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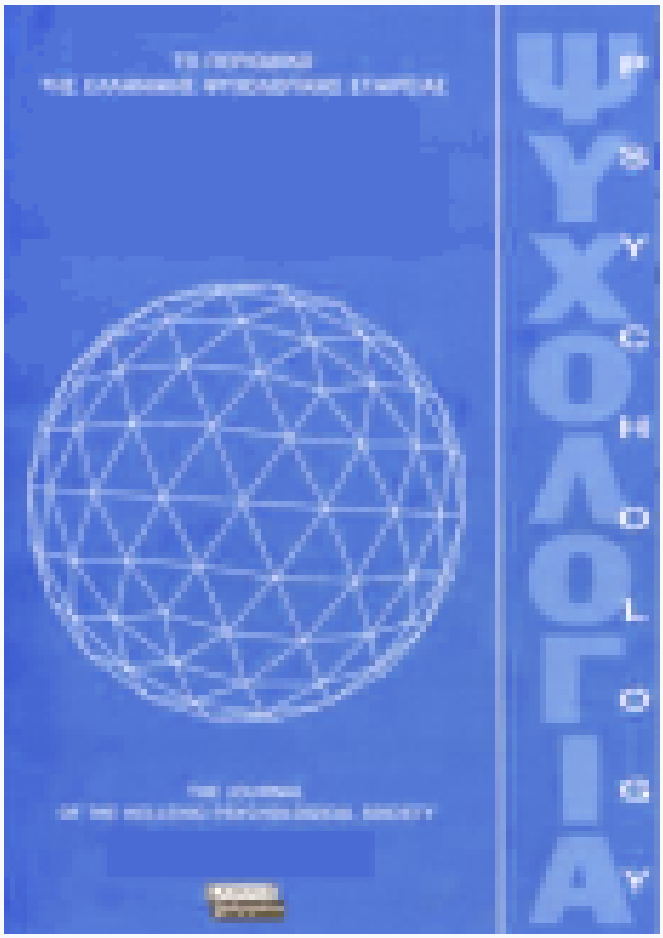


# The effects of age and language on paragraph recall performance: Findings from a preliminary cross-sctional study

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# The effects of age and language on paragraph recall performance: Findings from a preliminary cross-sctional study

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*ABSTRACT* This study investigated the effects of language and age on paragraph recall performance in 60 native Greek (Cypriots) and 45 English (American) speakers ages 16 and older. Subjects in each language group were subdivided into three age groups: young adults under 50, middle aged adults ages 55-70, and older adults over 70. In general, Greek speaking participants recalled fewer ideas than their English speaking counterparts during the immediate and delayed recall performance. In addition to language, age resulted in significant declines in the immediate and delayed recall performance for both language groups. The results support the necessity for normative data for linguistically and culturally diverse populations.

*Key words*: Memory, Elderly, Verbal recall, Cross-linguistic

## 1. Introduction

Older adults are the largest growing segment of western societies. Consequently, a great deal of attention is given in helping older adults maintain productivity and independence for several years after formal retirement. Research suggests that a decline in working memory performance is a consequence of normal aging and may interfere with independence and participation in daily activities (Baddeley et al., 1999. Constantinidou & Baker, 2002. Craik & Salthouse, 1992. Jones & Rabbitt, 1994). Age differences are generally observed after the 6th decade of life and are primarily noted in tasks that target working memory mechanisms by manipulating information or by requiring delayed recall, as compared to simple automatic tasks such as digit forward span tasks (Craik, 1991. Kasniak, Poon & Riege, 1986).

The Wechsler Memory Scales (WMS) enable the assessment of a broad range of episodic, declarative memory abilities (Price, et al., 2002). The Logical Memory subtest of the WMS-Revised and the WMS-III is a prose learning test that

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evaluates thematic recall and factual knowledge immediately and after a 30 minute delay (Gomez-Perez & Ostrosky-Solis, 2006). Logical Memory has been reported to be one of the most reliable tests in the discrimination between healthy older individuals and individuals with mild dementia (Calderon et al., 2001. Johnson, Storandt & Balota, 2003. Lautenschlager et al., 2006).

While neurologically normal older adults perform better on paragraph recall tasks than older adults with brain pathologies, normal aging has been shown to affect paragraph recall abilities (Fastenau, Denburg & Abeles, 1996. Horn et al., 1987. Lee et al., 2004). Paragraph recall tasks like the Logical Memory are sensitive to normal aging changes and to brain pathology because they place certain demands on the cognitive system, by requiring auditory comprehension, conceptual organization, and verbal auditory memory (encoding, retention, and retrieval) (Dunn et al., 2002).

The decline in working memory abilities is probably a result of the dynamic neurobiological processes that occur during the brain development across the lifespan. These processes seem to be selective, affecting different areas of the brain at different rates. The neuropathology of normal aging involves prefrontal cortical areas as well as the inferior temporal lobe areas. These areas sustain the greatest diminution of blood flow and neuronal loss and shrinkage. In addition, subcortical areas such as the hippocampus are susceptible to cell loss (Kramer, Mungas & Reed, 2007). In fact, the hippocampus loses approximately 5% of its cell mass for every decade past age 40 (Lezak, 1995). In addition to cell loss, the availability or reuptake efficiency of certain neurotransmitters seems to be affected by age, which in turn can result in a decrease in the speed of synaptic signal transmission (Wu, Oh & Distenhoft, 2002). The above neuropathological changes provide a framework for understanding the cognitive changes observed with aging because the prefrontal, inferior temporal, and hippocampal areas are critical for organizing, categorizing, learning, and retrieving information (Lee et al., 2004).

Based on the above changes, it has been hypothesized that the memory decline observed with aging on textual recall may be a result of a reduction in the processing capacity (Cohen, 1988). All three components of the processing capacity could be affected by the aging process: (a) working memory: the ability to hold information and the products of the manipulation of that information in a temporary storage, (b) speed of processing: for adequate processing of information, the rate of processing has to be at least the same as the rate of information input, else information will be either lost or inadequately processed, and (c) processing resources: processing resources can be understood as part of Baddeley's central executive system. Based on Baddeley's theory, the processing recourses are responsible for allocating attention and imposing control over the activities of the working memory (Baddeley, 1999. Baddeley, 2000. Fastenau, Denburg & Abeles, 1996).

The processing capacity hypothesis predicts greater age differences if the text is complex and it places demands on the processing system by requiring extensive information processing. In addition to the complexity, topic familiarity and rate of input influence information processing in older adults who seem to have difficulty in utilizing contextual information as effectively as younger adults (Cohen 1988. Constantinidou & Baker, 2002. Fastenau et al., 1996).

Based on the processing capacity hypothesis, older adults could experience difficulty primarily in information encoding. Information encoding is very much related to the initial (immediate) recall of textual information; hence older adults are expected to score lower than their younger cohorts at the immediate recall condition. Several studies provide support to the processing capacity hypothesis. Specifically, studies that measured prose recall using the Logical Memory I & II tests of either the WMS-R or the WMS-III reported a difference in performance between younger and older adults in both the immediate recall and the delayed recall conditions (e.g. Lange et al., 2006. Constantinidou

& Baker, 2002. Gomez-Perez & Ostrosky-Solis, 2006). Some studies reported that the percent retention during the delayed recall condition was comparable to that of younger subjects (Cullum et al., 1990. Halland, Price & LaRue, 2003. Price, Said & Halland, 2004).

While the most predominant expectation for studies comparing the performance of different age groups would be that age-associated decline will be evident in both recall conditions (due to impaired encoding), some studies reported decline only during the delayed recall condition (see Johnson, Storand & Balota, 2003). No differences in the immediate recall condition suggest that older people encode the textual information as effectively as their younger cohorts. Johnson et al. (2003) postulated that perhaps the capacity to store information declines with aging in comparison to the encoding capacity. However, if one were to approach normal aging like any other clinical condition, it could be hypothesized that there are different patterns of performance depending on the neurobiological patterns of aging as well as other important patient characteristics; one subgroup demonstrating encoding difficulties, whereas another subgroup demonstrating primarily retention difficulties. Of course, one cannot discount the fact that within the aging population, there may be individuals with memory impairments mixed-in with the healthy older adults. Consequently, it is important to use valid and reliable assessment tools in order to assess memory abilities accurately and then (depending on the type and nature of the impairment) implement appropriate treatment programs to improve memory functioning in older adults.

In addition to age, cultural differences have been shown to influence memory performance on standardized tests such as the WMS-R (Nell, 1999. Ardilla, 1995). Variables such as cultural biases regarding testing, the level and type of the speaker's education, the linguistic structure of a given language, as well as cultural experiences may have to be taken into consideration when a test is to be applied cross culturally.

According to Nell (1999), psychological tests were "conceived and standardized" within the western culture. A test situation is a competitive situation where the examinee is expected to achieve a specific level of performance. Standardized tests are a well-integrated part of the western society and hence from a very young age through education children are exposed to testing situations. This suggests that the majority of tests are more likely to assess "highly trained" abilities and also that the testing behaviour itself is encouraged and enhanced via the educational system and societal values. Members of individualistic cultures (like Western European countries, Canada, and the United States) are expected to demonstrate individual excellence, whereas for collectivistic cultures not the same rules or values for individual distinction apply (Nell, 1999). In non-westernized cultures where school systems and educational practices vary, individuals are very much likely to feel uncomfortable in a testing environment either due to lack of testing experience or because the content of the test may be meaningless to them (Nell, 1999).

In cross-cultural neuropsychology, cultural differences typically encompass language differences. After all, each cultural group is characterized by specific language patterns unique to their shared experiences. Consequently, teasing out and measuring the contribution of language vs. cultural differences in cross cultural-neuropsychological performance poses significant methodological challenges.

Language consists of the five cardinal aspects: phonology (the sounds and their combinations to make words), morphology (the smallest units of meaning), syntax (the combination of words to make sentences based on a set of rules), semantics (the meanings and concepts) and pragmatics (the accepted rules for the social use of language according the specific contexts). Language can be used in an oral or written format as a means of processing and expressing ideas for the purposes of communication and learning. Consequently, language proficiency (in oral and written form) as pointed by Gasquoine (1999) and

Lautenschlager, Bonney, Flicker, and Almeida (2006), has a mediating role during verbal memory test performance.

Several sensitive tests have been developed to assess memory abilities in speakers of English and have been adapted and standardized successfully with speakers of other languages. To date, cognitive-linguistic assessment has yielded test adaptations for speakers of numerous languages including Chinese, Chamorro, Cree, Croatian, Czech, Danish, Dutch, Finnish, French, German, Hindi, Icelandic, Italian, Japanese, Malay, Spanish, Vietnamese, and Yoruba (Wolfe, 2000). Only a few studies have addressed neuropsychological test adaptation from English into the Greek language (Vlahou & Kosmidis, 2002. Giannakou & Kosmidis, 2006). Likewise, there is scarcity in the number of studies that have generated normative data specifically for measuring cognitive-linguistic performance in older Greek speakers (Kosmidis et al., 2004. Messinis, Tsakona & Papathanasopoulos, 2006).

Even though there has been an effort by researchers in Greece and Cyprus to adapt sensitive measures into Greek, the population in Greece and Cyprus is not homogeneous and variables such as geographic location, level of education, use of a native dialect, and socioeconomic status need to be controlled and considered in order to obtain data with appropriate external validity.

Based on the above, test users need to be cautious when administrating tests that were developed with an English language framework in mind such as the Logical Memory test to populations who are not native English speakers, even if these populations are proficient in their daily use of English. The present study was part of a research program investigating the effects of age, language (and more extensively, culture) in memory performance. The purpose of this study was to explore the differences in performance between younger and older American-English and Greek-Cypriot speakers on the Logical Memory I & II Tests of the Wechsler Memory Scale-Revised. In order to reduce some of the aforementioned testing pitfalls, the Logical Memory paragraphs were translated and adapted by a team of psychologists and speech-language pathologists in Cyprus.

The primary research hypotheses were as follows:

a) There will be differences in paragraph recall performance between the English and Greek speaking participants across age groups during the immediate and delayed recall conditions.
b) The older adult groups will score lower than the middle age and younger adult groups during the immediate and the delayed recall conditions.
c) Older adults will demonstrate a greater degree of retroactive interference than younger participants in the study.

## 2. Methods

### Participants

The participants of this study were 117 males and females ranging in age from 16 to 88. Forty-five subjects (18 males, 27 females) were English speakers from the Southwest Ohio (USA) area and 72 subjects (30 males, 42 females) were native Greek speakers from Cyprus. Data from twelve Greek speakers were not included in the analyses because of low education levels (less than 9 years of formal education). Each language group was divided into 3 subgroups based on their age totalling to 6 subject groups. Table 1 presents the basic demographic characteristics per group. Participants were matched for age and education years (+ or -2 years). There were no significant differences between the US and Greek subgroups on age and education levels (see Table 1). In addition, there were no differences in education across the three age subgroups of the English or Greek participant groups, $F(2, 44)=2.57$, $p=0.089$ and $F(2, 57)=1.09$, $p=0.343$ respectively.

English speaking participants were recruited

**Table 1**
**Demographic information**

| | **Age** | | | **Education Years** | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | M (SD) | | | M (SD) | | |
| Groups | Greek | US | *t*(df) *p* | Greek | US | *t*(df) *p* |
| Under Fifty | 25.9 (6.83) N=33 (16.00-49.00) | 25.62 (5.80) N=16 (16.00-50.00) | 0.143(47) $p=0.887$ | 14.90 (2.90) (10.00-20.00) | 15.59 (1.2) (10-28) | 0.895(47) $p=0.375$ |
| 55-70 Middle Aged | 62.47 (5.10) 16 (55-70) | 63.59 (4.25) 14 (55-70) | 1.271 (28) $p=0.214$ | 13.82 (2.32) (12.00-19.00) | 14.96 (2.49) (12.00-21.00) | 1.348 (28) $p=0.188$ |
| 70+ Older | 75.77 (4.91) 9 (72-88) | 75.41 (2.80) 16 (71-79) | 2.43 (24) $p=0.810$ | 13.77 (1.78) (12.00-17.00) | 14.41 (1.66) (12.00-16.00) | 0.903 (24) $p=0.392$ |

by undergraduate and graduate students from Miami University, and Greek speaking participants by undergraduate students from the University of Cyprus and from registered speech-language pathologists who had access to normal older adults. Participants were non paid volunteers from Southwest Ohio and Northern Kentucky (US Group) and from the greater Nicosia district (Greek-Cypriot group). The US participants were recruited through flyers at local senior community centers, through the existing subject pool in the NeuroCognitive Disorders Laboratory, Department of Speech Pathology and Audiology at Miami University, or through personal contacts. The participants from Southwest Ohio were from middle class socioeconomic backgrounds and lived in suburban areas. The Greek-Cypriot participants were recruited through flyers and personal contacts. Similar to their US cohorts, the Cypriot participants were of middle class socioeconomic backgrounds who lived in suburbs of the greater Nicosia area. As a group, southwest Ohio and Nicosia residents tend to be conservative individuals who value education, hard work, and have strong family values. Before taking the test all participants were interviewed to determine eligibility.

The inclusion criteria for all participants were the following: (1) healthy males and females ages 16 and above, (2) negative history for uncorrected vision or hearing impairment, (3) negative history for neurological or psychiatric disorder, cognitive or learning disability, (4) native speakers of Greek or English. The exclusion criteria for all participants were set to be: (1) positive history for loss of consciousness, stroke or other neurological problem, (2) uncorrected hearing impairment, (3) language or speech disorder, (4) learning disability, (5) history of substance abuse, (6) less than 10 years of formal education.

### Measures and Procedures

For the purposes of this study the Logical

Memory I & II tests of the Wechsler Memory Scale-Revised were administered. The Greek translation of the test maintained the semantic part of all the story units. However, names of persons, streets, and places were replaced with appropriate Greek names. The examiners followed the standard procedures described in the WMS-R administration manual during the immediate and delayed administration of the test. Appendix A displays the original and the translated stories.

### Scoring

For the English speakers, the study implemented the exact scoring procedures described in the test manual. In order to develop accurate scoring criteria for the Greek speakers, the following procedures took place as suggested by Lautenschlager et al. (2006).

Initially qualitative analyses of subject responses was conducted. The paragraphs were presented in standard Greek; however, all of the Greek speakers were also speakers of the Greek-Cypriot dialect and some of their responses were influenced by the dialect. Responses that were influenced by the dialect (phonologically, grammatically, syntactically, and semantically) but retained the main ideas and intended message of the given unit were given credit following the paradigm of the Standard English version. Appendix B has the scoring criteria.

After the translation and development of the scoring criteria, the Logical Memory I & II transcriptions from 5 Greek speaking subjects (totaling to 20 paragraph recalls) were given to 15 trained independent raters for scoring. The interrater scoring reliability was calculated with a Cronbach alpha test at 0.80, and was deemed satisfactory for the study.

Each participant's scores for the immediate and the delayed recall of Story A and Story B were computed. Each story consisted of 25 information units. Each information unit was worth a point and, therefore, the maximum score per story was 25 points. The Logical Memory I score was computed by adding the immediate recall scores from the two paragraphs for a maximum total score of 50. The Logical Memory II score was obtained by adding the delayed recall scores from the two paragraphs for a maximum score of 50.

In addition to the actual scores for each recall condition, the percentage retention between the immediate and delayed recall was calculated for each subject by dividing the number of information units recalled at the delayed condition with the number of information units recalled at the immediate condition for each story.

## 3. Results

The primary interest of the current study was to determine the effects of language and age on paragraph recall abilities. A repeated multivariate analyses of variance procedure (ANOVA) with two between (age and language groups) and one within (memory condition: immediate and delayed recall) effects was implemented. The results yielded significant ($a=0.05$) main effects for language, $F(1, 96)=7.17$, $p=0.009$, age, $F(2, 96)=12.97$, $p=0.0001$, and memory condition, $F(1, 96)=97.22$, $p=0.0001$ across groups. Overall, subjects recalled more ideas during the immediate recall as compared to the delayed recall condition. Performance on paragraph recall was better for the English speakers as compared to the Greek speakers. Age had an effect on paragraph recall performance and the patterns of performance were different across the age groups as indicated by the age and memory condition interaction, $F(2, 96)=3.45$, $p=0.026$. The interactions between language and memory condition (immediate and delayed recall) and language, age, and memory condition were not statistically significant, $F(1, 96)=2.68$, $p=0.105$, *partial Eta squared*$=0.027$, *power*$=0.368$ and $F(2, 96)=0.317$, $p=0.729$, *partial Eta squared*$=0.007$, *power*$=0.099$, respectively. Table 2 presents the mean scores for each group of participants according to language. Figure 1 is a graphic display of the performance

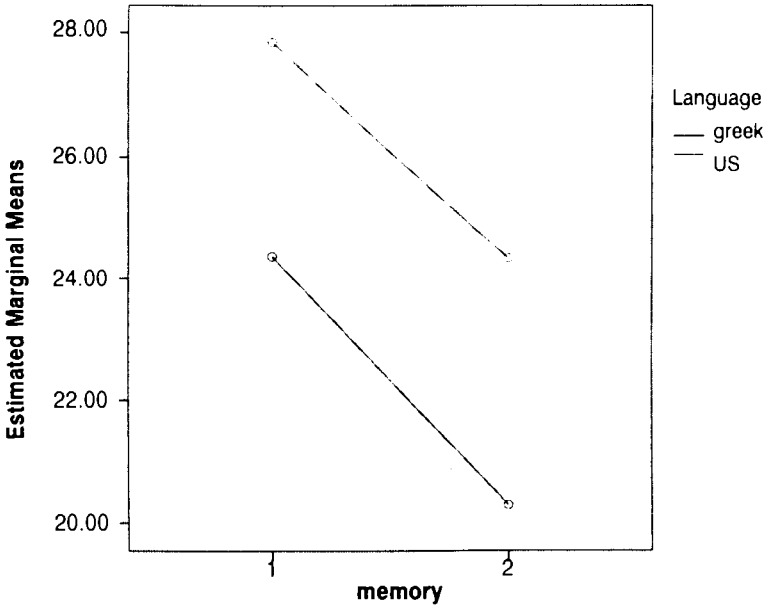


**Figure 1**
**Performance of the two language groups on the two memory tasks (1. immediate, 2. delayed).**

across language groups on the two memory conditions.

In order to further analyze the main effect of age, preplanned Helmert univariate contrasts (Bonferoni a/k=0.05/2=0.025) were conducted to determine which age groups contributed to the significant multivariate main effect. The analyses indicate that the younger group (under 50) and the middle aged group (55-70) performed significantly better than the older adult group (70 and older) $F(2, 96)=6.93$, $p=0.001$. There was no significant difference between the performance of the younger and middle aged groups, $F(1, 96)=2.75$, $p=0.069$. Pairwise comparisons conducted to investigate the age groups by memory condition interaction showed that the older group demonstrated a greater degree of change between the immediate recall condition and the delayed recall condition as compared to the other two groups, $F(1, 60)=6.49$, $p=0.013$. There was no significant difference in the degree of change between the immediate and delayed recall condition between the younger and middle aged groups, $F$ (1, 79)=3.78, $p=0.73$. Figure 2 is the performance across languages per age on the 2 memory conditions. Figure 3 is the performance according to age per language group.

### Effects of interference and retention scores

The percentage of retention for each story was calculated per participant as follows:

(Delayed Recall Score/Immediate Recall Score) x 100. MANOVA analyses (a=0.05) resulted in a significant age effect, $F(2, 96)=3.39$, $p=0.038$. Even though the mean retention score for the English speaking group was higher, the difference between the English and Greek speaking groups

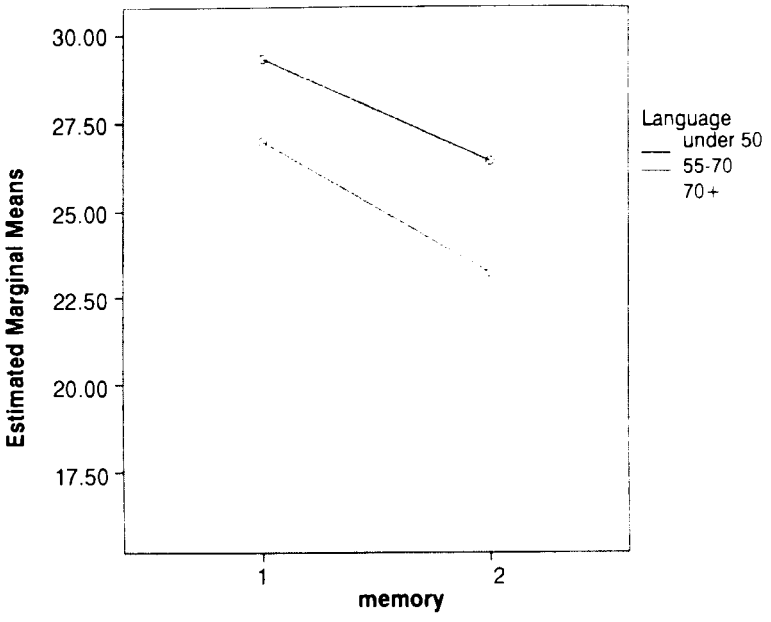


**Figure 2**
**Graphic plot of performance on the 2 memory tasks (1. immediate, 2. delayed) according to age groups**

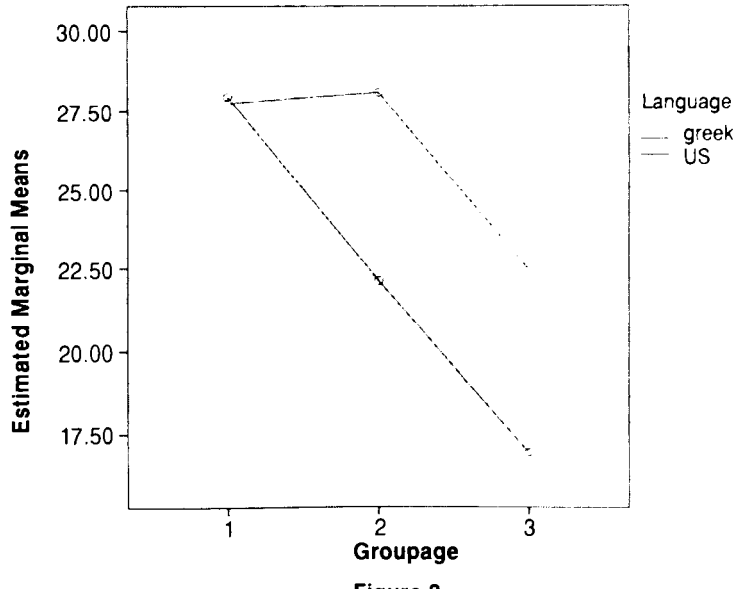


**Figure 3**
**Overall performance on the memory tasks according to language and age**

**Table 2**
**Logical Memory I & II per age and language group**

| | Logical Memory I | Logical Memory II |
|---|---|---|
| Greek Speakers | | |
| Under 50 | 30.34 (5.89) | 26.78 (8.01) |
| 55-70 | 25.18 (7.92) | 20.87 (7.70) |
| 70+ | 21.33 (5.89) | 14.78 (5.67) |
| Marginal Means | 24.87 (5.37) | 23.22 (8.73) |
| English Speakers | | |
| Under 50 | 29.87 (4.95) | 27.81 (5.45) |
| 55-70 | 30.79 (6.54) | 26.92 (7.33) |
| 70+ | 24.87 (5.37) | 20.46 (5.52) |
| Marginal Means | 28.49 (6.08) | 25.09 (6.84) |

Note. The score for Logical Memory I is the sum of the score for Stories A and B during the immediate recall condition; for Logical Memory II is the sum of the score for the two stories after the thirty minute delay.

**Table 3**
**Retention percentages per story and per group**

| | Retention % Story A | Retention % Story B |
|---|---|---|
| Greek Speakers | | |
| Under 50 | 84.52 (23.03) | 89.36 (25.52) |
| 55-70 | 77.55 (26.77) | 94.23 (35.85) |
| 70+ | 79.28 (31.42) | 60.90 (30.08) |
| Marginal Means | 81.73 (26.36) | 86.23 (31.00) |
| English Speakers | | |
| Under 50 | 84.17 (15.59) | 105.20 (21.29) |
| 55-70 | 85.90 (11.55) | 87.53 (18.39) |
| 70+ | 80.18 (24.02) | 87.54 (24.08) |
| Marginal Means | 83.38 (22.69) | 93.81 (22.63) |

**Table 4**
**Mean scores on immediate recall of Story A & B**

| | Recall Story A | Recall Story B |
|---|---|---|
| Greek Speakers | | |
| Under 50 | 16.36 (3.68) | 14.33 (3.18) |
| 55-70 | 12.91 (4.95) | 10.77 (4.13) |
| 70+ | 9.40 (4.43) | 8.27 (3.47) |
| Marginal Means | 13.78 (5.03) | 11.91 (4.30) |
| English Speakers | | |
| Under 50 | 15.12 (2.33) | 14.75 (3.18) |
| 55-70 | 15.86 (3.37) | 14.92 (3.73) |
| 70+ | 12.33 (3.37) | 12.53 (2.90) |
| Marginal Means | 14.42 (4.44) | 14.07 (3.70) |

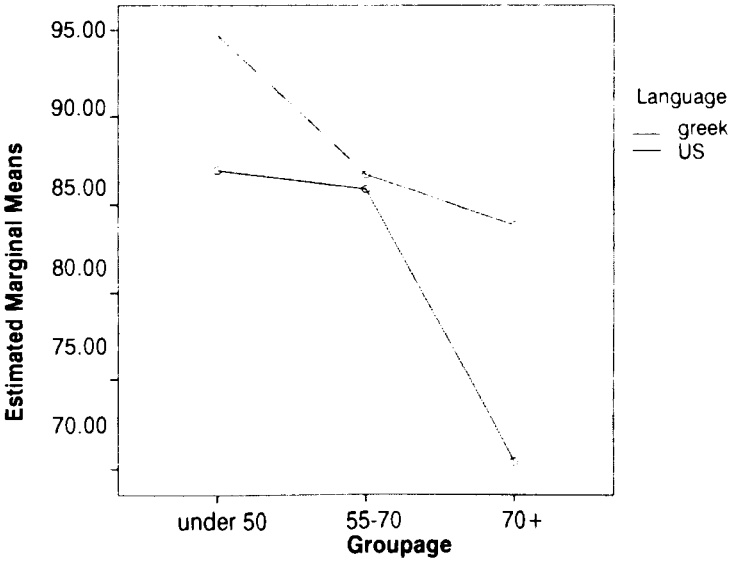


**Figure 4**
**Retention scores per language group according to age**

was not statistically significant, $F(1, 96)=2.96$, $p=0.089$, *partial Eta squared*$=0.03$, *power*$=0.398$.

As seen in Table 2, retention scores averaged at 77% for the older adult group, 86% for the middle aged group, and 90% for the younger adult group, across language groups. Preplanned univariate comparisons (Bonferoni a/k$=0.05/2=0.025$) indicate that the significant difference in retention occurred between the younger adult and the older adult groups, $F(2,96)=13.83$, $p=0.011$. There was no significant difference between the younger and middle adult groups or the middle aged and older adult groups, $F(1, 96)=4.51$, $p=0.356$ and $F(1, 96)=9.327$, $p=0.105$ respectively. Table 3 displays the retention scores per group. Figure 4 is a graphic display of the retention performances.

## 4. Discussion

The purpose of the present study was to investigate paragraph recall abilities in Greek (Cypriot) and English (American) subjects across three age groups: young adults under 50, middle age adults ages 55-70, and older age adults over 70. It was hypothesized that language and age will have an effect on paragraph recall abilities during immediate and delayed recall performance. The results indicate that the speakers of Greek who participated in this study recalled around 4-5 ideas less than their English speaking counterparts on both conditions (immediate and delayed recall conditions) of the paragraph recall task. Other researchers also reported the effects of linguistic factors affecting neuropsychological test performance during cross cultural research (Gasquoine, 1999. Kennepohl, 2004. and Nell, 1999).

In the present study, it is not possible to delineate the exact contribution of culture vs. language. The two groups lived about 10,000 km apart in different parts of the world. While great care was given in selecting participants with similar life styles and educational backgrounds, there is no doubt that underlying cultural differences occurred between the two groups. The stories were originally written in English and subsequently translated and adapted into Greek. Part of the difference between the two groups in encoding auditory verbal contextual information could be attributed to the fact that the original stories were written towards a different audience (both linguistically and culturally). So even though the stories were translated and adapted into Greek, the English speaking subjects had the "home advantage" so to speak. The present results are consistent with the context-process hypothesis (Wagner & Hayes, 2005). Drawing logical conclusions is influenced by culturally available schemata. *What* one thinks about, has some influence on *how* one thinks (Wagner and Hayes, 2005). Consequently, there is interplay between context (what) and process (how). In the present study, the context of the stories may have influenced the process, namely the encoding of the textual information.

One aspect of language that may have influenced the performance of the Greek speakers relates to the use of the Greek-Cypriot dialect spoken in the greater Nicosia area. Greek Cypriots receive all of their formal education in modern standard (mainland) Greek. The standard Greek is used during formal social and business dealings and in all written communication (both formally and informally since the dialect does not exist in written form). However, to some extend, most Cypriots use some aspects of the Greek-Cypriot dialect during daily social interactions. The dialect has differences (from modern standard Greek) not only in phonology (and pronunciation), but also in syntax, morphology, and semantics. Therefore it could be argued that the Greek dialect used during daily activities influenced the encoding and subsequent recall of the paragraphs which are similar in style to the written format found in magazine and newspaper articles. Familiarity and daily use and mastery of the standard Greek dialect and of the paragraph format could have influenced recall. Future studies may want to include a group of native speakers of standard Greek in order to investigate the exact contribution of the Greek Cypriot dialect in paragraph recall tasks.

In addition to language, age played a significant role in memory performance during both the immediate and delayed recall conditions. Older Greek and English speaking participants over 70 recalled significantly fewer ideas than their younger counterparts (subjects in the middle age and young adult groups) during the immediate and the thirty minute delayed conditions. The performance of participants in the young adult and the middle aged groups was similar. While this study is the first study investigating paragraph recall performance in Greek-Cypriot participants, the present findings are consistent with previous studies reporting observable significant declines in memory performance after 70 in English speaking participants (Craik, 1991. Kasniak, Poon & Riege, 1986. Lezak, 1995).

The present findings suggest that aging probably played a role during the initial encoding of information which in turn influenced the subsequent recall of ideas. Previous research with English speakers demonstrated similar patterns (to this study) during paragraph recall performance on the Logical Memory tests (Constantinidou & Baker, 2002. Price et al., 2004). Hence, the results are consistent with the processing capacity hypothesis, suggesting that the aging may have a large impact on the initial encoding of textual information (Price et al, 2004. Haaland et al., 2003). Fastenau et al, 1996).

The performance of older adults on the delayed recall condition is suggestive of a greater degree of retroactive interference effect in comparison to subjects under age 70. Future research should incorporate a recognition paradigm to determine if the retroactive interference effect was due to retrieval difficulties or due to a higher rate of forgetting in the older adult population.

### Conclusions and Clinical Implications

Native language and culture-related experiences more broadly can influence neuropsychological performance. Given the effects of injury and disease on memory abilities, memory testing plays an integral role during neuropsychological assessment. While there are several sensitive neuropsychological measures designed for English speaking patients, there is a scarcity of culturally appropriate tools designed for Greek speakers. Fortunately there is a trend in the past 10 years to adapt and norm tests into other languages. However, the Greek speaker from Nicosia, Cyprus and the Greek speaker from Astoria, New York for example have different linguistic and cultural influences that may affect their contextual and linguistic schemata and their performance on paragraph recall tasks. The present study points (one more time) to the need for population-specific normative data. Lack of culturally and age appropriate norms can result in overestimation or underestimation of cognitive abilities.

In the present study, Greek-Cypriot participants as a group did not perform at the same level as their English counterparts during the immediate recall and delayed recall conditions. The two groups were matched on important variables such as years of education, health, general socioeconomic status. However, while years of education were similar, it does not imply that the two groups had the same educational experiences. Furthermore, differences between the linguistic structure of the Greek language, the effects of the Greek-Cypriot dialect, and familiarity with the contextual information of the paragraphs could have influenced performance.

In addition to language, age contributed to performance changes across participant groups. While the age effects can be attributed in part by the neuropathology of normal aging, other factors can contribute to some of the different patters in performance noted between age groups. Ardilla et al. (2000) discussed the potential contribution of the cohort effects. The cohort effects refer to the unique experiences including specific educational experiences, of a group of people born at the same time or interval of time and the historical events or time effects that impact on developmental abilities, and may include changes in educational policy/

practices (Ardilla et al., 2000). Based on this theory, people born during the same period of history share many common experiences; consequently, differences between people born at different times may reflect the different influences operating on different cohorts rather than age differences per se.

### Limitations and future research

The present study is part of a systematic line of research in adult language and cognitive abilities with Greek participants. Given the modest sample sizes, the authors placed great effort in creating homogeneous groups. While this is one of the strengths of this study it also poses limitations in the generalization of the results. The results of the present study should be treated as preliminary until follow-up studies with larger sample sizes are conducted.

Further research is needed in this area that will include larger samples from a variety of educational and socioeconomic strata as these variables can influence memory performance. Additional samples representing diverse geographical regions would help avoid potential regional effects and provide a broader population representation. In addition, the interaction between age, language, and gender would be a fruitful line of investigation.

The paragraphs utilized in the present study were translated and adapted from the original English format of the test. This was done in order to maintain certain aspects of the test integrity. Future studies may consider generating stories that relate more to the cultural schema of the Greek speakers. In doing so, great care should need to be given to maintain the syntactic complexity, factual information structure, and demands on episodic memory of the current stories.

The assessment of paragraph recall abilities is an important aspect of clinical memory evaluation. Consequently, this line of research provides information on cross cultural effects in relationship to the interplay between language, cognition, and culture. In addition, it offers the opportunity for much needed normative data for clinicians working with Greek-speaking patients.

**Author Note**

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## Appendix A
## Stories for Logical Memory

*Note that the information units are separated by slashes (/). Each paragraph consists of 25 information units and each unit recalled correctly is worth one point.*

### Original Story A

Anna/Thompson/of South/Boston/, employed/as a cook/in a school/cafeteria/, reported/at the City Hall/Station/that she had been help up/on State Street/the night before/and robbed/of fifty-six dollars/. She had four/small children/, the rent was due/, and they had not eaten/for two days/. The police/, touched by the woman's story/, took up a collection/for her/.

### Original Story B

Robert/Miller/was driving/a ten-ton/truck/down a highway/at night/in the Mississippi/Delta/, carrying eggs/to Nashville/, when his axle/broke/. His truck skidded/off the road/, into a ditch/. He was thrown/against the dashboard/and was badly shaken/. There was no traffic/and he doubted that help would come/. Just then his two-way radio/buzzed/. He quickly answered/, "This is Grasshopper"/.

### Greek Version of Story A

Η Άννα/Θωμά/από την Κάτω/Πάφο/, που εργαζόταν/σαν μαγείρισσα/σε καφετέρια/ενός σχολείου/, κατέθεσε/στο σταθμό/της αστυνομίας/, ότι της επιτέθηκαν/στην οδό Ελευθερίας/το προηγούμενο βράδυ/και της έκλεψαν/πενήντα-έξι λίρες/. Είχε τέσσερα/μικρά παιδιά/που δεν είχαν φάει/για δύο μέρες/και χρωστούσε και το ενοίκιο/. Η αστυνομία/, ευαισθητοποιημένη από την ιστορία της γυναίκας/, έκανε έρανο/γι' αυτήν/.

### Greek Version of Story B

Ο Κώστας/Θεοδώρου/, οδηγούσε/το βράδυ/στον αυτοκινητόδρομο/φορτηγό/των 10 τόνων/, στην περιοχή/Λευκάρων/, μεταφέροντας αυγά/στη Λακατάμια/, όταν έσπασε/ο άξονας του φορτηγού/. Το φορτηγό γλίστρησε/από τον δρόμο/σ' ένα χαντάκι/. Ο ίδιος κτύπησε/στο παράθυρο/και τρακουνήθηκε άσχημα/. Δεν υπήρχε κίνηση/και αμφέβαλλε αν θα ερχόταν βοήθεια/. Ξαφνικά ο ασύρματός του/κτύπησε/. Ανταποκρίθηκε λέγοντας/«Εδώ Ακρίδα»/.

## *Scoring Criteria for Story A*

| α/α | Κείμενο Ιστορίας Α | Γενικός Κανόνας | Παραδείγματα απαντήσεων που παίρνουν 1 βαθμό | Παραδείγματα απαντήσεων που δεν παίρνουν κανένα βαθμό |
|---|---|---|---|---|
| 1 | Η Άννα | «Άννα» ή ένα παράγωγο του ονόματος | Άννυ, Αννίτα, Αννούλα | Αγγέλα, Μαρία, Ελένη |
| 2 | Θωμά | Αναγκαίο το «Θωμά» | | Θεοδώρου, Φωκά |
| 3 | Από την Κάτω | Αναγκαίο το «Κάτω» σε οποιοδήποτε Πλαίσιο | που ζούσε στην Κάτω, μένει στην Κάτω | |
| 4 | Πάφο | Αναγκαίο το «Πάφος» σε οποιοδήποτε Πλαίσιο | που δούλευε στην Πάφο, ερχόταν από την Πάφο, πήγαινε στην Πάφο | |
| 5 | Που εργαζόταν | Υπόδειξη ότι είχε δουλειά | δούλευε, που είχε δουλειά ως, που ήταν (μαγειρισσα), εργαζόμενη | ήθελε να γίνει, εργοδοτούσε ένα μαγειρα |
| 6 | σαν μαγείρισσα | Αναγκαίο το «μαγείρισσα» ή ένας τύπος της λέξης | η οποία μαγείρευε, μια μαγείρισσα | σαν σερβιτόρα, στην κουζίνα |
| 7 | σε καφετερία | Αναγκαία η λέξη «καφετερία» | Καντίνα | εστιατόριο, κουζίνα, μαγαζί |
| 8 | ενός σχολείου | Αναγκαία η λέξη «σχολείο» σε οποιοδήποτε πλαίσιο | σε σχολείο, στο σχολείο, του σχολείου | σε νοσοκομείο, σε εταιρεία |
| 9 | κατέθεσε | ένδειξη ότι μια επίσημη δήλωση έχει σε οποιοδήποτε πλαίσιο γίνει σε μια αρχή | είπε στην αστυνομία, κατάγγειλε, έκανε δήλωση, έκανε παράπονο, έδωσε την υπόθεση, ζήτησε τη βοήθεια | είπε, ανέφερε, διηγήθηκε |
| 10 | στο σταθμό | αναγκαία η λέξη «σταθμός» ή μια σχετική λέξη | στο τμήμα, στο αρχηγείο | |
| 11 | της αστυνομίας | αναγκαία η λέξη «αστυνομία» σε οποιοδήποτε πλαίσιο | πήγε στην αστυνομία/τηλεφώνησε στην Αστυνομία | |
| 12 | ότι της επιτέθηκαν | ένδειξη ότι δέχτηκε κάποιας μορφής επίθεση | ότι κάποιος της επιτέθηκε, δέχτηκε επίθεση | την έκλεψαν |
| 13 | στην οδό ελευθερίας | αναγκαία η φράση «οδός ελευθερίας» σε οποιοδήποτε πλαίσιο | ζούσε στην οδό Ελευθερίας, βρισκόταν καθ' οδόν για την οδό Ελευθερίας, στην λεωφόρο Ελευθερίας | σε κάποιο δρόμο/οδό, στην πλατεία Ελευθερίας |
| 14 | το προηγούμενο βράδυ | ένδειξη ότι η επίθεση έγινε το προηγούμενο βράδυ | το περασμένο βράδυ, την περασμένη νύχτα, χθες βράδυ | το βράδυ, ένα βράδυ, χθες, την προηγούμενη μέρα |
| 15 | και της έκλεψαν | ένδειξη ότι έγινε μια κλοπή | την έκλεψαν, τα λεφτά της κλάπηκαν, της πήραν τα λεφτά της, κάποιος της πήρε το πορτοφόλι της, τη λήστεψαν | έχασε τα λεφτά της, κάποιος της πήρε τα πραγματά της |
| 16 | πενήντα-έξι λίρες | ένδειξη ότι της πήραν ένα ποσό μεγαλύτερο των 49 λιρών και μικρότερο των 60 λιρων | πενήντα κάτι λίρες, πενήντα-πέντε λίρες, περίπου πενήντα λίρες | εξήντα-πέντε λίρες, πολλά λεφτά, η αστυνομία μάζεψε 56 λίρες γι' αυτήν |
| 17 | Είχε τέσσερα | αναγκαία η λέξη «τέσσερα», μαζί με μια ένδειξη ότι τα παιδιά ήταν δικά της | ήταν η μητέρα τεσσάρων | είχε δυο, είχε μερικά, υπήρχαν κάποια/μερικά |
| 18 | μικρά παιδιά | αναγκαία η λέξη «παιδιά» ή μια συνώνυμή της | παιδάκια, νεαρά παιδιά, μωρά, ανήλικα παιδιά | βρέφη, κορίτσια, γιούς, μικρά Αγόρια |
| 19 | που δεν είχαν φάει | ένδειξη ότι τα παιδιά της ή η οικογένειά της ήταν χωρίς φαγητό | στερούνταν το φαγητό, ήταν πεινασμένοι, δεν υπήρχε φαγητό, τα παιδιά δεν είχαν τίποτα να φανε, δεν μπορούσε να ταίσει την οικογένειά της | δεν υπήρχε πολύ φαγητό, είχαν μόνο λίγο φαγητό, δεν είχε να φάει, δεν είχε λεφτά ν' αγοράσει φαγητό |
| 20 | για δύο μέρες | η φράση «δύο μέρες»ή μια φράση που να σημαίνει περίπου δυο μέρες | για μιά-δυό μέρες, για δυό-τρεις μέρες | για μέρες, για πολλές μέρες, για μια μέρα, για τρεις μέρες |
| 21 | και χρωστούσε και το ενοικιο | μια φράση που να δείχνει ότι χρωστούσε το ενοίκιο | δεν είχε να πληρώσει το ενοίκιο, όφειλε το ενοίκιο, ο ενοικιαστής έπρεπε να πληρωθεί | χρωστούσε λεφτά, χρειαζόταν λεφτά, |
| 22 | Η αστυνομία | μια λέξη ή μια φράση που να δηλώνει ότι ένα ή περισσότερα μέλη του τμήματος της αστυνομίας (σε οποιοδήποτε πλαισιο) | οι αστυνομικοί, ο αστυνομικός, οι ντετέκτιβ, ο αξιωματικός της αστυνομίας ή οι λέξεις «αυτοί/ εκεινοι» όταν υπονοούνται οι αστυνομικοί | «αυτοί/εκεινοι» όταν οι λέξεις δεν διευκρινίζονται, κάποιοι άνθρωποι, οι γείτονες, κάποιος |
| 23 | ευαισθητοποιημένη απο την ιστορια της γυναίκας | ένδειξη ότι η ιστορία της προκάλεσε συμπάθεια, δηλωση συναισθηματικης αντίδρασης | ευαισθητοποιήθηκαν, ένιωσαν λύπη για τη γυναικα, ηθελαν να τη βοηθήσουν, εντυπωσιάστηκαν με την ιστορία, συγκινήθηκαν | ά κουσαν την ιστορία, τη βοήθησαν, την πιστεψαν |
| 24 | έκανε έρανο | μια φράση που να δείχνει ότι είχαν μαζευτει λεφτα | συνέβαλαν, μάζεψαν λεφτά, εισέφεραν κάποια λεφτα, μάζεψαν φαγητό | της έδωσαν λεφτά, της βρήκαν λεφτά |
| 25 | γι' αυτήν | ένδειξη ότι τα λεφτά που είχαν μαζευτει ήταν γι' αυτην ή για τα παιδια της | και της τα έδωσαν, για τα παιδιά της, για την οικογένειά της, για να τη βοηθησει, της εκανε έρανο | σαν δώρο, για να κάνουν τα πράγμα τα καλυτερα, για φαγητο |

## Appendix B

### *Scoring Criteria for Story B* (continued)

| α/α | Κείμενο Ιστορίας Α | Γενικός Κανόνας | Παραδείγματα απαντήσεων που παίρνουν 1 βαθμό | Παραδείγματα απαντήσεων που δεν παίρνουν κανένα βαθμό |
|---|---|---|---|---|
| 1 | Ο Κώστας | «Κώστας» ή ένα παράγωγο του Ονόματος | Κωστής, Κωστάκης | Ανδρέας, Θωμάς, Θεόδωρος |
| 2 | Θεοδώρου | αναγκαίο το «Θεοδώρου» | | Θωμά, Θεμιστοκλέους, Θεοκλέους |
| 3 | οδηγούσε | ένδειξη ότι ο Θεοδώρου ήταν ο οδηγός του οχήματος | οδήγησε, ήταν ο οδηγός του, ήταν στο τιμόνι ενός/του, ήταν οδηγός | επέβαινε στο, πήγαινε με, ταξίδευε με |
| 4 | το βράδυ | ένδειξη ότι ήταν μετά το σούρουπο | ένα βράδυ/ μια νύχτα, ψες τη νύχτα/ ψες το βράδυ, τα μεσάνυχτα | μια μέρα, ένα πρωινό |
| 5 | στον αυτοκινητό-δρομο | ένδειξη ότι το όχημα οδηγούνταν σε ασφαλτοστρωμένο δρόμο (όχι άστρωτο) ή κάποια οδική αρτηρία | σε ένα δρόμο, σε έναν κύριο δρόμο, σε μια λεωφόρο | χωματόδρομος, στο δρόμο του για... σε μια οδό |
| 6 | φορτηγό | αναγκαία η λέξη «φορτηγό» ή λέξη που να δηλώνει το ίδιο πράγμα | νταλίκα | όχημα, κάρο, αυτοκίνητο, βαν, τρέιλερ |
| 7 | των 10 τόνων | αναγκαία η φράση «δέκα τόνοι» | | μισός τόνος, δύο τόνοι, σ' ένα μεγάλο, 10 κιλών |
| 8 | στην περιοχή | «περιοχή» ή λέξη που να δηλώνει περίπου το ίδιο πράγμα | στην ενορία, στο δήμο | στο δρόμο των Λευκάρων |
| 9 | Λευκάρων | «Λεύκαρα» σε οποιοδήποτε Πλαίσιο | στα Λεύκαρα, προς/από τα Λεύκαρα, στο δρόμο για τα Λεύκαρα | Λευκωσία |
| 10 | μεταφέροντας αυγά | αναγκαία η λέξη «αυγά» μαζί με μια ένδειξη ότι αυτά ήταν μέρος φορτίου | κουβαλώντας αυγά, φορτωμένο αυγά, παραδίδοντας αυγά, μετακινώντας αυγά, παίρνοντας αυγά | μεταφέροντας κάτι, αυτός είχε κάποια αυγά |
| 11 | στη Λακατάμια | «Λακατάμια» σε οποιοδήποτε Πλαίσιο | στο δρόμο του για/ από την Λακατάμια έμενε στη Λακατάμια | στην Λάρνακα, Λευκωσία, Λεμεσό |
| 12 | όταν έσπασε | μια λέξη ή φράση που να δηλώνει σπάσιμο | κόπηκε, διαλύθηκε, χάλασε | γλίστρησε, κάλλησε, ξέφυγε |
| 13 | ο άξονας του φορτηγού | αναγκαία η λέξη «άξονας» | | όταν το φορτηγό/ αυτοκίνητο του, όταν το τιμόνι, όταν το λάστιχο |
| 14 | Το φορτηγό γλίστρησε | μια έκφραση που να δείχνει ότι το φορτηγό ήταν εκτός ελέγχου | αυτός γλίστρησε, το φορτηγό ξέφυγε/Παρεξέκλινε της πορείας του/ στριφογύρισε/αναπήδησε | σταμάτησε το φορτηγό του, το φορτηγό χάλασε, οδήγησε το φορτηγό του, συγκρούστηκε, έπαθε ατύχημα, αναποδογυρίστηκε |
| 15 | από το δρόμο | ένδειξη ότι το φορτηγό άφησε το δρόμο | εκτός του δρόμου, έξω από τον δρόμο, έξω | απέναντι από το δρόμο, μέσα στο δρόμο πάνω στο δρόμο |
| 16 | σ'ένα χαντάκι | χαντάκι « ή μια λέξη που να» δηλώνει το ίδιο πράγμα | ανάχωμα, λαγκούβα, χαράδρα, αυλάκι, γκρεμός | στη λάσπη, σε ένα χωράφι, πάνω σε ένα φράχτη |
| 17 | Ο ίδιος χτύπησε | μια ένδειξη ότι προσέκρουσε σε κάτι | προσέκρουσε, έπεσε πάνω στο | τραυματίστηκε, έπαθε ατύχημα |
| 18 | στο παράθυρο | αναγκαία η λέξη «παράθυρο» | στο τζάμι | στο τιμόνι, στην πόρτα |
| 19 | και ταρακουνήθηκε άσχημα | μια λέξη ή φράση που να δείχνει ότι τραντάχθηκε ή αναστατώθηκε χωρίς όμως να υποδηλώνει τραυματισμό | ταρακουνήθηκε, τραντάχθηκε, αναστατώθηκε, σοκαρίστηκε, έτρεμε, συγχύστηκε | χτύπησε το κεφάλι του, τραυματίστηκε, κόπηκε, αιμορραγούσε, έσπασε μέλος του σώματός του, γέμισε μώλωπες, πληγώθηκε |
| 20 | Δεν υπήρχε κίνηση | μια δήλωση που να δείχνει ότι δεν περνούσαν αυτοκίνητα | ο δρόμος ήταν έρημος, δεν περνούσαν αυτοκίνητα, δεν έβλεπε άλλα οχήματα | δεν υπήρχε κανένας τριγύρω, δεν υπήρχαν φώτα, δεν σταμάτησε κανένας να τον βοηθήσει |
| 21 | Και αμφέβαλλε αν θα ερχόταν βοήθεια | μια φράση που να εκφράζει αμφιβολία για το ότι κάποιος θα τον βοηθούσε | δεν πίστευε ότι θα' ρχόταν βοήθεια, δεν περίμενε βοήθεια, ήταν σίγουρος πως δεν θα'ρχόταν κανείς, σκέφτηκε ότι δεν υπήρχε ελπίδα για βοήθεια | δεν υπήρχε τρόπος να βρει βοήθεια, δεν μπορούσε να καλέσει για βοήθεια, ήταν άτυχος, δεν υπήρχε γκαράζ τριγύρω, περίμενε βοήθεια |
| 22 | Ξαφνικά ο ασύρματός του | ένδειξη ότι έχει ασύρματο | είχε ασύρματο, κάλεσε για βοήθεια με τον ασύρματο | κινητό/ τηλέφωνο, ράδιο |
| 23 | Χτύπησε | ένδειξη ότι ακούστηκε ένα σήμα ή μια φωνή | ακούστηκε, έδωσε σήμα, ήχησε, τηλεφώνησε κάλεσε), ήχησε, άκουσε κάτι/ κάποιον | άναψε, αναβόσβησε |
| 24 | Ανταποκρίθηκε λέγοντας | μια έκφραση που να δείχνει ότι αποκρίθηκε λεκτικά | απάντησε, είπε, ανακοίνωσε, δήλωσε, έδωσε το μήνυμα, μίλησε, φώναξε | ο ασύρματος είπε, ο ασύρματος , απάντησε κάποιος απάντησε, πάτησε το κουμπί |
| 25 | «Εδώ Ακοίδα» | «Ακοίδα» σε οποιοδήποτε πλαίσιο | Εδώ Ακοίδας, Ακοίδα, Ακοίδας | Ακοίτας, Εδώ..., Εδώ Ακοίτας, Ατσίδας |

# Η επίδραση της ηλικίας και της γλώσσας στην ικανότητα ανάκλησης ιστοριών: προκαταρκτικά αποτελέσματα

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ΜΑΡΙΑ ΙΩΑΝΝΟΥ

*ΠΕΡΙΛΗΨΗ* Η παρούσα εργασία εξετάζει την επίδραση της μητρικής γλώσσας και της ηλικίας στην ικανότητα ανάκλησης σύντομων ιστοριών. Το δείγμα αποτέλεσαν 60 άτομα με μητρική γλώσσα την Ελληνική και 45 άτομα με μητρική γλώσσα την Αγγλική, χωρισμένοι σε τρεις υποομάδες: άτομα ηλικίας 17-50 ετών, άτομα 55-70 ετών και ηλικιωμένοι άνω των 70 ετών. Κατά μέσο όρο οι Έλληνες ανακάλεσαν σημαντικά λιγότερα στοιχεία από τα άτομα με μητρική γλώσσα την Αγγλική, τόσο στη συνθήκη άμεσης όσο και στη συνθήκη καθυστερημένης ανάκλησης. Σημαντική επίδραση είχε επίσης η ηλικία στους δύο δείκτες ανάκλησης. Τα αποτελέσματα υπογραμμίζουν την αναγκαιότητα συλλογής εκτενών τυπικών δεδομένων, τουλάχιστον για δοκιμασίες λεκτικής μνήμης, σε πληθυσμούς με διαφορετική γλωσσική και πολιτισμική προέλευση.

*Λέξεις-κλειδιά*: Μνήμη, Ηλικία, Λεκτική ανάκληση, Γλωσσικό περιβάλλον

1. Διεύθυνση επικοινωνίας: Τμήμα Ψυχολογίας, Πανεπιστήμιο Κύπρου.