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Kent-Rosanoff Word Association Test: *Aged Twins With and Without Dementia*

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As part of a long-range study on mental functioning in old age, 53 twins (mean age 84 years) were given the Kent-Rosanoff Word Association test, a test which measures the cognitive ability to give discrete verbal association to common stimulus words. In general, the results obtained with the aging twins were similar to those previously reported for young adults tested in the early 20th century, nearly 90% of the responses being found in the 1910 Kent-Rosanoff norm tables. Our results are consistent with the trend reported in the literature toward diminished primary responses with advancing age. Unlike reports in the literature, however, the present study detected no sex differences, possibly due to the small sample size (18 men and 35 women). Moreover, Kent-Rosanoff performance was not significantly related to organic brain syndrome, as measured by psychiatric evaluation, Graham-Kendall Memory-for-Designs test, and Stroop-Color-Word test, possibly because most of the twins were diagnosed as having only a "mild" or "moderate" degree of impairment. The intraclass correlations were higher for MZ than DZ twin partners, the differences reaching statistical significance for two scoring categories, primary and unusual responses. Even though the sample was small, only six DZ and 12 MZ pairs, this finding suggests a possible hereditary component in the verbal associative behavior of octogenarians.

Key words: Aging, Kent-Rosanoff word association test, Dementia, Twins

INTRODUCTION

One of the problems confronting students of human aging is that of distinguishing biological from psychosocial determinants of mental functioning. Typically, genetic and environmental influences are inextricably fused, so that their interactions can only be

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surmised. Genetic influences persisting into old age have previously been reported from the New York State Psychiatric Institute study of Aging Twins, a longitudinal investigation of psychobiological changes with advancing age [4,19,21,26].

The present report deals with results of the Kent-Rosanoff Word Association test [28] in aged twins classified as to the presence or absence of dementia. The test measures one aspect of cognitive functioning, ie, the ability to respond to common stimulus words with discrete verbal associations. The Kent-Rosanoff word list contains 100 frequently used nouns and adjectives and was originally employed to discriminate "insane" from normal subjects. Since then, it has seen wide use as a research tool [10]. Responses to the test have been shown to vary with age [33,36,65,68], sex [44], anxiety level [8,30,38,39,47], cultural background [37], drug administration [18], "response set" [16,23,31,49], personality [17], and psychopathology [32,35,36,41,42]. An expanded word association test, involving repeated administration and memory factors, has even been reported to detect organic brain damage [2,3]. However, there appear to have been no reports on Kent-Rosanoff performance of aged twins.

METHODS

Subjects

The subjects were among 81 survivors (26 men and 55 women) of 268 senescent twins (134 pairs) selected originally for psychometric investigation in the late 1940s [25]. In order to qualify for the initial selection, the twin pairs had to meet the following criteria: They had to be of the same sex, in good health (noninstitutionalized), Caucasian, literate, English-speaking, residents of New York State or vicinity, and at least 60 years of age (for detailed description of the original sample, see Blum et al [7], Bank and Jarvik [4], and Feingold [11]).

Fifty-three of the 81 survivors (18 men and 35 women) completed the Kent-Rosanoff test, administered according to the oral-individual method (see Cramer [7], p 20). Of the remaining subjects, 15 were either unwilling or unable to take the test (four men and 11 women) and 13 completed only part of the test (four men and nine women). All 28 subjects lacking complete data were omitted from this analysis.

The 53 subjects with complete Kent-Rosanoff protocols ranged in age from 78 to 94 years; they had a mean age of 84 years (83.6 for men and 83.3 for women) and generally had a grammar school education. This subsample included 18 intact twin pairs (four male and eight female monozygotic pairs; two male and four female dizygotic pairs) and 17 single survivors. Forty-seven (17 men and 30 women) of the 53 subjects with complete Kent-Rosanoff protocols were classified as to the presence or absence of dementia (organic brain syndrome) according to the findings of a thorough psychiatric evaluation, including mental status examination [22]. The criteria were similar in all essentials to those specified in DSM III [1, pp 111–112] for primary degenerative and multiinfarct types of dementia. Eighteen (eight men and ten women) of them were diagnosed as suffering from dementia and 29 (nine men and 20 women) as free of dementia.

Procedures

The scoring system used was derived from Appelbaum [2], Cramer [10], Kent and Rosanoff [28], and Shakow and Jellinek [40] so that, depending on its frequency in the 1910 Kent-Rosanoff norms, each response was assigned to one of six categories: (1) primary, ie, highest frequency in the tables; (2) common, ie, second or third highest frequency in the tables; (3) usual, ie, in the tables but not a primary or common response; (4) individual, ie, not found in the tables but bearing a logical relationship to the stimulus word (see Kent and Rosanoff [28], pp 126–142); (5) unusual, ie, not found in the tables and not logically related to the stimulus word; and (6) multiword responses, ie, associations more than one word in length (the instructions required that the subject give a one-word association to each stimulus word as quickly as possible). Failure to respond was also noted and counted.

RESULTS AND DISCUSSION

In general, the mean percentages of responses given in the first five scoring categories (primary, common, usual, individual, and unusual) were consistent with those reported in other studies (Table 1). For example, the original Kent-Rosanoff [28] analysis indicated

TABLE 1. Kent-Rosanoff Response Frequencies (%) in Aged Subjects (Means and Standard Deviations)*

	Kent-Rosanoff scoring categories				
	Primary	Common	Usual	Individual	Unusual
Men (N = 18)					
Mean	29.8	19.8	39.8	5.0	5.7
SD	5.6	3.6	7.2	3.0	6.9
Women (N = 35)					
Mean	30.0	19.3	40.7	5.9	3.7
SD	9.4	4.6	8.3	3.5	2.2
Total group (N = 53)					
Mean	29.9	19.5	40.4	5.6	4.4
SD	8.3	4.2	7.8	3.3	4.4

*Responses were categorized by comparing each response with the Kent-Rosanoff [28] norms.

that 91.7% of the responses of normal subjects appeared in the norm tables (ie, were primary, common, or usual responses). Here, 89.8% of the responses did. Similarly, 49% of all responses in Schellenberg’s 1927 norms (analyzed by Jenkins and Russell [24]), were primary or common, and the same (49.4%) held true in the present study. We used the Kent-Rosanoff norms since we agree with Cramer’s [10] suggestion that word association norms established on young adults tested in the 1920s or earlier are more appropriate for elderly subjects tested in the 1960s than later norms developed on college students. Thus, subjects in the current study gave a mean of 30% primary responses, while Rosenzweig’s [37] study yielded an average of 38% primary responses from American college students and 32% from middle-aged American workers tested in the early 1960s. Even though these percentages are not directly comparable because of differences in scoring, the present results seem consistent with the literature (cf review by Cramer [10]) which indicates a tendency toward diminished primary responses with advancing age, a tendency codetermined, according to Riegel [33], by both age and “changing times.”

Sex differences reported by other investigators [10,44] did not appear in the present study (Table 1). In the current analysis, means for men and women were similar for primary, common, usual, and individual responses, as well as multiword responses (men 4.8%, women 4.5%). Unusual responses were somewhat less similar (men 5.7%, women 3.7%). Response failures were too rare to analyze separately. A trend toward longer reaction times for men than for women did emerge but was not strong enough to reach statistical significance (Table 2).

According to previous reports in the literature, unusual and multiword responses are more frequent in brain-damaged individuals than in those without brain damage [2,3,10]. By contrast, our comparisons between word associations and three measures of organicity all failed to reach statistical significance. Pearson product-moment correlations were calculated between Kent-Rosanoff scoring categories (except response failures and reaction times) and scores on both the Graham-Kendall Memory-for-Designs [14] and the Stroop-Color-Word test [43], a positive association having previously been found between scores on the latter two measures and the psychiatric diagnosis of organic brain syndrome [5,20]. In addition, Mann-Whitney U-tests [29] were performed to evaluate the relationship between the above-mentioned Kent-Rosanoff scores and the psychiatric diagnosis of dementia (or organic brain syndrome), OBS, as previously described [cf 20,22]. None of these analyses yielded significant results.

TABLE 2. Reaction Times on the Kent-Rosanoff Test for Aged Subjects With and Without Organic Brain Syndrome (OBS)

	Mean reaction time (sec)	Range (sec)
Men (N = 17)		
Without OBS (N = 9)	4.60	1.72– 9.95
With OBS (N = 8)	5.41	2.45–12.00
Women (N = 30)		
Without OBS (N = 20)	3.62	1.66–12.80
With OBS (N = 10)	3.48	1.71– 6.57
Total group (N = 53) ^a		
Men (N = 18)	4.85	1.72–12.00
Women (N = 35)	3.40	1.45–12.80

^aNo OBS diagnosis available for one man and five women.

Response failures, significantly more common in brain-damaged than nonbrain-damaged individuals in Appelbaum's [2] report, were rare in the present study. Only seven failures occurred among the 47 subjects diagnosed as to the presence or absence of dementia, and six of these failures occurred among the 29 without dementia. The results of Mann-Whitney U-tests, which included reaction times as well as response failures, again failed to reach statistical significance.

This lack of difference in the results for the demented and nondemented twins is of theoretical interest. Recent research in experimental psychology has focused on semantic and episodic memory distinctions [46]. Another measure of semantic memory is the lexical decision test, which measures reaction time for deciding whether or not a given series of letters constitutes a word. On one such lexical decision task Clark [9] found that geriatric patients with dementia were significantly slower than normal elderly. Lexical decision tasks, however, can also be used to indirectly assess word associations. On that measure, Clark's demented subjects, like the twins described in the present study, did not differ from normal elderly. These data, as well as the present findings, are compatible with Hasher and Zaks's [15] distinction between automatic and effortful processing. These authors contend that differences between young and elderly groups should be minimal when processing of information is automatic. Word associations are of an automatic, stamped-in nature, whether they are common or unusual responses. Thus, these data, as well as those of Clark [9], support the notion that automatic processing is less impaired by dementia than effortful processing.

Nearly all of the 29 subjects with the diagnosis of dementia showed "mild" or "moderate" rather than "severe" impairment, according to Goldfarb's [13] criteria (for details, please see Jarvik et al [22].) It is possible, therefore, that the lack of significant differences between those with and without dementia may, in part, reflect the relative lack of severity of dementia in our sample.

In contrast to the lack of significant association between Kent-Rosanoff scores and other determinants of organicity in the present study, an analysis of Kent-Rosanoff scores in twin partners did yield significant results (Table 3). First, Fisher intraclass correlations indicated that percentage primary and unusual responses were significantly more alike in the cotwins of the eight monozygotic female pairs than in those of persons taken at random from the general population ($r = 0.744$ primary and 0.756 unusual, respectively; $P < 0.01$). Since there were no statistically significant sex differences, results for male and

TABLE 3. Fisher Intraclass Correlations Between Kent-Rosanoff Responses of Senescent Twin Partners

Sex/zygosity	No. pairs	Primary	Common	Usual	Individual	Unusual	Multiword
MZ	Male	4	+0.3244	-0.5302	-0.4746	-0.0820	+0.4287
	Female	8	+0.7441 ^a	+0.2462	+0.7565	+0.1635	-0.0526
DZ	Male	2	Correlations could not be computed—N too small.				
	Female	4	-0.5049	-0.7821	-0.1371	-0.2541	-0.8922
Total MZ	12	+0.6653 ^b	+0.0663	+0.3823	+0.0945	-0.0035 ^b	+0.0429
Total DZ	6	-0.4899 ^b	-0.5055	-0.1344	-0.1794	-0.8878 ^b	+0.5717

^aSignificant at the 0.01 level, using the following formula: $F = (1 + r)/(1 - r)$. This formula allows only positive correlations to be tested for significance, since it considers whether the scores are more alike than scores for individuals in the general population.

^bSignificantly different at 0.01 level (two-tailed test), using Fisher Z-transformation.

female pairs were pooled to provide a larger number. Again, the intraclass correlation for percentage primary responses reached significance for monozygotic pairs ($r = 0.665$, $P < 0.01$). Moreover, with the exception of multiwords, all the correlations were more positive (or less negative) for monozygotic (MZ) than for dizygotic (DZ) cotwins, the intergroup comparison reaching statistical significance for percentages primary and unusual responses at the 0.01 level (Fisher Z transformation) despite the fact that there were only 12 MZ and six DZ pairs in the sample. As mentioned earlier, the primary responses are the ones which have been reported decreased in older age groups.

The greater similarity of MZ than DZ twin partners characterized the cognitive performance of these aged twins in other spheres [21]. As previously reported, intrapair differences were smaller, even in old age for MZ than for DZ pairs on various tests of intellectual functioning (see review by Bank and Jarvik [4]). And, the difference between MZ and DZ pairs was statistically significant in women for the Vocabulary, Similarities, Digit Symbol Substitution, and Block Design tests [27].

The lack of significant similarities between DZ twin partners, when it comes to performance on the Kent-Rosanoff Word Association test, is difficult to explain. The twins in our study shared much the same sociocultural milieu, family setting, and general environmental ambience. They were expected to show considerable intrapair similarities on the word association test regardless of zygosity, since word associations have been said to be strongly influenced by social class [37] and other environmental variables [12]. Because of the small sample size, the results cannot be considered definitive, but, even so, they contradict the notion that environmental factors exert the predominant influence on associative behavior.

One explanation may be derived from Cramer's [10] hypothesis that most verbal associations in adults are conceptual in origin, but that, nonetheless, the mediating link between words may at times be "short-circuited," in which case, the specified associations acquire a reflex character, becoming indirect word-word habits. It is conceivable that the mechanism which allows "short-circuiting" has hereditary as well as learned components. It might be argued that primary and unusual responses represent relatively "automatic" forms of processing [15] which would be most susceptible to "short-circuiting." Our results could, therefore, reflect actual differences in the associative patterns of MZ and DZ twin partners.

This conclusion clearly needs theoretical refinement and empirical study. For the moment, it provides one explanation for our finding, which appears to be the first to offer evidence of a genetic contribution to word associations.

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