

Structure and freedom in creativity: The interplay between externally imposed structure and personal cognitive style

LILACH SAGIV*, SHARON ARIELI, JACOB GOLDENBERG
AND AYALLA GOLDSCHMIDT

School of Business Administration, Hebrew University of Jerusalem, Jerusalem, Israel

Summary

This research investigates how creativity is influenced by externally imposed structure (how structured the task is), internal, cognitively produced, structure (how structured the individuals' cognitive style is), and the interaction between these two factors. Reviewing past literature, we find a contradiction. Studies that focused on the situational perspective found that externally imposed structure increases creativity. In contrast, studies that focused on the individual found that systematic (structured) cognitive style decreases creativity. In two empirical studies we investigated this seeming contradiction. We focused on two aspects of externally imposed structure: The construction of the task (Study 1) and the instructions provided (Study 2). The findings of both studies revealed that creativity was higher under structured conditions. We also show that intuitive individuals are more creative than systematic individuals, but mainly under free conditions, where structure is not externally imposed. Copyright © 2009 John Wiley & Sons, Ltd.

Introduction

Creativity is acknowledged as an important attribute for organizations (e.g., Taggar, 2002). It plays a central role in firms' potential for innovation and competitiveness on the global market (Miron, Erez, & Naveh, 2004). Research on creativity in organizations has received growing attention in recent years. Researchers have argued that *situational* factors in organizations influence individuals' creativity directly, and this influence is moderated by various *personal* attributes (e.g., Amabile, 1988; Amabile, Conti, & Coon, 1996; Oldham & Cummings, 1996; Woodman, Sawyer, & Griffin, 1993). In the current paper we join this line of research and advance it by studying the role of *structure* in creativity. We

* Correspondence to: Lilach Sagiv, School of Business Administration, Hebrew University of Jerusalem, Mount Scopus campus, Jerusalem 91905, Israel. E-mail: mslilach@mscc.huji.ac.il

Received 14 September 2007

Revised 27 July 2009

Accepted 19 August 2009

investigate how creativity is influenced by externally imposed structure (how structured the task is), internal, cognitively produced, structure (how structured the individuals' thinking style is), and the interaction between these two factors.

Two main approaches could lead to creativity in an organization. An *individual* perspective focuses on creativity as a personal attribute that may characterize a person to some degree. By selecting creative individuals as their members, organizations can increase the creativity of their products and services. A *situational* perspective focuses on situational factors that may influence creativity: Various organizational factors (e.g., reward systems, organizational values, and norms) may work independently or together to increase creativity (see Lee, Edmondson, Thomke, & Worline, 2004). Organizations can, therefore, increase individual creativity by molding the environment and employing socialization and training processes that generate a creative-friendly environment.

Past research on creativity has often explored the impact of either organizational variables reflecting organizational context (e.g., organizational climate, Amabile et al., 1996; perceived support, Scott & Bruce, 1994; presence of others, Shalley, 1995; goal setting, Shalley, 1991) or variables reflecting stable individual differences (e.g., intrinsic motivation, Amabile, 1997; personality, Oldham & Cummings, 1996; problem solving style, Scott & Bruce, 1994). In recent years, researchers have pointed out the importance of studying the effects of the interaction between personal and situational factors. Several empirical studies have indicated that personal attributes interact with situational factors to impact creativity (e.g., George & Zhou, 2001; Tierney, Farmer, & Graen, 1999; Zhou & George, 2001). In the current research we take another step in this line and study the effect of *structure* on creativity, from both the situational and the personal perspective.

Following classical organizational theories, we view structure in organizations as sets of rules and patterns that “program” individuals and procedures (Peterson, Smith, Bond, & Misumi, 1990; see also Galbraith, 1974, Thompson, 1967). Organizational members may experience structure internally or externally. Internal structure refers to personal tendencies to search for and apply rules versus follow one's intuition. Externally imposed structure refers to the goals, tasks, and procedures that the organization constructs for its members (e.g., rules, re-planning, and supervision).

Only a few past studies have considered the effect of structural variables on creativity. Several studies focused mainly on externally imposed structure and investigated how creativity is associated with the amount of autonomy organizational members have in crafting their jobs (Zhou, 1998; see also Amabile et al., 1996; Shalley, Gilson, & Blum, 2000, who focused only on situational variables). Other studies investigated both externally imposed structure and personal characteristics. Some found, for example, that job complexity interacted with creativity-relevant personal characteristics in affecting creative behavior (Baer, Oldham, & Cummings, 2003; Oldham & Cummings, 1996). Studying team performance, Taggar (2002) found that personal attributes (e.g., openness to experience) and creativity-relevant processes (e.g., preparation, setting a strategy) predicted individual creativity.

In the current research we explored the effect of externally imposed and internal, cognitively produced, structure on creativity, and the interaction between them. We focused on two aspects of externally imposed structure: The construction of the task (Study 1) and the instructions provided (Study 2). Starting with externally imposed structure, we review two opposing views of the creative process—the *Freedom* versus the *Structure* approach—which could guide organizations in constructing tasks and setting the conditions for enhancing creativity. We then discuss personal tendency to apply structure, reviewing research on individual differences in systematic (structured) versus intuitive cognitive style. We show that these two lines of research offer contradictory predictions with regards to the effect of structure on creativity. In two experiments we attempted to clarify this seeming contradiction: We studied how creativity is influenced by free versus constrained task construction, systematic (structured) versus intuitive cognitive style, and the interaction between them.

The Situational Perspective: The Structure Approach Versus the Freedom Approach to the Creative Process

How should externally imposed structure affect creativity? The answer depends on how creativity is defined: Is it an extraordinary phenomenon or an ordinary problem-solving process? Creativity researchers are divided over this issue (Maimon & Horowitz, 1999). Here we present two contrasting views: the Freedom approach versus the Structure approach.

The Freedom approach

The Freedom approach views creativity as qualitatively different from day-to-day thinking (see Guilford, 1950; Koestler, 1964; Wallas, 1926; see also Csikszentmihalyi, 1990, for the specific case of problem solving). According to this approach, the creative process involves a leap that cannot be adequately formulated, analyzed, or reconstructed. Boden (1996), for example, states that inventors, scientists and artists rarely know how their own original ideas arise; intuition is often mentioned, but little is known of its precise role in the process. Boden therefore considers creativity a puzzle, a paradox, or even a mystery. The Freedom approach is consistent with the psychoanalytical distinction between primary processes of thinking, which are associative and disorganized, and have been connected with artistic creation, and secondary processes, which characterize everyday thinking and are orderly and logical (see Kris, 1952; Martindale, 1999; Noy, 1999).

Because creative ideas differ from those arising under normal conditions, many researchers believe that creative ideation requires conditions dramatically different from those generally prevailing. The notion that one must overcome mental obstacles to produce creative ideas has often led to the belief that when a creative idea is generated, total freedom must be ensured by eliminating directional guidance, constraints, criticism, and thinking within bounded scopes (Csikszentmihalyi, 1996). Such elimination of barriers and constraints is expected to increase the accessibility of ideas drawn and contemplated from a typically infinite space of ideas (Grossman, Rodgers, & Moore, 1988; Koestler, 1964). According to this view, creative ideas should emerge from non-routine thinking, as opposed to algorithmic, problem-solving routines (Andrews & Smith, 1996). The emergence of creative ideas is facilitated if traditional or routine ways of conduct are challenged.

Most methods that dominate the field of practice (e.g., brainstorming, lateral thinking, random simulation) could be characterized as representing the Freedom approach. These methods reflect the Freedom view that creativity calls for qualitatively different thinking. To create conditions that allow for creative thinking, these methods apply the principle of not imposing any restriction or structure on people's thought processes. For example, the widely used *Blue-Sky* technique is designed to allow free association in developing creative ideas (Buzan, 1993; De Bono, 1992). Groups and individuals that use this technique are encouraged to follow their instincts and allow as many associations as possible to influence their thoughts. Individuals are instructed to think laterally and explore any direction that they feel comfortable with, and are asked to avoid systematic investigation of the problem.

Consider an example from advertising. The task is to generate a commercial ad for a brand of shoes. These shoes are especially comfortable because they are designed so that the shoe matches the shape of the foot. Adopting the *Blue-Sky* technique, the copywriter is encouraged to try and be attentive to herself in generating the best ideas she can. She is instructed *not* to follow any rule or systematic procedure, but instead, to act upon her natural instincts and allow as many associations as possible to influence her thoughts.

The Structure approach

The Structure approach views creativity as a reproducible, learnable, and in some cases even systematic type of thought process (see Maimon & Horowitz, 1999; Perkins, 1981; Simon, 1979, 1981). The thinking process is linear and thus each step in the ideation process stems from the previous one. Creativity is therefore perceived as an outcome of ordinary thinking that is only quantitatively different from everyday thinking, and does not necessarily require a qualitative leap (Perkins, 1981, 1988; Weisberg, 1992). Thus, according to Weisberg (1986), what distinguishes creative thinking from everyday thinking is its outcome and not the way it is produced.

The Structure approach asserts that it is not total freedom but rather some deliberate restriction that enhances creativity: Restricting the scope of a problem in a way that channels individuals to focus on its core elements is likely to lead to creativity. Thus, whereas the Freedom approach encourages exploring any direction of thinking in the infinite space, the Structure approach argues that limiting the number of variables under consideration from a very large number to a more manageable number of core components should increase inventive productivity. Constraining the space of thought may decrease the number of ideas, but should increase their creativity (Finke, Ward, & Smith, 1992). The Structure approach does not argue, therefore, that any type of restriction enhances creativity. Some restrictions may not increase, or may even decrease, creativity. Creativity results from restricting the space of possibilities in ways that lead individuals to focus on a manageable number of the central, most important, elements of the problem.

Creativity-enhancing methods that originate in the Structure approach prescribe a sequence of minor thinking tasks ordered as algorithmic procedures of thought (see review in Goldenberg & Mazursky, 2002). The *Creativity Templates* method (Goldenberg, Mazursky, & Solomon, 1999a), for example, captures the essence of the Structure approach: It provides a well-defined procedure that channels the thinking process. Templates are step-by-step sequences of operations that lead individuals to focus on the core elements of the problem. Therefore they allow individuals to systematically re-organize components of the problem's environment in a way that generates creative solutions.

Consider again the example of the advertisement for a brand of comfortable shoes. Following the Replacement Template procedure (which is fully described in Appendix C), the copywriter is led to focus on the core element of the product—in this case, the comfort the shoe provides (e.g., a sense of freedom, calmness, relaxation). At the next step, she is supposed to locate visual symbols that represent the chosen trait (e.g., a blue sky, an island, a beach, mountains). The copywriter will choose one symbol that best represents or is associated with the trait. Finally, she will visually link the symbol to the product or one of its direct components—for example, linking the symbol of a white cloud and a foot in such a way that the white cloud is shaped as a foot. A series of ads for the shoe brand “Bally” illustrate the basic scheme of the Replacement Template (Wieden & Kennedy, 1992, the one show).

The effectiveness of the freedom versus the structure approach: Empirical evidence

The effectiveness of free methods (e.g., brainstorming, lateral thinking, random simulation) has been questioned in numerous studies (Bouchard, 1969; Connolly, Routhieaux, & Schneider, 1993; Diehl & Stroebe, 1987, 1991; Paulus, Dzindolet, Poletes, & Mabel, 1993; Weisberg, 1992; for an exception see Sutton & Hargadon, 1996, who claimed research should look for criteria different from the ones used to evaluate brainstorming). The results of these studies show that the performance of individuals under Freedom conditions was not significantly superior to the performance of those who received no instructions.

Being more recent, structured approaches are still in a process of being adopted by firms, and are therefore less viable. Some evidence already shows, however, that the success rate of ideation processes guided by structured approaches is relatively high (Dasgupta, 1994; Goldenberg, Horowitz, Levav, & Mazursky, 2003). This observation is supported by controlled experiments on real-life problems in which individuals trained with structured methods performed better than individuals trained with free methods (Finke et al., 1992; Goldenberg, Mazursky, & Solomon, 1999b,c). For example, in a lab experiment (Goldenberg et al., 1999c) three groups of participants, each trained differently (a free technique, the structured Template technique, and no training), were asked to generate original, creative ads. A fourth group of participants subsequently judged the ads for originality and creativity. The judges rated the ads generated by the Template-trained group as more original and creative than those generated by participants with no training or by those who trained in the free technique.

Taken together, past studies indicate the advantage of structured methods that channel individuals to focus on a limited number of core elements of the problem. Thus, imposing structure and constraints on a task in such a way is more likely to induce creativity than creating conditions of total freedom.

The Individual-level Perspective: Personal Cognitive Style and Creativity

Past research has investigated the impact of various stable individual attributes on creativity. Creativity was found to be positively associated with openness to experience (Feist, 1999; George & Zhou, 2001; McCrae, 1987), divergent thinking (McCrae, 1987), Kirton's adaption-innovation style (Tierney et al., 1999), and low Latent Inhibition (Carson, Peterson, & Higgins, 2003; also see Simonton, 2003).

Especially relevant to the present research is the study of stable individual differences in the structure of thought systems. Previous studies have found creativity to be positively associated with intuitive versus systematic cognitive style (e.g., Scott & Bruce, 1995; Smith & DeCoster, 2000; Yates, 1999). This personal attribute involves individual differences in applying structure and is therefore conceptually related to the Freedom versus Structure approach discussed here. In the present research we draw on this literature and investigate how intuitive versus systematic (structured) cognitive style interacts with externally imposed structure to impact creativity.

Cognitive style of information processing

Researchers generally agree that there are two main modes of information processing: A rule-based mode, which focuses on the attempt to identify and use rules to process information, and an associative mode, which focuses on associative, context-dependent processes. Researchers agree that both modes of information processing are used by all people, depending on the nature of situation and the task (e.g., Schul & Mayo, 2003; Smith & DeCoster, 2000). Yet, over time, one of these two modes is likely to become consistently dominant for a person and reflect his or her main *cognitive style*. Cognitive style involves stable individual differences in organizing and processing information and experiences, and has been found to be consistent across time and situations, and independent of abilities, skills, and intelligence (Messick, 1984). It is reflected in consistent patterns of behavior characterizing the way individuals approach tasks (Perkins, 1981). Cognitive style thus affects the way people think and act. Accordingly, researchers have demonstrated its impact on learning (e.g., Kolb, 1984, Rayner & Riding, 1997), decision-making (see review in Phillips & Paziienza, 1988), management (e.g., Allinson, Armstrong, & Hayes, 2001; Riding, 1997), and more.

Various researchers have studied dimensions of cognitive style of information processing. These studies have been conducted in different fields and settings, and have produced various constructs and dimensions. To date, there is no consensus in the literature on a general approach or theory of cognitive style (Rayner & Riding, 1997). However, a review of the various constructs (see reviews in Allinson & Hayes, 1996; Phillips & Paziienza, 1988; Riding, 1997) shows that most researchers refer to a similar bipolar dimension, contrasting a systematic, structured style with an intuitive, associative one.

The *systematic* style refers to the tendency to logically and intentionally analyze a situation. The systematic person conducts a deep search and logically evaluates various alternatives in an attempt to identify systematic rules. These rules help organize the world into systematic patterns which may assist individuals in choosing ways of acting according to clear, systematic standards (Perkins, 1981; Scott & Bruce, 1995). In contrast, the *intuitive* style refers to the tendency to capture a pattern (e.g., meaning, structure) without being able to account for the source of the knowledge or information. Individuals relying on intuition may not be aware of the pattern, but it may nonetheless guide their ways of thinking (Perkins, 1981). Intuitive individuals often base their decisions on feelings and intuitions (Scott & Bruce, 1995).

Studies have suggested that creativity is related to the intuitive cognitive style (Scott & Bruce, 1995; Smith & DeCoster, 2000; Yates, 1999; see also Simonton, 2003, who suggested that creativity is related to a flat hierarchy of associations). Intuitive thinking involves linking various areas of thought and using imagination. The intuitive person tends to analyze information from various paradigms simultaneously, and is therefore likely to come up with original solutions to problems (Scott & Bruce, 1994). In contrast, systematic thinking usually relies on consistent rules and disciplinary boundaries, using logic and rationality. Systematic individuals tend to follow regular methods and processes, and therefore suggest fairly conventional solutions to problems. Accordingly, having an intuitive rather than a systematic cognitive style is positively correlated with creativity and originality (e.g., Jacobson, 1993; Scott & Bruce, 1995; Smith & DeCoster, 2000). The effect of cognitive style on actual creative behavior has rarely been studied empirically. Scott and Bruce (1994, 1995) found that general innovative behavior, as reported by participants' supervisors, correlated positively with the intuitive and negatively with the systematic ("rational") decision-making style. Our study is the first to directly investigate the effect of systematic (structured) versus intuitive cognitive style on the creativity of a specific product or a solution to a problem.¹

Taking an Integrated Approach to Structure and Creativity: Contradictory Impacts of Externally Imposed Structure and Personal Cognitive Style

Our analysis of past research on externally imposed structure suggests that structure and constraints should be imposed to enhance creativity. At the same time, however, our review of research on

¹Epstein, Pacini, Denes-Raj, and Heier (1996) suggested a similar typology of the main modes of information processing: rational versus experiential. They consider individuals with a dominant rational mode as having a great need for cognition (Cacioppo & Petty, 1982), whereas individuals with a dominant experiential mode are considered high on "faith in intuition" (Epstein et al., 1996). This typology does not relate to structure. Rather, Epstein et al. (1996) contrast a preference for deep thinking with reliance on intuition. Deep thinking, however, could involve either a logical search for rules, or associative and intuitive thinking. It is therefore neither congruent nor incongruent with the systematic style. Recent empirical data (Sagiv & Ein-Gar, 2009) provides support for this claim. The correlations of need for cognition with three highly interrelated measures of systematic cognitive style were near zero (r ranged from -0.02 to -0.19 , all ns).

cognitive style in information processing indicates that intuition, rather than a systematic search for rules, leads individuals to express creativity. Thus, there seems to be a paradox in the relation between structure and creativity—whereas structuring the task may increase creativity, a personal tendency to apply structure tends to decrease creativity.

By exploring the interaction between externally imposed structure and individual tendencies to apply structure, we aimed to clarify this seeming contradiction. When a task design offers freedom and lack of restrictions, the number of possible ideas or solutions is almost infinite, and so is the number of possible procedures for creating the ideas. Under such circumstances, systematic participants, who search for rules to follow, are unlikely to be effective. Intuitive individuals are therefore likely to produce more creative ideas and solutions than systematic ones.

In contrast, when the task is constrained in a way that channels individuals to focus on a limited set of core elements, it provides systematic individuals with an accessible structured procedure. Under such circumstances, the natural tendency of systematic individuals to search for rules and apply structure is a highly effective strategy that may lessen the superiority of intuitive individuals. Consequently, when the task is structured, individual differences in cognitive style may have only a negligible effect.

In two experiments we investigated the effect of externally imposed structure and personal cognitive style on creativity. We studied internal structure (i.e., personal cognitive style) and externally imposed structure (i.e., the task required of the individual). Studies 1 and 2 differ in the type of the external structure imposed: In Study 1 we focus on the way the task is constructed. We compare two tasks that differ in this respect—one task is constructed in a way that provides almost infinite possible solutions and hence is highly free, whereas the other task restricts the scope of possible solutions and is hence more structured. In Study 2, all participants were faced with the *same task*. The *instructions* for the task differed, however, in how free versus constrained they were. We used two sets of instructions that represent the two poles of the structure-freedom continuum.

Study 1

The main goal of Study 1 was to investigate the impact of internal structure (personal cognitive style) and externally imposed structure (task construction) on creativity. We compared two distinct tasks that differ in the extent of the external structure imposed. Specifically, we studied two ideation processes proposed by Finke et al. (Finke et al., 1992). We now describe the two processes and the differences between them in terms of imposed structure.

A creative idea can be generated in two spheres: *form* (e.g., a product, a commercial ad) and *function* (i.e., the use or purpose of the form). Finke et al. (1992) studied two ideation processes that combine form and function. The *Form Follows Function* process starts with the function sphere. Individuals are presented with a function and are asked to produce a form. Consider, for example, the following task: “Think of an idea that will help reduce industrial accidents caused by slipping.” In this example, reducing industrial accidents is the function. The task is to generate an idea for a form that supplies this function. The alternative ideation process is termed *Function Follows Form*. This process starts with the form. Individuals are presented with a form and are asked to find an appropriate function. For example: “Think of a possible use for a new shoe with sticky soles.” In this example, the shoe with the sticky soles is the form and the task is to create an idea for a function of the sticky soles.

Goldenberg and Mazursky (2002) argue that whereas both tasks are somewhat structured, the Function Follows Form is more structured than the other one. The Function Follows Form process focuses on the form: The form sphere is constrained and the function sphere kept free for exploration. A

careful look at the form sphere reveals that the components of the form are linked and interdependent. Consider a chair, for example. The components of the form (e.g., legs, seat) are all linked: If there were no legs, the seat could not be kept high; without a seat, the legs could not be kept together. The complete set of components of the chair, in this example, can provide, or match, only a limited number of functions (Goldenberg & Mazursky, 2002).

The Form Follows Function process focuses on the function: The function sphere is the one that is being constrained. This process is less structured because, unlike forms, the components of the function are independent of each other. For example, the two function components of the chair's secureness and esthetics are two benefits of the same object (chair), but they can be applied separately, and there is no connection between them.

Thus, although both processes pose constraints, they differ in the extent to which they are structured. In Form Follows Function the function sphere is limited, but there is no guidance or feedback for the next move after a particular function is used. The possibilities are therefore almost infinite. In contrast, the Function Follows Form process is much more structured: The form sphere provides but a small fraction of the almost infinite possibilities that the function sphere has. Moreover, as detailed above, this constraint directs the individual to focus on the relations among a limited, manageable number of components.

According to the Structure approach, structuring and constraining a task should enhance creativity. Thus, Finke et al. (1992) claim that individuals generate ideas at a higher level of creativity when their task is constructed as a Function Follows Form process, which is more constrained. Study 1 was designed to experimentally investigate this claim. Participants were presented with a series of ideation tasks, in which they were asked to generate creative solutions. The tasks (i.e., the problems to be solved) were identical in their context but differed in the constraints they included: Under the less structured, Form Follows Function, condition, the function was presented and the participants were asked to generate an appropriate and creative form. Under the more structured, Function Follows Form, condition the form was presented and the participants were asked to find a creative way to use it. We hypothesized that

H1: Solutions provided under the more structured Function Follows Form condition would be judged more original and creative than those provided under the less structured Form Follows Function condition.

To investigate the effect of the systematic (structured) versus the intuitive cognitive style, participants were asked to report their personal cognitive style. Following the literature reviewed above, we hypothesized that

H2: Solutions provided by *intuitive* participants would be judged more original and creative than those provided by *systematic* participants.

Interaction between task construction and cognitive style

Hypothesis 1 and 2 are each derived from a different segment of the literature on creativity. Taken together, however, they offer an intriguing contradiction: H1 expects structure (i.e., constrained task process) to increase creativity, whereas H2 expects structured thinking (i.e., systematic cognitive style) to decrease creativity. Integrating H1 and H2, we expect the superiority of intuitive participants will be greater when the task is very free. Under free conditions, systematic participants have no accessible procedure allowing them to search for rules and apply structure effectively. In contrast, systematic participants' rule-based strategy should be more effective when the task is constrained in a way that

channels individuals to focus on a limited set of core elements, thus providing them with an accessible structured procedure. Under these circumstances, the natural advantage of intuitive participants is likely to decrease. Thus, whereas intuitive participants should be more creative than systematic participants in both task conditions, the difference in creativity should be less under the more constrained Function Follows Form condition.

H3: The difference between *intuitive* and *systematic* participants in originality and creativity should be greater under the less structured condition (Form Follows Function) than under the more structured condition (Function Follows Form).

Method

Participants

Participants were 165 students at an Israeli university (60 per cent majored in social sciences and the rest in humanities; 60 per cent were women; mean age = 23). Participation was voluntary and anonymous. Participants received course credit or were paid 20 NIS (about \$4.50).

Procedure

Participants completed the Thinking and Working Style Scale. The responses served to classify participants as having a systematic or an intuitive cognitive style. Participants were then presented with four short descriptions of problems and were asked to suggest a creative solution for each one. Two problems were structured as Function Follows Form and two as Form Follows Function; two of the problems involved commercial ads and two were in the field of new product development. Participants worked independently. No time limits were set, but most participants completed the assignment within 30 minutes.

Design

The experiment included four within-participant replications of a 2 (process structure: Function Follows Form, Form Follows Function) \times 2 (cognitive style: systematic, intuitive) factorial between-participants design. Participants were randomly assigned to the task condition. The cognitive style factor reflects the individual differences that were assessed prior to the assignment.

Instruments

Task condition: To study the impact of the task construction, we used two problems involving commercial ads and two problems from the field of new product development. Using examples from both fields permits generalization of our findings. Each problem was constructed once as Function Follows Form and once as Form Follows Function (see Appendix B). Overall, there were eight problems, and each participant received four of them—two from each field and two of each construction. We then built two sets of four problems. Participants were randomly assigned to one of these two sets. They were presented with only one construct (either Function Follows Form or Form Follows Function) for each problem. They were then asked to generate solutions for each problem.

Cognitive style

Scale development: Various self-report measurements have been used to assess individual differences in cognitive style. Most inventories focus on a specific context (e.g., career decision making, work in a specific field) and/or include items that reflect constructs other than cognitive style (e.g., conformity motivation, leadership style, ability). We developed a new scale (the Thinking and

Working Style scale, henceforth TWS, see Appendix A) based on several existing inventories. The item-development process consisted of several steps. We first integrated past research to come up with theoretical definitions of the two cognitive styles presented above. We then created a pool of items by locating items on previous scales that matched these definitions (e.g., Epstein et al., 1996, from the “faith in intuition” scale; Harren, 1979, from the rational and intuitive scales; Scott & Bruce, 1995, from the GDMS).

Drawing on previous research (e.g., Messick, 1984; Perkins, 1981; Scott & Bruce, 1995), we define cognitive style as stable individual differences in organizing and processing information and experiences. Furthermore, cognitive style is reflected in consistent patterns of behavior in the way individuals approach tasks (Perkins, 1981). Because cognitive style is defined in terms of behavior, we focused on behavioral items rather than traits or characteristics. In the next step we modified these items to ensure that the scale was broad, general and context-free: Some of the items in the new scale refer to decision-making, some to carrying out an assignment, and others to action in general. In addition, we modified words and expressions that are highly socially desirable (e.g., “rational,” “logic”). Finally, we reviewed the content of these items and identified aspects of the definitions for which we could not find existing items. For example, one of the aspects of the intuitive style is that intuitive individuals may be guided by a pattern without being aware of the pattern or without being able to point it out (e.g., Perkins, 1981). We therefore developed an item stating “I often make a good decision without really knowing how I did it.”

Five items in the questionnaire were designed to measure systematic cognitive style (e.g., “Before I do something important, I plan carefully;” “I usually make decisions in a systematic and orderly way”). The remaining five items were designed to measure intuitive style (e.g., “I often follow my instincts;” “I often make a good decision without really knowing why I made this choice”). Respondents rated the extent to which each statement described them on a 5-point scale ranging from 1 (very incorrect) to 5 (very correct).

There is no agreement in the literature as to whether systematic and intuitive styles are two poles of the same dimension or two distinct dimensions. Researchers who study information processing agree that people have both rule-based and associative modes which they use depending on the situation. Most researchers also agree that individuals develop *one dominant* cognitive style. Some researchers argue, however, that a person may be highly capable of both intuitive and systematic thinking. Assessing those individuals who may be high on both intuitive and systematic style is challenging both theoretically and empirically. Conceptually, the meaning of being high on both systematic and intuitive thinking is not clear. A person cannot apply both intuitive and systematic thinking at the same moment—she can either search for a rule or rely on her instincts. Empirically, high scores on both the systematic and the intuitive items may reflect differences in scale use as well as actual cognitive style.² We therefore reversed the five intuitive items on the scale (items 2, 3, 6, 8, 10) to create a 10-item scale measuring the systematic versus intuitive cognitive style.³

We conducted two pre-tests to investigate the TWS scale (Sample 1: $N = 140$, high-school and university students, Halevy, unpublished data; Sample 2: $N = 167$, university students, Sagiv & Ein-Gar, 2009). The findings were very consistent in terms of factor analysis to the findings of the current study we report below.

The correlations between the systematic and the intuitive items were highly negative ($r = -0.56$; $p < 0.01$). We then ran an exploratory factor analysis with oblique rotation (promax)³. In both studies

²This was tested in a pilot study (Ein-Gar, unpublished data) in which a sample of managers who had completed the TWS were assigned to four groups based on their ratings: highly systematic, highly intuitive, high on both, and low on both. Comparing the four groups indicated that participants who were assigned to the high-high group scored higher on *all* variables studied. Thus, for example, they attributed greater importance to all types of personal values than the other three groups.

³Findings resulting from analyzing the “systematic” and “intuitive” scales separately are available from the authors.

the analysis yielded two factors. All items were loaded on the first factor (the systematic items loaded positively; the intuitive items negatively), but only seven of the 10 items had their primary loading on this factor (the five systematic items and two intuitive items). The other three intuitive items were loaded more strongly on a second factor. We created two alternative indexes for assessing cognitive style: the average of the seven items that loaded primarily on the first factor, and the average of all 10 items. Thus, in both indices higher values represent a more systematic tendency, whereas lower values represent a more intuitive tendency.

Classifying participants as “systematic” or “intuitive” based on either index yielded about 85 per cent agreement. We tested our hypotheses only on participants who were classified (as intuitive or systematic) in the same way using both indices. No substantive differences were found in the results obtained with the 7-item scale versus the 10-item index. We report the findings based on the 10-item index to provide a balanced representation of both types of cognitive styles (five of each type). The internal reliability (α) of this index was 0.81. We classified respondents above the median (0.40) as systematic. All others were classified as intuitive.

Measures of creativity: Self-reports of creativity are subjective by definition and may be biased. We therefore followed previous studies and relied instead on the judgments of experts in the relevant professional community, who reliably reflect the perceptions and judgments of creativity in that community (see Goldenberg et al., 1999b, for details). The judges were two experts in advertising (for the commercial ads) and two innovation experts (for the product ideas). The ad judges were both planners, and worked in two different advertising agencies. One had previous experience as an art director and the other in marketing research. Both had more than five years of employment experience, which included leading creative teams for advertising campaigns. Both new-product judges had an MBA in marketing, and employment experience of more than five years as product managers and marketing managers (one judge served as both ad and new-product judge).

The judges were blind to the nature of the experiment and the experimental conditions. They rated the solutions' creativity and originality on a scale of 1 (not original/creative at all) to 5 (very original/creative). The correlations between the ratings of originality and creativity ranged from 0.71 to 0.89, with a mean of 0.79. We therefore averaged the two to create a single measure of creativity. We used the Intra-class Correlation Coefficient (ICC2) as a measurement for inter-rater reliability (McGraw & Wong, 1996). The coefficients were 0.80, 0.79, 0.70 and 0.66, for problems 1–4, respectively. We therefore averaged the judges' ratings.⁴

Results

We conducted four 2 (task: Function Follows Form, Form Follows Function) \times 2 (cognitive style: systematic, intuitive) ANOVAs to test our hypotheses for each of the four creativity tasks. Table 1 presents the judges' mean ratings of creativity in each condition. Hypotheses 1 and 2 were confirmed for three of the four creativity tasks (sticky shoes, electric handle, and sweet ants; see Appendix B for descriptions of all the problems). As hypothesized (H1), the expert judges rated the proposed solutions produced in the Function Follows Form condition as much more creative than those produced in the Form Follows Function condition ($F(2, 160) = 159.0$, $F(2, 149) = 185.39$, $F(2, 159) = 36.94$ respectively; all $p < 0.001$). Also as hypothesized (H2), the judges rated the solutions produced by *intuitive* participants as more creative than those produced by *systematic* participants ($F(2, 160) = 5.42$, $p < 0.05$, $F(2, 149) = 6.10$, $p < 0.05$, $F(2, 159) = 3.85$, $p = 0.052$, for the three tasks, respectively). The

⁴The judges in both studies also rated the solutions' effectiveness. However, these ratings were only weakly correlated with the creativity ratings and therefore were not further analyzed.

Table 1. Means of creativity of generated solutions in Function Follows Form versus Form Follows Function conditions, among Systematic and Intuitive participants

Task	1: Sticky shoes			2: Electric handle			3: Sweet ants			4: Long fueling		
	Function Follows Form	Form Follows Function	All	Function Follows Form	Form Follows Function	All	Function Follows Form	Form Follows Function	All	Function Follows Form	Form Follows Function	All
Systematic	3.79 (N = 39)	1.92 (N = 42)	2.82	3.79 (N = 37)	1.79 (N = 40)	2.75	3.12 (N = 40)	2.21 (N = 40)	2.67	2.15 (N = 42)	2.34 (N = 39)	2.24
Intuitive	3.89 (N = 41)	2.43 (N = 42)	3.15	3.95 (N = 35)	2.26 (N = 41)	3.04	3.30 (N = 41)	2.57 (N = 42)	2.93	2.39 (N = 42)	2.58 (N = 40)	2.48
All	3.84	2.18		3.87	2.03		3.21	2.40		2.27	2.46	

findings failed to support H1 for the fourth problem (long fueling), in which no effect on creativity was found and the predicted effect of cognitive style (H2) was marginally significant ($F(2, 160) = 3.22$, $p < 0.08$).

Finally, we hypothesized that (H3) the effect of cognitive style would be greater in the Form Follows Function than in the Function Follows Form condition. A planned contrast comparing *intuitive* and *systematic* participants in the Form Follows Function condition yielded significant simple effects of cognitive style in creativity, in all three replications for which a main effect was found ($t(161) = 2.73$; $t(150) = 2.61$; $t(160) = 1.89$, for the three tasks, respectively; all $p < 0.01$). Conversely, a comparison of *intuitive* versus *systematic* participants in the Function Follows Form condition yielded only minimal differences, albeit in the same direction (all $ts < 1.3$; $ps > 0.1$). The findings therefore support the third hypothesis for three of the four replications.

Discussion

The findings of Study 1 generally support our hypotheses—the construction of the task clearly affected the creativity of the ads and the product ideas generated. Supporting H1, the solutions proposed by the participants were judged as more creative when the problems were highly structured (under the Function Follows Form condition) than when they were only somewhat structured (under the Form Follows Function condition). Thus, consistently with the Structure approach, our findings show that limiting the number of possibilities in a way that channels individuals to focus on the core elements of the problem enhances creativity. We failed to find a structure effect in one replication: The respondents had trouble using the picture of a restroom sign to create an ad for a car. It is possible that this task was especially difficult, because the idea of restrooms is too remote from car attributes and it was hard for the respondents to connect the two.

The findings further indicate that the more intuitive participants were, the more creative the solutions they generated. Thus, the findings support H2 as well, indicating contradictory main effects of (1) the construction of the task and (2) individuals' tendency to apply structure. A closer look, however, reveals that the difference in creativity between intuitive and systematic individuals occurred mainly in the less structured Form Follows Function condition. In fact, the difference was minimal in the more structured Function Follows Form condition. Thus, our findings suggest that while intuitive individuals are likely to be more creative than systematic individuals, there may be conditions under which systematic individuals will be just as creative.

Study 2 was designed to further investigate the effect of externally imposed structure on creativity. Whereas participants in Study 1 completed one of two distinct tasks, in Study 2 all participants were presented with the same task. In this study we investigated another type of externally imposed structure: The instructions to the participants. We studied two sets of instructions, one highly structure and the other highly free.

Study 2

Study 2 was designed to compare two conditions in which the same task was accompanied by different instructions: One that provided participants with an algorithmic-like procedure (i.e., highly structured), and another that encouraged participants to produce ideas based on free associations (i.e., highly free).

The Creativity Templates framework (Goldenberg & Mazursky, 2002) discussed above (p. 8) provides an example of a highly structured procedure. Past research has revealed a positive influence of this method on creativity in three different fields of expertise: new product development (Goldenberg et al., 1999b; Goldenberg, Lehmann, & Mazursky, 2001), advertising (Goldenberg et al., 1999c), and technological problem solving (Goldenberg, Mazursky, & Solomon, 1999d). Furthermore, the researchers aimed to isolate any psychological mechanism that might enhance the satisfaction with the method (e.g., enhanced confidence) and tested the value of the Template structure itself by implementing one Template (replacement) on a computer (Goldenberg et al., 1999a). Expert judges were asked to rate the originality and creativity of computer-generated ads, ads designed by professional advertisers and ads produced by laymen with no prior training. The judges were blind to the purpose of the experiment. The findings indicated that the Template-based ideas generated by the computers were ranked significantly higher on the originality and the creativity scales than the ideas produced by the laymen. Moreover, the computer-generated ideas were ranked virtually the same as the ads produced by the advertising professionals.

The fact that computers could be programmed to generate creative products highlights the structured, systematic nature of the Template approach. We suggest that the Template technique could be similarly useful for systematic *individuals* who prefer to apply structure—to search for rules and follow them systematically. Study 2 thus presented systematic individuals with a highly structured task that could allow them to overcome their difficulties so as to produce creative ideas. We compared this Template condition to the Blue-Sky technique, which encourages free association in developing creative ideas (Buzan, 1993).

As in Study 1, the present study explored the impact of externally imposed and internal, cognitively produced, structure. The two studies differ, however, in some respects. In Study 1 participants were presented with two different tasks that diverged in the extent of their structure. In Study 2, all participants were presented with the same task: They were all asked to generate a commercial ad for the same product. The two conditions offered different *instructions* for this task. Participants in the Blue-Sky condition were asked to use free association, whereas participants in the Template condition were asked to follow an algorithmic-like procedure.

As in Study 1, we hypothesized that both externally imposed and personal cognitive style would affect creativity:

H1: Ads generated under the highly structured Template condition would be judged more original and creative than ads generated under the highly free Blue-Sky condition.

H2: Ads generated by *intuitive* participants would be judged more original and creative than those generated by *systematic* participants.

As in Study 1, we also predicted a greater advantage for intuitive over systematic individuals in the less structured condition. We therefore hypothesized that

H3: The difference between intuitive and systematic participants in originality and creativity would be greater in the less structured Blue-Sky condition than in the highly structured Template condition.

The Template condition provided participants with highly systematic instructions designed to enhance creativity. These instructions, as described above, yielded highly creative solutions when applied to computers. We therefore predicted that the benefit of the Template technique would be greater for individuals who tend to think systematically and apply structure that is, systematic individuals—than for intuitive individuals who tend to avoid rules and rely instead on their instincts and associations. We therefore hypothesized that

H4: Participants with a systematic (structured) cognitive style would generate ads that are more creative and original in the Template condition than in the Blue-Sky free-association condition. This effect would be weaker (or even negative) for the intuitive participants.

Method

Participants and design

The participants were 124 business students enrolled in introductory marketing courses (49 per cent were women, mean age 23 years). The experiment followed a 2 (instructions: Template, Blue-Sky) \times 2 (cognitive style: systematic, intuitive) factorial between-participants design. The cognitive-style factor reflects individual differences between participants, as assessed prior to the assignment, whereas the instructions were manipulated through random assignment.

Procedure

The participants were randomly assigned to the Template or the Blue-Sky condition. They were asked to complete the TWS scale, along with several other scales. Their responses served to classify them as having a systematic or an intuitive cognitive style. The participants were then asked to develop advertising concepts for a product, following the instructions of their condition. The participants assigned to the Template condition were asked to follow a prescribed, step-by-step procedure. The participants in the free-association condition were instructed to follow the Blue-Sky version of the free-association technique, which encourages individuals to produce ideas randomly, based on free associations, maintaining an uninterrupted flow of ideas.

The participants were asked to write an ad promoting a special sports shoe whose unique cushioning effect provides support for the knee joints and protection against sports-related shocks. As an example of a creative ad, participants were shown an advertisement for discouraging smoking in which the cigarette was depicted in the shape of a gun, conveying a message of the dangers of smoking. Participants worked in groups of about 30–40, with two instructors ensuring independent work. No time limitations were set, but most participants completed the assignment within 30 minutes.

Instruments

Instructions condition: The participants were given written instructions designed to follow either the Replacement Template or the Blue-Sky version of free association (see Appendix C; for more details about the experimental method see Goldenberg et al., 1999b,c).

Cognitive style: We used the same self-report questionnaire as in Study 1. Again, the systematic and intuitive scales were highly negatively correlated ($r = -0.56$, $p < 0.01$) and were therefore combined. The internal reliability (α) of the 10-item questionnaire was 0.83. We classified respondents above the median (0.80) as systematic. All others were classified as intuitive.

Measures of creativity: Two new expert judges rated the originality and creativity of each ad generated in this experiment in the same way as in Study 1. Both judges had employment experience in advertising agencies in planning and managing campaigns. They were blind to the purpose of the experiment and the experimental condition. They rated the ads' originality and creativity on a scale of 1 (not original/creative at all) to 5 (very original/creative). The correlation between originality and creativity was 0.71 and 0.80 for the first and second judge, respectively. We therefore averaged

originality and creativity for one measure of evaluation for each judge. The Intra-class Correlation Coefficient (ICC2) was 0.78.

Manipulation check

To check our manipulation of the task instructions, the third author, who was blind to the experimental condition, rated the extent to which the Replacement Template was involved in each of the generated ads. As expected, ads generated in the Template condition were rated as involving the Replacement Template to a greater extent than ads generated in the Blue-Sky condition (2.50 versus 1.52, $F(2, 118) = 20.31, p < 0.001$). Systematic and intuitive individuals did not differ in the extent to which the ads they produced involved the Replacement Template (2.06 versus 1.90; $F(2, 116) = 0.001, p = ns$).

Results

We conducted a 2 (instructions: Template vs. Blue-Sky) \times 2 (cognitive style: systematic vs. intuitive) ANOVA to test our hypotheses. Table 2 presents the mean creativity ratings in each condition. As hypothesized (H1), participants in the Template condition produced ads that were judged more original and creative than those produced by participants in the Blue-Sky, free-association condition. ($F(2, 119) = 12.17, p < 0.01$). We also predicted that (H2) *intuitive* participants would generate ads that are more creative than those generated by *systematic* participants. The findings were in the predicted direction, but did not indicate a main effect for cognitive style ($F(2, 119) < 1; p > 0.1$). Thus, the findings do not support Hypothesis 2.

Following Study 1, we further hypothesized (H3) that the difference in creativity between *intuitive* and *systematic* participants would be greater under the Blue-Sky free-association condition than under the more structured Template condition. We used a planned contrast to test this hypothesis. The simple effect of cognitive style was significant under the free association condition: Ads produced by *intuitive* participants were rated as more creative than those produced by *systematic* participants (2.36 versus 1.88, $t(119) = 1.82, p < 0.05$, one-tailed, for the planned contrast). Conversely, and as predicted, there was no difference in the creativity of ads produced by *systematic* and *intuitive* participants in the Template condition. Hence, the findings support Hypothesis 3.

Finally, we predicted (H4) that the Template condition would improve the creativity of the ads produced by *systematic* participants more than those produced by *intuitive* participants. A planned contrast supported this hypothesis. *Systematic* participants in the Template condition produced ads that were judged as more creative than ads produced by *systematic* participants in the free-association condition ($t(119) = 3.65, p < 0.01$, for the planned contrast). The Template condition somewhat benefited *intuitive* participants as well, but the effect was not significant ($t(119) = 1.35; p > 0.1$). The findings therefore support Hypothesis 4. The combined effects of Hypotheses 3 and 4 are reflected in a planned contrast testing the interaction effect between process structure and cognitive style ($t(119) = 1.73; p < 0.05$ one-tailed).

Table 2. Means of creativity of ads produced in Template versus Blue-Sky free association conditions among Systematic and Intuitive participants

Condition/cognitive style	Free associations	Templates	All
Systematic	1.88 ($N = 36$)	2.89 ($N = 23$)	2.28
Intuitive	2.36 ($N = 28$)	2.71 ($N = 36$)	2.55
All	2.09	2.78	

Discussion

The findings of Study 2 replicate the positive effect of externally imposed structure on creativity: The highly structured instructions of the Template technique increased creativity in comparison to the free Blue-Sky technique. However, this effect was greater for individuals with a systematic (structured) cognitive style and weaker (insignificant) for those with an intuitive style. In addition, only under the free task condition were intuitive participants more creative than systematic ones. The structured Template technique hence proved useful mainly for individuals who tend to think and work systematically. It provided only a minimal advantage for those who naturally tend to be intuitive, associative, and impulsive in the way they think and act.

General Discussion

This research investigated the way externally imposed structure and individuals' internal tendency to apply structure affect creativity. We focused on two aspects of externally imposed structure: the construction of the task (Study 1) and the instructions provided (Study 2). The findings of Study 1 indicate that creativity is greater under conditions that restrict the scope of the problem in a way that leads individuals to focus on a manageable number of core elements (i.e., the Function Follows Form condition). The findings also reveal that intuitive individuals are more creative than systematic ones, but mainly under the relatively free condition (i.e., the Form Follows Function condition). In Study 2 all participants were presented with the same task, but with different instructions—either very free (the Blue-Sky condition) or highly structured (the Template condition). The findings replicated those of Study 1. The findings also reveal that, in contrast to the free condition, the highly structured instructions of the Template procedure benefited systematic participants more than intuitive ones.

Taken together, our findings indicate the usefulness of constraining the task, especially for individuals who prefer structure. The findings further suggest that whereas *intuitive* individuals are more creative than *systematic* ones under free conditions, systematic individuals could become as creative as intuitive ones if they worked under highly structured conditions, which allow them to search for and follow rules.

These findings are partly consistent with the extensive literature on person-environment fit, which suggests that people are likely to be most satisfied and productive when they are congruent with their environment (for a meta-analysis see Kristof-Brown, Zimmerman, & Johnson, 2005). The present paper can be seen as the first to study the congruency between cognitive style and externally imposed structure, and its effect on creativity. Our findings are consistent with the fit perspective for systematic participants, but not for intuitive ones. Systematic participants generated more creative ideas under conditions that matched their tendency to apply structure (i.e., under the more structured condition) than under conditions that were incongruent (i.e., free conditions). Intuitive participants, in contrast, were highly creative under free conditions, but were also creative—indeed, even more so—under the structured conditions (see Tables 1 and 2). Thus, consistently with previous research (e.g., Finke et al., 1992; Goldenberg et al., 1999b,c), externally imposed structure increases creativity for all individuals. Our research is the first to show that this beneficial effect is stronger for systematic individuals.

Several past studies stemming from the situational perspective showed an improvement in creativity when working under structured conditions such as the Template procedure (e.g., Goldenberg et al., 1999a,b). Our findings are consistent with those results. We also showed creativity was higher under the structured conditions: the Function Follows Form condition (in Study 1) and the Template condition (in

Study 2). Our findings reveal, however, that structures and constraints benefited systematic individuals more than intuitive ones (Study 2). Past findings could have resulted from a focus on systematic participants (e.g., engineers, R & D employees).

Past research on individual differences in creativity has found creative individuals to be more intuitive, associative, and impulsive than other people. Our research is among the first to relate intuitiveness not to a general tendency of creativity, but to the creativity of actual solutions produced (albeit in lab experiments). Our findings show that intuitive individuals were more creative than systematic ones, but mainly under “free” conditions. In Study 1 we found a main effect of cognitive style. However, the difference in creativity between intuitive and systematic participants was greater in the less structured condition. Consistent with this, in Study 2 intuitive participants were more creative than the systematic ones only in the free (i.e., Blue-Sky) condition. Indeed, past studies that found intuitive participants more creative than systematic ones (e.g., Scott & Bruce, 1995; Smith & DeCoster, 2000) did not investigate structured tasks.

The seminal research on job design (Hackman & Oldman, 1980), and the broad literature that originated from it, suggest that complex, challenging jobs lead to greater intrinsic motivation and therefore to greater creativity (e.g., Baer et al., 2003; Oldham & Cummings, 1996). In the present research we controlled for task complexity: We focused solely on highly complex and challenging tasks. In manipulating externally imposed structure we therefore did not manipulate the complexity of the task but rather the extent of the constraints. Our findings therefore suggest an additional characteristic of job design that affects creativity. In addition, in Study 2 participants in both task conditions had the same task, but were provided with different instructions on how to carry it out. The different instructions set a different type of task, but could also be seen as a means of framing the situation. In other words, providing participants with the Template instructions framed the situation as structured whereas providing them with the Blue-Sky instructions framed the situation as free. Framing can thus be seen as a type of job design. Future studies could explore this notion further.

The findings of the current research support the contention that constraining tasks should lead to higher creativity. We do not claim, however, that any structure at all is beneficial—indeed, some types of restriction may have detrimental effects. In the present research we tested the hypothesis that constraining the task in a way that leads individuals to focus on a manageable number of core elements enhances creativity. Future studies could investigate the usefulness of other types of restrictions and delineate the boundary conditions for externally imposed structure—which constraints are likely to boost creativity and which are ineffective, or may even decrease it.

This research is limited in several other ways. First, our measure of creativity focused solely on the quality (i.e., creativity) of the ideas generated. We did not examine the quantity of solutions and ideas produced. In addition, we relied on expert judges to measure creativity. Whereas this is a strength of the research—because experts are not subject to self-serving biases the way self-reports are—expert judges are bound by the conventions of their field and may be biased against highly unusual ideas. Future research could expand our findings by using additional measures of creativity.

The findings of the current research have practical implications for organizations’ attempts to increase creativity among their members. First, the findings of Study 1 suggest that managers may want to construct their tasks as Function Follows Form whenever possible. For example, it is a common practice to search for a new product opportunity emerging from the core technology of a firm. Similarly, companies may look for ways to utilize a solution an engineer has found to a local problem in order to solve additional problems. In advertising, for example, it is common practice to use previous campaigns to trigger thought processes—trying to see if any of the other products the agency is advertising can be advertised similarly.

However, often the task has to be constructed as a Form Follows Function task—for example, when a consumer need is identified through marketing research and a solution is required, or when the

company locates a production inefficiency that the engineers are asked to improve. In such cases managers may prefer to assign intuitive employees to the task, since they are likely to be creative under unstructured conditions as well. Furthermore, when working with systematic employees, managers may want to match the construction of the task to their cognitive style. Assigning a constructed task to systematic employees, or encouraging them to follow procedures such as the Templates, may increase their creativity. Future research could focus on the impact of employing a mixed team in which systematic and intuitive individuals work together.

In the present research we focused on situational and individual perspectives. Other perspectives may also be influential. Consider the example of professional socialization. Certain professions (e.g., engineering, accounting, software programming) require systematic work following specific rules under clear constraints. Other professions (e.g., therapy, acting, advertising) involve unpredictable circumstances, and may require more intuitiveness. Individuals who are trained in the former professions may be socialized to work systematically, while those who are trained in the latter may be socialized to work intuitively. These factors may affect the interaction between externally imposed structure and cognitive style, impacting creativity by means of the fit between personal style and the style encouraged by the organization, or between training methods and occupational requirements.

The importance of having creative individuals in an organization is likely to lead management to consider selecting creative individuals and offering them training to enhance their creativity. Our findings have consequences for both policies. Organizational recruiters may wish to hire *intuitive* individuals (particularly for positions involving unstructured, ill-defined tasks); and managers may wish to train employees to use *systematic* processes (especially when the teams are composed of *systematic* individuals). Our findings suggest that both personal and task factors should be taken into account. Recognizing the interdependence between cognitive style and externally imposed structure may enable organizations to increase the creativity of their products and solutions.

Acknowledgements

This research was supported by a grant from the Recanati Fund of the School of Business Administration at the Hebrew University to the first author and by a grant from the K-mart and Davidson Centers of the School of Business Administration at the Hebrew University to the third author. We thank Adi Amit, Nir Halevy, Avraham Kluger, Michal Master, Ruthi Mayo, Sonia Roccas, Yaacov Schul, the editor and three anonymous reviewers for their useful comments on earlier drafts of this paper.

Author biographies

Lilach Sagiv is a tenured associate professor at the School of Business Administration, the Hebrew University of Jerusalem. In 2005 she spent a sabbatical as a visiting professor at the Psychology Department at the University of Michigan. She received her PhD from the Hebrew University of Jerusalem. Her research interests focus on the role of values at the micro, meso, and macro level. She is currently studying the impact of personal and cultural values on organizational behavior and processes. She is also investigating cognitive style and its implications.

Sharon Arieli is a PhD student at the School of Business Administration at the Hebrew University of Jerusalem. Her dissertation focuses on interaction between culture and task in predicting cognitive problem solving. She is also studying cognitive processes and their impact on creativity.

Jacob Goldenberg is a professor of Marketing at the School of Business Administration at the Hebrew University of Jerusalem and a visiting professor in Columbia business school. His research focuses on creativity, new product development, diffusion of innovation, complexity in market dynamics and social networks effects. He has published in leading journals such as *Journal of Marketing*, *Journal of Marketing Research*, *Management Science*, *Marketing Science*, *Nature Physics* and *Science*. In addition, he is an author of two books by Cambridge University Press.

Ayalla Goldschmidt is a Program Director, Application Infrastructure Marketing at IBM. She received her MBA from the University of Georgia in 2003 and her Masters in Social Psychology from the Hebrew University of Jerusalem in 2002. Ayalla has been with IBM Marketing for the past six years, where she has specialized in B2B Marketing including Marketing Research, Database Analytics, Industry Marketing, Competitive Marketing, and Product Marketing.

References

- Allinson, C. W., Armstrong, S. J., & Hayes, J. (2001). The effects of cognitive style on leader-member exchange: A study of manager-subordinate dyads. *Journal of Occupational and Organizational Psychology*, *74*, 201–220.
- Allinson, C. W., & Hayes, J. (1996). The cognitive style index: A measure of intuition-analysis for organizational research. *Journal of Management Studies*, *33*, 119–135.
- Amabile, T. M. (1988). A model of creativity and innovation in organizations. In B. M. Staw, & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 10, pp. 123–167). Greenwich, CT: JAI Press.
- Amabile, T. M. (1997). Motivating creativity in organizations: On doing what you love and loving what you do. *California Management Review*, *40*, 123–167.
- Amabile, T. M., Conti, R., & Coon, H. (1996). Assessing the work environment for creativity. *Academy of Management Journal*, *39*, 292–339.
- Andrews, J., & Smith, D. C. (1996). In search of the marketing imagination: Factors affecting the creativity of marketing programs for mature products. *Journal of Marketing Research*, *33*, 174–187.
- Baer, M., Oldham, G. R., & Cummings, A. (2003). Rewarding creativity: When does it really matter? *The Leadership Quarterly*, *14*, 569–586. DOI: 0.1016/S1048-9843(03)00052-3
- Boden, M. A. (1996). What is creativity? In M. A. Boden (Ed.), *Dimensions of creativity* (pp. 75–117). London: MIT Press.
- Bouchard, T. J. (1969). Personality, problem solving procedures, and performance in small groups. *Journal of Applied Psychology*, *53*, 1–29. DOI: 10.1037/h0026747
- Buzan, T. B. (1993). *The mind map book*. London: BBC books.
- Cacioppo, J. T., & Petty, R. E. (1982). The need for cognition. *Journal of Personality and Social Psychology*, *42*, 116–131.
- Carson, S. H., Peterson, J. B., & Higgins, D. M. (2003). Decreased Latent Inhibition is associated with increased creativity achievement in high-functioning individuals. *Journal of Personality and Social Psychology*, *83*, 499–506.
- Connolly, T., Routhieaux, R. L., & Schneider, S. K. (1993). On the effectiveness of groups brainstorming: Test of one underlying cognitive mechanism. *Small Group Research*, *24*, 490–503.
- Csikszentmihalyi, M. (1990). Literacy and intrinsic motivation. *Daedalus*, *119*, 115–140.
- Csikszentmihalyi, M. (1996). *Creativity*. New York: Harper Collins Publishers.
- Dasgupta, S. (1994). *Creativity in invention and design: Computational and cognitive explorations of technological originality*. London: Cambridge University Press.
- De Bono, E. (1992). *Serious creativity*. New York: Harper Collins.
- Diehl, M., & Stroebe, W. (1987). Productivity loss in brainstorming groups: Towards the solution of a riddle. *Journal of Personality and Social Psychology*, *53*, 497–509.

- Diehl, M., & Stroebe, W. (1991). Productivity loss in idea-generating groups: Tracking down the blocking effect. *Journal of Personality and Social Psychology*, *61*, 392–403.
- Epstein, S., Pacini, R., Denes-Raj, V., & Heier, H. (1996). Individual differences in intuitive-experiential and analytical rational thinking styles. *Journal of Personality and Social Psychology*, *71*, 390–405.
- Feist, G. J. (1999). The influence of personality on artistic and scientific creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 273–296). London: Cambridge University Press.
- Finke, R. A., Ward, T. B., & Smith, S. M. (1992). *Creative cognition: Theory, research, and applications*. Massachusetts: MIT Press Cambridge.
- Galbraith, R. G. (1974). Organization design: An information processing view. *Interfaces*, *4*, 28–36.
- George, J. M., & Zhou, J. (2001). Openness to experience and conscientiousness are related to creative behavior: An interactional approach. *Journal of Applied Psychology*, *86*, 513–524.
- Goldenberg, J., Horowitz, R., Levav, A., & Mazursky, D. (2003). Finding the sweet spot of innovation. *Harvard Business Review*, *81*, 120–129.
- Goldenberg, J., Lehmann, R. D., & Mazursky, D. (2001). The idea itself and the circumstances of its emergence as predictors of new product success. *Management Science*, *47*, 69–84.
- Goldenberg, J., & Mazursky, D. (2002). *Creativity in product innovation*. London: Cambridge University Press.
- Goldenberg, J., Mazursky, D., & Solmon, S. (1999a). Creative sparks. *Science*, *285*, 1495–1496.
- Goldenberg, J., Mazursky, D., & Solmon, S. (1999b). Toward identifying the inventive templates of new products: A channeled ideation approach. *Journal of Marketing Research*, *36*, 200–210.
- Goldenberg, J., Mazursky, D., & Solmon, S. (1999c). Creativity templates: Towards identifying the fundamental schemes of quality advertisements. *Marketing Science*, *18*, 333–351.
- Goldenberg, J., Mazursky, D., & Solmon, S. (1999d). Templates of original innovation: Projecting original incremental innovations from intrinsic information. *Technological Forecasting and Social Change*, *61*, 1–12.
- Grossman, S. R., Rodgers, B. E., & Moore, B. R. (1988). *Innovation, Inc.: Unlocking creativity in the workplace*. New York: Wordware Publishing.
- Guilford, J. P. (1950). Creativity. *The American Psychologist*, *5*, 444–454.
- Hackman, J. R., & Oldham, G. R. (1980). *Work redesign*. London: Addison-Wesley.
- Harren, V. A. (1979). A model of career decision-making for college students. *Journal of Vocational Behavior*, *14*, 119–133.
- Jacobson, C. M. (1993). Cognitive styles of creativity: Relations of scores on the Kirton Adoption-Innovation Inventory and the Myers-Briggs Type Indicator among managers in USA. *Psychological Reports*, *72*, 1131–1138.
- Koestler, A. (1964). *The act of creation*. London: Penguin Arkana.
- Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. New Jersey: Prentice-Hall.
- Kris, E. (1952). *Psychoanalytic exploration of art*. New York: International Universities Press.
- Kristof-Brown, A. L., Zimmerman, R. D., & Johnson, E. C. (2005). Consequences of individuals' fit at work: A meta-analysis of person-job, person-organization, person-group, and person-supervisor fit. *Personnel Psychology*, *58*, 281–342.
- Lee, F., Edmondson, A. C., Thomke, S., & Worline, M. (2004). The mixed effects of inconsistency on experimentation in organizations. *Organization Science*, *15*, 310–326.
- Maimon, O. Z., & Horowitz, R. (1999). Sufficient conditions for design inventions. *IEEE Transactions on Systems Man and Cybernetics Part C-Applications and Reviews*, *29*, 349–361.
- Martindale, C. (1999). Biological basis of creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 137–152). London: Cambridge University Press.
- McCrae, R. R. (1987). Creativity, divergent thinking and openness to experience. *Journal of Personality and Social Psychology*, *52*, 1258–1265.
- McGraw, K. O., & Wong, S. P. (1996). Forming inferences about some intraclass correlation coefficients. *Psychological Methods*, *1*, 30–46.
- Messick, S. (1984). The nature of cognitive styles: Problems and promise in educational practice. *Educational Psychology*, *19*, 59–74.
- Miron, E., Erez, M., & Naveh, E. (2004). Do personal characteristics and cultural values that promote innovation, quality, and efficiency compete or complement each other? *Journal of Organizational Behavior*, *25*, 175–199.
- Noy, P. (1999). *Hapsichoanaliza Shel Haomanut Vehayetsiratiut* (The psychoanalysis of art and creativity). Tel-Aviv: Modan.
- Oldham, G. R., & Cammings, A. (1996). Employee creativity: Personal and contextual factors at work. *Academy of Management Journal*, *39*, 607–634.

- Paulus, P. B., Dzindolet, M. T., Poletes, G., & Mabel, C. L. (1993). Perception of performance in group brainstorming: The illusion of group productivity. *Personality and Social Psychology Bulletin*, *19*, 78–89.
- Perkins, D. N. (1981). *The mind's best work*. Cambridge, Massachusetts: Harvard University Press.
- Perkins, D. N. (1988). The possibility of invention. In R. J. Sternberg (Ed.), *The nature of creativity* (pp. 362–385). London: Cambridge University Press.
- Peterson, M. R., Smith, P. B., Bond, M. H., & Misumi, J. (1990). Personal reliance on alternative event-management processes in four countries. *Group & Organization Studies*, *15*, 75–92.
- Phillips, S. D., & Paziienza, N. J. (1988). History and theory of assessment of career development and decision making. In W. B. Walsh, & S. H. Osipow (Eds.), *Career decision-making* (pp. 1–31). New Jersey: Erlbaum, Hillsdale.
- Rayner, S., & Riding, R. J. (1997). Towards a categorisation of cognitive styles and learning styles. *Educational Psychology*, *17*, 5–27.
- Riding, R. J. (1997). On the nature of cognitive style. *Educational Psychology*, *17*, 29–49.
- Sagiv, L., & Ein-Gar, D. (2009). Cognitive style, personal values and personality traits. *Working Paper*.
- Schul, Y., & Mayo, R. (2003). Searching for certainty in an uncertain world: The difficulty of giving up the experiential for the rational mode of thinking. *Journal of Behavioral Decision Making*, *16*, 93–106.
- Scott, S. G., & Bruce, R. A. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal*, *37*, 580–596.
- Scott, S. G., & Bruce, R. A. (1995). Decision-making style: The development and assessment of a new measure. *Educational and Psychological Measurement*, *55*, 818–831.
- Shalley, C. E. (1991). Effects of productivity goals, creativity goals, and personal discretion on individual creativity. *Journal of Applied Psychology*, *76*, 179–185.
- Shalley, C. E. (1995). Effects of coercion, expected evaluation and goal setting on creativity and productivity. *Academy of Management Journal*, *38*, 483–503.
- Shalley, C. E., Gilson, L. L., & Blum, T. C. (2000). Matching creativity requirements and the work environment: Effects on satisfaction and intentions to leave. *The Academy of Management Journal*, *43*, 215–223.
- Simon, H. A. (1979). *Models of thoughts*. London: Yale University Press.
- Simon, H. A. (1981). *The sciences of the artificial*. London: MIT press.
- Simonton, D. K. (2003). Scientific creativity as constrained stochastic behavior: The integration of product, process, and person perspectives. *Psychological Bulletin*, *129*, 475–494.
- Smith, E. R., & DeCoster, J. (2000). Dual process models in social psychology: Conceptual integration and links to underlying memory systems. *Personality and Social Psychology Review*, *4*, 108–131.
- Sutton, R. I., & Hargadon, A. (1996). Brainstorming groups in context: Effectiveness in a product design firm. *Administrative Science Quarterly*, *41*, 685–718.
- Taggar, S. (2002). Individual creativity and group ability to utilize individual creative resources: A multilevel model. *Academy of Management Journal*, *45*, 315–330.
- Thompson, J. D. (1967). *Organizations in action*. New York: McGraw-Hill.
- Tierney, P., Farmer, S. M., & Graen, G. B. (1999). An examination of leadership and employee creativity: The relevance of traits and relationships. *Personnel Psychology*, *52*, 591–620.
- Wallas, G. (1926). *The art of thought*. New York: Harcourt Brace.
- Weisberg, R. W. (1986). *Creativity: Genius and other myths*. New York: W.H. Freeman.
- Weisberg, R. W. (1992). *Creativity beyond the Myth of Genius*. New York: W.H. Freeman.
- Wieden, D., & Kennedy, D. (1992). Bally Shoe. In M Warlick (Ed.), *The one show: Advertising's best print, radio, TV* (Vol. 14). Switzerland: Rotovision, S.A.
- Woodman, R. W., Sawyer, J. E., & Griffin, R. W. (1993). Towards a theory of organizational creativity. *Academy of Management Review*, *18*, 293–321.
- Yates, G. C. R. (1999). Cognitive style and learning strategies: Understanding style differences in learning and behaviour. *Educational Psychology* *19*, 103–105.
- Zhou, J. (1998). Feedback valence, feedback style, task autonomy, and achievement orientation: Interactive effects on creative performance. *Journal of Applied Psychology*, *83*, 261–276.
- Zhou, J., & George, J. M. (2001). When job dissatisfaction leads to creativity: Encouraging the expression of voice. *Academy of Management*, *44*, 682–696.

Appendix A: The Thinking and Working Style Questionnaire

Instructions. Bellow is a series of statements describing working styles of various people. A working style describes the way people make an important decision (e.g., choosing an occupation or renting an apartment) or carry out an important task (e.g., writing an academic paper or planning a vacation). For each of the following statements, please indicate how well it describes you. Please use the following scale:

Very incorrect 1	Somewhat incorrect 2	Sometimes correct and sometime incorrect 3	Somewhat correct 4	Very correct 5
---------------------	-------------------------	---	-----------------------	-------------------

- (1) Before I do anything important, I carefully plan my actions.
- (2) I often follow my instincts.
- (3) I know a way of conduct suits me, if I feel it's right.
- (4) Before I start working on an assignment, I gather all the needed information.
- (5) When I do something of great importance, I make an effort to follow my working plan.
- (6) I often start working on an assignment with no idea of what I'm about to do.
- (7) I usually make decisions in a systematic and organized way.
- (8) When I decide how to act, I follow my inner feelings and emotions.
- (9) When I have to choose between alternatives, I analyze each of them and choose the best one.
- (10) I often make a good decision without really knowing how I did it.

Appendix B: Description of the Tasks and Instructions in Study 1

Each participant was asked to generate one idea for a product and one for a commercial ad in the Form Follows Function task, and one idea for a product and one for a commercial ad in the Function Follows Form condition.

Instructions (Nicknames and structure modes not included in the original instructions). Following are descriptions of several problems. Read each description and try to suggest a creative solution for the problem it presents.

I. Sticky Shoes—Form Follows Function

You are the owner of a cleaning company. You are disturbed by the fact that 5 per cent of your cleaning workers are regularly absent as a result of industrial accidents caused by slipping. Can you think of an idea that will help reduce the percentage of accidents?

I. Sticky Shoes—Function Follows Form

You are the owner of a shoe store. The shoe manufacturer has offered you a new style of shoes, with sticky soles. Can you think of a possible use for the new shoes?

II. Electrifying Handle—Form Follows Function

You are working in the fire department of a big city. As a part of your job, you are responsible of the maintenance of the emergency exits in multi-story buildings. Many people use the emergency exits for their convenience, even when there is no emergency. This causes an increase in maintenance costs. You want to prevent people from using the emergency exits when it is not necessary, but you don't want to

lock the doors that lead to them, to avoid a disaster in an emergency. Can you think of an idea that will solve the problem?

II. Electrifying Handle—Function Follows Form

You are working in the fire department in a big city. As a part of your job, you are responsible for the maintenance of the emergency exits in multi-story buildings. You were told that someone has invented electrifying handles with a small current that causes no damage (only an unpleasant feeling). Can you think of an effective use for the new handles that can assist you in your job?

III. Sweet Ants—Form Follows Function

Think of a creative commercial for a sugar substitute, in which you want to deliver the message that it is sweeter than sugar.

III. Sweet Ants—Function Follows Form

Think of how you can use a winding line of ants in a creative way to advertise a sugar substitute (a picture of a winding trail of ants was attached).

IV. Long Fueling—Form Follows Function

Think of a creative commercial for a vehicle, in which you want to deliver the message that the vehicle can drive many miles with no need for refueling.

IV. Long Fueling—Function Follows Form

Think of how you can creatively use the following picture to advertise a vehicle (a picture of a restroom sign was attached).

Appendix C: Instructions for Participants in the Template Versus Blue-Sky Free Association Conditions

Template condition

Instructions. Please follow these steps to produce ideas:

- (1) Write down the product primary trait (or benefit) that you understand from the brief. For example—dog food provides dogs with energy.
- (2) Make a list of symbols that represent the character. A symbol is a visual object that stays in the subconscious of the target audience and is clearly and significantly linked to the trait you described in the previous stage. A symbol can be used as an example or an explanation of the trait. For example, symbols of energy are nuclear reactors, lightning, fuel, and electricity.
- (3) Choose one symbol (according to your personal taste). Symbols that better represent or are associated with the traits are preferred. Write down your chosen symbol.
- (4) Make a list of the symbol world. This list should include components that have direct (physical) contact with the chosen symbol or parts of it. For example, a partial list for the symbol fuel could be fuel pump, fuel, the gas tank of a car, drilling device, etc. Make sure that the symbol itself is a part of the symbol world. For example, the fuel itself is a part of the fuel world.
- (5) Make a list of the product world. This list should include the product itself and the parts of the product or components that are directly (physically) linked to the product. For example, for a product like dog food, a partial list of the world of dog food includes components like the food package, the food itself, a dog's plate, a dog.
- (6) Choose a pair of objects that includes one component from the product world and one component from the symbol world, and link them together. The linking should be performed by introducing a

visual fusion that changes the product and the symbol into a new visual concept. The outcome of a visual image that includes the product and the symbol is a graphical combination of the product and the character that we want to advertise.

(7) To look for a new idea, repeat stage 6 or return to stage 3 and repeat stages 3–6.

Free association condition

The thinking process you are requested to follow is called Blue-Sky. The aim of this process is to think intuitively and allow a free flow of ideas. We encourage you to act upon your natural instincts and allow as many associations as possible to influence your thoughts. Therefore, do not try to follow any rules or systematically investigate the problem. Try to be attentive to yourself and generate the best ideas you can.