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Validation of the Threshold Hypothesis in Computer Aided English Language Forgetting

[1,3,4]Yu Zhonggen and [2]Chang Liu
[1]Postdoctoral Research Station of Psychology of Nanjing Normal University, Nanjing, 210097, China
[2]School of Psychology, Nanjing Normal University, Nanjing 210097, China
[3]Foreign Languages School of Hohai University, Nanjing, 210098, China
[4]Tongda College of Nanjing University of Posts and Telecommunications, Nanjing, 210003, China

Abstract: The threshold hypothesis is well-known in the field of language forgetting. This study attempts to validate this hypothesis in computer aided English language forgetting among tertiary students in China. The data were collected from the test scores of 38 participants who had received computer aided English education and had not learned English for two years. The results indicated that participants who failed to pass CET 6 presented significant language forgetting regarding listening ($t = 3.21$, $p = 0.02$), reading ($t = 5.14$, $p = 0.01$), writing ($t = 2.15$, $p = 0.03$) and cloze ($t = 7.25$, $p = 0.01$). By contrast, participants who passed CET 6 showed no significant language forgetting as to listening ($t = 2.14$, $p = 0.06$) and cloze ($t = 2.72$, $p = 0.42$). Nevertheless, they showed significant language forgetting as to writing ($t = 2.83$, $p = 0.01$). In addition, it was somewhat surprising to find that they did not show significant language forgetting in reading comprehension. In contrast, their reading skills significantly gained after two years break ($t = 2.82$, $p = 0.03$).

Key words: Threshold hypothesis, computer aided English language learning, language forgetting

INTRODUCTION

So, far, many definitions of language forgetting have been provided. It could not only refer to the loss of any language skills due to some physical or pathological damage on the brain but also refer to the non-pathological, gradual loss through lack of practice or exposure (Schmid, 2006). Many terms, such as attrition, degradation, forgetting, loss and erosion, were used to refer to this phenomenon. This study prefers forgetting in order to keep consistent with studies in the field of psychology.

Four areas of language forgetting were discussed and explored. They could be summarized in Table 1 based on what language (L1 or L2) is forgotten and where (L1 or L2 context) the language is forgotten. The description of language forgetting based on these criteria is referred to as the "van Els taxonomy" (Van Els, 1986).

As illustrated in Table 1, L1 loss in an L1 environment can be found among people with dementia or those with aphasia in the situation of native language. L1 loss in an L2 setting can be found among immigrants who lose their first language in the new environment. L2 loss in an L1 setting is usually observed in individuals who have lost the ability to use an L2 that was perhaps studied at school in their L1 setting. Finally, L2 loss in an L2 environment is most commonly observed among immigrant communities without formal training in or immediate access to their L2 who lose that L2 as they age and revert to their L1. This study mainly concentrates on the forgetting of L2 (English) learners in an L1 (Chinese mandarin) language environment.

LITERATURE REVIEW

The most prominent theory to explain the retention of language proficiency is the threshold hypothesis proposed by Neisser (1984), stating that if learners can command a level of language ability up to a critical threshold, then it will get resistant against forgetting, i.e., the forgetting process will be hindered or slowed down. Studies on this hypothesis argue that threshold

Table 1: Taxonomy of language forgetting

Van Els terminology: possible forgetting	Language environment (L1)	Language environment (L2)
L1 loss	L1 (e.g., aphasia)	L1 (e.g., minority communities or immigrants)
L2 loss	L2 (e.g., language students)	L2 (e.g., older immigrants who revert to their L1)

Corresponding Author: Chang Liu, School of Psychology, Nanjing Normal University, Nanjing 210097, China

hypothesis should shed some light on future forgetting studies (Grendel, 1993; Weltens and Grendel, 1993; Weltens *et al*., 1989).

The inverse hypothesis claims that the higher the level of the language proficiency is, the slower the forgetting process will be. This view is supported by many researchers (Weltens *et al*., 1989; Edwards, 1977; Snow *et al*., 1984; Vechter *et al*., 1990), though there are still some disagreements. In order to study the inverse hypothesis to a further extent, Neisser (1984) thought that participants in Bahrick and Phelps (1988) might have attained to a "critical threshold" making them less subject to forgetting. This suggested that there was "a critical point in overall language proficiency below which forgetting is rapid and extensive, but above which, a large proportion of the initially acquired material is retained". It is claimed that those who have passed the threshold level must have developed a systematic ability to understand and internalize the knowledge structures, which is called a schema by Neisser (1984). He has argued that having this schema would enable the learner to be less vulnerable to forgetting. On the contrary, forgetting tends to be faster when information is made up of separate elements.

The distinguished linguistic expert Michel Paradis voiced his viewpoint clearly: "attrition is the result of long-term lack of simulation" (Paradis, 2007). He has put forward a rule named the Activation Threshold Hypothesis (ATH) which sounds reasonable and well accepted in the field of language forgetting. The ATH is on the basis of the theory that, when on some level of knowledge proficiency in human brain, humans feel easy to retrieve the information they desire. However, if the level is not reached, it will be difficult to retrieve. An example is that at times it is hard to remember even very familiar issues. (This is referred to as the tip-of-the-tongue state). This is because accessing something that is stored in memory needs a certain number of neural impulses. The more frequently the item has been used before, the less effort it is needed to activate it again. However, if something is not accessed for a long time, the amount of energy that is necessary to access it again slowly goes up- that is, the Activation Threshold increases (Schmid, 2011).

A bilingual who speaks his or her second language every day but has not used the first for a long time,therefore has words and structures that belong to the L2 which are highly active and easy to access but the corresponding bits of the L1 may have a very high Activation Threshold. This is why the L2 can often get in the way when a speaker attempts to use the L1 (Schmid, 2011).

This study focuses on the forgetting of English as an L2 among healthy English language learners who have learned English for some time with the aid of computer technology and later have not learned English for two years. The research question raised in this study is: Does threshold hypothesis hold water?

METHODS

This study attempts to integrate qualitative research method into the quantitative one. The data were obtained from the test scores of 38 participants who had undergone computer aided English instruction and had been beyond English formal education for two years. All of them did not need to use English when working. Among them, 19 successfully passed College English Test Band 6 in China (CET6), while the remaining 19 participants failed to pass it. All of the participants took CET6 (the test in June, 2010) at two time points, i.e., before and after two years. The test settings and requirements were both the same. The degree of contact with English made the only difference. The participants had sustained computer aided English education for three years before June, 2010. Later, however, they have been beyond formal English education for two years. The timeline of the tests is shown in Fig. 1.

As shown in Fig 1. participants took both pre and post tests with two years break. The pretest was taken in June, 2010 in Room 204, Teaching Building 2, Xianlin Campus, Nanjing University of Posts and Telecommunications (NJUPT); the post test was taken in the same room in June, 2012. The test scores were entered into SPSS 13.0 and analyzed through computing.

CET 6 has experienced convincible validation and a strong reliability has been established to test English learners' short conversation and passage listening comprehension, speed and in-depth reading comprehension, cloze and writing skills. Nearly 20 years has witnessed CET6's wide application in evaluating learners' English proficiency since it was born in the 20th century in China. The Ministry of Education of China launched this testing project and made it popular in China to measure learners' comprehensive English proficiency in terms of listening, speaking, reading and writing skills (Ministry of Education of the People's Republic of China (MEPRC, 2001). Yang and Weir (1998)

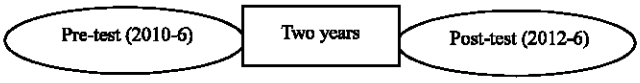

Fig. 1: Timeline of pre and post tests

conducted an empirical study whose results supported the validity and reliability of CET6 measurements of listening, speaking, reading and writing skills.

CET 6 is composed of writing, reading, listening and cloze test items:

Writing task: For the writing part, participants are allowed 30 min to write a short essay on the topic of due attention should be given to spelling. You should write at least 150 words following the outline given below:

- Nowadays, many students pay less attention to spelling when writing
- The reasons for this phenomenon are...
- In order to improve spelling, I think...

In addition, the translation task is one component of writing. Participants are required to complete the sentences by translating into English the Chinese given in brackets.

Reading comprehension: Two components were included in this part as follows:

- **Skimming and scanning:** In this part, participants will have 15 min to go over the passage quickly and answer the questions. For questions 1-7, they should choose the best answer from the four choices marked A), B), C) and D). For questions 8-10, they should complete the sentences with the information given in the passage
- **Reading in depth:** This part includes two sections, sections A and B. In section A, there is a short passage with 5 questions or incomplete statements. Participants are required to read the passage carefully and then answer the questions or complete the statements in the fewest possible words. In Section B, there are 2 passages. Each passage is followed by some questions or unfinished statements. For each of them there are four choices marked A), B), C) and D). Participants should decide on the best choice
- **Listening comprehension:** This part involves 7 short conversations, 2 long conversations, 3 short passages and 1 compound dictation. Participants should decide on the right choice according to the recording
- **Cloze:** In this part, there are 20 blanks in the following passage. For each blank there are four choices marked A), B), C) and D) on the right side of the paper. Participants should choose the one that best fits into the passage

RESULTS

The writing scoring process is based on national standard scoring criteria of CET6 set by Ministry of Education of China as follows.

The full score is 15 points. The scoring consists of five levels: 2 points, 5 points, 8 points, 11 points and 14 points. There are two standard samples for each level.

Scorers have all gone through strict training and been evidenced qualified. They made their judgments on the basis of criteria and samples. If a writing is similar to a sample (such as 8), then 8 points will be given; if it is slightly better than or slightly inferior to the sample, the scorer can add (9 points) or deduct one point (i.e., 7 points) but shall not add or deduct a half point.

Scoring criteria:

- **Two points:** Sentences are incoherent; thoughts are in disorder; there are many fragmental or wrong sentences, most of which contain serious mistakes
- **Five points:** The writing basically keeps to the title; thoughts are unclear and incoherent; there are many serious language errors
- **Eight points:** The writing fundamentally keeps to the title; thoughts are not clear and coherent enough; there are many language errors, some of which are serious
- **Eleven points:** The writing keeps to the title; thoughts are clear and coherent; there are a few language errors
- **Fourteen points:** The writing keeps to the title; Thoughts are very clear and coherent. There are few language errors

There are totally three independent scorers to evaluate writing task. The average score is considered as the final one for each participant. In case there is any wide gap between any score and the average, the score will be removed if found carelessly decided.

Aiming to gain reliable data, the same scorer who received the same training and scoring practice was selected to mark both pre and post writing tests. They, willing to participate in the study, were all richly experienced in writing scoring and acquainted with specific items in CET6.

After data of all tests were obtained, they were then entered into computer, processed in the program paired-samples T tests in SPSS 16.0. The results were summarized in Table 2.

Table 2: Data of both pre and post tests

Pairs	Mean	Mean differences (pre-post)	SD	T	Sig. (2-tailed)
Pair 1					
Prelistering 1	131.96	2.32	3.25	3.21	0.02
Postlistening1	131.56				
Pair 2					
Prereading 1	130.16	2.56	2.51	5.14	0.01
Postreading1	128.48				
Pair 3					
Prewriting1	73.44	2.21	3.61	2.15	0.03
Postwriting1	71.28				
Pair 4					
Precloze1	39.84	1.02	0.72	7.25	0.01
Postcloze1	38.84				
Pair 5					
Prelistening2	153.80	1.23	3.19	2.14	0.06
Postlistening2	154.52				
Pair 6					
Prereading2	154.48	-1.13	2.82	-2.22	0.04
Postreading2	155.76				
Pair 7					
Prewriting2	89.80	0.83	1.46	2.83	0.01
Postwriting2	88.84				
Pair 8					
Precloze 2	44.00	1.02	6.16	0.72	0.42
Postcloze2	46.00				

Prelistening1, Prereading1, Prewriting1, Precloze1: Tests taken by the participants who did not pass CET 6 before two years (2010-6), Postlistening1, Postreading1, Postwriting1, Postcloze1: Tests taken by the participants who did not pass CET 6 after two years (2012-6) Prelistening2, Prereading2, Prewriting2, Precloze2: Tests taken by the participants who passed CET 6 before two years (2010-6), Postlistening2, Postreading2, Postwriting2, Postcloze2: Refers to the tests taken by the participants who passed CET 6 after two years (2012-6). SD: Standard Deviation

As shown in Table 2, the first column indicates the compared pairs. The second one shows the means of different items. The third one presents the differences of pairs. The fourth one reveals the standard deviations of pairs. The fifth one shows the values of T and the last stands for the significance levels. It could be found that participants failing to pass CET 6 showed significant language attrition in terms of listening ($t = 3.21$, $p = 0.02$), reading ($t = 5.14$, $p = 0.01$), writing ($t = 2.15$, $p = 0.03$) and cloze ($t = 7.25$, $p = 0.01$). On the contrary, participants who passed CET 6 failed to show any significant language forgetting in terms of listening ($t = 2.14$, $p = 0.06$) and cloze ($t = 0.72$, $p = 0.42$). They, however, showed significant language forgetting in writing skills ($t = 2.83$, $p = 0.01$). Furthermore, it is uncommon to find that they failed to show significant language forgetting in reading comprehension. On the contrary, their reading comprehension significantly gained after two years' break ($t = 2.22$, $p = 0.04$).

DISCUSSION

The threshold hypothesis in language forgetting seemed selective rather than overall. As could be seen, participants with higher initial proficiency did not maintain language skills in all linguistic components. Reading comprehension skills significantly gained although skills in listening and cloze decayed. Receptive skills, such as reading comprehension might be more resistant against forgetting than productive skills. Writing skills were considered as productive skills and thus received significant decrease.

Reading skills having gained after certain time of nonuse were not in conformity with initial consideration. However, a further consideration would bring reasonable understanding to this phenomenon. Despite the fact that it was unnecessary for participants to learn English any more after graduation, they could not keep beyond any contact with English all the time in their daily life. Internet is nowadays a convenient medium to get access to English, which consists of various kinds of information in English. Participants have to learn English only if they want to retrieve and understand the abundance of information displayed on the screen. Even when they play computer games, they will easily get access to English since many instructions are written in English and many words in dialogues are also expressed in English. Furthermore, participants now frequently communicate with each other in English through the Internet. Information of various kinds is also often shown in English. Examples are international commercials, job opportunities, admission instructions, computer-human dialogues, shopping centers and vehicles' manuals and etc.

As a productive skill, writing tends to be more subject to forgetting (Weltens and van Els, 1986). Lack of practice might have contributed to this result. Participants might have rarely written English after graduation

since there was no immediate access to English in the working situation. Furthermore, participants' writing skills might be poor even when they were learning on campus which gave rise to a relatively lower proficiency compared with reading and listening skills. Lower proficiency might be more easily attrited than the higher proficiency according to the threshold hypothesis. Reading is easily accessed due to the fact that participants were immerged in English slogans, English ads, English TV programs and English instructions nearly everywhere. It is not necessary for participants to work hard if they want to read English. However, writing needs enough patience and concentration to accomplish. Participants have to focus on some topic and organize ideas by thinking over which needs painstaking effort. This might have caused participants to be unwilling to write since it was not so, easily handled.

Being unwilling to write might act as a factor which resulted in their writing skills having not reached the threshold. The writing skills might be administered in the brain by some interacted neural units. If the skills were not proficient enough for them to unite together steadily, then the neural units would be ephemeral, which led to the fact that the acquired writing skills were easily forgotten. On the contrary, if the skills reached or over passed a threshold, then the neural units might be able to unite together tightly and steadily which formed a relatively consolidated block against forgetting. The leading reason why participants' writing skills decreased significantly might be that their skills had not attained to the threshold level; the neural units managing the writing might have not formed a steady block, while the reading might have.

The assessment criteria might have influenced the results of writing. Much literature studied writing assessment. An example is ecological model of writing assessment which seeks to provide students, teachers, departments and institutions with fuller, richer accounts of the breadth of students' literate experiences and explores how those experiences impact their abilities to accomplish academic tasks throughout the undergraduate years and beyond (Wardlea and Roozenb, 2012). In this study, the writing performance was conducted based on CET 6 scoring criteria ignoring ecological perspective of literate development. Ecological factors such as scorer's mood, physical condition, surroundings and psychological state might have influenced the scoring results.

Listening, as a receptive skill, might be more resistant against forgetting compared with writing. During the complex process of listening, a person should be mentally active in order to differentiate the words, stress, intonation and grammatical structure of listeners, to constitute meaningful combinations by making classifications or combinations, to fill in the gaps logically by using background knowledge, to keep in mind and evaluate what has been listened to and to construct meaning (Long, 1989; Vandergrift, 1999).

The process of listening comprehension can only succeed with the participation of nerves. As the stimuli increase, the response of nerves will be more intense and the sensitivity to the stimuli will also be higher. With higher sensitivity, the activation of nerves will be easier. After frequent English input in the daily life, participants might have cultivated higher sensitivity to English input, which might have been memorized by the brain. When hearing English next time, the stored memory would be activated more easily than those not memorized and stored. Participants might be able to access English listening frequently since nowadays English is everywhere and participants can hear English without any great effort, which might have cultivated the high sensitivity to English listening and have made participants reach the threshold of listening comprehension. Participants might have successfully reached the critical stage before two years and then became more resistant against forgetting.

Research into the role of self-efficacy in listening seems to underline its importance in terms of listening performance. Within a certain context, self-efficacy would seem to have particular relevance. Nothing can fully prepare a second-language student for the experience of listening to a full-length lecture or participating in a rapid exchange of views in a seminar. However, it is important to ensure that these experiences do not give rise to the kind of listening anxiety that forces the student to rely almost exclusively upon visual input (PowerPoint slides and handouts) in the first case and remain totally silent in the second. The knowledge that he or she is capable of making sense of what is said to the extent of picking out critical words and phrases and main ideas will give much-needed confidence in the early days of an academic course. It will also mark the first step in the gradual and usually imperceptible process that occurs as a listener becomes attuned to a language by dint of extended exposure to it (Graham, 2011). Participants who must have known that this test would not mark their proficiency of English, might have relaxed themselves when taking the examination. Strong self-efficacy might have helped them perform better than the real CET 6 achievement test.

Computer anxiety and achievement in English were interrelated in a reverse order, meaning that more computer anxiety caused poorer achievements and vice versa. Students with higher English proficiency used

computers (both online and offline) more frequently than those with lower English proficiency. Computer ownership was also significantly related to students' success in English. It was also found that except gender, achievement in English, PC time and computer ownership were predictors of computer anxiety (Rahimi and Yadollahi, 2011). All of the participants in this study received computer aided English education. But two years later when they did not learn English on campus, they did not learn English, let alone use computer as a tool to learn English. This might account for the significant decrease in English skills.

Doubtlessly, computers are satisfactory tools for English learning. Language acquisition can be facilitated by use of computers. Computers can realize various modes of language acquisition, such as multi-media projecting, online listening, speaking, reading, writing and testing. Computer programs can also be used to analyze learning data and to design proper learning schedules. In the classroom, a sea of information can be displayed for students to absorb. Clickers is also considered a useful tool for students and instructors to provide effective and timely response and thus interact with each other.

The understanding of human learning is increasingly informed by findings from multiple fields-psychology, neuroscience, computer science, linguistic and education. A convergence of insights is forging a "new science of learning" within cognitive science (Heinz and Idsardi, 2011). To validate the threshold hypothesis is a difficult task for linguists to accomplish alone. To absorb cross-disciplinary knowledge and analyze data by using knowledge in multi-faceted fields is necessary. Furthermore, even though threshold hypothesis in language forgetting is nearly universally acknowledged, specific thresholds for different languages in different countries and areas might still not be easily determined. Scientists in many related fields, such as psycholinguistics, neuro-linguistics, cognition, neurology, medicine and computer, should work together. The integration between different disciplines is helpful for studies on the threshold hypothesis in the field of language forgetting.

Computer technologies such as clickers might be able to facilitate the process of reaching the threshold of English proficiency. Although not widely accepted in China, use of clickers is a popular way in USA to produce an interactive situation between students and teachers. Previous literature showed that students thought clickers enhanced the learning experience (Prather and Brissender, 2009). Several studies indicated that students believed clickers aid in correcting misunderstandings of course concepts (Bode *et al*., 2009). Clickers improved thelearning settings due to increase in interaction between students and instructor; there was a natural participatory quality to use of clickers that required student participation, inhibiting passive learning (Hoekstra, 2008).

In general, the threshold hypothesis in computer aided English learning might be well accepted in this study. Therefore, it is urgent for learners and instructors to use computer technologies to improve learners' English learning so that their English proficiency can attain to the threshold hypothesis as soon as possible. In this way, language forgetting may be avoided to a certain extent.

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