Snodgrass, J. G. , & Kinjo, H. (1998) On the generality of the generation effect. *Journal of. Experimental psychology: Learning Memory, and Cognition* 24(3) , 645- 658.

Slamecka, N. J., & Katsaiti, L. T. (1987). The generation effect as an artifact of selective displaced rehearsal. *Journal of Memory and Language, 26*, 589-607.

Spatz, C., & Johnson, J. O. (1989*). Basic statistics*. Pacific Grove, California: Brooks/Cole Publishing Company.

generation effect in bilingual recall and recognition. *Memory and Cognition, 21*(4), 488-95.

Peynircioglu, Z. F. (1989). The generation effect with pictures and nonsense figures. *Acta Psychologica, 70,* 153-60.

Postman, L. (1950). Choice behavior and the process of recognition. *American Journal of Psychology, 63*, 443-47.

Postman, L., Jenkins, W. O., & Pastman, D. L. (1948). An experimental comparison of active recall and recognition. *American Journal of Psychology*, 61, 511.

Raven, J. G., *CoManual for Raven's progressive matrices and vocabulary scales*. Londurt, J. H., & Raven, J. (1988). on: H.K. Lewis and Co.

Sharifian, F. (2001a). The mnemonic influence of self- cues on narrative recall. *Issues in Educational research*. 11 (1), 15-24

Slamecka, N. J., & Graf, P. (1978). The generation effect: delineation of a phenomenon. *Journal of Experimental Psychology: Human Learning and Memory, 4,* 592-604.

McDaniel, M. A. (1984). The role of elaborative and schema processes in story. *Memory and Cognition, 12*, 46-51.

McDaniel, M. A., Einstein, G. O., Dunay, P. K., & Cobb, R. E. (1986). Encoding difficulty and memory: toward a unifying theory. *Journal of Memory and Language, 25*, 645-56.

Molavi, H. (1994). Reliability and validity of Roven's standard progressive matrices in Iran: A preliminary standardization. *Research Bulletin of Esfahan University "Humanities"*. Esfahan University.

Moshfeghi, F. and Sharifian, F. (1998a). Gereration effect and associative learning. *Journal of Education and Psychology Research* 1, 1-20 [-8-].

Mulligan. N.W. (2002). The emergent generation effect and hypermnesia: influences of semantic and nonsemantic generation tasks. *Journal of Experimental Psychology*, May; 28(3): 541-54.

Murray, D. J. (1995). *Gestalt psychology and the cognitive revolution*. Heartfortshire: Harvester-Wheatsheaf a Division of Simon and Schuster International Group.

O'Neil, W., Roy, L., & Tremblay, R. (1993). A translation-based

Educational Psychology, 70, 626-35.

Kassaian, Z. (1997). *A sentence based generation effect in bilingual recognition and recall.* An unpublished Ph.D. Thesis. Tehran: Islamic Azad University.

Kinjo, H., & Snodgrass, J. G. (2000). Does the generation effect occur for pictures? *American Journal of Psychology* 113,95-117.

Kolers, P. A. (1966). Reading and talking bilingually. *American Journal of Psychology, 3,* 357-76.

MacDougall, R. (1904). Recognition and recall. *Journal of Philosophy, 1,* 299-333.

Macnamara, J., Krautammer, M., & Bolgar, M. (1968). Language switching in bilinguals as a function of stimulus and response uncertainty. *Journal of Experimental Psychology, 78,* 208-15.

Macnamara, J., & Kushmir, S. (1971). Linguistic interdependence of bilinguals: The input switch. *Journal of Verbal Learning and Verbal Behavior, 10,* 480-87

Gardiner, J. M., & Rowley, J. M. C. (1984). A generation effect with numbers rather than words. *Memory and Cognition,* 12, 443-445.

Graf, P. (1982). The memorial consequences of generation and transformation. *Journal of Verbal Learning and Verbal Behavior, 21, 539-48.*

Gross, R. D. (1989). *Psychology: The science of mind and behavior.* London: Hodder and Staghton.

Haist, F., Shimamura, A. P., & Squire, L. R.(1992). On the relationship between recall and recognition memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* 18, 691-702.

Hornby, A. S. (1967) *Oxford progressive English course.* London: Oxford University Press.

Jourabchi, S. (1994). *The effect of L2 knowledge on the generation effect phenomenon.* An unpublished Ph.D. Thesis. Tehran: Islamic Azad University.

Kane, J. H., & Anderson, R. C. (1978). Depth of processing and interference effects in the learning and remembering of sentences. *Journal of*

References

Anderson, R. C., Goldberg, S. R., & Hidde, J. L. (1971). Meaningful processing of sentences. *Journal of Educational Psychology*, 62, 395-99.

Chiaravalloti, V.D. (2002). *Self- generation as a means of maximizing learning in multiple sclerosis: an application of the generation effect.* PMID: 1216827 [PubMed- indexed for MEDLINE] ge and ms. htm (2004 107106).

Durgunoglu, A. Y., & Roediger, H. L., III (1987). Test differences in accessing bilingual memory. *Journal of Memory and Language*, 26, 377-91.

Einstein, G. O., McDaniel, M. A., Bowers, C. A., & Strevens, D. J. (1984). Memory for prose: The influence of relational and proposition-specific processing. *Journal of Experimental Psychology: Learning, Memory, and cognition*, 10, 133-143.

Gardiner, J. M., & Hampton, J. A. (1985). Semantic memory and the generation effect: Some tests of the lexical activation hypothesis. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* 11, 732-41.

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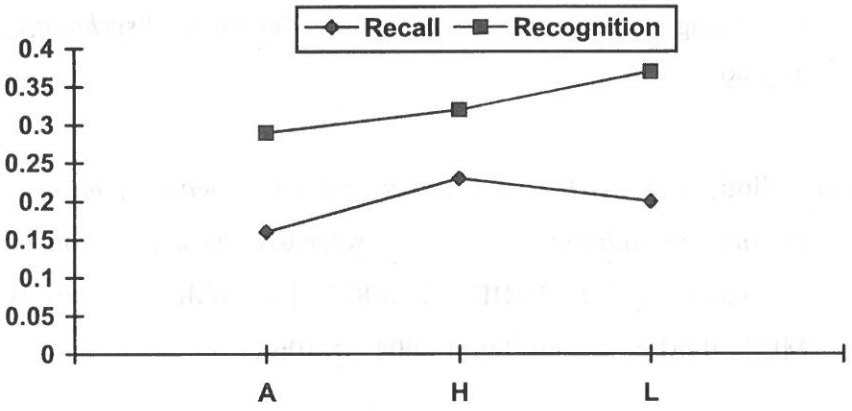

Figure 1

Top

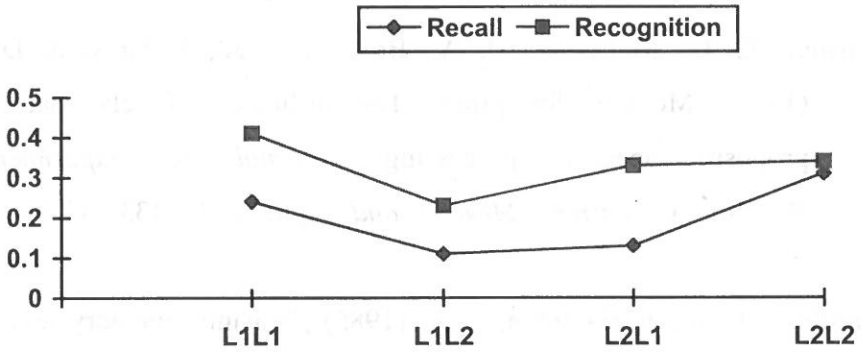

Figure 2

Table 6

The Effect of Intelligence on GE

Task	Recall			Recognition		
Level of Intelligence	1[a]	2[b]	3[c]	1	2	3
G-R[d]	.29	.22	.06	.36	.35	.26

Note. [a] High intelligence; [b] Average intelligence; [c] Low intelligence;

[d] The difference between generated and read items

Figure Captions

Figure 1. Superiority of the test of recognition to the test of recall regarding the GE, at advanced (A), high intermediate (H), and low intermediate (L) levels of language proficiency.

Figure 2. Superiority of the test of recognition to the test of recall regarding the GE, at both unilingual (i.e. L1L1 & L2L2) and bilingual (L1L2 & L2L1) conditions.

Table 4

Comparison of Read and Generated Items on the Whole Data

Test	$\bar{X}_{1a}$	$\bar{X}_{2b}$	SD_1	SD_2	t	df	p
Recall	.22	.43	.18	.18	-9.13	286	0.0000
Recognition	.63	.97	.26	.13	-13.50	286	0.0000

Note. a= read items; b= generated items.

t_{144} (0.05) = 1.6555

Table 5

The Mean Score of the Differences between Generated and Read items (G-R) for the Three Levels of Proficiency on the Whole Data

Level	Mean of the 4 Conditions in the Test of Recall	Mean of the 4 Conditions in the Test of Recognition
A	.16	.29
H	.23	.32
L	.20	.37

Note. A = advanced; H = high intermediate; L = low intermediate

	SD_R=.25 SD_G=.09 t=-5.70 p=.0000	SD_R=.17 SD_G=.11 t=-3.83 p=.0005	SD_R=.19 SD_G=.04 t=-1.96 p=.031	SD_R=.25 SD_G=.13 t=-4.59 p=.0001
High Int.	$\bar{X}_R$=.59 $\bar{X}_G$=.89 SD_R=.24 SD_G=.10 t=-3.90 p=.0004	$\bar{X}_R$=.65 $\bar{X}_G$=1.08 SD_R=.24 SD_G=.21 t=-4.59 p=.0001	$\bar{X}_R$=.75 $\bar{X}_G$=.02 SD_R=.25 SD_G=.09 t=-3.50 p=.0010	$\bar{X}_R$=.62 $\bar{X}_G$=.93 SD_R=.25 SD_G=.17 t=-3.49 p=.0011
Low Int.	$\bar{X}_R$=.41 $\bar{X}_G$=.91 SD_R=.24 SD_G=.10 t=-6.64 p=.0000	$\bar{X}_R$=.61 $\bar{X}_G$=.96 SD_R=.24 SD_G=.16 t=-4.22 p=.0002	$\bar{X}_R$=.62 $\bar{X}_G$=.94 SD_R=.23 SD_G=.10 t=-4.33 p=.0001	$\bar{X}_R$=.59 $\bar{X}_G$=.91 SD_R=.22 SD_G=.12 t=-4.27 p=.0002

Note. Adv. = advanced groups;

High Int. = high intermediate groups;

Low Int. = low intermediate groups

R = read

G = generate

For all conditions $\alpha = 0.05$

For all conditions df = 22

For all conditions $t_{12}(0.05) = 1.7823$

Table 2

The Mean Scores of the Difference between Generated and Read Items (G-R) for the Four Language Conditions on the Whole Data

Condition	Mean of the 3 Levels of Proficiency in the Test of Recall	Mean of the 3 Levels of Proficiency in the Test of Recognition
L1-L1	.24	.41
L1-L2	.11	.23
L2-L1	.13	.33
L2-L2	.31	.34

Table 3

Results of the t-test on the Read and Generate Items for the 12 Groups in the Test of Recognition

Level	Condition			
	L1-L1	L2-L2	L1-L2	L2-L1
Adv.	$\bar{X}_R$=.48 $\bar{X}_G$=.93	$\bar{X}_R$=.82 $\bar{X}_G$=1.06	$\bar{X}_R$=.89 $\bar{X}_G$=1.00	$\bar{X}_R$=.58 $\bar{X}_G$=.97

involvement of both explicit or conscious memory and implicit or non-conscious memory. This finding is supported by another evidence, too. In the recognition test, some subjects had remembered the items they had 'not' written down in their booklets during the generate study phase. That is, non-conscious generating resulted in subsequent recognition of the words. This event did not take place in the test of recall.

The last finding of the present study which may have theoretical implications is the possible effect of intelligence on the GE, as the results reveal that participants with higher intellectual capacities produce greater GE. If the above statement will be supported by future research, the effect of intelligence on the GE should be nullified in future experiments.

Table 1

The Difference between the Mean Scores of the Generated and Read Items (G-R) Recalled in Advanced (Adv.), High Intermediate (High Int.), and Low Intermediate (Low Int.) Levels of Proficiency

G-R	L1-L1	L2-L2	L2-L1	L1-L2
Adv.	.24	.23	.15	.04
High Int.	.25	.38	.18	.15
Low Int.	.25	.32	.08	.16

instrument for the enhancement of memory. Another interesting finding regarding the comparison between unilingual and bilingual conditions is that unilingual conditions exhibit more GE than bilingual conditions. This might imply that switching from one language to another requires greater mental effort. By contrast. the use of only one language(either the source or the target) will relieve mental occupation for concentration on the to be learned material; more specifically learning through generating the targets. This finding has pedagogical applications in that, by restricting the use of two languages in foreign language teaching situations, where memory is to be enhanced by mental abilities, the performance will not lower down because of language switching.

This research, further, suggests that L2 Knowledge does not affect the GE. That is the degree of L2 knowledge does not change the degree of the GE significantly. This could theoretically imply that GE is an independent cognitive effort that works as a problem solver and can benefit the learner regardless of his level of knowledge in a second language. Language learning processes, therefore, might be fostered by allowing for maximal generation of stimuli on the part of the learners at low intermediate, high intermediate, and advanced levels of proficiency.

Another finding relates to the greater exhibition of the GE in the test of recognition compared to the test of recall. It has been stated (Haist, Shimamura, and Squire, 1992) that recall depends on declarative (conscious) memory, and recognition depends on declarative memory as well as nondeclarative (implicit or non-conscious) memory. Consequently, it can be hypothesized that generation requires the

participants. In the test of recognition the correlation was low (r=0.10, p=0.19). Low correlations, however, do not always mean that there is no relationship between two variables (Spotz and Johnson, 1989).

Theoretical Interpretations and Implications

Advanced, high intermediate, and low intermediate foreign language learners exhibited GE at sentence level. This finding extends the scope of GE hypothesis claiming the possibility of GE irrespective of the levels of L2 knowledge as the participants came from 3 levels of language proficiency. The scope is expanded also to encompass a broader range of nationalities with different background knowledge as a sentence-based GE is demonstrated with Persian English bilinguals. The findings of cognitive research on memory can provide teachers with insights about the nature of memory and memory enhancement. GE theory provides evidence in favor of better memory enhancement for generated items and can suggest student centered methodologies of teaching in which the learner is looked at as an active problem solver and generator, rather than teacher centered environments in which the teacher provides ready made solutions.

GE was evident at bilingual conditions as well as unilingual conditions. This finding is opposed to Slamecka and Katsaiti(1987) who reported no GE in the dual language learning, the reason of which was explained before(page 2 in this paper). This finding ; therefore, expands the scope of GE adding bilingual conditions in its domain. The possibility of GE in bilingual condition can imply that translation can be used as an

The results showed that recognition was significantly greater than recall (t= -4.07, p= 0.0001, df= 286). This finding is in agreement with previous studies in the literature stating that recognition test of retained information leads to better performance than a recall test, e.g., of Macdougall (1904), Postman et al. (1948), Postman (1950) and Jourabchi (1994).

Finally, the effect of intelligence on the GE was measured. table 6 shows that GE is greater as the level of intelligence increases.

The results of the ANOVA suggested that the difference is significant in the test of recall [F(2,141)= 3.06, MSe= 0.06, F= 7.30, p= 0.001], but not significant in the test of recognition [F(2,141)= 3.06, MSe= 0.07, F= 1.55, p= 0.21]. However, GE is greater as the level of intelligence increases. To find out which levels of intelligence differed significantly in the test of recall, pairwise comparisons were performed. The results are illustrated below.

Compared Levels	$/t_0/$	Results
1/2	1.371	$p > 0.05$
1/3	3.668	$p < 0.05$
2/3	2.997	$p < 0.05$

The above pattern shows that levels 1 Vs 3 and 2 Vs 3, differ significantly. In the case of 1 Vs 2, the difference is not significant, however, 1 is greater than 2 (1>2).

To further check the relationship between intelligence and GE, these two variables were correlated. In the test of recall the degree of correlation was r=0.22, p=0.007 which is significant regarding 144

unilingual and bilingual conditions, and for the three levels of language proficiency (see table 3).

Comparison of read and generated items regarding the performance of 144 participants revealed that the retention of generated items significantly surpassed the retention of read items on the whole (see table 4).

It should be mentioned that in the previous experiments which failed to obtain a GE in a bilingual situation (Slamecka and Katsaiti, 1987), where the level of L2 knowledge was a decisive factor, the participants had not been checked regarding their ability for performing the expected tasks. Moreover, in those experiments the tests were intentional; therefore, the participants' performance was affected by the prior knowledge about the test. In the present research both of these variables have been controlled.

The results of the present experiment are in agreement with that of O'Neil et al. (1993) where the participants were balanced French-English bilinguals and the subsequent tests of recall and recognition were incidental.

Then the effect of the test type on the GE was evaluated. Comparing the obtained means for the three levels of proficiency (see table 5) and four language conditions (see table 2), it can be observed that recognition is superior to recall at all levels of language proficiency and in both unilingual and bilingual conditions. Figures 1 and 2 illustrate the differences. Based on the performance of the individual participants (144 participants), recognition and recall tests were compared on the whole.

language to another will result in lower performance of the participants, regarding the GE. This assumption is in agreement with previous findings as Kolers (1966), Macnamara et al. (1968), Macnamara and Kushmir (1971). They all concluded that switching from one language to another takes additional time and effort.

What is to be discussed next is the degree of the GE regarding different levels of language proficiency. Unlike Jourabchi (1994) who found L2 knowledge as an effective factor on the GE, the present study found no indication of a significant effect of L2 knowledge on the generation effect. Her study (experiment 1) revealed that GE was not present in low levels of proficiency (p. 64) and it increased as the level of L2 knowledge rose. The researchers of the present study believe that subjects with different levels of L2 knowledge should not be measured with the same treatment and test materials without having previously been measured for their ability for the expected tasks. Doing so would make the tasks biased in favor of the advanced levels. In this research the ability of the subjects for doing the expected tasks was measured, and consequently, the effect of insufficient knowledge was nullified.

In order to find out if L2 learners produced GE at sentence level, the retention of read and generated items were compared by means of t-tests for each group separately. It was found that generated items outweighed read items on all occasions and the differences were significant. These results show the occurrence of the GE in both

the recall measures revealed that, the main effect of the level of L2 knowledge was not significant [F(2,132) = 3.0648, MSe= 0.068, F= 1.03, p= 0.35], whereas the main effect of study conditions was significant [F(3,132) = 2.673, MSe= 0.68, F= 4.52, p= 0.005]. The interaction between proficiency and study conditions failed to attain significance [F(6,132) = 2.167, MSe= 0.068, F= 0.40, p= 0.875].

In the recognition measures a pattern of effects similar to that for recall was revealed. The main effect of proficiency was not significant [F(2,132)=3.0648, MSe= 0.069, F= 1.05, p= 0.35], whereas the effect of conditions was significant [F(3,132)= 2.673, MSe= 0.069, F= 2.85, p= 0.04]. The interaction between the proficiency and study conditions did not attain significance [F(6,132)=2.167, MSe= 0.069, F= 1.67, p= 0.13]. This means that the level of language knowledge did not affect language condition regarding GE.

Comparison of conditions revealed that GE was greater in unilingual conditions than in bilingual conditions at all levels of language proficiency, namely, at advanced, high intermediate, and low intermediate levels (see table 1).

The magnitude of the G-R (i.e. the magnitude of the difference between the mean scores of the generated and the read items) regarding comparison of unilingual and bilingual conditions on the whole data also shows that GE is greater in unilingual conditions than in bilingual conditions (see table 2).

These results imply that when two languages are used during the learning task, the involvement of memory while switching from one

Persian, at the bottom of the same page. In L2-L2 condition, the participants read the English sentence and wrote the intended word in English. In L2-L1 condition, the participants read the first sentence in English, then they read the translation of the English sentence in Persian and wrote the intended word in Persian. In L1-L2 condition, the participants read the first sentence in Persian, then they read the translation of the sentence in English and finally wrote the target word in English.

The Analysis of Data

Recall and recognition measures were analyzed separately. The mean percentage and the standard deviation of the scores in each group of twelve participants were calculated. Two sample t-tests were performed on the read and generated items for each group. Based on the three levels of language proficiency and the four language conditions, a factorial design was used for the analysis of variance. Recall and recognition scores of all the participants were compared by means of two sample t-tests. Finally an analysis of variance (ANOVA) was performed on the three levels of intelligence. The Minitab was used for the statistical computations of the whole data.

Results and Discussion

GE was measured separately for recall and recognition while the three levels of language proficiency were compared within the four conditions (L1-L1, L2-L2, L1-L2, L2-L1) under study.The ANOVA for

position effect the order of the two tasks- read Vs generate- was counterbalanced across participants. Six participants in each group first read the whole sentences and then generated the target words in the incomplete sentences; the other six had a generate-read sequence.

Experimental Test. Following the completion of the study phase, the booklets were collected and the participants were given a blank sheet of paper and allotted 10 minutes to write down the targets recalled in any order. The experimenter emphasized the fact that the targets should be the exact words they had written on the booklets. Following this, the participants received the relevant recognition list and were asked to mark only the words they had written on the study list. The recognition test included 24 targets and 24 distractors The distractors were selected among those in the pool of vocabulary screened out after ratings. The participants were allowed three minutes in this phase.

One reason for adopting two types of tests- recall and recognition- was to double check the results. Another reason was that the recall test was assumed to be aided by generating information rather than reading it, but recognition test could be accomplished by both of the two processes- a fast acting process like reading, and a slower, more effortful process like generating (Durgunoglu and Roediger, 1987). A combination of the two tests could, hopefully, provide more accurate results.

Conditions. All the participants followed the same procedure for reading and generating tasks and tests, regarding the four conditions; however, they differed in the following manner. In L1-L1 condition, the participants read the Persian sentence and wrote down the target word, in

Design and Procedure

Regarding their English proficiency, the participants were divided into 3 groups of low intermediate, high intermediate, and advanced. Each of the above groups was divided into 4 sub-groups to take part in either unilingual [Persian (L1L1) or English (L2L2)] or bilingual [English-Persian (L2L1) or Persian-English (L1L2)] conditions. There were 12 groups altogether, each of which were tested with 2 tests of recall and recognition. The intelligence variable was independently measured across the whole population.

The experiment was performed in a language laboratory. The participants were tested in groups of six. Upon arrival in the test room, they were instructed, in Persian, about the experimental task, but were not informed that retention tests were to follow. Intentional study procedures were not used, as previous experiments showed that the GE was abolished under intentional study procedures because of an enhancement of a reading-based retention (O'Neil et al., 1993).

Experimental Task. The booklets were then given to the participants. The experimenter told the participants to read the sentences and write the target words at the bottom of each page, under the related sentences. Half of the sentences in each booklet were incomplete. The participants were instructed to turn to the next page when signaled through earphones. The participants' voices were recorded on tape recorders. The reason for adapting this procedure was to make sure that the participants read the sentences and did not read just the target words. 10 seconds were allowed for each response. In order to nullify the serial

blank started with the first letter of the target word. If the initial letter did not acoustically match the first phoneme in the word, more letters were provided (e.g. A young hen is a ch--------.). In order to prevent the completion of the sentences with other possible words, the first letter of the intended word was followed by dashes corresponding to the number of the letters in that word (e.g. A dog is an a-----.). Furthermore, the plural ending 's' was given (e.g. This book has ten ch-----s.). Length and syntax variables were not controlled in sentence construction. Care was taken that the target word was not repeated in the same sentence.

An appropriate sample of examinees from each level completed the sentences with the required words. Only the sentences which had been completed correctly by 90% of the examinees were used in the experiment. Belonging to the advanced group, only 24 sentences were completed correctly. In the literature, a list of 24 sentences had been realized as appropriate in length (Anderson et al., 1971). In order to keep the balance, 24 sentences were randomly selected among those completed by 90% of the examinees in high and low intermediate groups, also. Therefore, there were, altogether, 72 English sentences. This amount was doubled by Persian translations of the English sentences which were used in bilingual conditions. Furthermore, following the same procedure adapted for selection of English sentences, 24 sentences were selected to be used in L1-L1 conditions. All the 168 Persian and English sentences were checked by 3 fluent bilingual judges.

textbook of first year elementary school. The rational was that all the participants were familiar with those words. English words were selected from among 3000 words in the vocabulary list of *Oxford Progressive English Course,* volume one for low intermediate, volume two for high intermediate, and volume three for advanced groups. After screening out the unwanted words, there were 188 words for the low intermediate, 103 words for the high intermediate, 100 words for the advanced groups, and 200 Persian words. Rating scales were prepared for each list of vocabulary. An appropriate sample of examinees from each level rated the vocabulary items in each list. The examinees rated the English words with respect to their familiarity with the meaning and usage of the words. They rated Persian words according to their frequency in daily conversations. The words with 90% scores were then selected to be used in sentences. There were 137 words for the low intermediate, 76 words for the high intermediate, 70 words for the advanced groups, and 68 Persian words.

Sentences. After the selection of the vocabulary, sentences were made. The last word of each sentence was missing and the sentence was to be completed with the appropriate word by the participants. For example, in "A dog is an a_____", the word 'animal' would complete the sentence. In Persian sentences, the intended word was not the last word of the sentence, but one word before the last since the sentences are normally ended with a verb in Persian, and our intended word in each of the English and Persian sentences was a noun.To limit the choice of the possible target words, while constructing the preliminary sentences, each

used in the experiment; 24 Persian words for the Persian unilingual (L1-L1) condition, 72 English words for the three levels of L2 knowledge, and 72 Persian translations of the English words.

The most important requirement for generating a word is the knowledge of that word. Consequently, English words were to be within the limits of the examinees L2 knowledge. Frequency is not an acceptable criterion in this regard; that is, more frequently used words by native speakers of English are neither necessarily the ones first learned, nor the ones more frequently used by Persian speakers. The vocabulary, therefore, was selected from Hornby's *Oxford Progressive English Course* (1967), which is among the books used for teaching English to Iranian students.

Some requirements were observed in selecting the vocabulary. They were nouns. They had no more than three syllables; this was to nullify the effect of the word length as, "the memory span for a sequence of long words (e.g. UNIVERSITY, TEMPERATURE,...) is lower than the span for a sequence of short words (e.g. DECK, LIST,...)" (Murray, 1995, p.97). They were not compound nouns. They were not among English loan words used in Persian. The Persian translations were acoustically distinct from them, and followed the requirements for word length too. Moreover, they were not compound nouns. The Persian translations of English words were not the same as the Persian words used in L1-L1 condition. The Persian translations were checked by 3 bilingual judges for their accuracy. For the L1-L1 condition, all the nouns having the above requirements were selected from the Persian reading

Method

Participants

The participants were 144 Iranian Persian-English bilinguals. They were selected from a pool composed of approximately 400 TEFL undergraduates in Esfahan University who had participated in a standardized placement test (Kassaian, 1997). The participants were assigned to 12 groups irrespective of their sex and age; however, 73 men and 71 women who were 18-30 years old took part.

All the participants were measured for their intellectual capacity, and an equal number of candidates with high, intermediate, or low intellectual capacity were placed in each of the 12 groups. The Raven test (Raven et al., 1988) was used for this purpose as it had previously been given to Iranian students, and its reliability and validity had been confirmed (Molavi, 1994).

Materials

A hundred and sixty-eight sentences were used for the elicitation task. The Persian version included 24 sentences. The English version included 3 lists, each consisting of 24 sentences for the 3 levels of L2 knowledge. In bilingual conditions, Persian translations of sentences were also used.

Words. The nature of the experiment was such that the sentences were to be read or completed with the aid of certain words. Therefore, the choice of vocabulary was a preliminary requirement.

A hundred and sixty eight Persian and English target words were

participants were balanced Spanish-English bilinguals, but the nature of the procedure may have encouraged participants to generate translation in their read-English-and-Spanish-translation conditions. Participants viewed the Spanish word on a screen and subsequently read the English word in a booklet. Thus, participants might have generated the English translations prior to actually reading the English word, making the read condition similar to the translation condition and masking any potential GEs. In the present study an attempt was made to reduce the likelihood of spontaneous translation in the read condition by presenting the translation simultaneously.

In this study, we attempted to find out (a) if L2 learners produce GE at sentence level, (b) the possibility of the effect of proficiency on GE, (c) if the degree of GE was the same in unilingual and bilingual conditions, and finally (d) if the degree of intelligence affects GE. The hypotheses were that (a) L2 learners would produce GE at sentence level, since it had been observed before in both unilingual and bilingual conditions (see above), (b) proficiency would affect GE, as it had been reported before (Jourabchi, 1994), (c) the degree of GE would not be the same in unilingual and bilingual conditions, since bilingual situations involve language switching which takes additional mental occupation (Macnamara and Kushmir, 1971), and (d) intelligence might affect GE, since generation is a kind of process that involves problem solving ability which is a component of intelligence. In order to check the results two types of tests; namely, recall and recognition, were used for measurement.

Related to the topic of the present research are: Anderson, Goldberg, & Hidde (1971), Kane & Anderson (1978), and Graf (1982) who observed a GE with meaningful sentences in unilingual conditions; Slamecka & Katsaiti (1987), who reported no GE in the dual language learning condition with Greek and English language combinations at the word level; O'Neil, Roy, & Tremblay (1993), who observed GE at the word level with relatively balanced French-English bilinguals; and Jourabchi (1994), who reported possible effect of L2 knowledge on GE at the word level.

In order to examine the possibility of GE in a bilingual situation, language proficiency and translation are two issues worth considering. Slamecka & Katsaiti (1987, experiments 1 & 2) failed to obtain GE in a bilingual situation where the level of second language (L2) knowledge was a decisive factor. They used Greek-English bilinguals who "were sufficiently fluent in both the Greek and English languages" (p. 591). No additional explanation was provided as to the degree of the participants' functional bilingualism or the relative dominance of one or the other of their two languages. In fact Slamecka personally stated (May 14, 1993) that "The Greek-descent subjects of the 1987 experiments were not tested for their language proficiency in either of the Greek or English languages" (Jourabchi, 1994, p.175). The present study employed Persian-English bilinguals whose L2 abilities were checked for performing the expected tasks.

The issue of translation can be discussed with regards to a study performed by Durgunoglu & Roediger (1987). In this study the

Introduction

From a cognitive perspective, one of the most frequently mentioned variables involved in learning is known to be memory. Learning depends on memory for its permanency and memory would have no content if learning was not taking place (Gross, 1989). One of the phenomenon concerning memory enhancement is generation effect (GE). GE refers to the finding that in a memory experiment, a self-generated word is better remembered than one that is externally presented (Slamecka & Graf, 1978; Snodgrass & Kinjo, 1998). In other words, an item which has been initially produced by means of a subject's own mental effort is significantly better recalled than if that same item had been originally presented for study in its entirety (Slamecka & Katsaiti, 1987).

GE has been the subject of numerous experimental efforts with a variety of subjects and experimental techniques. GE has been investigated, to check associative learning (Moshfeghi and Sharifian, 1998a), with pictures (Peynircioglu, 1989; Kinjo & Snodgrass,2000), multiplication sums (Gardiner & Rowley, 1984), letter bigrams (Gardiner & Hampton, 1985), words (Slamecka & Graf, 1978), sentences (Anderson, Goldberg, & Hidde, 1971), and texts (Einstein, McDaniel, Bowers, & Strevens, 1984; Sharifian,2001a) to name but a few.

GE has found its application recently even in rehabilitation medicine for maximizing learning in multiple sclerosis (Chiaravalloti and Deluca , 2002) and hypermnesia- increased recall over tests- (Mulligan, 2002).

A Sentence-Based Generation Effect in Bilingual Recognition and Recall

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Abstract

To investigate the presence of generation effect (GE) at sentence level, 144 bilinguals were selected as participants. They were examined at 3 levels of language proficiency, both unilingual and bilingual conditions. Recall and recognition tests of memory were used for measurement of the retained items. To measure the correlation between intelligence and GE, all the participants were tested regarding their intelligence. Analyzing the data, it was found that GE existed at the 3 levels of language proficiency, namely, advanced, high intermediate, and low intermediate levels. GE was evident at both unilingual and bilingual conditions while the degree of exhibition was higher at unilingual condition. The degree of second language (L2) knowledge did not change the degree of GE significantly. The recognition test manifested the GE more strongly than the test of recall, and finally correlation was found between intelligence and GE.

Key Words: generation – language proficiency– recognition tests – unilingual condition– test of recall.

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