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Expressive Language: Age-related Changes and the Role of Working Memory

by

Robert Barry Heller

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF Master of Science

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled Expressive Language: Age-related Changes and the Role of Working Memory submitted by Robert Barry Heller in partial fulfilment of the requirments for the degree of Master of Science.

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Supervisor

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.....

Date: September 18, 1987

Dedication

To Sandy Zawada for her patience and understanding and to Mary Heller for her faith.

Abstract

Evaluations of age-related changes in expressive language have been extremely limited and often confounded by the influence of cognitive variables such as long-term memory and field dependence. The present research used a task that controlled expressive language production and minimized the influence of extraneous cognitive factors. The expressive language of three age groups of adults, young, middle-age, and old, was examined in terms of content, style, references, and semantic organization. The main results showed important age-related changes in all four aspects that were characterized as a trend toward less cohesion and less specificity. Moreover, there were differences in performance within and between age groups as a function of differences in working memory flexibility. The discussion focused on the cognitive demands of the task as an explanation of both age effects and working memory effects.

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Recognition is also due to Dave Monaghan for his help in scoring the language protocols and in developing the scoring procedure.

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I. Introduction

A recent goal of cognitive psychology has been the delineation of cognitive changes that are associated with normal aging. Researchers in pursuit of this goal have begun to examine higher level processes, including those involved in memory for discourse (Hartley, 1986; Rice and Meyer, 1986), discourse comprehension (Cohen, 1979; Taub, 1979) and reasoning (Cohen, 1981; Light and Zelinski, 1982). Equally important, though neglected, is expressive language or the language that we use to describe the events in our lives in order to communicate or share knowledge. Like comprehension, expressive language is an integral part of daily communication skills and requires considerable high-level processing in order to be successful. North and Ulatowska (1981) found that the quality of expressive language correlated positively with competence in daily living in older adults. Moreover, deterioration in expressive language ability is thought to be an early symptom of progressive dementias (Assal, Favre, and Regli, 1984) and the pattern of deterioration has been found to distinguish patients with different cognitive pathologies (Nicholas, Obler, Albert, Helm-Estabrooks, 1985). Thus specification of the age-related changes in expressive language has

direct clinical implications and potential diagnostic capabilities.

The primary goal of the present research was to specify the changes in expressive language that are associated with normal aging. In order to achieve this goal, a method was required for collecting large samples of relatively comparable language protocols for analysis. In addition to guiding language production, the collection process had to minimize the confounding influence of extraneous variables such as memory and field dependence. Complex picture description and story retelling are two procedures that produce comparable language protocols. However, retelling a story is very dependent on memory and describing a static picture is influenced by the extent of field dependence. The influence of field dependence on oral descriptions is reflected by an inability to shift attentional processes in a strategic manner. Consequently, there is a decrease in the number of themes or concepts described. Age-related changes in both long-term memory (Craik, 1977) and field dependence (Panek, 1985) have been reported. Thus, findings of age-related changes in expressive language can be confounded by the influence of essentially non-linguistic processes.

The task used in the present research was originally developed by Tomlin (1983) to study the foreground/background distinction in psycholinguistic research. In this task, participants were asked to describe the contents of a video cartoon that ensured that the language protocols contained comparable information. Moreover, the dynamic presentation of the video minimized the effect of the increased field dependence of elderly adults. Attentional processes are directed by the foregrounded actions of the principal characters. To reduce the effect of long-term memory on language performance, participants gave their descriptions while the cartoon was playing, a procedure labeled oral on-line description. Because this on-line requirement may have taxed comprehension of the cartoon, participants first previewed the video cartoon. Thus, all participants were familiarized with the events to be described.

The protocols collected by using this task had three additional features. First, because of the on-line constraint, the order of events to be described was identical across subjects. Second, the on-line constraint minimized editorial-like comments. Finally, the language protocols exhibited a surprisingly rich narrative structure. Because of the extensive

psychological literature on narrative structure, there are many potential measures for analyzing this aspect of the language protocols. Altogether, the task used in the present research provides exceptional control over the production of expressive language while minimizing the inluence of extraneous variables.

The limitations associated with other expressive language tasks were noted earlier but, nevertheless, some important age-related changes in expressive language have been suggested by researchers using these tasks. Obler (1980) analyzed written descriptions of a complex picture and found age-related differences in certain measures of style. Older adults used syntactically complex sentences and modified nouns and verbs. Surprisingly, younger adults showed similar patterns whereas middle-aged adults used simple sentences and little elaboration. Obler (1980) suggested younger adults used a more complex style as an option because they found the task easy. The complex style of the older adult was believed to occur not because the task was necessarily easy, but because of an age-related trend toward a syntactically complex mode of description (Obler, 1980). However, it was not clear whether the syntactically complex modes of description by older adults and younger adults were

similar to each other. Furthermore, there was no evaluation of whether the complex mode of description added meaningful information or whether the complex mode of description added empty information (i.e. empty phrases and circumlocutions).

Obler (1980) also found that older adults used more words in their written descriptions than did middle-aged adults but that there was generally no difference in the number of themes that were mentioned by both groups. However, Yorkston and Beukelman (1980) analyzed oral descriptions of a complex picture and found older adults gave less content per minute. This inconsistency may reflect the differences between oral and written language and suggests that the pattern of age-related change in expressive language is different for oral and written language skills.

In a story retelling procedure, several researchers have found that ambiguous references and indefinite terms increased with age (Cohen, 1979; Obler, 1980; Ulatowska, Hayashi, Cannito, and Flemming, 1986). Ulatowska et al. (1986) also reported that older adults used more pronouns, relative to nouns, than did younger adults. In the story retelling procedure, older adults mentioned less content (Cohen, 1979; Obler, 1980) and showed less comprehenison (Ulatowska, et al., 1986).

Finally, Obler (1980) found that older adults made more comments and questions on the task when retelling stories.

The locus of age-related changes in expressive language has been thought to stem from several factors (Ulatowska et al., 1986). One of these factors has been an age-related decline in processing resources for organizing meaningful material (Cohen, 1979). Presumably, older adults have less processing resources to carry out simultaneously the cognitive processes involved in expressive language. The diminished resources view has been used to account for a variety of age-related deficits on cognitive tasks (Craik, 1977; Parkinson, Lindholm, and Urell, 1980; Rabinowitz, Craik, and Ackerman, 1982; Wright, 1981). In Baddeley's (1986) view, the effect of diminished resources is to reduce the efficiency of working memory, especially when task demands require active organization and manipulation of input.

A related but somewhat different view, suggested by Dobbs and Rule (1987), is that age-related deficits may not be due to diminished resources per se, but that deficits arise because working memory is less flexible in selecting, inhibiting, activating and coordinating cognitive processes in information processing. In the

present research, the term 'working memory' referred to a general system with both limited resources and limited flexibility. However, it was assumed that processing flexibility was a critical component in performing the oral on-line descriptions because the nature of the expressive language task required constant planning and frequent shifts in the perceptual, lexical, syntactic, semantic, and articulatory processes. If older adults are less able to select, activate, and inhibit these modes of processing, then their performance on the expressive language task should be impaired, particularly on aspects that are sensitive to processing flexibility.

The secondary goal of the present research was to examine whether differences in processing flexibility was related to expressive language performance. To achieve this goal, the present research used an individual differences approach (c.f. Daneman and Carpenter 1980; 1983). Daneman and Carpenter (1980; 1983) showed that individual differences in measures of working memory were positively related to measures of comprehension in a reading task. In the present research, a working memory task, developed by Dobbs and Rule (1987), was used to assess individual differences in processing flexibility. Unlike working memory tasks

that involve passive storage (e.g. digit span and sentence span) the Dobbs/Rule working memory task involves repeated shifts in processing with minimal storage requirements. Their task requires dynamic coordination of the encoding, storage and retrieval processes and this was believed to reflect a purer measure of working memory flexibility. Moreover, the expressive language and the Dobbs/Rule working memory task made similar demands on working memory in terms of the on-line coordination of cognitive processes. Consequently, the Dobbs/Rule working memory task was used to select participants from within three age ranges in order to examine changes in expressive language as a function of age and processing flexibility.

The procedure used to score the language protocols was developed to encompass several aspects of expressive language. By 'casting a wide net' there was a greater chance of isolating the most immediately fruitful area of investigation. Moreover, several aspects of expressive language were examined in order to compare the results of the present study with previous findings by Cohen (1979), Obler (1980), Ulatowska et al. (1986), and Yorkston and Beukelman

(1980). There were four components in the scoring procedure.

The first component of the scoring procedure, based on analogous research on organizational processes in comprehension, was designed to address high-level processes in expressive language production. It was hypothesized that plan schemas (Brewer and Dupree, 1983; Lichtenstein and Brewer, 1980) and causal knowledge (Kemper, 1982; Trabasso and Sperry, 1985; Warren, Nicholas, and Trabasso, 1979) were responsible for the semantic macrostructure of the expressive language (c.f. kintch and Van Dijk, 1978). Plan schemas are hierarchical knowledge structures used for organizing goal-directed actions. In the video cartoon used in the present research, there were many goal-directed actions on the part of the characters. If plan schemas are utilized in this task, then descriptions should be organized around the perceived goals of the characters.

Similarly, causal knowledge is used for organizing actions with consequences and, for generating inferences when either actions or consequences are missing. Of particular importance are the mental actions and consequences or thoughts and emotions. Kemper (1983) found that college students often

inserted mental states between actions when asked to 'edit' a narrative story. Her model predicts that mental states are generated in order to maintain cohesion. In the present task, thoughts and emotions are not as overtly portrayed as the physical actions and are thus, largely inferred by participants. Consequently, the extent to which thoughts and emotions are described may reflect the utilization of causal knowledge.

If causal knowledge and plan schemas are partly responsible for cohesiveness in expressive language, then an important question concerns the possibility of age-related changes in the utilization of casual knowledge and plan schemas in expressive language. It was assumed that this type of planning in expressive language would be especially susceptible to limitations in processing flexibility. Although there is no direct evidence on the resource demands of expressive language, there is an established relationship between individual differences in processing flexibility and measures of integration in comprehension (Daneman and Carpenter, 1983; Daneman and Green, 1986; Masson and Miller, 1983). The processing similarities between integration in comprehension and organization in expressive language suggest that a similar relationship

may exist between processing flexibility and measures of organization in expressive language. Thus, it was expected that measures of organization would be particularly sensitive to differences in processing flexibility.

A second component of the scoring procedure was developed to measure the content of the protocols in terms of significant events, as determined by Tomlin (1983), and salient objects, as determined by pilot work. It was predicted that because of the online constraint, older adults would provide less content than younger adults and would have higher error rates. This prediction was based on Yorkston and Beukelman's (1980) results in which older adults provided less content per minute than younger adults. This prediction also was based on research reported in Obler and Albert (1985) because they found that older adults had more errors and longer latencies in a object naming task as well as an action naming task.

The third component was developed to measure stylistic differences in terms of metalinguistic comments and elaboration. Previous research by Obler (1980) found that older adults added more comments than did younger adults in an oral story retelling task. Older adults also modified more nouns and verbs than

did younger adults in a written picture description procedure. Although the scoring procedure captured differences in style, it was not clear whether any age differences would emerge in the present research given that a time constraint was imposed and that output was oral rather than written. Consequently, it was expected that the age-related differences in style would not be as great as in past studies.

The final component in the expressive language scoring procedure was developed to examine differences in the referring expressions used to identify characters. Previous research has shown an increase in the frequency of pronouns or anaphoric references and referential errors among older adults in a story retelling procedure (Cohen, 1979; Obler, 1980; Ulatowska et al., 1986). If these effects are independent of retrieval deficits in longterm memory, then the present task should also produce referential disruption in the older adults. Referring expressions were also measured along dimensions of specificity to determine whether the increases in the use of pronouns was part of a general trend toward less specificity.

In all analyses, performance was examined as a function of chronological age and working memory flexibility as assessed by the Dobbs and Rule (1987)

working memory task. These researchers found a substantial age-related decline in processing flexibility and as a result, it was difficult to orthogonally vary age and performance on the working memory task. Because of the strong relationship between age and working memory, the lowest performing young adult was substantially higher than the lowest performing old adult. Instead of using absolute performance criteria on the working memory task, relative performance was used to classify adults as being below average, average, and above average in working memory flexibility for their own age grouping. Because of the age-related differences in processing flexibility, it was expected that the effect of differences in processing flexibility would be stronger in the group of older adults because of their greater disparity in working memory scores.

II. Method

A. Participants

Ninety participants, 54 females and 36 males, were selected from the pool of volunteers that had participated in a Lifespan Adult Memory Project at the University of Alberta under the direction of Dobbs and Rule. Participants in this sample reported that they were in relatively good health. Visual assessment with the Snellon eyechart revealed that all participants had 20/15 vision or better. On the basis of self-reports from a health status inventory, participants were excluded from the study if they reported taking psychotrophic drugs or had experienced an alcoholic blackout. Participants with neurological impairments (head injury, stroke) were also excluded from this study.

The ninety participants were grouped into three age ranges (28 to 45 years, 46 to 58 years and 60 to 76 years) and within each age range, participants were further assigned into below average, average, and above average working memory groupings according to their performance on the third condition of the Dobbs/Rule working memory task. The third condition was used because it was the most difficult condition and showed stronger age-related effects. The assignment of participants into working memory groups was based on

the average performance within each age group. For younger adults, the average score on the third condition was 6.8 out of a possible ten. For middle-aged adults, the average score was 6.1 and for older adults the average score was 5.3. Table 1 provides averages and standard deviations for age, working memory scores, and number of years of education for each group. There were six females and four males in each of the nine groups.

B. Materials

The silent video cartoon in the expressive language task was presented on a black and white TV monitor and lasted 108 seconds. It depicted a goldfish who inadvertantly swam into the ocean where he was subsequently chased by a crab, then by a pike, and finally by both.

C. Procedure

All participants were tested individually by a woman research assistant on three separate days. On the first day, medical history information was collected. The working memory task was administered on the second day and the expressive language task was administered on the third day.

Table 1

Mean and Standard Deviation of Age, Working Memory, and Education

		Young		Middle-Age		Old	
		M	SD	M	SD	M	SD
Age in years	BA	36.3	5.4	52.1	3.9	69.3	4.5
	A	37.3	4.3	50.5	3.9	66.5	4.9
	AA	36.7	4.1	51.3	4.5	65.4	5.1
WM task 1 back	BA	6.8	2.6	7.1	2.7	2.9	1.6
	A	9.9	0.3	9.5	1.6	7.3	1.4
	AA	10.0	0.0	10.0	0.0	9.3	1.3
WM task 2 back	BA	4.1	2.3	2.4	1.8	2.4	1.5
	A	6.5	0.9	6.0	1.1	4.8	3.3
	AA	9.8	0.6	9.8	0.6	8.8	2.6
Education in years	BA	14.9	2.5	14.1	1.5	14.0	2.2
	A	14.7	2.5	14.1	3.3	14.1	3.3
	AA	14.1	1.9	13.3	2.6	15.1	2.4

Note. BA refers to below average working memory score, A refers to average working memory score and AA refers to above average working memory score. WM 1 back refers to the one back condition of the working memory task and WM 2 back refers to the two back condition of the working memory task. The scores in the zero back condition of the working memory were perfect for all groups.

In the working memory task, participants were required to repeat a series of digits under three conditions. The digits were presented every 1.8 seconds over headphones using a tape recorder. In the first or zero-back condition, participants repeated the digits as they heard them. In the second or one-back condition, participants repeated the digit that was one position back from the present digit. In the third or two-back condition, participants repeated the digit that was two positions back from the present digit. The order of the conditions, zero back, one back, and two back, was the same for all subjects. The research assistant was present during the testing and wrote down the participants responses. The number of digits correctly reported in each condition (maximun = 10) served as a measure of their processing flexibility. To perform well in this task, participants must coordinate input and output processes under increasingly difficult conditions. As noted earlier, there were considerable differences in working memory performance within each working memory grouping. Consequently, it was expected that older adults with below average scores would show the greatest deficits relative to all other groups.

In the expressive language task, participants were first asked to watch the cartoon silently. The research

assistant was present for the duration of the task and sat behind the video monitor off to one side where she controlled the video tape player. In the second viewing, the participants were asked to describe everything they saw happening in the cartoon, as it happened. The participant was asked to imagine that the description was for someone who had never seen the cartoon. The oral descriptions were tape recorded and later transcribed for scoring and subsequent analyses.

D. Scoring Procedure and Measures

The protocols were scored under blind conditions by two trained judges. Two reliability checks were done on a random selection of two sets of ten protocols. Cohen's (1960) coefficient of agreement for nominal scales was used to calculate reliability. In the first reliability check of ten protocols, the coefficient of agreement between judges was .75. In the second reliability check of ten different protocols, the coefficient of agreement was .82. The scoring procedure measured four aspects of the language protocols: content, semantic organization, references, and style. A complete description of each scoring component is provided in Appendix A.

To examine differences in content, fourteen events were selected from the video cartoon based on research

by Tomlin (1983). He found that participants were more likely to report these events in their on-line descriptions and that judges rated these events as more important in a comprehension task. If an event was described, judges either rated the description as correct, vague, or incorrect. The mean proportion of correct, vague, and incorrect events was calculated and analyzed in separate ANOVAs. A similar procedure was developed for scoring the descriptions of objects portrayed in the video. From pilot work with this task, twenty-four objects were found to be frequently mentioned in participants on-line description. For each object identified, judges rated the description as either correct, vague or incorrect. The mean proportion of correct, vague, and incorrect objects was calculated and analyzed in separate two-way ANOVAs.

To examine differences in semantic organization, eight categories of semantic information were developed based on the significance of goals and causal relations in language comprehension. The semantic units were state, action, goal, perception, emotion, thought, outcome, and unclassifiable information. The semantic units were generally defined as content words that referred to the ongoing sequence of action portrayed in

the cartoon. The mean frequency of each category was calculated and analyzed in separate two-way ANOVAs.

To examine references in expressive language, the referring expressions used to identify characters in the cartoon were categorized into nouns and pronouns. The clear majority of nouns were nouns that defined a class of animals. These nouns were broken down according to specificity: unspecified (e.g. animal), general (e.g. fish), specific (e.g. goldfish). There were also role nouns (e.g. hero) and proper names (e.g. Crabby the Crab). Finally, nouns were sometimes modified by spatial adjectives like 'big' or 'little' and personal adjectives like 'mean' or 'cute'. Pronouns were further divided into those whose antecedent reference could be determined from those whose antecedent reference could not be determnined. The mean frequency of each category was calculated and combinations of categories were analyzed in separate three-way ANOVAs.

Finally, to examine stylistic differences, eight different categories were developed based on pilot work with the language protocols and the categories used by Obler (1980). These included metalinguistic comments related to the task, hedges or linguistic indices of uncertainty on the part of the speaker, sound effects,

repetitions, detail, object attributes (adjectives), action attributes (adverbs) and unclassifiable information. The mean frequency of each category was calculated and analyzed separately in two-way ANOVAs.

III. Results

All scores were analyzed using the analysis of variance technique. Only statistically reliable effects and their associated mean scores are reported in the results section. Tables with all mean scores are included in Appendix B.

A. Content Analysis

The proportion of events that were correctly mentioned in the descriptions was analyzed in a 3 (Age) X 3 (Working Memory Score) analysis of variance. The Age variable showed a marginally significant effect, $F(2,81) = 2.90$, $p < 0.06$ with the proportion of correctly mentioned events declining as a function of age (young = .61, middle-age = .54 and old = .51).

The proportion of correctly mentioned objects was analyzed using the same design and again, only the Age variable was reliable, $F(2,81) = 10.49$, $p < 0.001$. The pattern of mean scores was the same as for events (young = .46, middle-age = .37 and old = .31).

There were few overt errors for the events and objects. The proportion of both object and event errors were analyzed separately in a 3 (Age) X 3 (Working Memory Score) analysis of variance. The Age variable was significant for the event errors, $F(2,81) = 16.60$, $p < 0.001$ (young = .00, middle-age = .01 and old = .04). The same pattern of increasing errors with age

was found for the proportion of object errors, F (2,81) = 5.24, $p < 0.007$ (young = .02, middle-age = .02 and old = .04).

These findings indicated that the proportion of significant events and objects included in the oral description decreased as age increased. Consistent with this decrease in accurate content, was the small but reliable increase in incorrect identifications of both objects and events with advancing age. Although less content and greater errors were associated with age, the working memory variable did not produce reliable effects.

B. Semantic Analysis

The different categories of semantic information included in the oral descriptions were analyzed in separate 3 (Age) X 3 (Working Memory Score) analysis of variance. The analysis of the goal, action, and thought categories all showed reliable effects of Age and the same pattern of decreasing usage with increasing age. For the goal category, the mean frequencies were; young = 12.4, middle-age = 10.5 and old = 8.4, F (2,81) = 9.87, $p < 0.001$. For the action category, the mean frequencies were; young = 21.8, middle-age = 19.3 and old = 17.4, F (2,81) = 3.37, $p < 0.04$. For the thought category, the mean frequencies were; young = 1.9,

middle-age = 1.5 and old = 1.1, $\underline{F}$ (2,81) = 3.18, $p < 0.05$. The Working Memory Score variable did not produce a reliable effect in any of these analyses.

The Working Memory Score variable produced a reliable effect in the analysis of the emotion category, $\underline{F}$ (2,81) = 3.64, $p < 0.03$. The mean frequency of the emotion category increased as working memory scores increased (above average = 1.0, average = .6 and below average = .5). The Age variable produced a marginally reliable effect, $\underline{F}$ (2,81) = 2.94, $p < 0.06$, but the pattern of mean frequencies was irregular (young = .77, middle-age = .93 and old = .43).

The 3 (Age) X 3 (Working Memory Score) analysis of the state category yielded a reliable interaction, $\underline{F}$ (2,81) = 2.70, $p < 0.04$. The mean frequencies for this interaction are shown in Table 2. Table 2 shows that higher working memory scores were associated with lesser amounts of state information in the descriptions given by young and middle-aged adults. In contrast, higher working memory scores were associated with greater amounts of state information in the descriptions given by older adults.

Table 2

Frequency of State Information as a Function of Age X Working Memory Score

Working Memory Score	Age		
	Young	Middle-age	Old
Above average	4.3	4.8	3.2
Average	3.9	3.4	4.0
Below Average	3.6	2.4	5.4

The findings of these analyses indicated that the frequency of goal, action, and thought, and emotion information in the oral descriptions declined with age. Moreover, the frequency of emotion information in the oral descriptions decreased with decreasing working memory scores. Finally, for young and middle-aged adults, the frequency of state information decreased as working memory scores increased whereas for older adults, the frequency of state information increased as working memory scores increased.

C. Reference Analysis

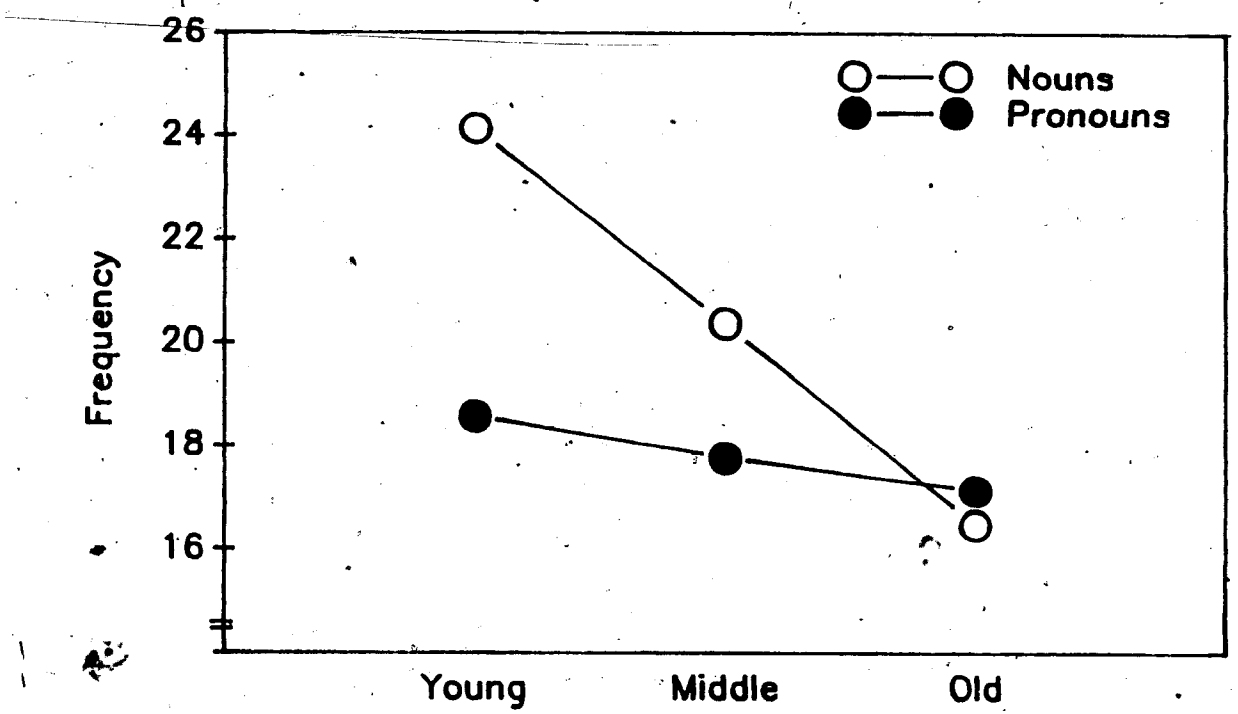
All nouns (role, name, specific, general, and unspecified) were combined to form a single measure of noun references. All pronouns (with and without

antecedent) were combined to form a single measure of pronoun references. The two reference measures, noun and pronoun were analyzed in a 3 (Age) X 3 (Working Memory Score) X 2 (Reference Type) design. There was a significant effect of Age, $\underline{F}$ (2,81) = 4.84, $p < 0.01$, and a significant effect of Reference Type, $\underline{F}$ (2,81) = 5.33, $p < 0.02$. These effects were qualified by a moderately significant interaction between Age and Reference Type, $\underline{F}$ (2,81) = 2.76, $p < 0.07$. The mean frequencies for noun and pronoun references are shown in Figure 1. The use of pronouns showed no relation to age (young = 18.57, middle = 17.77, and old = 17.13) whereas the use of nouns clearly declined with age (young = 24.13, middle = 20.37, and old = 16.46). This pattern of mean scores was consistent with the results of Ulatowska et al., (1986) as she found that older adults used more pronouns relative to nouns than did younger adults.

In the second analysis, general nouns and specific nouns were examined as a within measure labeled Noun Type to determine which type of noun decreased with age. The other nouns were omitted because they were relatively infrequent. It was anticipated that specific nouns would show more of an effect of age than general nouns because the pattern of nouns and pronouns used by

Figure 1

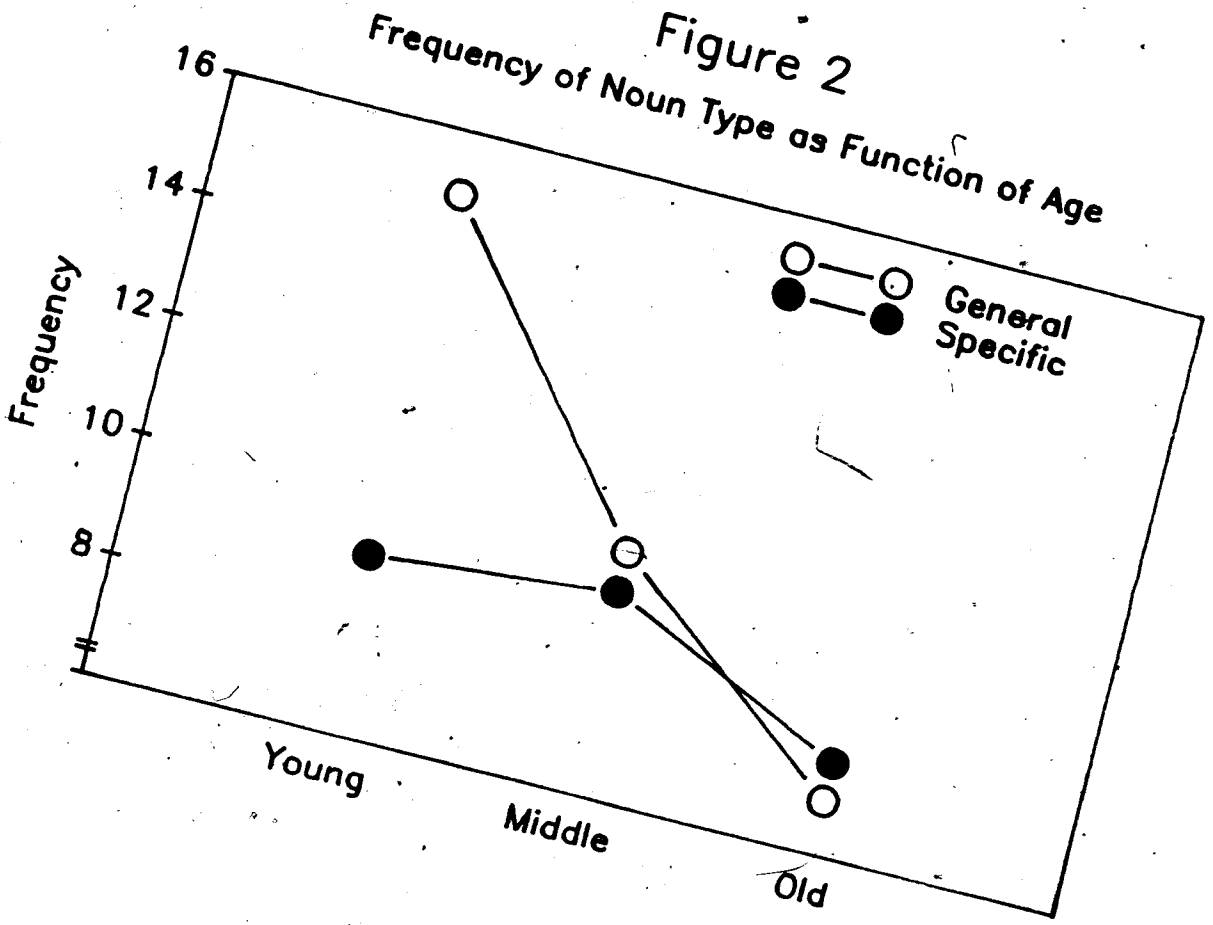
Frequency of Reference Type as a Function of Age



older adults can be characterized as a trend toward less specificity. There was a significant effect of Age, F (2,81) = 11.26, $p < 0.001$, and a significant effect of Noun Type, F (2,81) = 7.11, $p < 0.009$. However, although the interaction between Noun Type and Age was significant, F (2,81) = 7.28, $p < 0.001$, it was not in the predicted direction. The mean frequencies for this interaction are shown in Figure 2. The use of specific nouns did not change as a function of age (young = 8.97, middle-age = 9.37 and old = 7.53). Instead, it was the use of general nouns that was related to age (young = 14.47, middle-age = 10.03 and old = 6.90). Thus the interaction between Age and Reference Type found in the first analysis was due to the declining use of general nouns as age increased.

The third analysis examined ambiguous references. Unspecified nouns and pronouns whose antecedents could not be identified were analyzed as a within group measure labeled Ambiguity Type. Based on results by Cohen (1979) and Ulatowska et al. (1986), a significant Age effect was expected and obtained F (2,81) = 6.44, $p < 0.003$. The pattern of mean scores showed that the use of ambiguous references increased with age (young = 0.48, middle-age = .77 and old = 1.55).

Figure 2

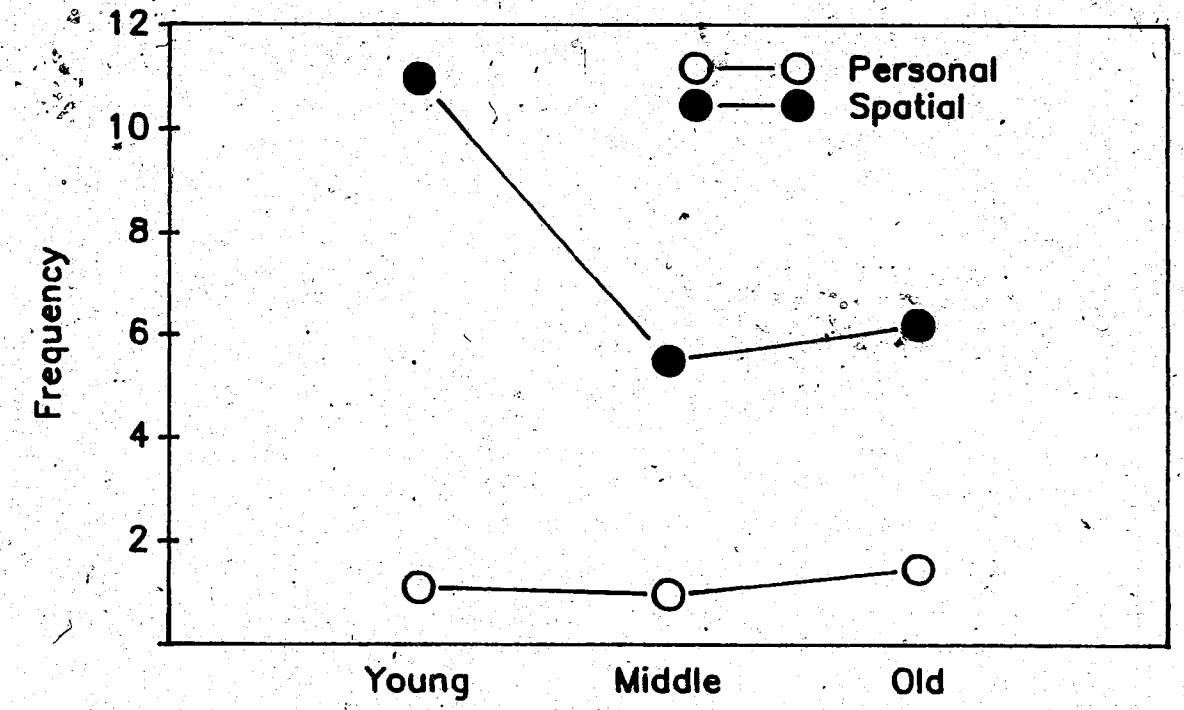

Frequency of Noun Type as Function of Age
16
14
12
10
8
Frequency
General
Specific
Young
Middle
Old

In the final analysis, the two types of modifiers, personal and spatial, were analyzed as a within group measure labeled Modifier Type. It was expected that older adults would use fewer modifiers to distinguish characters given the results of the previous analysis on referential ambiguity. There was a significant effect of Age, F (2,81) = 12.238, $p < 0.001$, and a significant effect of Modifier Type, F (2,81) = 167.246, $p < 0.001$. Both of these effects were qualified by a significant interaction between Modifier Type and Age F (2,81) = 7.28, $p < 0.001$. The mean frequencies for spatial and personal modifiers are shown in Figure 3. The use of personal modifiers showed no relation to age (young = 1.10, middle-age = 0.97 and old = 1.47), whereas the use of spatial modifiers clearly declined with age (young = 10.97, middle-age = 5.50 and old = 6.20).

These analyses indicated that the use of general nouns and spatial modifiers in the oral descriptions decreased with age, whereas the use of pronouns, personal modifiers and all other types of nouns remained relatively constant across age. Moreover, the findings also indicated that the use of ambiguous references in the oral on-line descriptions increased as age increased.

Figure 3

Frequency of Modifier Types as Function of Age



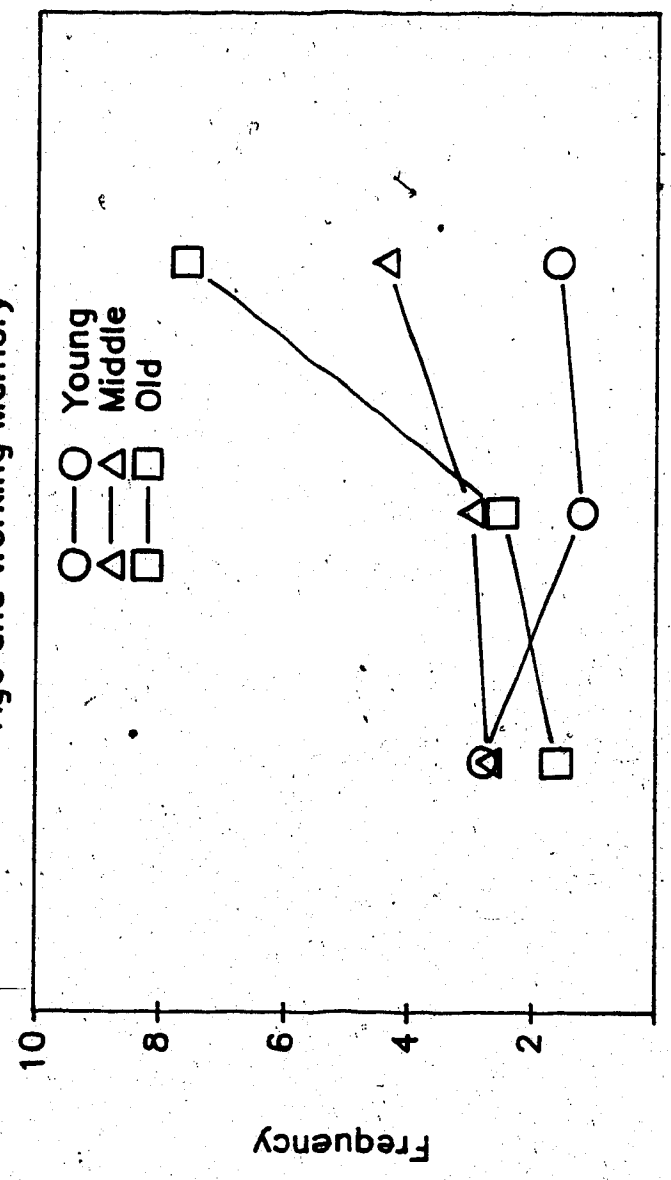
D. Style Analysis

The mean frequency of each style category was analyzed in separate 3 (Age) X 3 (Working Memory Score) analysis of variance. The analysis of hedges or linguistic expressions of uncertainty, showed a reliable effect of Age, F (2,81) = 15.485, $p < 0.001$, that was qualified by a reliable Age X Working Memory Score interaction, F (2,81) = 4.142, $p < 0.004$. The mean frequencies for this interaction are presented in Figure 4. The Working Memory Score variable had little effect on the use of hedges for the young adults and the middle-aged adults, but above average working memory scores were strongly related to the use of hedges in the older adults.

The Working Memory Score variable was reliable in the analysis of the detail category, F (2,81) = 11.69, $p < 0.001$ and the object attribute category, F (2,81) = 4.76, $p < 0.01$. The pattern of the means was unexpected in that the below average and above average working memory scores were both associated with greater amounts of detail and object attributes whereas the average working memory score was associated with low amounts of detail and object attributes. The mean frequencies for the detail category were; above average = 2.2, average = .77 and below average = 2.8. The mean frequencies for

Figure 4

Frequency of Hedges as a Function of Age and Working Memory



the object attribute category were; above average = .77, average = .17 and below average = .87.

These findings indicated that for older adults, the use of hedges in the oral description increased with increasing working memory scores. These findings also indicated that adults with average working memory scores provided lower amounts of detail and object attrributes in their oral descriptions, whereas both adults with above average and below working memory scores provide greater amounts of detail and object attributes in their descriptions.

IV. Discussion

The primary goal of the present research was to specify changes in expressive language that are associated with normal aging. Several age-related changes in expressive language were revealed. First, referential specificity declined with age. Older adults used relatively fewer nouns than pronouns, used more ambiguous references, and used fewer spatial modifiers than did younger adults. Second, older adults correctly labeled fewer objects and, to a lesser extent, fewer events than did younger adults. Consistent with this finding, older adults made more errors in labeling objects and events than did younger persons. Third, older adults provided less goal information, and to a lesser extent, action, and thought information than did younger adults. Older adults also provided less emotion information than did middle-aged adults.

The performance of older adults should be considered in terms of the cognitive demands of the expressive language task. Successful performance in the oral on-line description procedure depends on the extent to which lexical, syntactic, and semantic processes can be flexibly deployed in producing oral expressive language. Older adults with diminished processing flexibility might have difficulty coordinating (i.e. selecting, activating, inhibiting) these processes as

well as do younger adults. One consequence of this difficulty would be a loss in the amount of information conveyed in situations like the expressive language task.

The diminished processing flexibility explanation for the poorer performance of older adults would have been more compelling if working memory scores were positively related to measures of expressive language performance. The lack of significant effects was not surprising, given that the working memory scores of younger adults in the below average group were considerably higher than the below average working memory scores of the older adults. Because the working memory scores were correlated with age, the effect of processing flexibility per se was difficult to isolate. However, to support partially the diminished processing flexibility explanation, the sum of the most frequently used semantic categories (state, action, and goal) was used as a global measure of performance. This measure was higher for older adults with above average working memory scores ($\underline{M}$ = 35.0) than it was for older adults with below average scores ($\underline{M}$ = 25.3) and almost indistinguishable from the performance of younger adults (above average = 38.2, average = 38.6 and below

average = 37.6) and middle-aged adults (above average = 35.4, average = 30.7 and below average = 34.0).

The secondary goal of the present research was to examine whether differences in processing flexibility influenced performance on the expressive language task. The results of this study showed an unusual and unanticipated effect of working memory flexibility on expressive language performance. Adults with average working memory scores for their age range used less detail and fewer object attributes in their descriptions than adults with above average scores and adults with below average scores. Adults with above working memory scores may have found the task less demanding, making it easier to add additional detail and object attributes. They describe most of the actions with elaboration. Adults with average working memory scores may have found the task somewhat demanding, making it harder to add detail and object attributes. They describe most of the actions but with little elaboration. Adults with below average scores may have found the task even more demanding, making it harder to describe all the actions. They substitute detail and object attribute information instead of describing actions. They describe fewer actions but with more elaboration.

Consistent with this post hoc explanation, adults with below average working memory scores provided fewer actions (M = 18.1) than adults with above average scores (M = 21.1). Moreover, adults with average working memory scores had a higher proportion of vague descriptions of significant events (M = .19) than adults with above average working memory scores (M = .14) and adults with below average scores (M = .15). This suggested that the descriptions by adults with average working memory scores were less likely to contain detail and object attributes. Thus, individual differences in working memory flexibility may be related to tradeoffs between providing additional actions and elaborating already established actions.

There was an unanticipated interaction between Working Memory and Age in the analysis of the state category. Young and middle-aged adults with below average scores used less state information than young and middle-aged adults with above average scores whereas older adults show the opposite pattern. State information is presumably easier to provide but less informative than action or goal information. As processing flexibility increases, there is a tradeoff toward providing action and goal instead of state information which explains the increase in the amount

of state information as working memory scores decrease for young adults (above average = 3.6, average = 3.9 and below average = 4.3) and middle-aged adults (above average = 2.4, average = 3.4 and below average = 4.8). However, as working memory scores increased in older adults, the average amount of state information also increased because older adults still found the task somewhat demanding and provided state information when action information occurred too quickly. With more processing flexibility, perhaps older adults would substitute the state information for action information as hypothesized for younger and older adults.

There was also a similar interaction between working memory and age in the analysis of hedges. Older adults with above average working memory scores used more hedges than older adults with below average scores whereas young and middle-age adults show no relation between the use of hedges and working memory score. Although hedges were assumed to reflect uncertainty on the part of the speaker, some hedges could also reflect a type of elaboration in that the use of hedges often qualifies the information being conveyed. Viewed in this way, older adults with above average scores elaborated their description by adding hedges whereas younger adults elaborated their descriptions by adding

detail and object attributes. The cautiousness of older adults in decision making is well documented (Botwinick, 1978) and may also be related to their greater use of hedges.

Two final points are raised with respect to analagous research in language comprehension. First, referential specificity appears to decline in older adults independently of retrieval deficits in long-term memory. The oral on-line procedure lacked the long-term memory component that was required in the story retelling procedure. Part of the reason why older adults are less specific in their referring expressions may result from inadequate monitoring of communicative needs or a false assumption of greater shared knowledge (Ulatowska et al., 1986). However, recent research by Light and Capps (1986) on pronoun comprehension by young and old adults showed that older adults did not comprehend pronouns as well as did younger adults. Light and Capps (1986) attributed this effect to the older adults failure to recall the relevant contextual information to determine the antecedent referent. In contrast, the present study found evidence of referential disruption in older adults independent of long-term retrieval processes. Most of the contextual cues were available at the time the description was

occurring. An important question for future research concerns whether the reference effects with the present procedure are due to the same factor that caused reference effects in research of Light and Capps (1986).

Second, although the concepts of causal knowledge and plan schemata were developed to explain comprehension of connected discourse, the present research suggested that they are equally important in organizing the semantic macrostructure of expressive language. Semantic organization may also be more susceptible to diminished processing flexibility. In support of this claim, older adults with below average scores provided significantly fewer goal statements than all other adults. Moreover, more emotion information was given by adults with above average working memory scores. Goals and emotions are important cohesive devices in causal representations of narrative discourse (Kemper, 1982; Trabasso and Sperry, 1985; Warren, Nicholas and Trabasso, 1979).

The findings of the present study indicated that several aspects of expressive language in older adults are likely to change under conditions requiring considerable processing. These changes can be characterized as a trend toward less cohesiveness, less

specificity and less elaboration in expressive language. Moreover, the nature of age-related changes in expressive language is qualified by individual differences in processing flexibility. Relative to younger adults, older adults with above average flexibility show smaller performance decrements than older adults with below average flexibility.

The findings of the present study are generally consistent with previous research on expressive language and aging. However, it should be recalled that that the sample of older adults in the present study represented the 'cream' of the older adult population (healthy, well-educated, and with no neurological impairments). Hence, the age effects obtained in the present are likely to be underestimates of the extent of changes typical in the general population. Disruptions in language skills are symptomatic of certain pathologies that have higher incidences among older adults (e.g. dementias). The present study shows the importance of aquiring normative data on the changes in expressive language associated with normal aging. Moreover, the present data should be considered when diagnosing language abilities in older adults.

There are two directions for future research. First, it is important to determine whether age-related

differences in expressive language can be reduced by task manipulations (e.g. different instructions, different temporal constraints) and material maniplulations (e.g. familiarity, pre-experimental knowledge). Moreover, subject variables (e.g. verbal ability, IQ, health, personality traits) may also be related to measures of expressive language. This line of research has implications for possible remedial programs on maintaining language skills. Second, the measures used in the present research reflect global indices of performance and may be insensitive to certain aspects of expressive language. Future research should be directed toward the development of more sensitive measures, particularly measures of organization and semantic cohesion. The expressive language task has unlimited potential as a tool to investigate expressive language changes across adulthood as well as expressive language in general.

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VI. Appendix A: Scoring Procedure

A. Significant Events

The fourteen events are numbered and described below along with examples. After familiarizing yourself with each event, indicate how each event was mentioned by using the following numbers.

1 - stated correctly
2 - stated vaguely
3 - stated incorrectly (i.e. misperception)

1) fish swimming - Refers to the opening scene where the fish is swimming by a rock just before it is attacked by the crab. The idea of 'swimming' has to be present to receive a score of '1'. Saying 'there is a fish' is coded as '2'.

1	2	3
floating	appears to be	flying
swims up to	there is a	attack by a
	comes up	rock
	this is	annihilates
	you see	kills
	comes up	

2) crab attacking fish - Refers to the crab attacking the fish for the first time. Score as vague if the verb for attack is ambiguous or too general (e.g. meeting, confrontation).

1	2	3
chase	going back and	eats
grabs	forth	
after it	he after in	
fight	runs into	
tries to catch		
snapping away		
tries to grab		

3) fish crawling - Refers to the snail/fish crawling away once under the shell. There has to be a verb denoting motion on the part of the fish if the unit is scored as correct.

1	2	3
walking	continues on	
sneaking	gets away	
creeping		
moving along		

4) fish relieved - Refers to the scene in which the fish wipes his brow after crawling onto a rock ledge that is shaped like an alligator. Score this event as

incorrect if ledge is called an alligator. (NB. Also score the object 'ledge' as incorrect).

1	2	3
thinks he is safe		swimming into
figures he's secure		inside a mouth
		climbs into a

5) crab attacking fish - Refers to the crab attacking the fish for the second time. Score as vague if the verb for attack is ambiguous or too general (e.g. meeting, confrontation).

1	2	3
tries to catch	runs into	
trying to get it	keeps away from C	
chasing him	getting away	
chases	upon him	
after it		
snipping at him		
snips at him		

6) fish meeting eyefish - Refers to the little fish running into the fish with big eyes. Score as vague if there is no mention of 'traveling' by the little fish before it sees the fish with big eyes.

1	2	3
goes and sees	by some eyes	other objects
meets	there	chasing it
runs into	big eyes after	
approaches	him	
is met by	saw his eyes	
swam past and saw	here is a pair	
	sees 2 big eyes	
comes across	there is a couple	
swims and sees		

7) crab attacking fish - Refers to the crab attacking the fish for the third time after the fish has encountered the fish with big eyes. Score as vague if the verb for attack is ambiguous or too general (e.g. meeting, confrontation).

1	2	3
to cut at him	interviews	
at it again	smack into	
fighting	avoiding trouble	
after him	running into	
gone after	there comes the crab	
catches and tries	coming at him	
	have another encounter	
to get it	caught up with it	

8) fish escaping pike - When the fish escapes the third crab attack, he swims into the mouth of the pike and quickly swims out. Code as explicit when they say the 'fish gets out of the mouth' or 'goes in the mouth and leaves'. Code as vague when they say 'just about got eaten'.

1	2	3
gets away	just about got	
gets out of	eaten	
there	leaves	
	didn't get caught	
	just missed him	
	about to be eaten	

9) crab attacking fish - The fish escapes the pike by swimming out of its mouth but before it gets too far, it runs into the crab for the fourth time. The crab attacks but only for a moment as the pike appears with its mouth open. This event is not mentioned very often and if it is, it is usually vague.

1	2	3
trying to get	goes underneath	
tries to get	crab is after	
	crab right behind him	

10) pike chasing fish - Refers to the pike chasing the fish. Code as vague if they only mention 'swimming' without a direction (like 'after him').

1	2	3
is after	they're running	
takes after	is ahead	
being chased	is trying to get away	
	swimming around	

11) fish and pike entering ship - Refers to either the pike or fish entering the sunken ship. Score as vague if they do not use verbs of motion or movement but simply say 'they are inside'. NB. They do not have to mention both pike and fish, as long as they mention one of them.

1	2	3
chased inside	in and out	
chased into	they come to a hole	
down into	chase continues	
has gone down	is in	
goes in	off through	
goes down		
going into		

12) fish and pike entering sponge - Refers to either the pike or fish entering the sponge. Score as vague if they do not use verbs of motion or movement but simply say 'they are inside' NB. They do not have to mention both pike and fish but as long as they mention one of them.

1	2	3
lands in	into	
swam into	comes to a place	
disappears into	in a	
swims into	off into	
goes into		
both land		
swims in		
gone into		

13) bubbles rising - Refers the scene after the pike has entered the sponge and has looked around. A bunch of bubbles are shown floating to the top.

1	2	3
* bubbles in motion	* bubbles as a state	
bubbles that float	causing a lot of bubbles	
bubbles going up	a mass of bubbles	
bubbles are escaping	bubbles all over	
	see bubbles	

14) pike and crab attacking fish - Refers to either the crab or pike attacking the fish at the very end of the cartoon. Score as vague if the verb for attack is ambiguous or too general (e.g. meeting, confrontation)

1	2	3
trying to puncture	having another set	attack another creature
tries to get	sticks at it	

B. Salient Objects

The 24 objects are numbered and examples are provided below. After familiarizing yourself with each object, indicate how each object was mentioned by using the following numbers.

1 - stated correctly
2 - stated vaguely
3 - stated incorrectly (the object was mispercieved or misinterpreted)

Object #	Specific	Vague	Incorrect
1	ocean sea water		
2	rock		animal
3	claws pincers		scissors
4	shell	cover hood	house
5	twig vine tree foliage piece of seaweed branch	piece of something something or other	
6	rock	shell of some kind perch	mouth
7	ledge	shelf	
8	cap hat shell		
9	rock		
10	claws pincers	sharp fingers	
11	cavern cave	somewhere rock	
12	eyeballs eyefish luminous eyes	large face mask	
13	mouth		
14	jaws teeth		

15	pincers claws	sharp fingers	
16	mast		
17	shipwreck sunken boat boat derelict ship sunken wreck sunken ship	obstruction night thing boat cavern various places	some kind of machine
18	hold hole in the deck hatch hull of boat	hole porthole	treasure chest manhole
19	porthole	some piece tube little hole opening	
20	seaweed sponge sand garbage	softlike material structure like snow sand or foam soft material foamy thing jellied mush pile of bubbles pourous	coral shells rock surface mushrooms snowbank jellyfish
21	like soap bubbles air bubbles bubbles	ball circle	
22	pincers		
23	fish bubble	container	
24	mouth		

C. Semantic Units

The transcripts have already been parsed in such a manner so that each line preceded by an 'S' indicates one utterance. Utterances are classified into semantic categories according to nature of the information they

convey. When coding for semantic information, consider only content words. Remove or ignore all the extraneous or noncontent words and consider only the nouns and verbs that refer to the ongoing action of the story. There are eight different categories of semantic information.

Utterances often contain both semantic information and stylistic infromation as well as multiple occurrences of each type of story information. Two or more categories of semantic information in one utterance is indicated by the use of conjunctives like 'but' or 'and' as well as prepositions like 'to' when they are followed by verb phrases (as in 'to do something'). When two or more categories are conveyed in the same utterance, join the codes (used to represent each category) into a multiple code.

1 - State - An objective condition of the world environment or characters. Independent existence from any action or event. Because their are state changes throughout the cartoon, this information can be conveyed at any time. NB. Use this category only when the majority of the utterance is state information. State information in the form of adjectives or adverbs are coded as elaborations.

eg. - takes place in the ocean
- there is a crab
- he is too big
- there is a ship

2 - Goal Information: Actions, events or states which by virtue of the verb or additional information (information which provides an explanation of the behavior) communicate purposive behavior or behavior directly related to the implicit goals behind each character (implicit goal - fish wants to escape and the crab and the pike want to catch the fish).

eg. - swims away, swimming
- hides, hiding
- escapes, escaping
- chases, chasing
- gets away, getting away
- goes after, going after
- attacks, attacking
- trying to attack/get away
- the snail turns around to see if the crab was watching

NB. the additional information "to see if the crab was watching" qualifies this as a goal.

- threatening
- didn't catch him
- finds it
- doesn't find it
- is safe
- is looking for him
- seeking

NB Use the goal information conservatively to avoid coding utterances that only indirectly reflect goals. When additional information is included, do not score it separately as it is already captured by the goal related code. The exception to this is when the additional information refers to novel action/events that have occurred in the story.

3 - Actions Information - Information describing physical action such as 'swimming' or 'running' on the part of a character with no overt or direct relationship to the goal at hand. In other words, no explanation for the behavior can be derived from the information within the utterance. Can also refer to action on the part of inanimate objects.

eg. - the shell fell off
- the bubble rose
- crawling on the ocean floor
- turns around and continues
- swimming by a rock

4 - Perception Information - Information describing the perception of a character. Usually by the word "see". Words like "looking" and "watching" are not considered as perceptons but they may be goal-related information. NB. The word "see" can also refer to a thought so caution is advised when coding perceptions.

eg. - the crab sees the fish in the bubble
- captures his attention
- spots the fish
- spies the fish
- notices
- can't see

5 - Thoughts Information - Information describing the current thoughts and beliefs of characters. Usually indicated by verbs "knows" and "thinks" that specify internal events. The additional information following such verbs is captured by the code for thoughts so do not code the additional information unless it is novel. This category also includes any speech acts by any character (e.g. says 'how do you do?')

eg. - the fish thought this was a great way of fooling the crab.
NB. 'fooling the crab' has already occurred so it is not coded
- thinks he is safe
- thinks he is smart
- knows he is in trouble

6 - Emotions - Information describing the emotions and feelings of characters. These can be embedded and reasons may be given for the emotion. Do not code for the reasons unless the information is novel (eg. the fish got scared because he ran into an eye fish). Emotions are usually one word expressions and thoughts are usually longer expressions

eg. - the fish was scared
- the fish was frightened
- the fish felt secure

7 - Outcome - Information provided only at the end of the cartoon which explicitly informs the listener that the story is over.

eg. - that is all
- that is the end
- that is it

8 - Unclassifiable - Information which does not fall into any of the categories above, but is definitely related to the story.

D. Referring Expressions

Code for the way in which the fish (snail), crab and pike characters (or parts thereof) are refered to at any time. Each time a character is mentioned, (as a subject or an object of a sentence) use the following codes to indicate how they are mentioned. Use combinations of codes when appropriate. When multiple labeling of a character occurs, do not code for categories that are repeated within the mulitple label unit. (eg. the character reference is coded as 43 in 'the fish or big fish is chasing the . . .')

0 - role - villian, good guy, victim, hero
1 - proper names - Donald, Mister Crab
2 - specific - crab, shark, aligator, goldfish, snail
3 - general - fish
4 - spatial - big, small, little
5 - personal - vicious, delectable, poor, mean
6 - unspecified - gaffer, creature, animal, fellow, guy, thing

When the characters (fish, crab, and pike) are referred to anaphorically, use the following single codes. Do not code anaphoric references that are immediately repeated (eg. he, he swam away) or in transcribers' brackets (eg. he (he was) is too big).

7 - anaphoric - eg. pronouns like he, she, it, or they
8 - ambiguous anaphoric - when the referent cannot be determined

E. Style Units

A - Questions/Hedges - Use this category when the utterance communicates labeling difficulty or uncertainty either in the form of a question or as an admission of uncertainty in lexical terms.

eg. - what is that
- I don't know what that is
- alligator or crocodile
- looks like
- kind of like
- seems like
- seems to be
- something

B - Exclamations/Sound Effects - Use this category for clear examples. Exclamations like "oh", "um" and "ahh" are to be ignored.

eg. - oh my goodness,
- zoom
- zip
- lo and behold

C - Detail - Use this category when additional detail on objects and places are mentioned. This usually includes modifiers like 'on top of' or at the bottom'. Only use the code once if several modifiers are applied the same object.

D - Action Attributes - Use this category when the manner of action or goal information is specified. Usually adverbs. Only one code per action (e.g. "silently and carefully walking" is coded with one code).

E - Object Attributes - Use this category when a property(ies) of an object is mentioned. Usually adjectives. Only one code per object.

eg. - dark cave
- big eyes

F - Repititions - Use this category for utterances containing multiple instances of a single word.

eg. - running and running

G - Story Comments - Use this category for utterances directed towards the audience. Usually holistic in nature (ie. refering to the entire story). Usually opinions and story evaluations.

H - Unclassifiable - Utterances which do not fall into any of the categories above, but are definitely not related to the story.

VII. Appendix B: Summary Tables

Table A

Mean proportion of Correct, Vague and Incorrect Events

Category		Young	Middle-Age	Old
Correct	BA	0.61	0.56	0.53
	A	0.61	0.48	0.46
	AA	0.61	0.56	0.54
	M	0.61	0.54	0.51
Vague	BA	0.17	0.13	0.15
	A	0.18	0.18	0.20
	AA	0.14	0.11	0.16
	M	0.16	0.14	0.17
Incorrect	BA	0.00	0.01	0.04
	A	0.00	0.02	0.03
	AA	0.00	0.00	0.04
	M	0.00	0.01	0.04

Note. BA refers to below average working memory score, A refers to average working memory score and AA refers to above average working memory score.

Table B

Mean proportion of Correct, Vague and Incorrect Objects

Category		Young	Middle-Age	Old
Correct	BA	0.42	0.38	0.29
	A	0.51	0.33	0.27
	AA	0.45	0.40	0.36
	M	0.46	0.37	0.31
Vague	BA	0.05	0.05	0.04
	A	0.03	0.05	0.04
	AA	0.03	0.03	0.05
	M	0.04	0.04	0.04
Incorrect	BA	0.02	0.03	0.03
	A	0.01	0.02	0.04
	AA	0.02	0.01	0.04
	M	0.02	0.01	0.04

Note. BA refers to below average working memory score, A refers to average working memory score and AA refers to above average working memory score.

Table C

Mean Frequency of State, Action, and Goal Semantic Categories

Category		Young	Middle-Age	Old
State	BA	4.30	4.80	3.20
	A	3.90	3.40	4.00
	AA	3.60	2.40	5.40
	M	3.93	3.53	4.20
Action	BA	19.70	19.40	15.20
	A	24.00	17.80	16.50
	AA	21.80	20.80	20.60
	M	21.83	19.33	17.43
Goal	BA	13.60	9.80	6.90
	A	10.70	9.50	9.20
	AA	12.80	12.20	9.00
	M	12.37	10.50	8.37

Note. BA refers to below average working memory score, A refers to average working memory score and AA refers to above average working memory score.

Table D

Mean Frequency of Perception, Thought, Emotion, Outcome, and Unclassifiable Semantic Categories

Category		Young	Middle-Age	Old
Percept.	BA	1.50	0.80	1.70
	A	1.70	1.20	1.30
	AA	1.60	1.30	0.80
	M	1.60	1.10	1.27
Thought	BA	1.90	1.60	1.30
	A	1.70	1.40	0.80
	AA	2.20	1.50	1.20
	M	1.93	1.50	1.10
Emotion	BA	0.40	0.60	0.10
	A	0.70	1.00	0.50
	AA	1.20	1.20	0.70
	M	0.77	0.93	0.43
Outcome	BA	0.20	0.10	0.10
	A	0.10	0.20	0.30
	AA	0.20	0.30	0.20
	M	0.17	0.20	0.20
Unclass.	BA	0.50	0.20	0.40
	A	0.20	0.40	0.30
	AA	0.10	0.40	0.10
	M	0.27	0.33	0.27

Note. BA refers to below average working memory score, A refers to average working memory score and AA refers to above average working memory score.

Table E

Mean Frequency of Noun Categories

Category		Young	Middle-Age	Old
Role	BA	0.00	0.00	0.20
	A	0.00	0.00	0.00
	AA	0.00	0.00	0.10
	M	0.00	0.00	0.10
Name	BA	0.00	0.00	0.00
	A	0.00	0.00	0.00
	AA	0.50	0.00	0.10
	M	0.17	0.00	0.03
Specific	BA	6.90	9.60	6.50
	A	8.90	8.90	7.30
	AA	11.10	9.60	7.40
	M	8.97	9.37	7.53
General	BA	16.10	10.20	6.00
	A	14.30	8.40	7.30
	AA	13.00	11.50	7.40
	M	14.47	10.03	6.90
Unspec.	BA	1.30	0.80	2.50
	A	0.20	1.80	1.80
	AA	0.10	0.30	1.40
	M	0.53	0.97	1.90

Note. BA refers to below average working memory score, A refers to average working memory score and AA refers to above average working memory score.

Table F

Mean Frequency of Pronoun Categories

Category		Young	Middle-Age	Old
With	BA	17.30	16.50	15.90
	A	16.50	18.40	14.90
	AA	20.60	16.70	17.00
	M	18.13	17.20	15.93
Without	BA	0.60	0.50	1.60
	A	0.40	0.40	1.20
	AA	0.30	0.80	0.80
	M	0.43	0.57	1.20

Note. BA refers to below average working memory score, A refers to average working memory score and AA refers to above average working memory score. With refers to pronouns whose antecedent reference could be determined and Without refers to pronouns whose antecedent reference could not be determined.

Table G

Mean Frequency of Modifier Categories

Category		Young	Middle-Age	Old
Personal	BA	1.20	1.40	1.10
	A	0.70	0.70	1.30
	AA	1.40	0.80	2.00
	M	1.10	0.97	1.47
Spatial	BA	13.20	4.90	5.70
	A	10.50	6.20	5.70
	AA	9.20	5.40	7.20
	M	10.97	5.50	6.20

Note. BA refers to below average working memory score, A refers to average working memory score and AA refers to above average working memory score.

Table H

Mean Frequency of Detail, Action Attribute, Object Attribute, and Repitition Style Categories

Category		Young	Middle-Age	Old
Detail	BA	2.10	3.10	1.40
	A	0.90	0.70	0.70
	AA	2.50	3.20	2.80
	M	1.83	2.33	1.63
Action Attr.	BA	0.90	1.00	1.00
	A	0.80	0.50	0.10
	AA	1.10	0.40	0.60
	M	0.93	0.63	0.57
Object Attr.	BA	0.70	1.00	0.50
	A	0.20	0.00	0.30
	AA	0.50	1.30	0.80
	M	0.47	0.77	0.53
Repit.	BA	0.60	0.20	0.50
	A	0.50	0.30	0.60
	AA	0.30	0.40	0.40
	M	0.47	0.30	0.50

Note. BA refers to below average working memory score, A refers to average working memory score and AA refers to above average working memory score.

Table I

Mean Frequency of Hedge, Sound Effect, Comment and Unclassifiable Style Categories

Category		Young	Middle-Age	Old
Hedge	BA	2.80	2.70	3.40
	A	1.20	3.00	4.40
	AA	1.60	2.50	7.60
	M	1.87	2.73	5.13
Sound Effect	BA	2.10	0.30	0.20
	A	0.20	0.60	0.00
	AA	0.20	0.60	0.60
	M	0.83	0.33	0.27
Comment	BA	1.30	0.90	0.60
	A	0.70	0.80	1.40
	AA	1.00	0.90	0.70
	M	1.00	0.87	0.90
Unclass.	BA	0.00	0.20	0.10
	A	0.10	0.00	0.00
	AA	0.00	0.00	0.00
	M	0.03	0.07	0.03

Note. BA refers to below average working memory score, A refers to average working memory score and AA refers to above average working memory score.