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Acquiring Foreign Language Vocabulary Through Meaningful Linguistic Context: Where is the Limit to Vocabulary Learning?

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Abstract The present studies examined the effects of varying degrees of unfamiliar vocabulary within written discourse on individuals' abilities to use linguistic context for the purposes of translation and comprehension (i.e., lexical inferencing). Prose varied in the number of foreign words introduced into each sentence (e.g., 0 through 7 content words per sentence). Furthermore, Krashen's Input Hypothesis and the Evaluation component of the Involvement Load Hypothesis were tested to determine the degree at which non-comprehensible input hinders the ability of a learner to successfully use linguistic context for translation and comprehension. Results indicated that, as the number of foreign words per sentence, i.e., non-comprehensible input, increased the ability to successfully translate foreign words and create situational models for comprehension begins to decrease especially beyond five unfamiliar words per sentence. This result suggests that there is an optimal level of effectiveness in the use of a linguistic context strategy for learning foreign language vocabulary, but also that there is a limit to the strategy's effectiveness. Implications and applications to the field of foreign language learning are discussed.

Keywords Linguistic inferencing · Context learning · Vocabulary learning

Introduction

"How does one best acquire vocabulary of a new language?" Although, this is possibly one of the most frequently asked questions by foreign language learners, many individuals overlook the fact that, to learn a language, one clearly needs to learn the appropriate vocabulary of that language. To acquire this first step, learners are continuously faced with, or have the option of choosing, a variety of language learning techniques. To better facilitate the vocabulary

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acquisition process, foreign language learners may frequently implement numerous techniques in the hope of acquiring the new vocabulary; yet, many leaners are quick to abandon a technique, or worse, leave attempting to learn a language altogether, potentially due to discouragement at what they see as substandard results.

Although numerous techniques exist for learners to use, many have been widely studied within the literature. Of the existing techniques, some of the most widely examined include the Keyword Mnemonic (Rodriguez and Sadoski 2000), Word Association (Runquist 1966) and acquisition of vocabulary through the use of linguistic context (i.e., linguistic inferencing/context learning) (Nagy et al. 1987; Nash and Snowling 2006; Yildirim et al. 2014). The common feature that exists between all vocabulary learning techniques is the hope that learners will be able to adequately acquire novel vocabulary. Aside from solely acquiring the novel vocabulary (i.e., knowing the meaning of the vocabulary), learners foresee that they will be able to use the vocabulary and understand communication that may occur with the newly acquired vocabulary (i.e., being able to comprehend what is being communicated).

Although the acquisition of foreign language vocabulary is one of the most basic steps, the ultimate goal of language acquisition is to comprehend the language and successful use it in daily interactions. Moreover, the acquisition of vocabulary, as would be expected, has been repeatedly shown to be a significant predictor of comprehension (Baumann 2009; Laufer 1992; Nation 1993). This would suggest that the degree of reading ability further predicts the learner's ability to successfully infer the meaning of vocabulary from context. Previous research suggests that, for children and adults, poorer reading comprehension will lead to significant declines in lexical inferencing (Bengeleil and Paribakht 2004; Cain et al. 2004), thus demonstrating the critical relationship between attaining adequate vocabulary knowledge, so as to attain successful reading ability for the purpose of correctly comprehending given information (Alavi and Kaivanpanah 2009; Cain et al. 2004; Paribakht and Wesche 2006; Tannenbaum et al. 2006).

Because of the importance of vocabulary knowledge for overall comprehension, it is crucial to evaluate the effectiveness and limits of vocabulary learning techniques. The purpose of testing such techniques is to be able to increaser the probability of the learner's success in vocabulary acquisition and to attain adequate comprehension of linguistic input. With this in mind, the present studies attempted to evaluate the effectiveness and limit of one of the previously mentioned vocabulary learning techniques. Specifically, the context learning vocabulary learning technique (i.e., Lexical Inferencing) was evaluated for the purposes of acquiring foreign language vocabulary. The present studies attempted to estimate the degree (i.e., the point) at which vocabulary acquisition from linguistic context would begin to deteriorate; that is to say, where does attempting to acquiring novel vocabulary become too difficult for the novice learner when using a linguistic inferencing learning method? The present studies examined this question by presenting text in English, the native language of the learners, with varying numbers of content words replaced with novel vocabulary which were not in the learner's native language (e.g,. Spanish or Pseudo-Finnish).

Learning Words in Context: Lexical Inferencing

During discourse processing, such as while reading text, we typically find ourselves encountering vocabulary items which in some instances may be unknown to us. To resolve this issue, readers may typically scan the surrounding context of an unfamiliar word to assist in the identification of meaning of the unknown item. The use of linguistic context information

and/or contextual cues for the identification of unfamiliar words in one's native language has been vastly explored; findings suggest that in instances when unfamiliar vocabulary appears, individuals are often able to accurately infer the meaning of the unknown word(s) based on the linguistic discourse cues which have been provided (Nagy et al. 1987, 1985). Furthermore, for learning unfamiliar words in the reader's L1 (i.e., primary language) from written context, individuals with a low degree of knowledge of the unfamiliar vocabulary are able to use linguistic information (i.e., contextual cues) from written text as a means to increase their L1 vocabulary knowledge (Nagy et al. 1987, 1985; Tabossi 1988; Moore and Surber 1992; Prince 1996; Rodriguez and Sadoski 2000; Webb 2007a; Weber 2007b), a result which has been found for both children and adults (Bolger et al. 2008; Brusnighan and Folk 2012; Cain 2007; Dockrell et al. 2007; Gardner 2007; Marinellie and Kneile 2012). This is not to suggest that successful acquisition or identification of vocabulary will occur solely through the use of contextual cues. Numerous factors (e.g., linguistic knowledge or morphological cues) may also contribute to how effective a learning strategy may be to a learner (Bengeleil 2001; de Bot et al. 1997; Fraser 1999; Nassaji 2003, 2004; Paribakht and Wesche 1999). Interestingly, although factors such as morphological cues are accessed during identification of unfamiliar words, Mori (2003) suggests that, for L2 learners, accessing such cues does not significantly predict a learner's ability to accurately deduce the meaning of words.

Because the meaning of words in a foreign language are at best vague, and more likely entirely opaque, to the non-speaker of the language, it is critical to examine the usefulness of context information in assisting the reader in determining the meaning of the unfamiliar foreign words (i.e., correctly identify the novel vocabulary). Contextual information should also facilitate comprehension since critical information is provided by the discourse and should allow the reader to create situational models. Situational models, as proposed by Zwaan and Radvansky (1998), are mental representations of the text which represent the situation that is being discussed. For full comprehension to take place, it is necessary for the reader to construct situational models to understand the underlying message which is being transmitted and not merely to understand individual units (e.g., words), as proposed by the surface level of representation (van Dijk and Kintsch 1983; Kintsch 1998). When examining the utility of contextual information and the integration of ambiguous/unfamiliar information with known information, it is necessary to evaluate its usefulness in allowing individuals to extrapolate the underlying implications of the intended message (i.e., draw pragmatic inferences), extract explicit factual information, and interpret novel vocabulary (i.e., identify novel words in terms of native language equivalents).

Although the use of linguistic information has been suggested to facilitate vocabulary learning, there is no guarantee that a foreign language learner, utilizing a context learning strategy, will ultimately acquire the language. The importance of using a context learning strategy is to provide the learner with a "knowledge framework", since the acquisition of a foreign language begins with basic level knowledge, such as acquiring vocabulary, and then gradually progressing into higher level skills (e.g., construction of sentences). Since language acquisition does not begin with higher level skills, it is critical to understand at what point foreign language learners are no longer able to use linguistic context strategies to acquire novel vocabulary. This is to say, when using linguistic context learning for vocabulary acquisition, when does the vocabulary learning strategy begin to lose its effectiveness for the language learner, due to an excessive amount of unfamiliar vocabulary? To understand how and why a foreign language learner will ultimately find a strategy to be ineffective, one needs to first evaluate the baseline level of knowledge and the optimal level of presentation of the novel vocabulary. For example, if the learner is presented with a large number of foreign vocabulary words with little context in their own language, the learner will ultimately fail to acquire the

vocabulary. The failure to acquire the vocabulary may be due to insufficient context in the L1, thus not providing sufficient information to allow construction of an appropriate situational model to infer the meaning of the unfamiliar vocabulary.

Because of the amount of L1 linguistic context may eventually become insufficient for the novice learner, it is critical to establish this point at which the contextual instructional method will become ineffective. In order for the novice learner to begin to understand the foreign language vocabulary, there is a need to have comprehensible input which will lead the learner to successfully acquire the vocabulary (Krashen 1989; Barnes et al. 1989). With this in mind, it is also critical to evaluate the degree of involvement (i.e., attentional resources) that is needed by a given task.

The comprehensible input is of primary interest since inadequate input in either the learner's native language or a known L2 would lead to a failure to acquire novel vocabulary. In terms of the level of instruction exceeding the learners' base knowledge, one can attempt to apply the assumptions of the Input Hypothesis to the acquisition of novel vocabulary through the use of the linguistic context learning strategy. Additionally, examining the relationship between the task difficulty and the learner's ability to manage the completion of the task may help identify when vocabulary acquisition may become too difficult for the learner to achieve.

The Input and Involvement Load Hypotheses

When initiating any learning task, cognitive psychologists stress the importance of limiting the cognitive load which may be present (Morey and Cowan 2005); by such limiting, i.e., ensuring the appropriate amount of information at an appropriate level of difficulty, a learner would be able to focus attention or retrieval of information to allow for adequate processing of that information. Similarly, Krashen (1989) proposed that for a language learner, whether novice, intermediate or advanced, to adequately acquire a language, various factors needed to be controlled in the learning environment.

Based on this assumption, Krashen (1989) proposed that a foreign language learner's environment could be expressed in quasi "mathematical" terms; this description includes both the current base level knowledge of the learner and the instructional environment the learner is placed in. The level proposed by Krashen (1989) is expressed as $i + 1$(The Input Hypothesis); i being equal to the current base level L2 knowledge of the learner and 1 signifying a difficulty slightly above this level. According to Krashen, one of the most important factors to consider is that a language learner, with an optimal instructional environment/method, is provided enough comprehensible input to acquire language vocabulary. For successful acquisition, the L2 input would need to be slightly above the learner's base level of knowledge (i.e., the task would not be found to be too difficult or too easy). For optimal learning to occur, it would be assumed that the foreign/ambiguous information must neither far exceed their current level of knowledge nor be at or below that level. If the ambiguous information far surpasses the knowledge of the learner, the learner will fail to acquire new information. Based on this assumption, the Input Hypothesis proposes that for the learner to advance (i.e., acquire language knowledge), the $i + 1$ level of instruction above the current level of knowledge needs to become the new level of knowledge (i.e., i has increased) after successful acquisition has occurred.

Applying these assumptions to the acquisition of the novel vocabulary, one can propose that a new language learner's i would approximate zero, since the individual is a novice learner who has had no exposure to the vocabulary being learned, and thus any exposure to that vocabulary would be above their i (i.e., above their current level of knowledge).

Based on these proposed assumptions for novel vocabulary acquisition, the current studies examined if novice learners would be able to adequately acquire novel vocabulary when utilizing a linguistic context vocabulary learning strategy, which varied the number of foreign content words per sentence based on substitutions made with Pseudo-Finnish or Spanish words. The present studies tested the assumptions of Krashen's $i+1$ model for the acquisition of novel vocabulary. By increasing the number of content words replaced by novel vocabulary, the level of instruction would be at differing levels above the learner's current level of knowledge, thus potentially decreasing the likelihood of successful vocabulary acquisition. A secondary purpose of the present studies examined the reader's creation of situational models based on integrating and increasing non-comprehensible vocabulary per sentence. The primary purpose of creating situational models is for a reader/learner to adequately comprehend the intended message being transmitted. If non-comprehensible input is integrated, and systematically increases, it could be predicted that comprehension, at some point, would begin to steadily decline.

Consistent with the predictions proposed by the $i + 1$ Hypothesis, Laufer and Hulstijn's (2001) Involvement Load Hypothesis similarly proposed that the degree of task involvement of the learner would significantly predict his/her ability to adequately complete a given task. The Involvement Load Hypothesis uses a three-component framework, which includes the components of: Need, Search, and Evaluation (the last two components being cognitive in nature); if the Evaluation component of a task becomes too demanding and exceeds the cognitive ability of the learner (i.e., the task has become too difficult in terms of Krashen's i + 1 Input Hypothesis Model), performance will begin to decline. Even though performance may improve overall as task involvement increases, it is important to determine if there is a point at which task involvement may exceed the ability of the learner to adequately implement a vocabulary learning strategy, such as lexical inferencing. Furthermore, Kim (2008) supported the predictions made by the Involvement Load Hypothesis even when controlling the amount of time which was allotted to complete various tasks. Rott (2005, 2007) and Rott and Williams (2003) suggested that the more in-depth processing which a task requires (i.e., more elaboration needed by the task), the better the solidification of information into knowledge which would lead to greater processing ability. Schmidt (2001) suggested that L2 learners' successful acquisition of novel vocabulary was highly dependent on the degree of attention which was paid to the unknown word.

Laufer (1991) further proposed that a minimum or threshold level of vocabulary knowledge is necessary in order to be able to successfully implement a lexical inferencing strategy. Thus, using Krashen's $i + 1$ Input Hypothesis Model, Laufer's (1991) minimum threshold level of knowledge, and the Involvement Load Hypothesis (Laufer and Hulstijn 2001) as theoretical bases for the predictions made in these studies, it was predicted that if there is an excess of unfamiliar linguistic context, performance in vocabulary identification would significantly decrease as a certain point of evaluation in task involvement is exceeded.

The Present Research

Study 1[1]

Using the predictions made by both models (Input and Involvement Load Hypotheses), Study 1 aimed to examine: (1) The utility of using a linguistic context strategy as the number of substituted content words increases from 0 to 3 novel words per sentence; (2) If substituting the number of primary content words, which were in the reader's native language (i.e., English), with 0–3 novel vocabulary words (i.e., items which were either Pseudo-Finnish or Spanish words) would impede the creation of situational models for comprehension.

From these points, it was predicted that comparing monolinguals and bilinguals on Spanish translations, bilinguals' translation change scores (from pre-test to post-test) would be significantly lower than those of monolingual speakers. It was suggested that monolinguals' scores would moderately increase from pre- to post-test since contextual information is still present, yet there should be at some point a decline in scores as more foreign words are introduced, since increasing amounts of L1 contextual information would be lost.

When comparing monolinguals and bilinguals on Pseudo-Finnish translations, however, Spanish–English bilinguals and English monolinguals scores should moderately increase from pre- to post-test, since there continues to be a large degree of contextual information that is known to those readers, although scores would at some point begin to decline as increasing L1 comprehensible contextual information is being lost due to the presence of more foreign words.

Lastly, when presented with the Spanish condition, bilinguals' comprehension performance (i.e., for factual information) would remain high while monolinguals' performance would gradually decline as the number of foreign words increased per sentence. Moreover, in the Pseudo-Finnish condition, both bilingual and monolingual comprehension performance would gradually decline to approximate the same degree.

Finnish pseudo-words were utilized as the non-familiar foreign vocabulary. Pseudo-Finnish words (i.e., words used from the Finnish language which were morphologically manipulated to maintain a degree of validity of true Finnish words, yet the words were not a true representation of their accurate spelling or meaning. This also functioned as a manipulation check for participants' true knowledge of Finnish vocabulary. If a participant were able to identify the inaccuracy associated with the stimulus item, that participant could be withheld from analyses due to their knowledge of Finnish vocabulary Finnish was selected since Finnish has a high degree of dissimilarity to Spanish and English, which both are highly familiar languages with the samples tested, who were very likely to have previously encountered them in varying degrees. Moreover, the use of pseudo-vocabulary items were selected as a manipulation check to identify if learners would indicate that the words used were not stylistically correct, this also guaranteed us that no learner had actually encountered such items in the past. Although written in the familiar Latin alphabet, Finnish is a non-Indo-European (Finno-Ugric) language which is unknown to most individuals in the United States. It has very few cognates or common roots with English or Spanish. Additionally, Spanish was utilized as the familiar foreign language due to its high degree of incidence within the samples tested (i.e., high degree of exposure in media and public sources within the United States) and the availability of a fluent sample of Spanish–English bilinguals, for Study 1.

[1] Initially Study 1 also included a comparison of monolingual English and bilingual Spanish–English speakers as the primary samples. Bilingualism status was used as a moderating variable since it was assumed that bilinguals, since they have already learned a second language, would be at an advantage in general foreign language learning in comparison to monolingual speakers.

Method

Participants

Three hundred and forty-nine undergraduate students from a south Texas university (N = 181) and a large Mid-Western U.S. university (N = 168) participated in Study 1. Participants from south Texas consisted almost entirely of highly fluent Spanish–English bilinguals, while participants from the Mid-West consisted primarily of monolingual individuals with minimal or no knowledge of Spanish. Participants were randomly assigned to one of eight conditions (i.e., Spanish or Pseudo-Finnish with 0, 1, 2, or 3 foreign words per sentence). Three hundred and sixty-four total participants were tested in this study, although 15 individuals were excluded from the analyses due to being bilingual in languages other than English and Spanish. Only one individual knew any Finnish but had been randomly assigned to one of the Spanish conditions.

Mean age of participants from south Texas was 25.1 years. Thirty-two men (17.7 %) and 125 (69.1 %) women, while 24 individuals (13.3 %) who not report their gender participated in the study.[2] 86.2 % (N = 156) of participants self-categorized themselves as Spanish–English bilinguals, while 13.8 % (N = 25) self-categorized themselves as English monolinguals. The self-categorization was based on a binary choice task which forced participants to categorize themselves as either monolingual or bilingual based on a general definition of bilingualism and a proficiency self-rating measure. The mean age of participants from the Mid-West was 19.7 years. While 8.9 % (N = 15) self-categorized themselves as Spanish–English bilinguals, 91.1 % (N = 153) self-categorized themselves as English monolinguals. Those who designated themselves as bilinguals had an overall mean Spanish self-proficiency rating (i.e., Spanish reading, writing, speaking, and overall understanding) of 7.1 out of 9 and mean reading self-proficiency rating of 7.1 out of 9. Additionally, self-designated bilinguals had an overall mean English self-proficiency rating (i.e., English reading, writing, speaking, and overall understanding) of 8.6 and mean reading self-proficiency rating of 8.6. Those who designated themselves as English monolinguals had an overall mean Spanish self-proficiency rating of 2.6 and reading self-proficiency mean rating of 3.0. Additionally, monolinguals had an overall mean English self-proficiency rating of 8.8 and mean reading self-proficiency of 8.9, ratings which did not differ from English ratings of the bilinguals.

Materials/Procedure/Design

Prior to the start of the experiment, participants were given both oral and written instructions, all in English, explaining the proper procedure for completing the tasks, but were not given

[2] Even though categorization of bilingualism status was based on a binary choice task (i.e., Yes or No), a secondary method to identify bilingualism status was used. A self-report Likert scale (1–9) required participants to self-evaluate themselves on four dimensions of language knowledge (i.e., Reading, Writing, Understanding, and Speaking) for English and Spanish. Participant averages were created across the four dimensions to create one average proficiency score for each language. Subsequently, all participants who met the criteria of obtaining an average Spanish and English proficiency self-rating of 7 or greater, higher scores indicating higher self-perceived proficiency beliefs, and who self-categorized as bilingual, were categorized as bilingual. Participants who self-categorized as bilingual but did obtain the criteria of 7 or greater, were excluded from the study. Although using a self-rating scale is not standard practice for identifying proficiency levels, Grosjean (1998) has suggested that the use of self-ratings significantly correlate with standardized measures of proficiency and can be used as a valid method by which to identify general proficiency levels. As such, through the use of the binary choice task and the self-report measure of proficiency, bilinguals in this study are believed to be a representative sample of the population.

enough information which would lead them to infer the true purpose of the study. Participants from both samples were randomly assigned to one of eight experimental conditions. Initially, a Language Experience Questionnaire (LEQ) was given to all participants. The LEQ inquired about experiences that the participants had with the languages under study, demographic information, and other information related to the participants' experiences/history with various languages.

The first task, following the LEQ, consisted of a pre-test translation task in which participants attempted to translate either Spanish or Pseudo-Finnish vocabulary prior to reading the experimental story. The pre-test translation task consisted of the 21 words in either Spanish or Pseudo-Finnish, of which none were cognates nor false-cognates to either English or Spanish. These words later appeared in the stories presented later, although not all appeared for all conditions (all words appeared only in the 3-word condition). The items were not given in the same order of presentation as they appeared in the text.

Once having completed the pre-test task, participants were given a written story passage of about 137 words (seven sentences, mean of 19.1 words per sentence and range of 8–28 words per sentence) in one of eight different experimental conditions, which they were instructed to read. Condition One (i.e., all-English–0 foreign words) consisted of a written passage entirely in English. A second experimental condition consisted of all English information except for one content word within each sentence which was in Spanish or Pseudo-Finnish, for a total of seven Spanish or Pseudo-Finnish words in the story. A third condition consisted of presenting the same material but with two content words in Spanish or Pseudo-Finnish within each sentence, for a total of fourteen Spanish or Pseudo-Finnish words. A fourth condition consisted of three content words in Spanish in every sentence of the story, for a total of twenty-one Spanish or Pseudo-Finnish words. In some cases, it was impossible to have a direct one-to-one translation of a word due to the required use of articles (e.g., el, la, or su) in Spanish. In these instances, articles were included to maintain the structure of the sentence and to have the Spanish content word function with the proper article. The last four conditions were exactly the same except for the use of Pseudo-Finnish rather than Spanish words. For an example of the 3 Pseudo-Finnish word condition used in Study 1 refer to Table 1.

The third task consisted of a translation post-test in which participants once again translated each of the 21 Spanish or Pseudo-Finnish vocabulary words given in the pre-test. Printed at the top of this task was the story which participants had just completed reading, in order to allow them to refer back to the original story for assistance in translation. The foreign vocabulary words were presented in the translation post-test in the order of presentation within the story passage which corresponded with the condition which the participant was in. Each of the experimental conditions received all 21 Spanish or Pseudo-Finnish words, sometimes including words which may not have appeared in the text they had read, depending on the condition which they were randomly assigned to.

The fourth task was a filler task in which participants completed 10 simple mathematical addition problems within 1 min; the purpose was to eliminate working memory processing and prevent rehearsal of the information which the participants had completed reading. Once participants had completed the mathematical problems, a 12-item multiple-choice test, with four choices per item, memory test was administered to test their memory for information provided. All questions specifically asked about content which had appeared in the Spanish or Pseudo-Finnish words in one or more of the conditions. A sample item that appeared in this assessment was as follows: "What dilemma did Abel encounter at school?" All questions in the comprehension task were in English across all conditions. The total time of completion for the entire study was approximately 30 min.

Table 1 3 (Study 1) and 7 (Study 2) Pseudo-Finnish words conditions used

3 words per sentence
Eilispäivä Abel graduated from a very surri jalo koulia. While in koulu everyone always ajatus in him because he was a stellar opiskelija. Abel erionomaisuus in all of his classes and all of his opettaja had great odattaa for him. Abel would always do the best on tentti no matter what the aihe was or how hard the questions were because he always spent so much time opiskella. One day while at school Abel perustaa himself with an ethical kysmys he couldn't hajota. He knew that some students were myydä drugs but he didn't know if he should tell the ensimmäinen or not because he wasn't sure of what would tapahtua. From that day forward Abel knew he made a mistake, and that he should have mainittu something to joku about what those inhmiset were doing
7 words per sentence
Eilispäivä Abel asteikolla from a very surri jalo koulia where he had many ystävyys from many different maaseutu but who were all vanhempi than him. Jotavastoin in koulu, jokainen always ajattelutapa of him as a tähtimäinen opiskelija and as a osa esikuvallinen for all of the other students in school. Abel erinomaisuus in all of his keskiluokka, and all of his opettaja uskoin that he was the greatest menestys tarina they had ever tunnettu. Abel would always do the paras on tentti, no matter what the aihe was or how vaikea the kysymykse were, because he always käytetty so much time opiskella. One päivä at school, Abel perustaa himself with an ethical kysmys he could not hajota, and had never encountered a tilanne like this one ennen in his elämä. Abel sahata some students kaupata lääkeaine but was not taattu if he should kertoa the ensimmäinen or not because of what may tapahtua if he did. From that day esiin Abel osata he made a erehtyä, and that he should have puhua to someone noin what those inhmiset were toimiva

Results

Prior to examining differences between word conditions, testing of the zero-word condition, for both Spanish and Pseudo-Finnish conditions for monolinguals and bilinguals, was done. The review of the zero-word condition was used to determine if potential confounds were present which could negatively affect translation scores. This is to say, if changes from pre- to post-test scores were shown, even when no manipulation was given during pre- and post-test measures, it would be assumed that a potential confound may be responsible for such changes in translation scores. Results demonstrated no significant changes from pre- to post-test for monolinguals and bilinguals at the zero-word condition (see Figs. 1, 2).

Analyses

The primary dependent variables used in the study were (a) difference scores in translation accuracy from pre-test to post-test (i.e., change scores), and (b) the number of correct comprehension items. The method of calculation of the difference scores for translation accuracy was to subtract pre-test scores from post-test scores (i.e., Post-Test minus Pre-Test). Furthermore, pre-test and post-test scores were calculated by summing the number of correct verbatim and correct gist responses. Responses were coded as "correct verbatim" when the responses in the translation task (pre-test and post-test) were precisely what appeared in English in the zero foreign word condition. Responses were coded as "correct gist" when the responses in the translation task approximated the exact word in meaning but were not the precise words which were set in the experiment. Inter-rater reliability analysis demonstrated a high degree of reliability between two coders ($\alpha = .92$). For the purposes of creating an overall correct response as the primary dependent variable for the translation task, verbatim and gist responses were combined to create a new overall correct response variable. The

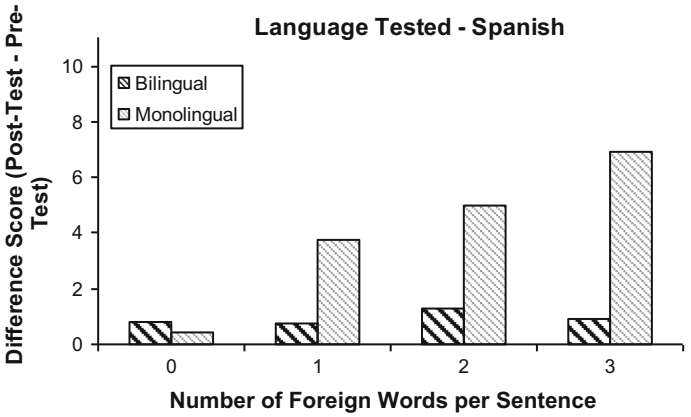

Fig. 1 Difference scores in translation accuracy between Monolinguals and Bilinguals when tested in Spanish dependent on the number of foreign words presented in Study 1

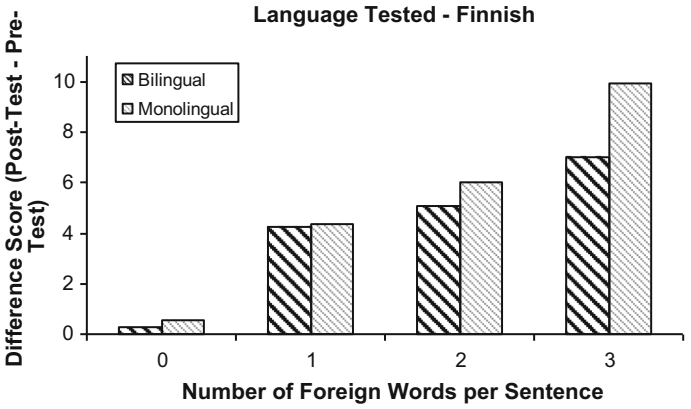

Fig. 2 Difference scores in translation accuracy between Monolinguals and Bilinguals when tested in Pseudo-Finnish dependent on the number of foreign words presented in Study 1

rationale for creating a new overall variable, which combined gist and verbatim responses, was that many possible alternative wordings (i.e., gist response) may capture a concrete idea, even though those responses are not the precise verbatim response. Thus, the most accurate measure of vocabulary learning should incorporate both gist and verbatim responses as both responses may accurately represent the idea presented.

Translation Accuracy Difference Scores

It was predicted that bilinguals' difference scores in translation of Spanish would be low throughout all conditions (i.e., 0, 1, 2, and 3 foreign words per sentence) since pre-test and post-test translation accuracy scores would both be very high. The results from the simple effects analysis indicated that, as predicted, no significant differences were found for bilinguals when tested in Spanish in any of the three Spanish word conditions, $F(3, 333) =< 1$, $p > .05$, $\eta^2 = .02$. Multiple comparisons of the four groups, using a Bonferroni correction, further supported this finding, thus supporting our prediction.

Additionally, monolinguals' difference scores in translation of Spanish vocabulary indicated that a significant difference between the three conditions did arise, $F(3, 333) = 22.15$, $p < .001$, $\eta^2 = .47$. Multiple comparisons ($p = .0125$) indicated significant differences between the zero Spanish word condition ($M = .44$, $SD = 1.24$) to the one ($M = 3.74$, $SD = 1.98$), two ($M = 5.10$, $SD = 2.44$), and three ($M = 6.86$, $SD = 4.00$) word conditions. Significant differences were also found between the one Spanish word condition to the three Spanish word condition, $p < .001$. Additionally, the three foreign word conditions together were significantly different from the one-word condition (see Fig. 1), $p < .001$. Results from this analysis suggests that monolinguals, when attempting to learn the meaning of Spanish words through a linguistic context learning strategy, were able to increase their translation accuracy from pre-test to post-test. Even though there is a decrease in the amount of English contextual information provided to the monolingual reader; however, enough information was provided for the reader to accurately understand some foreign words and be able to accurately translate than into English.

Examination of translation accuracy for bilinguals' and monolinguals' difference scores in translation of Pseudo-Finnish words, $F(3, 333) = 21.43$, $p < .001$, $\eta^2 = .40$, indicated that significant differences between the conditions did exist. Multiple comparisons using Bonferroni correction indicated that no significant differences were found between the one ($M = 4.11$, $SD = 1.41$), two ($M = 5.10$, $SD = 3.41$), or three ($M = 7.05$, $SD = 4.57$), all ps $> .05$, Pseudo-Finnish word conditions for Bilinguals, but all conditions were significantly different from the zero Pseudo-Finnish word condition ($M = .28$, $SD = .75$), all ps $< .001$, (see Fig. 2). Simple effects indicated a significant difference between the four Pseudo-Finnish word conditions for monolinguals, $F(3, 333) = 44.59$, $p < .001$, $\eta^2 = .63$; multiple comparisons found significant differences existed between the one-word condition ($M = 4.39$, $SD = 1.62$) and the three-word condition ($M = 9.65$, $SD = 3.69$) and the zero-word condition ($M = .52$, $SD = 1.31$). Additionally, significant differences were found between the two-words per sentence condition ($M = 5.77$, $SD = 2.99$) and the three-words per sentence condition ($M = 9.65$, $SD = 3.69$) and the zero Pseudo-Finnish word condition ($M = .52$, $SD = 1.31$).

These findings are of great importance since they suggest that both monolinguals and bilinguals, none of whom knew Finnish, were able to utilize linguistic context information when intending to disambiguate unfamiliar words from an unfamiliar language such as Pseudo-Finnish (see Fig. 2). The increase in translation accuracy from pre-test to post-test as the number of Pseudo-Finnish words increased demonstrates how much of a critical factor context information is for an individual who does not know any aspect of a language and is intending to acquire the vocabulary.

Comprehension Accuracy Scores

Since comprehension was also of concern to examine, it was predicted that bilinguals' comprehension accuracy scores for factual information would be high in all Spanish conditions, while monolinguals' comprehension accuracy scores for factual information would gradually decline as the number of Spanish words per sentenced increased. Results indicated that no significant differences were found between the four Spanish word conditions for bilinguals, $F(3, 333) = <1$, $p > .05$, $\eta^2 = .03$, while monolinguals' comprehension accuracy scores also did not significantly differ, $F(3, 333) = 1.10$, $p > .05$, $\eta^2 = .06$ (see Table 2). The findings suggest that, even though there was a substantial decrease in English contextual information, monolinguals' comprehension accuracy for recognition of factual information was unaffected by the introduction of Spanish vocabulary words. The findings also suggest

Table 2 Monolinguals' and Bilinguals' fact comprehension based on the number of Spanish words per sentence (6 total fact items)—Study 1

Number of Spanish words	Bilinguals		Monolinguals	
	M	*SD*	*M*	*SD*
0	5.24	1.09	5.65	.78
1	5.61	.94	5.35	.71
2	5.56	.71	5.15	.81
3	5.50	.74	5.43	.75

No significant differences for Monolinguals and Bilinguals as the number of Spanish vocabulary words increased

Table 3 Monolinguals' and Bilinguals' fact comprehension based on the number of Pseudo-Finnish words per sentence (6 total inference items)—Study 1

Number of Pseudo-Finnish words	Bilinguals		Monolinguals	
	M	*SD*	*M*	*SD*
0	5.72	.57	5.70	.47
1	4.63	.90	5.13	.76
2	4.67	1.24	4.82	1.05
3	4.55	1.30	4.78	1.35

Significant differences found for Monolinguals and Bilinguals between the zero word condition and the three word condition

that, even a substantial decrease in the comprehensible contextual information did not prevent monolinguals from creating situational models and utilizing those models at a later time.

Significant differences were found for bilinguals comparing the zero Pseudo-Finnish word condition ($M = 5.72$ out of 6, $SD = .57$) to the three-word condition ($M = 4.55$ out of 6, $SD = 1.30$). Results indicated a significant decrease in comprehension accuracy between the two conditions for bilinguals, suggesting that the incorporation of foreign language words in text decreases comprehension ability to a certain extent for bilinguals. This result also suggests that in terms of creating situational models, bilinguals are able to create situational models, since their scores are not at zero, but they may begin to have difficulties in creating accurate models when three Pseudo-Finnish words are included per sentence.

Significant differences were also found for Monolinguals when comparing the zero Pseudo-Finnish word condition ($M = 5.70$ out of 6, $SD = .47$) to the three Pseudo-Finnish word condition ($M = 4.78$ out of 6, $SD = 1.35$). Results suggested a significant decrease in comprehension accuracy for monolinguals, when three Pseudo-Finnish words were embedded within each sentence of the text when compared to the zero Pseudo-Finnish words per sentence condition. This result partially supports the prediction in suggesting that when Pseudo-Finnish words are included within text, then there is a corresponding decrease in comprehension accuracy. Although there were no significant pairwise difference between the one, two, and three Pseudo-Finnish word conditions for bilinguals or monolinguals, results were in the predicted direction (i.e., gradually decreasing) across all Pseudo-Finnish conditions. These findings also provided partial support for the claim that, by increasing the number of novel vocabulary into each sentence of the text, there would be a corresponding decrease in an individual's ability to accurately create a situational model of the given discourse (Table 3).

Discussion

The results from Study 1 clearly demonstrated that, although foreign language learners may have no knowledge of a foreign language's vocabulary, in this case Pseudo-Finnish or Spanish, they are still able to use the existing L1 context to correctly translate novel words into their native language with surprising ease. Furthermore, these findings also suggest that, in creating situational models, novice language learners may still successfully construct these models to assist in the recall of factual information even when there is a substantial decrease in the amount of content words in the reader's native language. Even though these findings suggest interesting implications for the learning of novel vocabulary, it still has not specifically identified, in terms of Krashen's $i+1$ model and the Involvement Load Hypothesis, the precise limit (i.e., peak) in the effectiveness of context information in the translations/identification of novel vocabulary. This is to say, how much "foreign" material needs to be present before there is insufficient context to construct the needed situational models to infer the meaning of unfamiliar vocabulary?

Study 2

Prior to the commencement of Study 1, it was assumed that by increasing the number of foreign words per sentence, learners would be increasingly less able to accurately identify the foreign information/vocabulary. Though this result was not found (results showed that performance continued to increase even under the most difficult conditions), it is still necessary to identify where the limit is for the technique. In terms of Krashen's $i+1$ model and the Involvement Load Hypothesis, Study 2 increased the difficulty of the task in order to identify at what point has the comprehensible input become insufficient and the difficulty of the task become too great for the learner to attain minimal vocabulary acquisition. Additionally, the issue of bilingual status (i.e., bilingual or monolingual) was not included in this study since it was of primary concern to focus on the limit of context learning for foreign language learners, thus only focusing on learners as a whole and not on those who were or were not bilingual.

It was predicted that both translation and comprehension accuracy would begin to decrease once increasing the number of foreign words per sentence beyond three (i.e., 4, 5, 6, and 7). These predictions suggest that the comprehensible input and task difficulty would have exceeded the limit for the effectiveness of context information to be used for the purposes of translation and comprehension accuracy.

Method

Participants

One hundred and forty-seven non-Finnish-speaking individuals (13 self-categorized as Spanish–English bilinguals and 134 self-categorized as English monolinguals) from a large Mid-Western university participated in the study for course credit. The mean age of the sample was 18.94 (SD = 1.19), with a mean English proficiency rating (i.e., understanding, reading, speaking, and writing) of 8.68 (SD = 1.01) and a reading-only English proficiency rating of 8.73 (SD = 1.01) on 9-point scales.

Materials/Design

The materials and procedure used in Study 2 were identical to Study 1 barring some minor differences in the story passage and in the pre- and post-translation tasks (e.g., time allotted and number of items to be translated). In Study 1 the manipulated story passage contained seven sentences which ranged between 8 and 28 words, suggesting a considerable degree of variability within each sentence. Furthermore, in Study 1, no maximum time allotted was given to participants when completing either the pre-, post-test, reading of the story passage, or completion of the comprehension assessment. Study 2 addressed this issue by allotting participants a maximum of 4 min to complete both pre- and post-test assessments, 3 min to read/review the story passage, and 4 min to complete the comprehension assessment given at the end of the study. The comprehension assessment evaluated participants on factual and inference based questions from the stimulus passage. The manipulated story passage contained seven sentences and was identical in content to the story passage used in Study 1, with a mean number of words per sentence of 25.71 (SD = 1.79), with a total of 180 words in the passage. Additionally, pre- and post-translation tasks included 42 items rather than 32 items as used in Study 1. The difference in the number of translation items increased due to the increase in the number of foreign words per sentence to seven. Lastly, six conditions were examined (0, 2, 4, 5, 6 and 7 foreign content words per sentence) to evaluate the limit of contextual learning of unfamiliar/foreign words.

Results

Results indicated a significant main effect for number of foreign words per sentence on translation accuracy difference score, $F(5, 146) = 45.40$, $p < .001$, $\eta^2 = .62$, see Fig. 3. When using a context learning strategy, translation accuracy continued to significantly increase when incorporating up to five foreign words per sentence. However, translation significantly began to decrease when six and seven foreign words per sentences were presented in text. In terms of Krashen's $i + 1$ model and the Involvement Load Hypothesis, the point at which the comprehensible input is optimal for the learner to satisfactorily learn novel vocabulary (the 1 in his model) is suggested to be around five novel words per sentence.

Results also indicated a significant main effect of number of words per sentence for comprehension accuracy, $F(5, 146) = 19.03$, $p < .001$, $\eta^2 = .40$, see Fig. 3. Post-hoc results suggest that comprehension accuracy (i.e., the creation of situational models) decreased when incorporating any amount of novel vocabulary, but increasing the number of foreign words per sentence beyond four (i.e., 5, 6, or 7) demonstrated a greater decrease in comprehension accuracy.

Although no specific predictions were made regarding the contrasts between fact and inference items. It was of interest to further divide total comprehension into fact and inference items, since the predictor could potentially affect specific sub-components of total comprehension scores. Exploratory analyses reveled significant main effects for both fact, $F(5, 146) = 13.21$, $p < .001$, $\eta^2 = .32$, and inference items, $F(5, 146) = 14.36$, $p < .001$, $\eta^2 = .34$, see Fig. 4. This finding suggests that overall fact comprehension significantly decreased more rapidly when compared to inference drawing. This finding in some way may suggest that, with the inclusion of foreign words within otherwise unilingual text, there may be greater decrements in the creation of situational models for factual information (i.e., the understanding of explicitly given information) than for the creation of situational models for inference processing (i.e., the prediction of future events). This finding may be

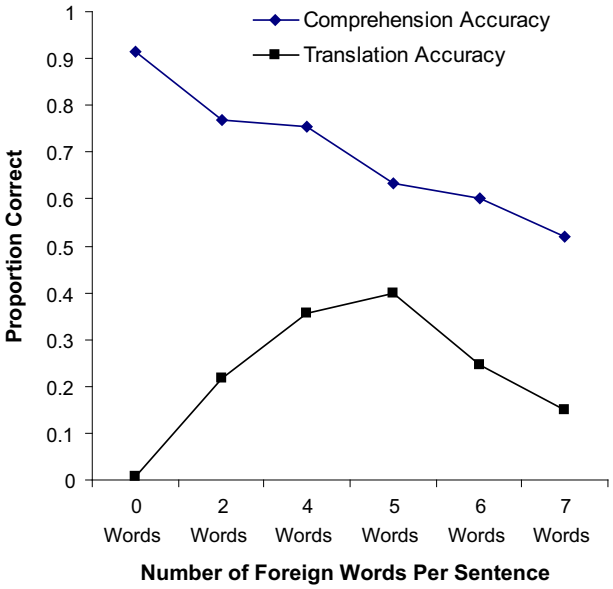

Fig. 3 Difference scores in translation accuracy and total comprehension scores (fact and inference combined) between conditions in Study 2

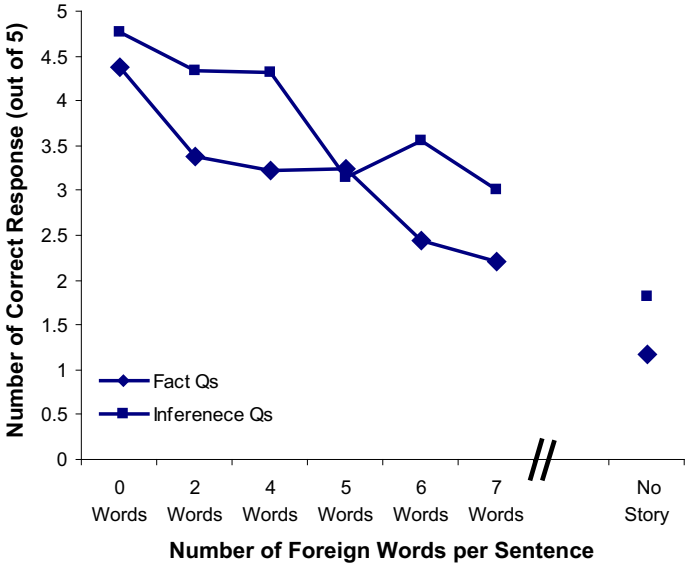

Fig. 4 Differences between fact and inference scores dependent on the number of foreign words per presented in Study 2

a strong indication that for the processing of future events related to a given scenario (i.e., inference drawing), individuals may not need a complete understanding of every detail of a given situation, but instead may have sufficient information needed to understand and predict possible future events.

Discussion

The findings from Study 2 suggest that, for the acquisition of novel foreign language vocabulary, a certain limit does exist in individuals' ability to correctly identify/translate novel information. This is to say, Study 2 may have identified the limit (i.e., peak) in the effectiveness of the context learning strategy for the translation of foreign vocabulary, this limit being at five foreign words per sentence. It was also found that comprehension accuracy significantly decreased as the number of foreign words per sentence increases, suggesting that the creation of situational comprehension models become more difficult to form as more novel information is introduced. Interestingly it was also found, when assessing fact and inference items separately, that an individual's ability to correctly recognize factual information decreased more rapidly than an individual's ability to extract factual information as the number of foreign vocabulary increased.

General Discussion

Implications for Learning Words in Context

The results from these two studies are applicable to the field of foreign language learning. Study 1 and Study 2 demonstrated that the use of a linguistic context learning strategy is a formidable technique to acquire vocabulary for a novel language. In other words, intermixing words from the target language (i.e., language attempting to be acquired) with prose from a base language (i.e., primary or known language by the learner) will help in the identification and translation of novel vocabulary items and also assist in their acquisition for later use. The findings from this study are consistent with the findings from Nagy et al. (1987) and Nagy et al. (1985), who suggested that the use of the context learning method would allow individuals to successfully infer the meaning of unknown vocabulary in the learner's L1, based on the surrounding cues given by the text or speech. The findings from this study also demonstrated this finding but extended the use of this method to the learning of novel vocabulary.

Even though this finding is of substantial interest, the most notable result stems from the findings in Study 2; even though individuals found the context learning method (i.e, lexical inferencing) to be useful for the identification of novel vocabulary, there was a limit to the usefulness of this technique. This is to say, when a large number of words are presented in an unknown language (e.g., either a real language or pseudo-language), the ability of the individual to successfully use the context learning method eventually deteriorates and produces a decrease in their translation/identification ability. This finding is consistent with what is predicted by Krashen's Input Hypothesis and the Involvement Load Hypothesis' Evaluation component. Our task became too difficult to use the appropriate contextual cues in the most difficult conditions. Thus, the minimal level of knowledge which the learner needed to continue to successfully use this learning method, as proposed by Krashen (1989) and Laufer (1991), was exceeded as the degree of foreign language input continued to increase. This is to say, that if the comprehensible input that is given to learners is beyond their level of knowledge/competence, then the ability to adequately "learn" the information will deteriorate and performance will subsequently decrease. Based on the findings from Study 2, the optimal level which one is able to adequately use the context learning method is approximately five unknown/foreign content words per sentence.

Implications for Comprehension Performance

Given the results from the comprehension assessments in Studies 1 and 2, it is suggested that, as individuals' ability to accurately create situational models becomes more difficult, thus, comprehension (i.e., extraction of fact and inference information) systematically decreases as the amount of foreign information (i.e., non-comprehensible input) increases. Additionally, the current results are consistent with previous research which also found that for comprehension to occur, the reader must first extrapolate the correct meaning of vocabulary items (Alavi and Kaivanpanah 2009; Bengeleil and Paribakht 2004; Cain et al. 2004; Paribakht and Wesche 2006; Tannenbaum et al. 2006). Thus, if the identification of vocabulary does not occur, due to difficulty of text or because of lack of knowledge, the appropriate situational models are very difficult to create. Furthermore, when examining comprehension of discourse, an individual's ability to correctly extract surface and propositional representations (i.e., remembering exact words and their meaning), such as factual information from the text, there is a greater deterioration in comprehension for these types of representations (i.e., text-base representations) than for the extraction of global inferences (i.e., predicting future events) (see Fig. 4).

General Implications

Overall, the findings from these studies provide insights over the possible mechanisms that may be at work when an individual attempts to comprehend and identify novel information. In other words, these results provide us with a basic understanding of the usefulness of linguistic context for the purposes of comprehension and translation. Additionally, these findings provide support for Krashen's Input Hypothesis model in which it could be suggested that some of the basic properties of this model (e.g., degree of comprehensible input) may be useful when attempting to understand the method by which individuals are attempting to acquire information, either from a native or foreign language.

The results from these studies have many potential applications. For example, foreign language instructional methods, which use a linguistic context strategy or a variation of it, may benefit from using a similar method as the one proposed and attempt to apply the strategy to each learner individually by first identifying their personal competence level and goal. Further experimentation is needed to assess other foreign language instructional methods and identify, using a similar theoretical model in regard to the identification of limits to the strategy's usefulness, each of the method's instructional value for the purposes of learning a foreign language that may benefit from a similar methodological approach.

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