worse when the scores on the Motive to Approach Success are in the higher range. Explorers should perform better when scores on the Motive to Approach Success are in the higher range and worse when the scores are in the lower range.

Finally, because some style constructs were contaminated by intelligence (Martinsen, 1997) in previous style research, it is important to control for intelligence to provide evidence for the validity of style constructs. We included a measure of fluid intelligence, which has been found to have a high loading on the G-factor (Undheim, 1981).

2. Method

2.1. Sample

Eighty-three students (54 males and 27 females) from a Norwegian upper high school participated. Their mean age was 18.5 years. Upper high school in Norway lasts three years and includes students between the ages of 16–17 and 18–19 years.

2.2. Measures

2.2.1. A–E inventory

The revised A–E inventory (Kaufmann & Martinsen, 1992) was used. The scale is continuous and Explorers have higher scores and Assimilators lower scores on the inventory. Each item has a five-point response scale and the present version of the inventory has 30 items. The inventory has been validated in previous studies (Martinsen & Diseth, 2011; Martinsen & Kaufmann, 2000). Alpha for the A–E inventory was .91 in the present study.

2.2.2. Achievement motive

A short form of the Achievement Motives Scale (AMS; Gjesme & Nygård, 1970; Nygård & Gjesme, 1973; Lang & Fries, 2006) was used. The present version of this scale (Nygård, 1997 [personal communication]) includes a brief vignette where the participant is asked to think of a problem-solving situation in which there is uncertainty about the outcome. Following this, the participant was asked to respond to 20 adjectives describing achievement affects. Ten adjectives described positive affects (e.g., engaging) that indicated motivation to achieve (motive for success: Ms), and 10 adjectives described negative affects (e.g., unpleasant) that indicated motivation to avoid failure (motive to avoid failure: Mf). We used a five-point response scale for each item and two summed scores. Cronbach's alpha reliabilities were .87 for Ms and .90 for Mf. We presently use Mf as a control variable based on previous studies (Martinsen, 1994).

2.2.3. Verbal analogies

A brief and standard test of verbal analogies was taken from Mønnesland (1985) and used as a measure of fluid intelligence. This test has 20 items and participants were given 6 min to complete the test.

2.2.4. Remote Associates Test (RAT)

Fifteen items were constructed using the procedure described by Bowden et al. (2005) but adapted so that word pairs became the main basis for item construction. Since translations from Norwegian to English may not be illustrative, we cite examples provided by Bowden et al. (2005, p. 324). These include “French, car, shoe” (correctly associated word: “horn”), and “Boot, summer, ground” (correctly associated word: “camp”). Participants were given 20 min on this test, and its alpha reliability was .74.

2.3. Procedure

Participants were encouraged to volunteer by the school staff. They were told that they were participating in research on problem-solving and were debriefed after the study was completed, which took 60 min. Participants first completed the A–E inventory, the short AMS scale, the verbal analogies test, and finally the present version of RAT.