Do Older People Use Older Words:

A Qualitative Analysis of Word Fluency Responses

K. Warner Schaie, Megan Hurley-Tesluk, and Sherry L. Willis

Department of Human Development and Family Studies

The Pennsylvania State University

115 South Henderson Building

University Park, PA 16802

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Abstract

Word Fluency serves as an assessment tool to examine many topics in the study of cognition, such as mental functioning, individual differences, and dementia. Most prior research on word fluency has been conducted using the total number of responses provided within a fixed time period. Most word fluency data is cross-sectional and some studies do not control for educational differences between participants. This study contributes to the literature by examining word fluency from a longitudinal linguistic perspective involving qualitative analyses. Over a 21 year period, 311 subjects were followed. Their word fluency answers were analyzed for grammatical and morphological changes. Changes in the structure of the responses (number of letters and syllables) were also examined. Finally, the age of the words that subjects generated was examined. In general, as participants aged, the complexity of their answers increased. And subjects used newer words over time, reflecting continued vocabulary growth through out life.

INTRODUCTION

Language development has traditionally been studied during childhood. Acquisition of a communication system has been carefully documented in a chronological order up to adolescence. Adulthood was rarely considered by researchers to be a period which marked much, if any, language development. Language is a broad latent construct like intelligence, consisting of many subcomponents. Similar to fluid and crystallized intelligence, language has subcomponents (e.g.., syntax, pragmatics, semantics, morphology, and phonology) that each have their own trajectory of change across the life span.

Within the last two decades a considerable amount of effort has been devoted to studying age differences in language. Overview chapters on adult language development have illuminated several age differences. For instance, Kemper (1992) provided an extensive summary of much of the research for several of the subcomponents of language. Syntactic complexity is believed to decline with age. Several studies (Kynette & Kemper, 1986; Kemper, 1987; Walker, Roberts, & Hedrick, 1988) have revealed that written and spoken sentences are shorter and less complex for older adults, than for younger adults. Due to memory limitations, older adults have been found to demonstrate less understanding of complex sentences (Feier & Gerstman, 1980; Kemper, 1986). Light's (1990) overview chapter reported similar results, claiming that older adults have trouble comprehending left embedded clauses (which are more complex).

The study of semantic changes in adults includes the research on word retrieval skills. Burke, MacKay, Worthley & Wade (1991) have documented increased word finding or tip-of-the-tongue (TOT) problems in older adults. In confrontation naming tasks, Nicholas, Obler, Albert, and Goodglass (1985) found that older adults have poorer retrieval skills. Bowles and Poon (1985) concluded that aging effects were caused by either a disruption of semantic priming or phonological information.

The Word Fluency Test (Thurstone & Thurstone, 1948) has been used as an assessment tool for more global word retrieval skills. Instead of inducing TOT experiences, it requires adults to generate as many words that fit a lexical rule, under a timed condition. Traditionally, it has been evaluated cross-sectionally by analyzing the number of words produced. Individuals who are older and/or have less education tend to produce fewer words.

It has been reported that there are gender differences favoring women in word frequency tasks (Alvis, Ward, & Dodson 1989; Buckelew & Hannay 1986). Additional research demonstrates that word fluency scores decline with age (Alexander, Langer, Newman, Chandler, & Davies 1989; McCrae, Arenberg, & Costa 1987; Obler & Albert, 1985). Heller and Dobbs (1993) argue that an alternative method for examining changes in word retrieval patterns is in actual conversation and non conversational settings. They found evidence that age related word retrieval deficits remain even when a context (in discourse) is provided.

Few researchers if any, have examined what types of changes that occur over time in the word fluency task. Systematically decomposing responses and examining how they change over time could provide researchers with a better understanding of questions about how people change over time (e.g., do older people generate older words, words with more syllables or words with more letters, more complex words?). This type of decomposition would require an exploration of longitudinal qualiatative changes in words.

The present study examines word frequency responses longitudinally using grammatical, morphological and other qualitative methods. This investigation was carried out after a prelimary investigation examined how adults' word frequency responses changed over a seven year period. The data for the first investigation included participants from the 1984 and 1991 data collection periods of the Seattle Longitudinal Study.

Two main findings concerning longitudinal changes in word fluency responses were discovered. First, although the number of words produced decreased with age, the level of

complexity of the words produced increased. Second, a gender difference existed, where women out performed men in the oldest and youngest groups. Men in the middle age group did better than the women in the same age group. This suggested that gender differences show a reversal from age 64-77. Finally, participants over age 77 had a significant decrease in the number of verbs recalled. A possible explanation was that verbs and nouns were the most common parts of speech recalled (as high as 95% of responses). Nouns may have been easier to recall than verbs, because there are more nouns, and they are more concrete concepts.

The current study examines these and other qualitative differences between younger and older adults, and how these qualitative differences change over time. If older adults are generating fewer words, in what way do these words differ from what the younger participants generate? What types of characteristics of the words have changed? This study will explore several characteristics that could show age differences. The average number of letters and average number of syllables per word will be used to look for age differences as well as differences over time. Also the average age of the words will be used to determine if older adults use older words. Grammatical and morphological analyses from the previous study will now be applied to data collected over a 21 year period, in four 7 year increments (1970, 1977, 1984, 1991).

The following hypotheses are proposed for this study:

1. Participants will to show an increase in complexity of responses as the number of words decreases.
2. The grammatical analysis will support the previous findings and show a decrease in the percentage of responses that are verbs.
3. Women will out perform men in this task at the oldest and youngest age groups.
4. Older adults will also generate words fewer syllables and letters.
5. Older words will generate more older words than younger adults.

METHOD

Participants

Participants were subjects from the Seattle Longitudinal Study (SLS). This large scale longitudinal-sequential study of adult cognitive development begun in 1956, has involved more than 5,000 participants (Schaie, 1983, 1993). All participants in the present investigation took part in the 1970, 1977, 1984 and the 1991 assessment sessions.

Participants (N = 311; Males = 161, Females = 150) were divided into three age groups. The middle-aged group ranged in age from 43 to 63 years old (M = 56.02, SD = 5.80, n = 119), the young-old group ranged in age from 64 to 77 years old (M = 70.5, SD = 3.86, n = 131), and the old-old group ranged in age from 78 to 92 years old (M = 81.66, SD = 3.53, n = 61). The mean educational level was 14.52 years (SD = 3.01, range = 1-20), and the mean income was $ 27,700 (SD = $8,160, range = $ 2,000 - $ 34,00). A description of the sample found in Table 1 further divides participants by gender.

Insert Table 1 about here

Materials

Participants were administered the Word Fluency Test from the Primary Mental Abilities battery (Thurstone & Thurstone, 1948) in 1970, 1977, 1984 and 1991. Word fluency is a task concerned with speeded verbal production. Participants were given five minutes to write down as many words as they could beginning with the letter 's'. Participants were instructed not to list proper nouns or the conjugation of verbs (i.e., not to include the present and past tense of the same verb) in their responses.

In addition to the number of 's' words generated at each of the four occasions, several other variables were created; each response was categorized by parts of speech and by number of morphemes. The parts of speech were determined by The English Oxford Dictionary (1973).

Two independent raters trained in Linguistics divided the words into morphemes. Almost all of the responses (about 95% of total responses by all the subjects) contained between one and three morphemes per word When the raters did not agree on the morphological division, the etymology of the word was consulted to determine which morpheme value should be used. Raters disagreed on only 5 % of the corpus of responses. Only words found in the Oxford Dictionary were included in the analysis.

Each word was categorized by the number of syllables and letters as determined by The English Oxford Dictionary (1973). The age of the word was determined by the Oxford English Dictionary (1986). This is a special twenty eight volume dictionary that includes information about the exact first time a word appeared in printed literature. Each word was assigned a 'birth date' for the analyses.

Procedure

The word fluency measure was administered as part of a broad cognitive battery at each wave of the SLS. Subjects were tested in small groups of 6-10 persons. The battery was administered at each measurement occasion (1970, 1977, 1984, and 1991) by a tester and a proctor.

Results and Discussion

Table 2 presents by age and gender the number of words produced and the number of morphemes per word. Table 3 presents the percentage of nouns, verbs, adjectives, adverbs, as well as the average number of syllables and letter per word, and the average age of the words.

Insert Tables 2 and 3 about here

Number of Words Produced

To examine change in the number of words that participants produced, a repeated measures 2 (gender) x 3 (age) x 4 (occasions) Analysis of Variance (ANOVA) was calculated. Repeated measures 2 (gender) x 3 (age) x 4 (occasions) Analysis of Covariance

(ANCOVA) was calculated separately to control for education. Tukey's honestly significant difference test (HSDs) for unequal ns was computed for the significant main effects and interactions.

A significant main effect was found for age ($F(2) = 6.09$, $p < .05$). The middle-aged group produced the highest number of responses, followed by the young-old group and then the old-old group. There was also a significant main effect for occasion ($F(3) = 2.65$, $p < .05$). Generally, participants' scores declined across the four time periods. Finally, a significant interaction between age and occasion was found ($F(6) = 6.54$, $p < .001$). While middle aged participants produced more owrds over time, young-old and old-old participants produced fewer words (see Figure 1). These results remained significant after education was controlled.

Insert Figure 1 about here

For each qualitative variable (i.e., part of speech (noun, verb, adjective, and adverb), proportion of morphemes, average number of letters and syllabus, and average age of words), a repeated measures 2 (gender) x 3 (age) x 4 (occasions) ANOVA and ANCOVA controlling for education level were calculated. Tukey's HS for unequal ns was computed for the significant main effects and interactions.

Grammatical Analysis

Verbs

An occasion main effect was present for verbs ($F(3) = 6.74$, $p < .001$), indicating that participants generated a larger proportion of verbs at each successive time period. A significant age main effect was also found ($F(2) = 4.58$, $p < .05$), with the middle aged participants producing the highest proportions, and the young-old and old-old groups producing less and about the

proportion as each other. When education was controlled, these findings remained significant. Figure 2 presents the proportion of verbs for each age group across occasions.

Insert Figure 2 about here

Nouns, Adjectives, and Adverbs

An occasion main effect was present for the grammatical categories of nouns (F (3) = 4.34, $p < .01$), adjectives (F (3) = 14.49, $p < .001$), and adverbs (F (3) = 4.08, $p < .01$), indicating that all age groups generated a larger proportion of nouns, adjectives and adverbs over time (see Figures 3-5). These results remained significant after education was controlled.

Insert Figures 3-5 about here

Morphological Analysis

There were no significant main effects for age or gender, nor was there a significant interaction between age and gender. A main effect for occasion ($F(3) = 31.17$, $p < .001$) indicated that at each successive testing period, participants' responses included more complex words (i.e., greater number of morphemes per word) than during the previous testing session. An interaction between age and occasion was present ($F(6) = 3.59$, $p < .002$) , suggesting that the rate of change was dependent on the age group. These results remained after controlling for education, and are shown in Figure 6.

Insert Figure 6 about here

Letter Analysis

There were no significant interactions main effects involving age or gender. There was, however a significant main effect for occasion ($F(3) = 16.75$, $p < .001$). In general, all groups increased the average length of words generated (see Figure 7). This result did not change when education was controlled.

Insert Figure 7 about here

Syllable Analysis

Significant main effects for both age and occasion were found. The occasion main effect ($F(3) = 10.91$, $p < .01$) revealed a general increase in the average number of syllables per word produced by subjects in each age group. After education was controlled, the main effect for age ($F(2) = 5.35$, $p < .01$) suggested that the young-old group out performed the old-old and middle-aged group (see Figure 8).

Insert Figure 8 about here

Word age Analysis

The average age of the words generated did not differ significantly based on age or gender. However, a main effect for occasion was present ($F(3) = 9.06$, $p < .01$), with a general increase over time in the average age of words that were produced. As people aged, they generated newer words. Also an interaction between occasion and age ($F(6) = 2.32$, $p < .05$) and a three way interaction between age, gender, and occasion ($F(6) = 2.14$, $p < .05$) were both significant. The rate of newer words that were generated changed the most for middle aged participants toward the end of the study (see Figure 9). These results remained significant when education was controlled.

Insert Figure 9 about here

CONCLUSION

The previous research on the Word Fluency task has provided quantitative information suggesting the number of responses decreases with age and that women perform better than men on the task. This investigation adds to the knowledge baseby using several qualitative approaches to examine changes in grammar and word complexity that occur as participants age.

Our hypotheses were partially confirmed. First, the level of complexity of words generated (i.e., the number of morphemes per word) increased over time, as shown by the significant interaction for occasion by age over the 21-year examination period. By measuring this linguistic ability, it can be inferred that as people age their responses contain more meaningful parts (i.e., are more complex), and they then are using more linguistic rules to form responses. Older participants when retrieving words, activate more linguistic rules than younger participants who have a lower complexity scores.

Our second hypothesis was that grammatical changes in the words generated wouldbe demonstrated by decreases in the production of certain parts of speech (verbs). Across occasions, participants were actually generated more words that contained several parts of speech (e.g., *snow* is both a noun and a verb) as opposed to words that can only be used as one part of speech (e.g,, *sing* is only a verb). Due to the nature of this task, the researchers have no way of determining whether a participant means *snow* as in the verb snowing or whether they mean the noun form. Thus, the grammatical analyses are performed separately, first calculating how many words in a list are nouns. Then the entire list is considered again for all possible verbs, and the same is done for adjectives and adverbs. Therefore, a person can have proportions that total more than 100%, due to words like *snow* that are more than one part of speech. Thus this hypothesis was not supported.

Our third hypothesis that there would be gender differences in performance, was also confirmed. Women out performed men in all three age groups for the total number of words produced. In terms of grammatical and morphological analyses, trends were found where women out performed men, but the differences did not reach statistical levels of significance.

The fourth hypothesis stated that older participants would produce words with fewer syllables and fewer letters. This was proposed because it could be used as a possible strategy for older adults. It may take them longer to write down words due to slowed motor skills or arthritis, so they compensate by writing short words. The exact opposite result was found. As subjects aged, they listed words with a greater number of letters and syllables.

Instead of using shorter words as a compensation strategy, longer but fewer words were generated. The final hypothesis stated that older people would generate older words. This hypothesis was not supported by the data. Instead, the data support the idea that people can continue to learn new vocabulary as they age.

There is a tension that exists between a subject's decreasing number of responses and increasing complexity as seen by increases in average number of morphemes, letters and syllables per word, and an increase in the number of words that are more than one part of speech. This could be explained by the concept of selective optimization with compensation (Baltes & Baltes, 1980). Simply stated, "When and if, limits (thresholds) of capacity are exceeded during the course of aging for a given individual, the following developmental consequences result: (a) Increased selection (channeling) and further reduction of the number of high-efficacy domains; (b) Development of compensatory and/or substitute mechanisms" (Baltes, 1987, p.612). Similarly, in the word fluency task, older subjects may generate fewer words, they compensate by generating words of a more complex nature.

The decline in number of responses on the word fluency task coupled with the increase in complexity may be attributed to practice effects rather than secular trends. Although there are some secular trends in the data, they are few and not the driving force that could explain the results. Current events at the time of data collection are the best illustration of the secular trend. For

example, in 1970, many people generated the word *shrapnel*, due to its high use frequency during the Vietnam War. In the next two data points (1977 and 1984), *shrapnel* disappeared. In the 1991 data collection, words associated with the Gulf War like *sortie* and *scud* were listed often. Although these are examples of secular trends, it makes much more sense to argue that people use language (spoken and written) every day to communicate. Therefore, they practice it, and acquire new words through out their life time. It seems much less logical to argue that people in general knew and used less words in 1977 than in 1991.

The present study supports the previous findings that responses on the word fluency task decline with age and that women out perform men (Schaie, 1995). Younger subjects out performed older subjects on other verbal tasks, such as the word retrieval task (Bowles & Poon, 1985 a,b).

The time consuming process of establishing a data base of morphemes, parts of speech and dates of first use allows for detailed analyses of word fluency data. However, one clear limitation of this study is the inability to ask subjects how they generated words. It is not known if this is a conscious process involving the generation of more complex words to compensate for few words, or if it occurs without the person's awareness. The ratio of complex words (words that contain more than one morpheme) to the number of simple words (words containing only one morpheme) also warrants additional explanation.

References

Alexander, C., Langer, E., Newman, R., Chandler, H., & Davies, J. (1989). Transcendental meditation, mindfulness, and longevity: An experimental study with the elderly. *Journal of Personality and Social Psychology, 57*, 950-964.

Alvis, G., Ward, J., & Dodson, D. (1989). Equivalence of male and female performance on a tactuospatial maze. *Bulletin of Psychonomic Society, 27*, 29-30.

Berko, J. (1958). The child's learning of English morphology. *Word ,14*, 150-177.

Bowles, N.L. & Poon, L.W. (1985). Agomg and retrieval of words in semantic memory. Journal of Gerontology, 40 71-77.

Brown, R. (1973). *A first language: The early stages.* Cambridge, Mass. Harvard University Press.

Buckelew, S. & Hannay, J. (1986). Relationships among anxiety defensiveness, sex, task difficulty, and performance on various neuropsychological tasks. *Perceptual and Motor Skills, 63*, 711-718.

Burke, D.M., MacKay, D.G., Worthley, J., & Wade, E. (1991). On the tip of the tongue: What causes for finding failures in young and older adults? *Journal of Memory and Language, 30*, 542-579.

Feier, C.D., & Gertman, L.J. (1980). Sentence comprehension abilities throughout the adult life span. *Journal of Gerontology, 35*, 722-728.

Heller, R. & Dobbs, A. (1993). Age differences in word finding in discouse and nondiscourse situations. *Psychology and Aging*, 8, 433-450.

Kemper, S. (1992). Language and Aging. In F.I.M. Craik & T.A. Salthouse (eds.) The Handbook of Aging. Hillsdale, NJ: Lawrence Erlbaum.

Kemper, S. (1987). Lifespan changes in syntactic complexity. Journal of Gerontology, 42, 323-328.

Kemper, S. (1986). Imitation of complex syntactic constructions by elderly adults. *Applied Psycholinguistics, 7,* 277-297.

Kynette, D., & Kemper, S. (1986). Aging and the loss of grammatical forms: A cross-sectional study of language performance. *Language and Communication, 6,* 43-49.

Light, L.L. (1990). Interactions between memory and language in old age. In J. E. Birren & K. W. Schaie (Eds.) *Handbook of the Psychology of Aging* (Third Edition) (pp. 275-290) New York. Van Nostrand Reinhold.

McCrae, R., Arenberg, D., & Costa, P. (1987). Declines in divergent thinking with age: Cross-sectional, longitudinal, and cross-sequential analyses. *Psychology and Aging, 2,* 130-137.

Nicholas, M., Olber, L., ALbert, M., & Goodglass, H. (1985). Lexical retrieval in healthy aging. *Cortex, 21,* 595-606.

Obler, L. K. & Albert M. L. (1985). Language skills across adulthood. In J. E. Birren & K. W. Schaie (Eds.) *Handbook of the Psychology of Aging* (Second Edition) (pp. 463-473) New York. Van Nostrand Reinhold.

Schaie, K. W. (1983). The Seattle Longitudinal Study: A 21-year exploration of psychometric intelligence in adulthood. In K. W. Schaie (Ed.), *Longitudinal studies of adult psychological development* (pp. 64-135) New York: Guilford.

Schaie, K. W. (1993). The course of adult intellectual development. *American Psychologist, 49.*

Schaie, K. W. & Willis, S. L. (1991). *Adult Development and Aging.* (3rd ed.) New York: Harper Collins Publishers.

Tesluk, M. M., McGuire, L. C., Scaie, K.W., & Willis, S.L. (1993). Change in word fluency over the adult life span: A longitudinal linguistic analysis. Poster presented at the Cognitve Aging Conference, Atlanta, Georgia, April 1993.

Thurstone, L. L. & Thurstone, T. G. (1949). *Examiner manual for the SRA Mental Abilities Test* (Form 10-14). Chicago: Science Research Associates.

Walker, V.G., Roberts, P.M., & Hedrick, D.L. (1988). Linguistic anaylses of the discourse narratives of young aged women. *Folia Phoniatica, 40*, 58-64.