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ABSTRACT

The hypothesis of positive skew in distributions of response to creative thinking tasks was studied. Data were obtained from examinees' responses to problem-solving tasks in three published studies of creative thinking. Subjects included 23 fifth graders (12 females and 11 males), 29 high school students (10 females and 19 males), and 47 female college students. Significant positive skew was discovered in distributions of response to four out of five ill-defined problem-solving tasks. In each case, skew appeared to be greater for responses to ill-defined tasks than for responses to better-defined tasks that had been solved concurrently. Discussion centers on task difficulty as an explanation for positive skew in distributions of response to creative thinking tasks. One table contains skews of responses. (Author/SLD)

Is Creative Thinking Normally Distributed?

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RUNNING HEAD: Is Creative Thinking Normally Distributed?

Paper presented at the meeting of the Southeastern Psychological Association, New Orleans, LA, March 20-23, 1991

Abstract

This study explored the hypothesis of positive skew in distributions of response to creative-thinking tasks. Data were obtained from responses to problem solving tasks in three published studies of creative thinking. Subjects (N = 99) were in fifth grade, high school, or college. Significant positive skew ($p < .01$) was discovered in distributions of response to four out of five ill-defined problem-solving tasks. In each case, skew appeared to be greater for responses to ill-defined tasks than for responses to better-defined tasks that had been solved concurrently. Discussion centered on task difficulty as an explanation for positive skew in distributions of response to creative-thinking tasks.

Is Creative Thinking Normally Distributed?

The question of the normality of the distribution of creative thinking is raised by the putative difficulty of the task. Maddi (1975), for example, argued that creative thinking is far more strenuous than many theorists have assumed. More recently, Kim (1990) based his analysis of creative thinking on the twin suppositions that "a difficult problem is a task whose resolution is not obvious," and "a creative solution is a resolution to a difficult problem" (p. 16). In both of these analyses of creative thinking, task difficulty is a necessary, if not sufficient condition for the emergence of creative thought.

Tasks which are particularly difficult tend to result in responses that are positively skewed, that is, the mode of the distribution lies below the mean. Such responses exhibit what is called a "floor effect" (Cronbach, 1984, p. 179), piling up at the lower end of a distribution. Responses on tests to distinguish among the best members of a group of applicants, or to determine exemptions from some requirement, or to award scholarships typically exhibit floor effects. The problems posed on such tests, however, do not necessarily require creative thinking. The

difficulty of problems that require creative thinking lies in their "ill-defined" nature (Kim, 1990). Ill-defined problems -- with no given formulation, solution procedures, nor agreed-upon criteria for the correctness of solutions (Reitman, 1965) -- are necessarily difficult.

From such descriptions of creative thinking, one might reasonably develop two hypotheses with regard to the distribution of creative thinking as response to ill-defined tasks:

1. The distribution of creative thinking should be positively skewed due to task difficulty.

2. Skew of these distributions should be greater than skew of responses to better- defined problems.

These hypotheses formed the basis for an empirical study of the distribution of creative thinking.

Method

Subjects

Data were compiled from three published studies. The first study (Wakefield, 1985) included 23 fifth graders (12 females and 11 males) of average and above intellectual ability. The second study (Runco & Okuda, 1988) included 29 intellectually talented high school students (10 females and 19 males). The third study (Wakefield, 1986) included 47

female educational psychology students at a highly selective university. Other details of subject demographics have been reported elsewhere.

Instruments

The different studies included different measures of creative thinking. Reliability and validity data have been presented in the separate study reports, but some task descriptions are warranted. The first study (Wakefield, 1985) utilized Wallach and Kogan's (1965) Pattern Meanings and Line Meanings. These untimed tests called for divergent response to patterns or lines presented by examiners. To introduce ill-defined problems, the subjects were asked to draw a pattern (or line) of their own and respond divergently to the self-set problems. Scores were computed as the number of responses to presented (better-defined) or invented (ill-defined) item types. Correlation of scores with normal curve equivalent scores on the Group Inventory for Finding Creative Talent resulted in Pearson product-moment correlations of.33 for the responses to presented problems and .46 for the responses to the invented problems.

The second study (Runco & Okuda, 1988) utilized Wallach and Kogan's (1965) Uses, Similarities, and Instances

tasks. These untimed tests consisted of items in which subjects were asked to either list uses for objects, to list similarities between objects, or to list instances of given categories of objects. Each test was followed by an ill-defined item in which the examinee was asked to set the problem before responding divergently (e.g, name an object before listing uses for it). Scores were computed as the number of responses to presented or invented items. Canonical correlation of all scores with scale scores on a Creative Activities Check List resulted in a canonical correlation of .78, with a significant percent of the variance uniquely attributable to responses to the invented problems.

The third study (Wakefield, 1986) utilized ten cards selected from the Thematic Apperception Test (Murray, 1943). The ninth card in the presentation set was blank (Card 16), with the instructions to imagine a picture before telling a story. The nine picture card tasks were better defined than the blank card task, which has been variously described as a "testing of limits" (Tomkins, 1947) or an "extreme challenge" to the subject's creativity (Henry, 1956). Fluency of response was computed as the average number of words spoken in response to the picture cards

(better-defined problems), or the number of words spoken in response to the blank card (an ill-defined problem). Correlation of fluency of response with scores on two tests of creative thinking (Unusual Uses -- fluency from the Torrance Tests of Creative Thinking and the Remote Associates Test score) resulted in Pearson product-moment correlations averaging .11 for the picture cards (the better-defined tasks) and .29 for the blank card (the ill-defined task).

Procedure

Skew for each response distribution was calculated by the coefficient of skewness (Snedecor & Cochran, 1980). This calculation is essentially an average of z scores which have been raised to the third power. The significance of resulting coefficients was estimated using values from a table for testing skewness (Snedecor & Cochran, 1980, p. 492). These values indicated .05 and .01 levels of significance on one-tailed tests for skew using sample sizes from 25 to 500.

Stories for the blank card of the TAT also presented an unique opportunity to examine projective content. The contents of extremely long and short stories were examined to explore any relationship between response content and the

shape of the response distribution.

Results

Both hypotheses were generally supported by the results of statistical tests. As Table 1 shows, the skews of responses to the ill-defined tasks were significantly positive in four out of five cases, and in all four cases of significance, the skews of response to ill-defined tasks were apparently greater than the corresponding skews of response to better-defined tasks. The support of the second hypothesis could not be statistically confirmed, however, because a statistical test of difference between

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Insert Table 1 about here

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coefficients of skewness could not be located in the literature. It was noteworthy, however, that only two of the five distributions of response to better-defined tasks manifested significantly positive skew.

In terms of the content of the 47 blank card stories, exploratory findings were most pronounced for extremely short or long responses. Several of the subjects who essentially rejected the card through the brevity of their responses began by remarking about the difficulty of the

imaginative task of the blank card:

> "What I'm thinking of is probably not very imaginative or anything. . . ."
>
> "This is true imagination, oh boy. . . ."
>
> "I have to imagine a picture, right?"
>
> "Just imagine something on here? I donno."

Such responses were not modal, but neither were they rare. They may have contributed to the piling of responses at the lower end of the distribution for response length.

At the other extreme were a few subjects who told elaborate stories in response to the blank card. Although it is impossible to summarize these stories here (see Wakefield, in pres.), they tended to manifest themes that included variance from the mode or variance from conventional behavior. The longest story, for example, was a romance in which the daughter of an aged king was rescued by the court jester from an arranged marriage with a knight. She in turn rescued the court jester from the knight by releasing lions into an arena during a jousting match between the rivals. This rollicking romance appeared to be built with unusual twists on conventional themes, as were

other extremely long stories told for the blank card.

Discussion

The assumption of normality in the distribution of creative thinking is psychometrically convenient, but relatively recent conceptions of creative thinking suggest that this assumption may not be accurate. This study of an hypothesis of positive skew due to task difficulty involved data from three published studies of creative thinking. The original studies involved a total of almost 100 subjects at different age levels, and at least five measures of creative thinking (ill-defined problems). Not only was skew of response found to be positive in four out of five cases, but it was also apparently greater than corresponding skews of response to better-defined problems which accompanied the creative-thinking tasks.

The single exception (Similarities) cannot be explained using the data at hand, but it may well be attributable to a random effect. If combined with the results of the other exercises used in the same study (Instances and Uses), the exception would disappear, but the data were not manipulated to present varnished results. They were tested as found in the original studies.

Analysis of the content of extremely short and long

stories in response to the TAT blank card was not systematic, but it resulted in several impressions. First of all, more than a few subjects found response to the blank card task very difficult. The perceived difficulty seemed to curtail these responses. Second, subjects at the other extreme expressed no such difficulty, but elaborated stories that seemed to manifest a fertile imagination and originality.

Several empirical and theoretical questions are raised by this study. First, the ill-defined problems employed in the original studies seemed to be more valid as creative thinking tasks than the better-defined problems. At this time, we do not know whether the comparatively high validity coefficients are causes or effects of comparatively high skew. Skewed scores may distort correlations, but on the other hand, correlations may genuinely reflect the relative validity of ill-defined versus better-defined problems as measures of creative thinking.

Second, a related theoretical question is, do all ill-defined problems call for creative thinking? This large question is intriguing because it represents an alternative approach to the study of creative thinking. In this paradigm, divergent thinking tasks may represent problems

with some but not all of the characteristics of well-defined problem-solving tasks (Wakefield, 1989). Divergent-thinking tasks generally present better defined problems than creative-thinking tasks, but responses to them do not have well-defined solutions. The evidence presented in this study suggests that untimed divergent-thinking tasks have an intermediary status between convergent-thinking and creative-thinking tasks, but no conclusive evidence regarding this hypothesis was sought or collected.

This study presents evidence to address the question of whether or not creative thinking tasks evoke normally distributed responses. Insofar as such tasks can be identified, they do not appear to evoke normally distributed responses because of task difficulty. We do not yet know whether violations of the assumption of normality are serious enough to affect statistical procedures (particularly correlation) involved in the validation of creative-thinking tests, or are serious enough to affect talent identification procedures.

Knowledge of the shape of the underlying distribution can be useful, however, in comprehending the self-perceptions of creative individuals. Creative individuals may not perceive their creativity in terms of deviance from

the norm but in terms of deviation from the mode, or the most popular response. Conformity may be a greater concern for them than normality because the mode is clearly below average with respect to creativity. Knowledge of the shape of the underlying distribution, then, may have major implications for counseling and education. Pursuit of such implications, however, must await confirmatory studies of creative thinking as a variable that is skewed by the intrinsic difficulty of solving ill-defined problems.

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Author Note

My thanks to Dr. Mark A. Runco for generously sharing the data from one of his studies (Runco & Okuda, 1988).

Table 1

Skews of Response to Presented and Invented Items

Variable	N	Skewness	
		Presented Items	Invented Items
Patterns and Lines	23	1.13*	1.49*
Instances	29	.48	1.65*
Uses	29	.16	1.98*
Similarities	29	.46	- .16
TAT story length	47	1.17*	1.81*

*$p < .01$, one-tailed.