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Multi-Dimensional Assessment of Creativity

Abstract

Today there are many conceptions of what creativity is and as many ways of measuring what is creative and what is not. While these measures have proved to be reliable and valid predictors of what they are measuring, there is little data on how they relate to each other. This study compares the scores of 55 undergraduates on creativity measures of inhibition, convergent and divergent thinking, realistic creativity, and lifetime achievement. There was a significant relationship between the originality sub-score of divergent thinking measures, realistic examples of creativity, and lifetime creative achievement. The relationship between convergent thinking and realistic creativity was inconclusive. There was no relationship between convergent thinking and lifetime achievement.

Multi-Dimensional Assessment of Creativity

Creativity has been described as “one of the most enigmatic subjects in cognitive psychology” (Kim, Cramond, & Bandalos, 2006). It is difficult to define and tricky to measure, but seemingly easy to recognize (Amabile, 1982). It may also have a host of benefits for those who possess it; previous research has suggested that creative interventions can have a significant impact in many different areas, from increasing life satisfaction and sense of purpose in the elderly, to supporting teacher effectiveness (Davidovitch & Milgram, 2006; Krawczynski & Olszewski, 2000; Cook, 1998; Dawson & Baller, 1972).

Though many today would agree that creativity is significant and that it should be nurtured, not many would be able to agree on exactly what creativity is or how to go about supporting its development. The nature of creativity is highly subjective, and there is little agreement among researchers as to a specific definition (Johnson & Carruthers, 2006). Some define creativity simply as “the ability to produce work which is both novel and appropriate” (Lubart, 1994). Others focus on the making of connections between previously unrelated concepts (Mednick, 1964). Still others focus on the evaluation of creative products, defining a creative product as something which is judged to be “creative” by people who are knowledgeable in the field (Amabile, 1979; Amabile, 1982a; Amabile, 1982b; Amabile, 1983; Amabile & Gitomer, 1984).

Assessment is therefore difficult; different tasks are developed according to different conceptions of creativity, and research projects will typically use only one type of measure (Johnson & Carruthers, 2006; Kim, Cramond, & Bandalos, 2006). Because these measures test different abilities, it is difficult to make connections between separate

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studies in order to draw conclusions about what types of creative processes might relate to realistic creative output and lifetime achievement.

Creativity Assessment

Some of the oldest conceptions of creativity are based on the cognitive processes thought to be necessary for creativity to be present. Within this process based approach, two types of thinking are stressed: convergent thinking, which is the ability to combine different pieces of information based on the elements they have in common; and divergent thinking, which is the ability to create many different ideas based on a single topic.

Mednick, one of the earliest proponents of convergent thinking as an indicator of creativity, defined creative thinking as: “forming of associative elements into new combinations which either meet specified requirements or are in some way useful” (Mednick, 1964). He therefore based many of his assessments on verbal association tasks, such as the Remote Associates Task in which participants are provided with a grouping of three seemingly unrelated words and asked to think of a fourth word which links the previous three; and a response task, in which participants are provided with a single word and asked to think of as many words that are associated with the original word as possible (Houston & Mednick, 1963; Mednick, Mednick, & Jung 1964).

This type of thinking indicates an ability to focus on correct responses while disregarding irrelevant responses in order to come to a correct answer (White & Shah, 2006). This focus and concentration on important aspects of a problem may be important in order to produce a creative piece of work (Sosik, Kahai, & Avolio, 1999). However, the same focus that allows a person to disregard irrelevant information may also prevent

them from considering “off the wall” solutions that are often thought of as being creative (White & Shah, 2006).

Divergent thinking, on the other hand, encourages the individual to think of as many ideas as possible – even if they seem odd or unworkable at first glance. Guilford (1950) suggests that an important factor in creativity is fluency, which is the quantity of creative production. Although rapid and prolific production alone will not guarantee a creative final product, if two people are producing the same quality of work, and one of those people is able to produce *more*, that person will be more likely to come up with a significantly creative idea (Guilford, 1950). Testing of divergent thinking often involves asking the participant to engage in brainstorming activities, such as responding to the prompt: “What are some possible uses for a paperclip” (Plucker & Runco, 1998). While at first responses will usually be somewhat mundane (“hold paper together”), after these typical responses are exhausted something original might come to mind (“arrange clips to spell ‘tip’ and leave at a restaurant when the service has been poor”).

While Guilford argues that more production will simply lead to a greater likelihood of a creative response, one danger of the divergent thinking conception of creativity is that often, quality is ignored in favor of quantity (Cropley, 2006; Guilford, 1950). While it is possible for a person to happen upon a creative solution through divergent thinking alone, it is more likely that some convergent thinking will be necessary in order to produce an idea that is accurate and meaningful (Cropley, 2006).

Assessment using both of the previous models of creativity is based on the process that results in a creative product. However, neither model focuses much on any realistic examples of creativity. While understanding the cognitive processes that drive

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creativity can aid researchers who are searching for ways to mold creative young minds, often these process assessments of creativity suffer from lack of a direct link to a creative product (Amabile, 1982b).

Self-report of previous creative achievement is one way of assessing creativity through actual accomplishments. Carson, Higgins, & Peterson (2003) suggests that because certain processes associated with creativity – such as divergent thinking – are also present at a higher than average level in some disordered populations who do not tend to engage in creative production, these processes may not be enough by themselves to identify creative individuals. Therefore, in order to determine which people are truly creative achievers they suggest gathering information about their lifetime accomplishments.

Carson, Peterson, & Higgins (2005) conducted several experiments designed to test their Creativity Achievement Questionnaire (CAQ). This questionnaire was developed in order to assess creativity on the basis of past creative accomplishments (Carson, Peterson, & Higgins, 2005). They were able to show that the CAQ was a good predictor of creative ability and future creative behavior, and that the CAQ correlated with personality traits associated with highly creative individuals, and with divergent thinking abilities.

While this type of questionnaire is valuable for its ability to identify creative individuals, it is difficult to use the results in order to determine what creates, drives, and nurtures creativity. Scoring is objective and leaves little room for interpretation. Amabile (1982b) suggests that a definition of creativity that focuses on environment and motivation is necessary in order to avoid the “translation problem” that many other

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assessment techniques face. Amabile does not attempt to quantify creativity using mathematical formulas and detailed coding, rather she admits that her scoring techniques are subjective, but asserts that they are still reliable.

In Amabile (1979) 95 undergraduates at Stanford University were asked to create a collage with the theme of “silliness” for an experiment on different moods. As a part of 8 separate experimental conditions, subjects were told that their work would or would not be evaluated, and then were either given no specific instruction on how to complete the collage, instructions relating to technical goodness, or instructions relating to creativity. In the “instructions” conditions, subjects were further divided into groups that either received very specific instructions or broad general instructions.

15 judges with prior art experience were asked to rate the collages on 16 different artistic categories, one of which was ‘creativity,’ which they received brief descriptions of before judging. The judges did not work together and were not given any special training before rating the collages. Reliability for the dimension of creativity was .79, demonstrating that it is possible for judges to recognize and rate creativity using subjective criteria for realistic products.

This method of assessing realistic creativity is very useful in studies of motivation and environment, but is weak in the area of defining personal characteristics that a creative person might possess. Like the other methods of assessing creativity, it is limited in scope and seems to be missing a part of the equation.

The Present Study

Though many methods of measures of creativity have been identified, because of the conceptual differences noted above, it is unclear how these measures may be related

to each other. Do laboratory tasks such as the Remote Associates and the Unusual Uses predict real life creativity? How do laboratory tasks that attempt to mimic real life creative production relate to traditional measures of creative processes?

Previous theories have suggested that both convergent and divergent thinking may be important for creative production (Cropley, 2006; Finke, 1996). In Finke's model of "creative realism," the creative process begins with an "exploratory phase" in which divergent thinking plays a primary role, and then moves into a "generative phase" that involves a greater deal of convergent thinking (Finke, 1996). This type of model would result in creative inventions that were both spontaneous and practical (Finke, 1996).

In the present study we seek to combine several of the traditional methods of assessment in order to create a more complete picture of the factors of each that contribute to creativity. We tested a large group of undergraduates using several convergent thinking, divergent thinking, realistic product, and self-report measures of creativity. We predicted that high scores on the measures of divergent thinking would have a positive relationship with higher scores on realistic creative products and on the self-report measure of creative accomplishment. We further hypothesized that high scores on measures of convergent thinking would also be related to high scores on realistic creative products and the self-report measure of creative accomplishment.

Methods

Participants

55 college students from the Introductory Psychology Subject Pool of a large, Midwestern university were included in this study. One student did not complete the study; therefore the final sample size was 54. Of these, there were a total of 31 males and

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23 females. Participants were between the ages of 18 and 22 (mean = 19.17) and were from ethnicities which represented the demographics of the university.

Procedures

Students participated in the study in groups ranging from a single student to 30 students at a time. All measures were included in a booklet provided at the beginning of the session, and were completed with a pen or pencil. The tasks were administered and timed by the principal investigator, and the entire session lasted approximately 1 hour. Before beginning, students were asked to read and sign a consent form detailing their rights as subjects, and were given background information about the study by the principal investigator.

After signing the consent form, participants completed eight measures: the Hasher Inhibition Task, a Haiku Task, the Remote Associates Task, the Unusual Uses Task, a Children's Adapted Remote Associates Task, a Circles Task, the Creativity Achievement Questionnaire, and a General Information Questionnaire. Following completion of the General Information Questionnaire, students were given a debriefing form and thanked for their contribution to the study. Participants received 1 credit of research for their Introductory Psychology class.

Measures

Hasher Inhibition Task. The first task administered to the participants was adapted from a reading task developed to test ability to ignore distracting information (Connelly, S.L., Hasher, L., & Zacks, R.T., 1991). Participants were asked to read 8 short stories while ignoring irrelevant stimuli present within the stories. In 4 of the stories the irrelevant stimuli consisted of italicized words that did not relate to the story, while in

the other 4 control stories, the irrelevant stimuli was a row of italicized x's.

The stories were presented to each participant, individually, on a sheet of unlined paper. Participants were able to read silently, at their own pace. After every person in the group finished reading, 4 comprehension questions were asked in multiple choice format. The questions for the irrelevant word stories each had two unrelated answers, a foil answer relating to the irrelevant words which were supposed to be ignored and the correct answer. The questions for the irrelevant x's stories each had three unrelated answers and the correct answer. Participants were scored based on the number of correct answers in the extra word stories versus the number of correct answers in the control stories. A higher score indicated a higher level of inhibition.

Haiku Task. A haiku is a structured poem that is written in 3 lines. The first line contains 5 syllables, the second line contains 7 syllables, and the third line contains 5 syllables. This type of task is thought to represent realistic creativity (Amabile, 1983). Participants were given 3 minutes to create an original haiku about "summer." The creativity of the poems was scored from 0-2 in the categories of: Metaphor Imagery, Form, Movement, and Rhythm, for a possible score between 0 and 10. For example, in the category of "metaphor," a poem was given a score of "0" if no metaphors were present, "1" if it contained a simple metaphor (no depth) or a simile, and a "2" if it contained a profound metaphor with depth and quality which developed through the poem. A higher score in each category represents a greater mastery of that category. A higher total score indicates a higher level of creativity.

Remote Associates Task. The Remote Associates task (RAT) is a measure of convergent thinking abilities (Mednick, 1962). Participants were presented with 46 word

trios and were given 7 minutes to complete the trios with a fourth word that could be related to the previous three. An example of this is the trio “call, pay, line” in which all of the words can be related to the fourth word “phone.” It is thought that the ability to mentally screen irrelevant answers in order to produce a single correct answer is a necessary skill for the RAT, and that this skill reflects convergent thinking abilities. A greater number of correct responses was associated with a higher level of convergent thinking.

Children’s Adapted Remote Associates Task. The Children’s Remote Associates Task (CRAT) is a measure of convergent thinking abilities which has been adapted from the original Remote Associates task (Mednick, 1962) and the Mattel children’s game Tribond Jr. for children at an upper elementary school level. Participants were presented with 57 word trios and given 7 minutes to complete the trios with a fourth word that could be related to the previous three. An example of this is the trio “band, first, lemon” in which all of the words can be related to the fourth word “aid.” It is thought that the ability to complete this task is related to the ability to complete the original Remote Associates task. A greater number of correct responses was associated with a higher level of convergent thinking.

Unusual Uses Task. The Unusual Uses task is a measure of divergent thinking abilities (Guilford, 1950). Participants were given 2 minutes each to think of as many uses as possible for a brick, and another 2 minutes to think of possible uses for a bucket. Answers were scored on the criteria of Fluency (number of unique answers), Flexibility (number of unique categories and number of categorical shifts between answers), and Originality (uniqueness of the response in relation to the sample of responses). Higher

scores in each of the three scoring areas are associated with higher levels of divergent thinking.

Circles Task. The circles task is a measure of divergent thinking adapted from the Torrance Test of Creative Thinking (Torrance, 1974). Participants were given 7 minutes to create designs using 16 blank circles. Answers were scored on the criteria of Fluency (number of unique answers), Flexibility (number of unique categories and number of categorical shifts between answers), and Originality (uniqueness of the response in relation to the sample of responses). A higher score on the circles task indicates a higher level of divergent thinking.

Creativity Achievement Questionnaire. The Creativity Achievement Questionnaire (Carsons, Higgins, & Peterson, 2001) was designed to rate the level of creative accomplishment of the respondent. This task was not timed. Participants were asked to check each statement that applied to them in each of 7 different creative categories. Statements such as “I do not have any training or experience in this field” were scored as a 0, whereas statements such as “My work has been reviewed in a national publication” were scored as a 7. Total scores for each category were created by adding the score (0-7) of each checked statement for that category, then multiplying the number of times the respondent had achieved the top level in that category by 7 and adding that to the original score. A higher score indicates a higher level of creative achievement.

General Information Questionnaire. The last item administered was a General Information Questionnaire. This task was not timed. This questionnaire was designed to provide background information on each of the participants. Subjects were asked to provide their age, their academic major(s)/minor(s), and current ADD/ADHD/learning

disability status. They were also asked to check off interests and hobbies from a provided list, and to write down any other hobbies not listed.

Results

The first hypothesis predicted that higher scores on the divergent thinking tasks would correlate with higher scores on the measure of realistic creativity and of self-report measures of creative achievement. To test this hypothesis, we ran a correlational analysis on the Unusual Uses task, the circles task, the haiku task, and the Creativity Achievement Questionnaire (CAQ). The results of the analysis are summarized in Table 1. We found that our prediction was partially supported.

As shown in Table 1, no significant relationship was found between the fluency sub-scores and the flexibility sub-scores on the haiku task. Participants who provided more answers, or demonstrated more categorical shifts, on divergent thinking tasks did not tend to score higher on the task of realistic creativity. This did not support our hypothesis. Table 1 also shows that flexibility was not significantly related to self-report of previous achievement, which did not support our hypothesis.

There were mixed results on the relationship between fluency and previous achievements. Table 1 shows that there was a significant relationship between fluency on the Unusual Uses task and the CAQ, but there was no significant relationship between fluency on the circles task and the CAQ. These results are inconclusive and do not support our hypothesis.

However, there was a significant relationship between the originality sub-score and the haiku task. Originality on the Unusual Uses task was significantly related to the haiku task, $r = .303$, $p = .034$. There was also a significant relationship between

originality on the circles task and the haiku task, $r = .333, p = .015$. Participants who exhibited a higher level of originality on divergent thinking tasks tended to score higher on the realistic assessment of creativity. These results lend support to our hypothesis.

There was also a significant relationship between the originality sub-score and reports of previous creative achievements. The originality sub-score on the Unusual Uses task was positively correlated with the CAQ, $r = .534, p = .000$. The originality sub-score on the circles task was also positively correlated with the CAQ, $r = .309, p = .024$. A higher level of originality on divergent thinking tasks was associated with greater previous creative accomplishments. This provides support for our hypothesis.

In order to control for the effects of other variables on the haiku task, a multiple-linear regression was performed with the originality sub-scores of the Unusual Uses task and the circles task as the predictor variables, and the haiku task as the outcome variable. The results of this analysis are provided in Table 2. There was a marginally significant relationship between originality on the two divergent thinking tasks and the Haiku task, $p = .055$. A step-wise linear regression showed that originality on the Circles task contributed significantly ($R = 10.3\%$) towards predicting haiku scores, $p = .000$.

The second hypothesis predicted that scores on measures of convergent thinking would be related with scores on measures of realistic creativity and self-reports of previous creative achievement. To test this hypothesis, a correlational analysis was performed on the Remote Associates task (RAT), the Children's Remote Associates task (CRAT), the haiku task, and the CAQ. The results of this analysis are summarized in Table 1. The relationship between convergent thinking and realistic creativity produced mixed results. Table 1 shows that while no significant relationship was found between the

CRAT and the haiku task, a significant relationship was demonstrated between the RAT and the haiku task. These results are inconclusive and do not support our hypothesis.

Convergent thinking did not seem to be significantly related to self report of previous creative accomplishment. As shown in Table 1, no significant relationship was found between the CRAT and the CAQ, or the RAT and the CAQ. Participants who exhibited higher levels of convergent thinking tended to have fewer previous creative accomplishments. These results do not support our hypothesis.

Discussion

The purpose of this study was to examine the ways in which different available measures of creativity might be related to each other. Measures of convergent thinking, divergent thinking, realistic creativity, and self-report were examined. The results showed that the originality sub-score for both of the divergent thinking tasks was positively correlated with the realistic creativity task. The originality sub-score was also positively correlated with self-report of creative accomplishment.

Our findings suggest that one of the main forces behind creativity could be the factor of “originality.” Guilford (1950) considered “novelty,” in the way of producing uncommon but serviceable ideas, to be a primary element for defining a creative person. This implies that in order to be creative a person must be able generate many ideas, which would increase the likelihood of coming across a novel one, but must also be capable of the focused thinking that creates answers that are functional (Cropley, 2006).

Interestingly, neither the category of “fluency,” nor the category of “flexibility,” was significantly related to higher scores on the realistic assessment of creativity (Table 1). This suggests that divergent thinking alone probably cannot account for creative end-

products. Rather, there is likely another process taking place which works with originality. Previous researchers have theorized that convergent thinking is that second process (Cropley, 2006). In this model, divergent thinking allows for the brainstorming of original ideas while convergent thinking allows for the critical appraisal of these ideas (Cropley, 2006).

In this study, the relationship between convergent thinking and realistic creativity was inconclusive. The results showed that while the original Remote Associates task (RAT) was significantly related to higher scores on the haiku task, the Children's Remote Associates task (CRAT) was not. Though the RAT and CRAT themselves were significantly related, the correlation was not overwhelmingly strong, and it is possible that this new task simply did not measure convergent thinking as well as the original. If this was the case, it is possible that given only the correlation between the original RAT and haiku scores we could conclude that convergent thinking was in fact related to realistic creativity.

The use of an adapted version of the RAT was a significant limitation of this study. The purpose of using the CRAT was to test it for later use with a younger population. However, the results of this study may have been stronger had a time-tested measure of convergent thinking been used. Future research in this area should focus on identifying another method of testing convergent thinking that can be paired with the RAT.

Another limitation of this study was the fact that both the RAT and the CRAT had over 40 items each for the participants to answer. The researcher running the study noticed that many participants seemed to become bored with the task towards the end of

the allotted 7 minutes. This appeared to be more of a problem with the RAT, which was a more difficult task. When coding the data, it was noted that a number of the participants did not even reach the last page of the RAT. While it is possible that this was due to time constraints, given the information about participants seeming to “not try” towards the end of the task, it seems that boredom was a very likely culprit. If this is the case, the number of RAT trio’s answered per participants could be lower than normal, artificially lowering the correlation between convergent thinking and the haiku. This problem could be corrected for future studies by limiting the number of items on these tasks.

As predicted, different measures of creativity relate to each other in different ways. The originality sub-score for divergent thinking measures has a clear relationship with realistic creativity, while convergent thinking measures seem like they may have a relationship with realistic creativity given better assessments. This finding suggests that future research could focus on defining a unified assessment of creativity. This type of assessment would acknowledge that no one definition of creativity can account for the many dimensions involved, and a more holistic account could be an excellent resource for future creative investigations.

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Table 1

Intercorrelations Between Convergent thinking, Divergent thinking, Realistic creativity,

	CRAT	RAT	CAQ	Haiku	UU Fluency	UU Flexibility	UU Originality	Circles Fluency	Circles Flexibility	Circles Originality
CRAT	1.00	.336*	-.190	.235	-.064	-.124	.041	.174	-.084	-.087
RAT		1.00	.009	.517**	.293*	.252	.277	.164	.198	.116
CAQ			1.00	.267	.342*	.216	.534**	.218	.147	.309*
Haiku				1.00	.205	.075	.303*	.118	-.024	.333*
UU Fluency					1.00	.917**	.903**	.365*	.167	.588**
UU Flexibility						1.00	.826**	.338*	.152	.581**
UU Originality							1.00	.357*	.181	.605**
Circles Fluency								1.00	.068	.591**
Circles Flexibility									1.00	.001
Circles Originality										1.00

and Self-report of creativity.

* $p < .05$ ** $p < .01$

Table 2

Summary of Regression Analysis for Variables Predicting Haiku Scores

	<i>B</i>	<i>SEB</i>	<i>β</i>
Unusual Uses	.266	.180	.215
Originality			
Circles Originality	.063	.066	.166