

EFFECTS OF AGE AND SEX ON VERBAL DIVERGENT THINKING IN ADULTHOOD

Liang-Jei Lee

李 良 哲*

摘 要

本研究以美國東部某大學城 200 位（男性 101 人，女性 99 人）不同年齡階段的成人為研究對象。受試者對刺激字「衣架」（coat hanger）和「磚塊」（brick）在無時間限制的情境下說出它們可能的各種不同用途。使用標準的記分法得到每位受試者的三種語文擴散思考（verbal divergent thinking）指標——流暢力（fluency），變通力（flexibility），與獨創力（originality）。結果顯示中年受試者在全部三種能力上的得分最高，但此三種能力沒有顯著的性別差異。同時，性別與年齡對此三種能力的交互作用效果不顯著。

Abstract

200 adults (101 male and 99 female) across four age cohorts were asked to respond to the stimulus words "coat hanger" and "brick," giving alternate uses without a time limit. The age cohorts were young (17-22), middle-aged (40-50), old (60-70), and old-old (75+). Standard methods of scoring were used to obtain measures of fluency, flexibility, and originality. The results showed that middle-aged subjects scored highest on all 3 measures, and sex had no significant effect on any measure and did not interact significantly with age.

Cognitive studies of creativity have been focused on divergent thinking (Guilford, 1967), which many researchers (e.g., Alpaugh & Birren, 1977) have assumed is one of the essential ingredients of creativity. In contrast to the single correct answer demanded by convergent tests, divergent tests call for as many appropriate answers as the respondent can generate. In some divergent

*作者為本校心理系副教授

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tests, the emphasis is on the quantity of productions. For example, word fluency tasks (Christensen & Guilford, 1958) require respondents to list as many words as they can that contain specified letters. Other tests (e.g., Consequences — Christensen, Merrifield, & Guilford, 1958) are scored for unusual and original responses. Factor analyses have shown that all these kinds of tests form a single factor, distinct from although related to general intelligence (McCrae, Arenberg, & Costa, 1987). Nevertheless, divergent thinking tests have been widely criticized as measures of creativity. Sternberg (1985) declined to use tests of creativity because he felt that “such tests capture, at best, only the most trivial aspects of creativity” (p. 618). However, Barron and Harrington (1981) cautiously concluded, “some divergent thinking tests, administered under some conditions and scored by some sets of criteria, do measure abilities related to creative achievement and behavior in some domains” (p. 447).

Age group differences and sex differences in creativity or divergent thinking have been well documented in an extensive literature. However, many researchers have found that divergent thinking shows a decline after early middle age and a differential sex difference. In the 1950s, when models of divergent thinking were first proposed, most psychologists assumed that intellectual functioning in adults declines with age. Baldwin, Colangelo, and Dettmann (1984) presented three models of creativity as a life-span phenomenon. The *decrement* model was based on the idea that creativity is measured by product output that peaks by early adulthood. The *Ulyssean* model was based on a process orientation toward creative functioning and personality. The *creative stage* model was based on a differentiation of motivations and products that correlate with life stage. The decrement model has had the greatest implicit and explicit influence on present-day theories and educational practices.

In the early work concerning age and creativity, noteworthy creative persons from history were considered retrospectively (e.g., Dennis, 1966; Lehman, 1953). Age differences were assessed by comparing the creative individual's quantity or quality of creative products at different ages. A decline in creative productivity with age was found. Other studies have also shown a decrement in creativity with increasing age (Alpaugh & Birren, 1977; Bromly, 1956), but with a cognitive-process approach rather than a product-centered approach. Cross-sectional differences in divergent thinking are sometimes cited (Kausler, 1982) as possible explanations for the decline in creative contributions after middle age, supporting a point made by Lehman (1953). Guilford (1967) reviewed a number of cross-sectional studies and concluded that fluency, flexibility, and originality decline after the age of 30 or

40. Later research has supported this conclusion (Alpaugh & Birren, 1977; McCrae et al., 1987), although the decline has sometimes been found to begin after middle age (Jaquish & Ripple, 1981). Komulainen (1985) identified two cycles of creative productivity, one occurring in the 30's and the other in the 60's, but his subjects were self-selected as creative. In summary, most cross-sectional and longitudinal studies of creativity have shown declines, particularly after age 40, although in some studies creativity has remained more or less constant into early old age.

Sex has also been found to influence creativity in adulthood. Although no sex differences were found in some studies (e.g., Agarwal & Kumari, 1982; Alpaugh & Birren, 1977; Bromley, 1956; Jaquish & Ripple, 1981), other studies revealed sex differences. For example, Bharadwaj (1985) found greater fluency in female than male college students in India. In contrast, Ruth and Birren (1985) found that men performed better than women, but on tests pertaining to technical creativity.

In summary, although creativity appears to decline after early middle age, some studies reveal that it still remains intact in early old age. Sex differences in creativity are sometimes found, but they may be the result of data having been collected on youths or young adults rather than older adults. On the basis of these considerations, the present study was addressed to the effects of age, sex and their interaction on verbal divergent thinking in adulthood.

Method

Subjects

The research participants were drawn from a large-scale cross-sectional study of cognition in adulthood and old age (Reese, Cohen, Puckett, 1986-1990) in which 400 adults were given a battery of questionnaires, tests, and tasks that yielded scores on well over a hundred different variables. The 400 research participants were from four age cohorts, 17-22, 40-50, 60-70, and 75 or more years old; we refer to the age groups as young, middle-aged, old, and old-old. For the present study, we randomly selected 50 participants from each of the four age groups, for a total of 101 males and 99 females. The mean years of education of the young, middle-aged, old, and old-old groups were 12.9, 13.8, 13.9, 12.7, respectively.

Measures

We obtained three divergent thinking scores from a two-item alternate uses task. In this task, the participants were asked to respond first to "coat hanger" and then to "brick," giving alternate uses without an effective time limit for either item. This two items were assumed to be parallel forms for eliciting verbal divergent thinking responses. Specifically, the participant was told, "I am going to name an everyday object, and I would like you to tell me as many unusual uses of the object you can think of." When the participant stopped responding, a prompt was given ("Can you think of any more unusual uses?") in accordance with the following rules: (a) No more than two prompts were to be given during the first 3 minutes for each item, and (b) if the participant was still responding at the end of this interval, responding was to be terminated at the participant's next pause by praising the participant and then presenting the second test item. Rule (b) turned out not to be needed, as all participants received the two prompts and stopped responding to a given test item before 3 minutes had passed.

Responses were tape-recorded and later transcribed. Standard methods of scoring were used to obtain measures of fluency (number of responses) and flexibility (number of categories). Originality was scored by first coding each response categorically, then tallying the frequency count for each category, and finally using the frequency count of the appropriate category as the converse of originality of the response. We obtained 38 categories of responses for coat hanger and 45 for brick. The originality score was formed by summing the frequencies assigned to the participant's responses, then dividing by the number of responses and dividing the quotient by 38 for responses to coat hanger and 45 for brick. Thus, smaller scores indicate greater originality.

Results

Correlations Between Coat Hanger and Brick Measures

The coat hanger and brick items constitute a two-item divergent thinking test, and therefore the split-test reliability is the correlation between the scores on these items. The upper right quadrant of Table 1 shows the correlations between coat hanger and brick responses. Although all the correlations were statistically significant, they were low enough to suggest either that the measures are not reliable or that

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coat hanger and brick are not “parallel forms” of this test of divergent thinking. The upper left and lower right quadrants of Table 1 show the correlations among measures for coat hanger and brick, respectively. These correlations clearly reveal that fluency and flexibility are highly correlated with each other, but not so highly that they should be collapsed into a single index of divergent thinking. The correlations in these quadrants also indicate that originality is positively related to fluency and flexibility (the *rs* are negative because low originality scores indicate high creativity); but these correlations were relatively low and thus indicate that originality is a different dimension of divergent thinking.

Table 1
Correlations Between Coat Hanger and Brick Measures

| Measure | Coat hanger | | | Brick | |
|-------------|-------------|-------------|---------|-------------|-------------|
| | Flexibility | Originality | Fluency | Flexibility | Originality |
| Coat hanger | | | | | |
| Fluency | .77* | -.51* | .67* | .57* | -.28* |
| Flexibility | — | -.54* | .55* | .54* | -.27* |
| Originality | | — | -.34* | -.34* | .19* |
| Brick | | | | | |
| Fluency | | | — | .84* | -.27* |
| Flexibility | | | | — | -.38* |

* $p < .01$

Analysis of Covariance for Fluency, Flexibility, and Originality

Several studies in which sequential strategies were used to analyze the intelligence-age relationship in adulthood have indicated that the major proportion of age group differences can be explained by cohort variations (e.g., Schaie & Labouvie-Vief, 1974; Schaie & Strother, 1968). Educational opportunity presumably contributes substantially to this effect. Age and cohort were confounded in the present cross-sectional study; therefore, years of education was used as a covariate in three-way analyses of covariance, with age group and sex as between-subjects independent variables and stimulus word (coat hanger vs brick) as a repeated measures independent

variable, and with fluency, flexibility, and originality as dependent variables in separate analyses.

Fluency. The analysis of fluency revealed significant effects only of age, $F(3,191)=4.54$, $p<.01$, age x stimulus, $F(3,192)=6.28$, $p<.001$, and sex x stimulus, $F(1,192)=5.43$, $p<.01$. The relevant means are shown in Tables 2 and 3. Pairwise

Table 2
Means (and Standard Deviations) of the Age Groups in Fluency,
Flexibility, and Originality

| Stimulus | Young | Middle-aged | Old | Old-old |
|-------------|------------------------------|------------------------------|------------------------------|------------------------------|
| Fluency | | | | |
| Coat hanger | 5.96 (4.52) | 6.86 ^a (3.47) | 5.80 (3.67) | 4.08 ^a (1.91) |
| Brick | 4.86 ^{ab} (3.59) | 6.98 ^{ac} (3.83) | 6.84 ^{bd} (2.94) | 4.94 ^{cd} (2.71) |
| Flexibility | | | | |
| Coat hanger | 3.44 ^a (1.33) | 3.70 ^{bc} (1.15) | 3.04 ^b (1.05) | 2.72 ^{ac} (0.95) |
| Brick | 3.20 ^a (1.69) | 4.32 ^{ab} (1.91) | 3.90 (1.59) | 3.08 ^b (1.50) |
| Originality | | | | |
| Coat hanger | 6.02 (2.38) | 5.79 ^a (1.71) | 6.25 (1.71) | 7.05 ^a (2.47) |
| Brick | 5.97 (2.24) | 5.62 (1.72) | 6.45 (1.96) | 6.38 (2.39) |
| Both | 5.99 (1.78) | 5.71 ^a (1.44) | 6.35 (1.41) | 6.71 ^a (1.75) |

Note. Means with the same superscript letter within a row were significantly different from each other at the .05 level.

Low originality scores indicate high creativity.

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comparisons (*t* test) indicated that the young group was more fluent with the coat hanger than the brick and the old and old-old groups were more fluent with the brick than the coat hanger. For both stimuli, the middle-aged group had the largest mean; for the coat hanger the old-old group had the smallest mean; and for the brick the young and old-old groups were virtually tied for the smallest mean. The difference between the middle-aged and old-old groups was significant for both stimuli, and for the brick the differences between the young group and the middle-aged and old groups and between the old and old-old groups were also significant. As can be seen in Table 3, men were more fluent with the coat hanger than the brick; women were more fluent with the brick than the coat hanger; and the sex difference was larger for the coat hanger than for the brick. The only significant differences were the stimulus difference for women and the sex difference for the coat hanger.

Table 3
Means (and Standard Deviations) of the Sex Groups in Fluency,
Flexibility, and Originality

| Stimulus | Male | | Female |
|-------------|----------------|-------------|----------------|
| | | Fluency | |
| Coat hanger | 6.17 (3.89) | | 5.17 (3.30) |
| Brick | 5.95 (3.42) | | 5.86 (3.45) |
| | | Flexibility | |
| Coat hanger | 3.32 (1.19) | | 3.13 (1.17) |
| Brick | 3.66 (1.62) | | 3.59 (1.87) |
| | | Originality | |
| Coat hanger | 6.20 (2.34) | | 6.36 (1.92) |
| Brick | 5.96 (2.14) | | 6.25 (2.07) |

Flexibility. The analysis of flexibility revealed significant effects of age, $F(3,191)=5.75$, $p<.01$, stimulus, $F(1,192)=15.53$, $p<.001$, and age x stimulus, $F(3,192)=5.39$, $p<.01$. Pairwise comparisons indicated that the young group was more flexible with the coat hanger than the brick, but not significantly so; and the middle-aged and both old groups were more flexible with the brick than the coat hanger, but not significantly so for the old-old group. For both stimuli, again, the middle-aged group had the largest mean and the old-old group had the smallest mean, and the difference was significant for both stimuli.

Originality. The analysis of originality revealed only a significant effect of age, $F(3,191)=3.35$, $p<.05$. As can be seen in Table 2, the middle-aged group had the greatest originality, and the old-old group had the least originality, and the difference between these groups was significant.

Discussion

This study was designed to examine the effects of age and sex on verbal divergent thinking in adulthood, with research participants drawn semi-randomly from a larger study. We found that age had a significant effect on verbal fluency, flexibility, and originality: Middle-aged participants scored highest on fluency, flexibility, and originality, although not significantly higher than young adults in some comparisons. The peaking of divergent thinking in middle age is consistent with the findings of Jaquish and Ripple (1981), and the decline after middle age is in addition consistent with the findings of Lehman (1953), Guilford (1967), Alpaugh and Birren (1977), McCrae et al., (1987). The old-old group had the lowest fluency, flexibility, and originality. The obtained age group differences might reflect an effect of response speed on verbal divergent thinking: The task was untimed, but a speed requirement could have been self-imposed, especially by the elderly participants either as a means to self-esteem (slowness is a stereotypical aspect of aging) or as a means to hasten the end of a bothersome task. If so, then even if life experiences enhance the ability or skill of divergent thinking, the divergent thinking performance of old-old adults would have been hindered by reduced speed of response. Alternatively, creativity itself may decline in old-old age.

Some previous reports indicated sex differences in verbal creativity, especially for young subjects. In the present study, the only significant sex difference was that women were more fluent than men with the brick. Also, the age x sex interaction did not reach statistical significance for any measure (largest $F(3,191)=1.50$); thus,

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in the heterogeneous population that was sampled in the present study, sex is evidently not an important moderator of the effect of age on verbal divergent thinking.

Young adults were more fluent and flexible with the coat hanger; old adults and old-old adults were more fluent and flexible with the brick; and middle-aged adults -- the most creative group -- were equally fluent and flexible with these stimuli. Whatever the cause of these findings might be, they confirm the correlational analysis and they have a methodological implication: The coat hanger and brick measures are either not reliable or the tests are not parallel forms of a test of verbal divergent thinking. The original intention of adopting coat hanger and brick as stimulus items was to assess the consistency of verbal divergent thinking responses with 2 items. On the basis of the author's intuitive experiences when translating and recording the responses subjects reported, the brick item seems to be more appropriate and suitable for eliciting responses than coat hanger item. Therefore, the only brick item is recommended to the future relevant researches as stimulus in order to free of the controversial results.

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