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Motivation for Creativity in Design Students

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The purpose was to study motivation for creativity in design students in the framework of the cognitive orientation theory which defines motivation as a function of beliefs of four types (about goals, norms, oneself and reality) concerning themes identified as relevant for creativity. It was hypothesized that scores of the four belief types would enable predicting creativity. The participants were 52 design students who were administered an actual design task and questionnaires: The Survey about Attitudes, Questionnaire about Designing and the Cognitive Orientation of Creativity (COQ-CR). The independent variables were the scores of the belief types based on the COQ-CR. The dependent variables were the evaluation of the creativity of the designs by four expert architects, and various variables based on self-evaluation of the students in the questionnaires referring to the design and designing process: fluency, flexibility, elaboration, fulfilling requirements, considering the context, having a central idea, meaningfulness of the task, involvement of feelings in designing, and handling constraints. Regression analyses showed that the majority of variables referring to creativity were predicted significantly by the predictors. The findings support the validity of the COQ-CR for assessing motivation for creativity and of the cognitive motivational approach to creativity.

> "Out of clutter, find simplicity. From discord, find harmony. In the middle of difficulty, find opportunity."
> —A. Einstein about creativity

In recent years attention in creativity research has turned increasingly to the question of motivation. In parallel with the insight that creativity depends on a number of components, it became clear to an ever growing circle of investigators that motivation may be not just one of the components making up the network of antecedents affecting creativity, but that it may possibly be the most important one, so that when it is missing the other components do not yield the expected creativity product (Collins & Amabile, 1999; Runco, 2004, 2005).

The study of motivation for creativity may be classified under three headings. One major heading is intrinsic motivation. Motivation is defined as intrinsic when the individual engages in some activity mainly for its own sake, for example, because it is enjoyable, satisfying or interesting. Intrinsic motivation characterizes activities whose reward is inherent in the activity itself, in its very performance (Amabile, 1983; Gardner, 1993). Different studies described creative individuals as task-focused (Sternberg & Lubart, 1996), rewarded by the exercise of their creativity (Torrance, 1962), and enthusiastic about being involved in their work (Henle, 1962).

The second major heading is extrinsic motivation that denotes motivation to engage in some activity mainly in order to get some goal external to the activity itself, such as winning a prize or fulfilling some obligation (Lepper, Greene, & Nisbett, 1973). A third approach is based on considering both the intrinsic and extrinsic determinants of creativity, emphasizing not only the contribution of these two major factors but also their interactions and synergistic effects (Rubenson & Runco, 1992; Runco,

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2004b, pp. 66–63; Wylie & Wylie, 1989). A fourth heading is unconscious motivation advocated by the psychodynamic approach which considers the creative act as an attempt to solve a personal problem that is mostly unconscious, such as satisfying a repressed need, or resolving an unconscious conflict (Freud, 1915, 1957; Stokes, 1963; Kreitler & Kreitler, 1972; Kris, 1952). Actually, the psychodynamic approach can be considered as a special class of intrinsic motives that are ''unconscious''. It is generally accepted that intrinsic and unconscious motivation promote creativity whereas extrinsic motivation is detrimental to it (Amabile, 1983), although also positive effects of extrinsic motivation have been reported (e.g., Hennessey & Zbikowski, 1993).

The quadripartite conception of motivation for creativity leaves out a host of observations and characterizations of motivation for creativity, such as personality traits, attitudes and experiences of creative individuals. In the course of time, observations and findings of this kind have been increasingly subsumed under the heading of intrinsic motivation. As a result, the definition of the term has become so broad that practically it has come to denote any characteristic of the individual that could be considered related or responsible for involvement in the creative act, ranging from the enjoyable experience of ''flow'' (Csikszentmihalyi, 1990), or fascination with a problem (Gruber & Davis, 1988), through various traits, such as self determination, competence, achievement orientation, and sensation seeking (Rosenbloom, 2006; Amabile, Hill, Hennessey, & Tighe, 1994), up to innovation motivation that comprises the need to be different and innovation expectancy (Stephen, 2005). These examples demonstrate that the concept of intrinsic motivation has become so loose that anything could fit in, consequences of creativity no less than antecedents or promoting factors, which themselves may be related to creativity in different direct or indirect ways (Kreitler & Kreitler, 1990a). Thus, it seems that the study of creativity in general and of the motivation for creativity in particular could benefit from the introduction of a theoretical framework.

In the present study the conceptual and methodological approach based on the cognitive orientation theory will be applied to the study of motivation for creativity in design students. The cognitive orientation (CO) theory is a cognitive-motivational approach to the understanding, prediction and change of behaviors in different domains, such as motor, emotional and cognitive (Kreitler & Kreitler, 1976, 1982; Kreitler, 2004). The major tenet of the CO theory is that outputs are a function of a motivational disposition and a performance plan. The motivational disposition is considered to be a product of cognitive contents and processes, elaborated in a series of steps, focused sequentially on identifying the input and elaborating its meaning. Its major characteristics are directionality and strength. Directionality of the motivational disposition reflects the activity toward which the motivational disposition is oriented. It depends on specific beliefs characterized in terms of form and contents. From the point of view of form, four types of beliefs have been defined: about self, goals, norms, and general (about others and reality). From the point of view of contents, the beliefs relevant for a particular activity are those that refer to meanings underlying the specific activity in question. The CO theory has generated a standard procedure for identifying the meanings underlying the studied behavior (which are called themes) (Kreitler et al., 1982; Kreitler et al., 1976).

Accordingly, the motivational disposition is the combined product of beliefs of the four types concerning the set of underlying meanings that has been identified as relevant for the specified behavior. It is assessed by a CO questionnaire that includes beliefs of the four types referring to statements representing the identified themes. Each CO questionnaire represents in fact a matrix of items, whose columns are formed by the four belief types and whose rows are the themes, each row a different theme. The items of the matrix make up the CO questionnaire. The CO questionnaire yields scores for the belief types (one for each of the four belief types) and scores for the themes represented in the questionnaire. The four scores of the belief types define the motivational disposition, whereas the scores of the themes represent the underlying meanings of the behavior in question. As noted above, the themes refer to the underlying meanings of the behavior but do not suggest, indicate or hint at the behavior itself in any direct or indirect manner. Hence, assessing the directionality and strength of the motivational disposition do not depend in any way on the conscious considerations or reporting of the participants.

The CO questionnaire assesses acceptance or rejection of certain beliefs that do not mention explicitly or implicitly the behavior in question. This procedure is in accord with the theoretical tenet of the CO theory that the whole process of formation of the motivational disposition is unconscious, non-voluntary, and not necessarily rational or reasonable (see also Runco, 2004a, 2006). This conception contrasts with the assumption of other cognitive models that the motivational disposition is based on reasoned weighing of pros and cons or a consciously conceived decision to act in one way or another (Ajzen & Fishbein, 2004; Becker & Maiman, 1975).

The validity of CO measures of motivational tendencies was demonstrated in studies assessing CO motivations concerning a broad range of different behaviors, such as undergoing tests for the early detection of cancer

or reward seeking, as well as cognitive acts, such as planning or curiosity in different populations, ranging from students to mentally challenged individuals (Kreitler, Chaitchik, Kreitler, & Weissler, 1994; Kreitler & Kreitler, 1987a, 1987b, 1988, 1991, 1994). Studies of this kind showed that the motivational tendencies assessed in terms of clusters of beliefs show considerable variability in different behaviors, but are replicable in different examinations of the same behavior (Kreitler & Kreitler, 1994; Kreitler, Weissler, & Nurymberg, 2004).

The CO questionnaire of creativity (COQ-CR) is a measure of the motivation for creativity that was developed and applied in regard to several kinds of creativity in different samples, such as creativity in solving engineering problems, interpretation of metaphors, devising innovative uses for energy (Margaliot, 2005). It provides scores in the four belief types and in a set of themes that describe contents relevant for engaging in creativity (see Method). The special advantages of this measure are (a) it has been constructed according to a theoretically-driven methodology that specifies which contents are relevant, (b) it is based on a variety of contents that define a profile of creativity, (c) it has been tested empirically, (d) it does not depend on rational and conscious considerations of the respondents, and (e) it has a broad range of applicability for creativity outputs. Although some of the above claims may seem to describe other measures of creativity too, the CO measure is unique in that *all* of the mentioned claims apply to it and that it is grounded in a tightly structured theory that itself is of broad applicability.

In the present study the COQ-CR will be applied for studying the effects of motivation on the creativity of design students requested to produce creative designs. The creativity of the students was evaluated in terms of self-reported evaluations as well as in terms of evaluations by experts. The self-reported evaluations referred to the product as well as to different aspects of the process leading up to the product. By selecting a variety of facets for the evaluation of creativity we strove to do justice to the multiplicity of components involved in creativity (Andersson & Sahlin, 1997), as reflected also in the taxonomy of measurements of creativity presented by Hocevar and Bachelor (1989) and in the systems approach to creativity (Csikzentmihalyi, 1999; Gruber & Wallace, 2000; Sriraman, 2004; Tan, 1998).

The major hypothesis of the study was that the COQ-CR would enable predicting the various assessed aspects of creativity. More specifically, in view of the CO theory and previous findings, it was expected that the four belief types would enable predicting the scores of the participants on the various measures of creativity employed in the study. In general, it was expected that the variables of the basic set that referred to the design would be predicted better than the additional variables that referred to the processes of designing. The rationale was that the manifest characteristics of creativity are related to the motivational tendencies more than the processes of designing insofar as creativity of a design may be due to a variety of underlying processes. In addition to the scores of the four belief types that were expected to provide the major directionality of the motivational disposition for creativity, the themes, reflecting the contents relevant for creativity, were expected to provide insights into the specific personal dynamics of the motivation for creativity in the present sample.

This study was unique in that the sample consisted of students of design. Design is a subject matter that is commonly considered as requiring creativity. However, the selected sample is of students who may be impaired in the manifestations of their creativity by factors, such as lack of confidence, low level of expertise, and limited knowledge-base about design. Under these circumstances the testing of the relations of motivation for creativity and creativity manifestations is made especially challenging and important.

METHOD

Participants

The participants were 52 students of architecture (35 men and 17 women), recruited randomly from the population of students in the first to fifth year of studies in a school of architecture in a college in central Israel. The majority were born in Israel (85.11%). Their mean age was 22.85 years (range 21 to 35), and they had a mean of 13.91 years of education.

Instruments

Design Task

The students received a task that required designing in a creative manner a small museum, with spaces for the following functions: an exhibition area for the exposition of artistic pictures and posters, a gallery for sculptures, a coffee-shop area, one multipurpose room mainly for seminars and lectures, another room for administrative jobs, and locations for general services (i.e., bathrooms, cleaning room, and a small deposit) (see schematic map in Figure 1). The building was to be located in a contentious area characterized by historical buildings, viz. a 100 year old Town Hall, and a natural park. The instructions specified that the museum was intended to promote the cultural life in a little town and that the design was expected to provide a creative solution to the problems of interrelating the urbanized and the green areas, as well as the old and the new structures.

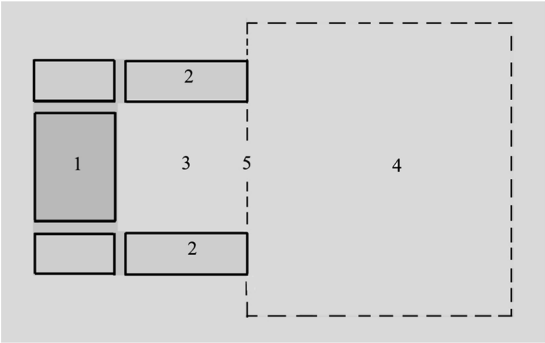

FIGURE 1 Schema illustrating the urban context provided in the design task. 1. Town Hall; 2. Dwellings; 3. Square; 4. Park; 5. Area available for the design of the museum.

Questionnaires

The three following questionnaires were administered to the students:

(a) The Survey of Attitudes (SA), which included 33 items representing various viewpoints, assessments and evaluations relevant to the process of designing and evaluation of designs (Table 1). The items were based on the transcribed interviews of pretest architecture students interviewed about designing. The interviewees were 20 students of the 4th and 5th years. All aspects of designing mentioned by at least 4 (20%) of the interviewees were included in the questionnaire. The participants were requested to check one of the four response alternatives presented with each item (very true, true, not

TABLE 1
Listing of Items in the Survey of Attitudes about Creative Design Problem

No	*Items*
1	The design task provided me with sufficient freedom to think about different aspects I wanted to examine and about different possible solutions
2	In the course of designing I made an effort to understand in depth the nature of the problem posed by the task
3	I have tried to develop an original idea and to produce a unique final product
4	I have tried to include in the design aspects and functions that I have not been explicitly asked to include
5	I could have developed the design further if I had more time
6	In the course of designing I have done more things intuitively than according to rules and knowledge
7	In the course of designing I have considered mainly elements of the task that seemed adequate to me and to my designing goals and ignored all the rest
8	The terrain and elements of the environment played a crucial role in my design
9	The designing task enabled me to learn things I have not known before
10	In the course of designing I made use of ideas from my inner world
11	The designing task included too few degrees of freedom (namely, it did not have enough constraints, conditions and limitations)
12	What I like about the task was that it had many challenges and mystery
13	Despite time limitations allocated to the task, I have succeeded to cope with the designing problems as best as I could
14	All I have done in the course of designing was necessary in order to attain a satisfactory solution
15	The final product reflects clearly my original design idea
16	Time limitations have helped me to be creative in the course of designing
17	The open framework of the task and the scarcity of limitations made it difficult for me to develop the design
18	What I liked most about the design task was that it confronted me with several problems which I had to solve prior to completing the design
19	The theme of the design interested me and made me check additional alternatives in allied domains
20	In the course of designing I have struggled with the situation so as to be able to express my original idea without compromising
21	In the course of designing I have tried to make my design not only interesting and original but also amenable to application and realization in reality
22	The absence of explicit design requirements and clearly defined design goals have not been helpful in improving my design
23	In the course of designing I felt as if the task was a game and designing was a playful activity
24	Despite the fact that the description of the project's environment was very poor and schematic I have succeeded to extract from it hints that have affected my design
25	In the course of designing I have considered more aesthetic aspects than practical and applied aspects
26	I liked the design problem because it is a brief and clear task that does not require handling and development for a long time
27	In the course of designing I tried to imagine how the problem would have been tackled by someone with other ideas and an approach contrary to mine
28	My interest in the design problem makes me check it from different points of view
29	The design problem was challenging because it can evoke contrary approaches and opposing ideas
30	I feel that I have had many good ideas and good design intentions that I have failed to apply and include in the final design
31	What has bothered me a lot in the course of designing was that I could not know what the final product would turn out to be
32	What I like about the design problem was that it concerned a project supposed to serve many people and contribute to the promotion of a small town
33	In the course of designing I have focused mainly on what I wanted to attain and express through this task rather than about how it would be viewed by the people in town or the entrepreneurs

true, not at all true, scored as 4, 3, 2, and 1, respectively). The reliability of the SA was high ($\alpha = .86$).

(b) Questionnaire about Designing. It included questions and ratings about the design process. The six questions relevant for the present study referred to the existence of a central idea guiding the design, experiencing difficulties in designing, using any additional materials in designing, interestingness of the task, meaningfulness of the task, involvement of feelings in addition to reason in the design process (for the questions see Table 2, variables 11–15 respectively). The reliability of this questionnaire was satisfactory ($\alpha = .74$).

(c) The Cognitive Orientation (CO) of Creativity (COQ-CR) (Kreitler & Kreitler, 1990b). It included 384 items presented in four randomly ordered consecutive parts, each referring to one of the four belief types (for beliefs about self, general beliefs, beliefs about norms and beliefs about goals, there were 98, 91, 98, and 97 items, respectively). Each item presented a particular content, e.g., curiosity, playfulness, doing things for fun. The items referred to different themes ($n = 79$), identified in interviews with creative individuals in different domains, according to the standard procedure for constructing CO questionnaires. The themes formed

TABLE 2
Definition, Means and Reliability Coefficients of Creativity Variables Based on Students' Evaluations

Variables	*Operational Definition of the Variables*	*Mean and SD*	*Cronbach's Alpha*
1. Fluency	Fluency index: Mean of items 1, 10, and 23 of SA	2.84 (.41)	.65
2. Flexibility	Flexibility index: Mean of items 19, 28, 29 in SA	2.95 (.33)	.77
3. Elaboration	Elaboration index: Mean of items 5 and 26 (reversed) in SA	1.67 (.23)	.62
4. Usefulness, functionality	Functionality index: Mean of items 21, 32, 25 (reversed) in SA	3.11 (.08)	.69
5. Innovation	Innovation index: Mean of items 3 and 20	3.03 (.45)	.64
6. Fulfilling specified design requirements	Fulfilling requirements index: Mean of items 7 (reversed) and 14 in SA	2.83 (.52)	.78
7. Considering context	Context index: Mean of items 8 and 24 in SA	3.09 (.05)	.65
8. Mastery of skills concerning the esthetics of the design	Skills index: Mean of items 6 (reversed) and 30 in SA	2.07 (.58)	.70
9. Coping with constraints	Index of overall attitude to constraints: Index constructed as a mean of items 1, 13, 16, and reversed values of items 11, 17, 22, 5 [that express complaints about too many or too few constraints]	2.36 (.41)	.67
10. Central idea	Question: Has there been any central idea that has guided you? If yes, which one (the responses were categorized in terms of a 4-point scale, ranging from 4 = clear central idea existing and identified, to 1 = no central idea).	2.86 (.50)	–
11. Difficulties in designing	Difficulty question: To your mind, to what extent has the designing been difficult? Rating of difficulty on a linear scale defined by the poles "very difficult" vs. "very easy" (ratings evaluated in terms of a 4-point scale, ranging from 4 = very difficult, to 1 = very easy)	1.79 (.41)	–
12. Use of additional materials	Question about additional materials: Have you applied in designing images from your memory, or ideas known to you from reading books or journals, from your studies, or the internet etc.? If yes, describe them briefly (the responses were categorized in terms of a 4-point scale, ranging from 4 = variety of materials used, to 1 = no additional materials used)	2.07 (.94)	–
13. Interestingness value	Question about interestingness: To your mind, to what extent has the designing been interesting? Rating of interestingness on a linear scale defined by the poles "exciting, interesting" vs. "boring, routine" (ratings evaluated in terms of a 4-point scale)	2.44 (.83)	–
14. Meaningfulness of task	Question about meaningfulness of task: To your mind, to what extent has the designing been meaningful? Rating of meaningfulness on a linear scale defined by the poles "meaningful, important" vs. "meaningless, unimportant" (ratings evaluated in terms of a 4-point scale)	1.83 (.60)	–
15. Involvement of feelings in addition to reason	Question about involvement of feelings: To your mind, to what extent there was involvement of feelings in addition to reason in the designing? Rating of involvement of feelings on a linear scale defined by the poles "involvement of feelings and sensations in addition to reason" vs. "involvement of reason almost exclusively" (ratings evaluated in terms of a 4-point scale)	2.85 (.21)	–

Note. In the third column, the first number is the mean and the second (in parentheses) is the standard deviation.
SA = Survey of Attitudes about Creative Design Problem (see Table 1).

the following 11 groupings, in line with cluster and confirmatory factor analyses (Kreitler & Casakin, submitted): 1. Self development [investing, promoting and guarding oneself]; 2. Emphasis on the inner world [identifying, knowing, developing and expressing one's thinking, feeling and imagination]; 3. Inner-directedness [emphasis on one's desires, will and decision, self confidence in one's ability to succeed]; 4. Contribution to society [concern with contributing something meaningful to the community or society even if it does not involve personal advancement]; 5. Awareness of one's own uniqueness as an individual [emphasis on oneself as an individual unique in one's talents and way of perceiving, behaving and being, not necessarily due to nonconformity]; 6. Freedom in acting [need to act in line with rules and regulations set by oneself rather than by others]; 7. Restricted openness to the environment [readiness and need to absorb from the environment knowledge and inspiration coupled with resistance to being overwhelmed and harmed by too much openness]; 8. Acting under conditions of uncertainty [readiness to act under conditions of uncertainty concerning the results, with no control over the circumstances, a tendency which may resemble risk-taking]; 9. Demanding from oneself [demanding from oneself effort, perseverance, giving up comfort and readiness for total investment, despite difficulties and even failures]; 10. Self expression [concern with using one's talents and expressing oneself with authenticity and characteristically]; 11. Non-functionality [readiness to act even if functionality is not clearly evident from the start].

The participants were requested to check in regard to each item one of four presented response alternatives (agree completely, agree, disagree, disagree completely, scored as 4, 3, 2, and 1 points, respectively). The reliability of the COQ-CR was shown to be satisfactory in various studies (Cronbach's alpha ranged from .80 to .92 for each of the four belief types). The validity was supported by findings that the questionnaire scores predicted levels of creativity assessed by different instruments in different samples (Kreitler & Kreitler, 1990b; Margaliot, 2005; Richter, 2003). The COQ-CR provided for each participant four major scores for belief types (one for each belief type) and additional scores for the groupings of themes (11 scores, one for each grouping of themes).

Procedure

Administering Design Task and Questionnaires to Students

The design task and two of the questionnaires (Survey of Attitudes and Questionnaire about Designing) were administered in one session, and the COQ-CR in another, separated by two to four weeks. For half of the participants the COQ-CR was administered first, and for half as second. The design task was administered in group sessions, with 3–5 students participating in each. Each session lasted for approximately two hours. The design task was explained to the students orally and then they were presented a sheet containing the general instructions and a schematic map of the area, as well as 10 A3 numbered sheets of paper which they were asked to use serially. After handing in the completed design, the participants were administered the questionnaires (Survey of Attitudes and Questionnaire about Designing in balanced order). The study was conducted in line with the appropriate ethical guidelines and has been approved by the institutional Helsinki committee.

Evaluation of Creativity by Experts

The designs produced by the students were evaluated for creativity by four architects, with an experience of at least 10 years in design practice. The evaluations consisted in rating the overall creativity of each design on a 5-point scale ranging from 1 (= low creativity) to 5 (= high creativity). The evaluations were done independently. The evaluators were naïve to the goals of the study. The design solutions were coded so as to preserve the identity of participants, and avoid possible bias in the evaluation.

The Creativity Variables Based on Student Reports

The creativity variables were defined on the basis of the students' assessments and evaluations (see Table 2). There were 15 variables referring to different aspects of the process and outcome of creative design: 1. fluency, 2. flexibility, 3. elaboration, 4. innovation, 5. functionality, 6. fulfilling specific design requirements, 7. considering context, 8. mastery skills concerning the esthetics of the design representation, 9. handling constraints, 10. having a central idea, 11. experiencing difficulties in the design process, 12. use of additional materials, 13. interestingness value of the task, 14. meaningfulness of task, and 15. involvement of feelings in addition to reason in the design process.

This list includes two sets of variables. The first ('basic set,'' variables nos. 1–8) refers to creativity features of the designs, and constitutes the core of creativity evaluation in this study. It was used and validated in previous studies for characterizing and evaluating architectural designs (Casakin & Kreitler, 2005a, 2005b). It was first defined in terms of objective criteria used by architects in evaluating architectural designs, and then validated in terms of the evaluations provided by students of architecture (Casakin & Kreitler, 2006; Kreitler

& Casakin, submitted). It will be noted that it includes the four classical factors of creativity (nos. 1–4: fluency, flexibility, elaboration and originality), first defined by Guilford (1981) and later applied in assessments of creativity in design and other domains (e.g., Casakin and Kreitler, 2005a, 2005b); and four additional variables (nos. 5–8), which represent themes studied by others and that were also mentioned by at least 50% of 25 architects who had been asked in an email survey about important aspects in evaluating architectural designs: functionality or usefulness (e.g., Franken, 2001); extent of dealing with the design requirements by including all the required functions, possibly also additional ones (e.g., Weisberg, 1993; Ariyo, Eckert, & Clarkson, 2006); reference of the design to the physical context, which defined in fact the problem domain of the design task; and mastery of esthetic skills for design representation (e.g., Christiaans, 2002).

The second set of variables (nos. 9–15) referred to the design process and represented the aspects that were mentioned by at least 50% of architecture students interviewed about characteristics of the process of designing. Table 2 presents the operational definitions of all 15 variables.

TABLE 3
Factor Analysis[a] of the Groupings of Belief Themes in the Cognitive Orientationof Creativity Questionnaire

Groupings of belief themes	*Factor 1*	*Factor 2*
1. Self development	**.896**	−.023
5. Emphasizing one's uniqueness	**.866**	.094
10. Self-expression	**.851**	.212
9. Demanding from oneself	**.751**	.332
4. Contributing to society, the community	**.731**	.229
2. Emphasis on inner world	**.651**	.478
6. Freedom in functioning	.082	**.758**
7. Being receptive to the environment, absorbing from the environment	.176	**.752**
8. Functioning under conditions of uncertainty	.017	**.705**
11. Non-functionality	.387	**.646**
3. Inner directedness	.452	**.564**
Eigenvalue	5.319	1.690
Per cent of variance	48.358	15.363

Note. The numbers in the cells are saturations of the variables on each of the factors. The highest saturations that are considered for defining the factor are typed in bold.

[a]The factor analysis was performed according to the principal components rotated varimx procedure after Kaiser normalization.

RESULTS

Control Analyses

Comparisons of the means of the major dependent and independent variables in participants of the two genders as well as between those who got the COQ-CR before or after the design task yielded significant results for fewer than 5% of the tests. Hence gender and order of administration of tasks were not considered in further data analyses.

Concerning the evaluations by the architects, we checked the degree of correspondence between the four evaluators with respect to creativity. The scores of the four referees were considered as items in a scale. Since the reliability coefficient of the scale was high (Cronbach's $\alpha = .73$), the scores assigned to each individual participant in regard to creativity were merged by calculating for each participant the mean of the four evaluations.

Factors of the COQ-CR

The 11 groupings based on the themes of the COQ-CR were factor analyzed in order to evaluate the similarity of the findings in the present sample with those in a previous sample of students (Giessen & Kreitler, submitted) and to present a more concise view of the contents of the questionnaire. Table 3 shows that the factor analysis of the 11 groupings yielded two factors which account together for 63.72% of the variance. The first and main factor is saturated mainly on the following groupings: Self development; emphasizing one's uniqueness; self-expression, as well as demanding from oneself; contributing to society; and emphasis on inner world. The emphasis seems to be mainly on the self—its uniqueness, development and expression. The second factor is weaker and is saturated mainly on the following groupings: Freedom in functioning; being receptive to the environment; absorbing from the environment; functioning under conditions of uncertainty; non-functionality; as well as inner directedness. The different groupings deal with the relations between the self and the environment, emphasizing on the one hand receptiveness and absorption from the environment, and on the other hand keeping inner directness and freedom from potential restrictions, such as uncertainty and functionality. Hence, it seems that the second factor could be labeled as maintaining openness to the environment but without compromising inner directness. Notably, on the whole the two factors resemble those obtained in a previous study with students of engineering (Giessen & Kreitler, submitted).

Factors of the "basic Set" of Variables Based on Student Evaluations

The variables of the "basic set" were factor analyzed in order to better characterize their contents (Table 4). The

TABLE 4
Factor Analysis[a] of Students' Evaluations of Their Design work

Factor III	*Factor II*	*Factor I*	*Variables*
0.202	−0.006	**0.867**	Context
0.338	−0.063	**0.736**	Requirements
0.135	0.137	**0.609**	Fluency
−0.217	**0.820**	0.235	Functionality
0.352	**0.688**	0.163	Flexibility
−0.063	**−0.587**	0.312	Expertise
0.876	−0.096	0.110	Elaboration
0.629	0.448	0.036	Innovation
1.270	1.635	2.187	Eigenvalue
15.873	20.438	27.337	% of variance

Note. The numbers in the cells are saturations of the variables on each of the factors. The highest saturations that are considered for defining the factor are typed in bold.

[a]The factor analysis was performed according to the principal components rotated varimx procedure after Kaiser normalization.

analysis yielded three factors which together accounted for 63.65% of the variance. The first and strongest factor (accounting for 27.33% of the variance) represents mainly consideration of context and requirements and may hence be labeled as fulfilling requirements of the task design. The second factor represents mainly consideration of usefulness and different alternatives (flexibility). It may be labeled as the factor of functionality. The negative saturation of this factor on skills may indicate that consideration of usefulness for students who are still relatively unskilled may require testing a great number of alternatives (viz. flexibility). Finally the third and weakest factor is saturated mainly on elaboration and innovation. Since in students innovation may depend on elaboration, the factor may be labeled as the factor of innovation or rather innovative elaboration.

The Relations Between the Independent and Dependent Variables of Creativity

The independent variables in this study are those that assess motivation for creativity (i.e., the four belief types as well as the 11 belief groupings) and the dependent ones are (a) the evaluation of creativity of the designs by the architects (one variable), and (b) the variables assessing creativity in terms of the students' evaluations (i.e., the "basic set" of eight variables as well as the three factors they define, and the additional seven variables referring to design processes) (18 variables). Regression analyses were used in order to test the major hypothesis of the study concerning the relation of the four belief types and each of the 19 dependent variables. Table 5 shows that in regard to 12 of the 19 variables the regression analyses yielded significant results. These results cannot be attributed to chance (12 of 19 constitute 63.16% and this per cent deviates significantly from the 5% expected by chance, Critical Value = 3.72, $p < .001$). However, the findings that are based on a significance level of $p < .05$ need to be considered with caution because the Bonferroni test requires $p = .003$ for findings on the $p <$. 05 level. Actually only the findings for flexibility pass this criterion.

Table 5 shows that the four belief types enable a significant prediction in regard to the creativity evaluations by the architects and the majority of the variables of the basic set of variables (5 of the 8, i.e., 62,5%): fluency, flexibility, elaboration, fulfilling requirements,

TABLE 5
Results of Significant Regression Analyses with the Four Belief Types as Predictors and Creativity Assessing Variables as Dependent Variables

	Beta Coefficients					
Dependent Variable	*Beliefs about Self*	*General Beliefs*	*Norm Beliefs*	*Goal Beliefs*	F^a	R^2
Architects' evaluation	.308	.224	.076	.465*	2.59*	.194
Factor 1	.323	.525*	.775*	.465*	2.56*	.187
Factor 3	.200	.538*	.661*	.309	2.85*	.240
Fluency	.377*	.508*	.468*	.542*	2.95*	.245
Flexibility	.472	.722**	.416*	.196	7.88**	.249
Elaboration	.325	.582*	.647*	.870**	2.59*	.211
Requirements	.312	.395	.617*	.476*	5.79*	.223
Context	.347	.347	.628*	.599*	2.51*	.212
Constraints	.215	.702**	.832**	.490*	2.66*	.242
Central idea	.118	.403	.611*	.406*	2.55*	.222
Meaningfulness	.418*	.326	.743**	.571**	2.91*	.278
Involv.of feelings	.216	.538*	.259	.669*	3.17*	.218

Note. The first row presents the results in regard to the architects' evaluation, rows 2–12 the results in regard to the variables based on the students' responses.

[a]The degrees of freedom are 4/48.

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

and considering the context, as well as two of the three factors based on this set of variables: Factor 1 which was labeled "fulfilling requirements of the task design" and Factor 3 which was labeled "innovative elaboration." In addition, the four belief types enabled a significant prediction of four of the seven variables that refer to the design process (i.e., 57.14%): coping with constraints, having a central idea, meaningfulness of the task and involvement of feelings in addition to reason in the design process.

In all cases all four belief types were involved in the prediction, as expected in line with the CO theory, although in most cases not all four belief variables had a significant contribution. Beliefs about norms and beliefs about goals had a significant contribution in 10 of the 12 variables with significant results. In contrast, general beliefs had a significant contribution in regard to seven variables, and beliefs about self in two cases only.

On the whole, the contribution of the motivational predictors to the prediction of the dependent variables is on the average 23%. It ranges from 18.7% (in the case of factor 1) to 27.8% the case of the meaningfulness of the task. The contribution is highest in regard to task meaningfulness, flexibility and fluency; it is lowest in regard to elaboration, consideration of context and factor 1 which was labeled "fulfilling requirements of the task design."

It is of importance to note also which dependent variables were not predicted by the four belief types of the COQ-CR: function, skills and innovation (from the "basic set"), and experiencing difficulties, using other materials, and interestingness value (from the additional variables).

In order to get a deeper insight into the relations between the cognitive motivational variables and the dependent variables assessing creativity the correlations between the 11 groupings of themes in the COQ-CR and the dependent variables (based on the responses of the students) were examined (Table 6). It will be noted that each of the 11 groupings was related to one or more of the dependent variables. Some of the notable findings are the following: elaboration was related significantly to a broad set of groupings including self development, inner world, inner directedness, awareness of one's own uniqueness, demanding from oneself and self expression, in sum, most of the groupings loaded on the first CO factor labeled "the self—its uniqueness, development, and expression." Fulfilling requirements was also related to several groupings, notably emphasis on the inner world, inner directedness, freedom in acting, and acting under conditions of uncertainty. Also Factor 3 "elaborative innovation" was related to four groupings (self development, freedom in acting, demanding from oneself, and self expression). Other creativity variables were related only to two groupings, for example, fluency (emphasis on the inner world, and restricted openness to the environment); flexibility (acting under conditions of uncertainty, and non-functionality); and coping with constraints (self development and freedom in acting). Finally, factor 1 "fulfilling requirements of the task design" was related only to one grouping (emphasis on the inner world). The grouping that was related to the largest number of creativity variables ($n = 4$) was emphasis on the inner world, followed by self development and demanding from oneself, each of which was related to three creativity variables.

Some of the creativity variables were not correlated with any of the groupings. These are functionality, considering context, innovation, and factor 2 labeled as the factor of functionality, as well as six of the additional variables referring to the design processes (i.e., central idea, experiencing difficulties, use of additional materials, interestingness value, meaningfulness value, and involvement of feelings in addition to reason).

TABLE 6
Significant Spearman Product-Moment Correlations Between the Groupings of CO Themes in the COQ-CR and Creativity Assessing Variables

Groupings of CO Themes	*Factor 1*	*Factor 3*	*Fluency*	*Flexibility*	*Elaboration*	*Requirements*	*Constraints*
1. Self development		.281*			.366**		−.274*
2. Emphasis on the inner world	.312*		.275*		.278*	.361**	
3. Inner-directedness		.279*			.296*	.301*	
4. Contribution to society							
5. Awareness of one's own uniqueness as an individual							
6. Freedom in acting		.339*			.274*	.273*	.710***
7. Restricted openness to the environment			.300*				
8. Acting under conditions of uncertainty			.375*		.340*		
9. Demanding from oneself		.447***			.507***	.277*	
10. Self expression		.281*			.298*		
11. Non-functionality			.276*				

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

DISCUSSION

The major findings of the study refer to the role of the variables assessed by the COQ-CR in regard to the various dependent variables relevant for creativity. The variables assessed by the COQ-CR are considered as representing the motivation for creativity. This statement is based both on the CO theory underlying the instrument and on the methodology by means of which it has been constructed. The instrument is inspired by the basic conception that motivation for an activity is a function of four belief types referring to contents reflecting underlying meanings related to creativity. The main result of the study is that, as expected, the four belief types enabled predictions of most of the dependent variables assessing different aspects of creativity. These variables included the evaluation of creativity by the four expert architects and 11 of the 18 variables based on the students' responses. The latter included the majority of the variables of the basic set, subsumed also under the factors labeled "fulfilling requirements of the task design" and "innovative elaboration." Again, as expected, the four CO belief types predicted more of the basic set variables, referring to the design features, than of the additional variables, referring to the designing processes.

The findings show that the measure of motivation for creativity anchored in the CO theory has predictive power in regard to a broad range of variables reflecting creativity. The predicted variables include both the more objective evaluation of creativity by experts as well as the evaluations of creativity by the students themselves. Whereas the experts' evaluations referred to creativity as a whole, the students' evaluations, though admittedly subjective, referred to particular aspects reflecting creativity: fluency, flexibility, elaboration, fulfilling requirements, considering the context, having a central idea, meaningfulness of the task, involvement of feelings in designing, and handling constraints. It will be noted that the predicted variables include a variety of aspects concerning the design itself and the process of designing. This fact enhances the conclusion about the validity of the CO measure of motivation for creativity.

No less important for evaluating the CO measure of motivation for creativity are the variables whose predictions did not provide significant results. These are: functionality, skills, innovation, using additional materials in designing, difficulties in designing and interestingness (or boredom). The fact that functionality was not predicted by the CO measure should not be surprising in view of the fact that a non-functional approach constitutes one of theme groupings of the COQ-CR. Further, functionality may play an important role in architectural design, but not necessarily in creativity. Further, it is possible to maintain that mastery of designing skills, using additional materials, and experiencing difficulties may reflect rather technical aspects of designing and are related to creativity only indirectly. The same claim may hold also in regard to the two further variables that were not predicted by the CO measure: innovation and interestingness value of the task. Concerning innovation, the factor analysis of the students' evaluations reveals that students tended to consider innovation together with elaboration as forming the third and weakest factor. Hence, they did not seem to estimate innovation as a salient component of creativity. Yet, the factor of innovative elaboration was predicted by the CO measure. Concerning interestingness, it is possible that the students viewed it as related to trivial problem solving, in contrast to meaningfulness and hence as not quite so challenging.

The findings show that the CO measure of motivation for creativity is potentially indicative of motivational components for creativity. The relatively low per cent of variance accounted for by this measure in the present study (mean of 23%) may be due to the relatively low level of creativity manifestations that are to be expected in a sample of students that is in addition fairly small.

The findings contribute also to broadening the conception of motivation for creativity. The CO conception of motivation integrates the formal aspect of the four belief types with the consideration of contents manifested in the themes. From the more formal point of view our findings indicate that although all four belief types are involved in the predictions of creativity variables, the two belief types with the largest contributions are beliefs about norms and about goals. Thus, it seems that the motivation for creativity is guided primarily by beliefs about how things should be and about the values and conceptions the designer is supposed to consider, supported by the designer's personal goals. In contrast, beliefs about how things actually are in reality and in regard to oneself play a smaller role. The generality of this conclusion needs to be checked in further samples.

From the point of view of contents, the CO measure suggests that motivation for creativity is a highly complex and variegated construct. As noted, it started as a measure with 79 themes, which were clustered into 11 groupings, which yielded two factors in factor analysis. A measure of such complexity allows for multiple combinations of themes to make up motivation for creativity in different individuals. Accordingly, it is in principle possible, even likely, that different individuals manifesting similar levels of creativity may have motivations for creativity composed of highly different themes. This possibility extends the potentiality for promoting creativity in a great variety of individuals with highly different personality and cognitive backgrounds.

Despite the variegated thematic panorama the groupings of themes can be summarized in terms of two major

axial factors: the first is anchored mainly on the self—its uniqueness, development and expression; the second highlights openness to the environment without compromising inner directedness. The importance of the self in the motivation for creativity is revealed also in the finding that the grouping that was related to the largest number of creativity variables was emphasis on the inner world, followed by self development and demanding from oneself.

Thus, it seems that the motivation for creativity hinges on the dual poles of the self and the environment. This conclusion is consistent with Murray's (1938) conception of "press" factors, whose relevance for the study of creativity was elaborated by Runco (2004b, pp. 661–663). Yet, defining the motivation for creativity in terms of this polarity would yield an overly restricted conception of motivation for creativity that includes also components, such as preserving freedom in functioning, acting under uncertainty, contributing to society and demanding a lot from oneself. Notably, many of the identified themes and groupings of themes were mentioned by other investigators (e.g., Runco, 2005). The special advantage of the CO measure is its comprehensive character due to the theoretical framework in which it is anchored. Further, the motivational conception of the CO theory is sufficiently broad to accommodate many of the motivational concepts for creativity of the extrinsic, intrinsic and unconscious types. However, at present the generalizability of the findings is limited by the small number of participants and the broad range of expertise they represent. Further studies and applications of the measure need to be done in order to get deeper insight into the motivational dynamics of what is probably the highest manifestation of the complex cognition-emotion-personality.

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