Deserted island or a child's first language forgetting

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The longitudinal study reported in the present paper examines L1 vocabulary decline by a child whose native language input effectively ceased after her immersion into the L2 environment. The subject of the study was a Russian girl adopted by an American family, brought to the USA, and completely isolated from any contact with the Russian-speaking environment. The analysis of the data was based on the results of picture naming tasks and reaction time measurements. Three groups of words showed high vulnerability to forgetting: high frequency words, cognates, and semantically convergent pairs (pairs of words lexically distinguished in L2 and non-distinguished in L1). Fast forgetting of these lexical items in L1 was related to the acquisition of their equivalents in L2. The comparison of noun versus verb retention/acquisition suggested that there might be a delay in L1 verb forgetting / L2 verb acquisition at the early stage of an extensive exposure to the second language.

Introduction

The field of study known variously as first language forgetting, first language loss, or first language attrition (Seliger and Vago, 1991) has seen a surge of interest in the past decade. First language (L1) loss in normal speakers is usually documented when native speakers lose contact with their first language or have restricted contact with their native language due to immersion in a second language environment. Traditionally, the study of language loss has been undertaken from a sociolinguistic rather than a psycholinguistic perspective. The psycholinguistic approach to this field is a relatively modern science which was known as an "emerging discipline" (Pan and Gleason, 1986) just fifteen years ago, and since then has not been broadly explored (de Bot, 1999).

The psycholinguistic studies on L1 loss can be roughly broken down into three categories. The first category concerns longitudinal case studies reporting L1 changes in a single subject (Burling, 1978; Fantini, 1978; Berman, 1979; Kaufman and Aronoff, 1991; Turian and Altenberg, 1991; Kravin, 1992) and non-longitudinal studies based on the analysis of the linguistic data collected from a single informant (Jaspaert and Kroon, 1992) or a few informants (Klatter-Folmer, 1997; Schoenmakers-Klein Gunnewiek, 1997). The second category deals with experimental studies (Olshtain and Barzilay, 1991; Levine, 1996; Schaufeli, 1996; Leyen, 1984; Merino, 1983; Liu, Bates and Li, 1992; Silva-Corvalan, 1991; Mayor, 1992; Segalowitz, 1991; Hakuta and D'Andrea, 1992; Ammerlaan, 1997; Soesman, 1997). Finally, a new group of studies emerged with the recent publication by Kouritzin (1999) that looked at language loss from the personal perspective of those individuals who experienced a decline in their native language proficiency.

This paper reports on the findings from a longitudinal case study. The present study attempted to further explore the process of first language loss in a unique subject, a child who lost contact with her native-language-speaking community and was immersed in a strictly English-speaking environment. Given the uniqueness of the subject used in the present case study, the author was tempted to investigate changes in all aspects of language, such as morphology, syntax, and vocabulary. However, the subject's reluctance to participate in conversations and the difficulty she had in performing picture description and storytelling tasks at the later stage of the observation period resulted in an insufficient amount of data for qualitative analyses of syntactic and morphological changes. Thus, only changes in vocabulary will be reported on in the present paper.

A further analysis of psycholinguistic studies on L1 loss reveals that different aspects of language are usually scrutinized in attriters. While there were just a few studies exploring the phonological changes in a person's L1 speech (Mayor, 1992), the research has demonstrated that second language acquisition has possible effects on first language syntax (Merino, 1983; Altenberg, 1991; Silva-Corvalan, 1991; Liu, Bates and Li, 1992; Schaufeli, 1996; Schoenmakers-Klein Gunnewiek, 1997) or first language vocabulary (Leopold, 1939; Leyen, 1984; Olshtain and Barzilay, 1991; Hakuta and D'Andrea, 1992; Kravin, 1992; Ammerlaan, 1997; Klatter-Folmer, 1997; Soesman,

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1997). The latter was found more vulnerable in L1 loss, that vocabulary was reportedly the first aspect of language affected by the attrition process (Leyen, 1984; Kaufman and Aronoff, 1991; Olshtein and Barzilay, 1991).

The findings from earlier studies on vocabulary decline suggested that accessibility of vocabulary items can differ from one task to another. For example, recall in the picture naming task was found to be affected by L1 loss more than recall of the same items in the recognition task (Hakuta and D'Andrea, 1992; Ammerlaan, 1997). In addition, certain word categories were found more susceptible to L1 loss than others; e.g. low frequency words showed more retrieval problems than high frequency words (Leyen, 1984; Olshtain and Barzilay, 1991; Hakuta and D'Andrea, 1992; Ammerlaan, 1997; Soesmann, 1997). Scientists came to the same conclusion that low frequency words tend to disappear faster from a person's first language repertoire due to their disuse or infrequent use in a new language setting. There is consistency in the recent findings on word frequency as a factor of L1 loss.

Another word category, which was examined in the previous studies on L1 loss, deals with cross-linguistic similarity, or those words which have a similar phonetic realization and meaning in two languages. This is often known as cognateness. Cognates were reported the least affected category in Ammerlaan's study (1997). Participants of the study were what he called "dormant" speakers of Dutch in Australia who had not used their language at all in the years preceding the testing. The results of the experiment showed that cognates were recalled and recognized better than non-cognates. The researcher based his explanation on the hypothesis of bilingual lexical processing (de Groot, 1992), which suggests that cognates may share access routes; that activation of a cognate word in one language may simultaneously activate its corresponding pair in another language. In other words, cognates in a "dormant" language may get more "practice" than non-cognates, even in a case where the language is not used for everyday purposes.

However, the author also mentioned that the role of similarity is uncertain and that cross-linguistic similarity may result in facilitation as well as confusion (Ammerlaan, 1997, 70). The latter were supported by de Bot (1999) who suggested that cognateness may be a problem in recalling an L1 word. Their research with Dutch speakers in Australia (notice that the contact languages were the same as in Ammerlaan's 1997 study) showed that participants avoided the use of the perfectly correct Dutch word "railing" in their description of a picture because that word is a direct cognate of the English word (de Bot and Clyne, 1994). In other words, the role of cognateness in the process of first language loss seems uncertain and calls for further research.

There is controversy in the literature as to whether grammatical categories, like nouns and verbs, can be affected differently by the attrition process. Klatter-Folmer's (1997) study, involving the qualitative analysis of letters written by Dutch immigrants to New Zealand, and the results of the language proficiency test administered to the same group of informants, revealed a few vulnerable word categories, like verbs, articles, and conjunctions. Nouns were not reported as a category affected by L1 loss in that study. On the other hand, Kravin (1992) reported "word mortality" among nouns rather than verbs.

The process of forgetting the native language in terms of these two word categories has not been theoretically or empirically explored. However, studies on L1 acquisition claim that there might be a difference in how nouns are learned, i.e., whether they are learned faster than verbs (Gentner, 1982) or not (Tardif, 1996; Tardif, Shatz and Naigles, 1997). Applying the claim that L1 nouns are acquired faster than verbs, we could argue that, in L2 acquisition, L2 nouns may also be acquired early, causing L1 loss, or L1 nouns may be less vulnerable to loss due to their earlier acquisition. The present research not only attempted to find the most vulnerable word categories, but also looked into the possibility that noun and verb forgetting can take different paths. The picture naming task employed in the present research was controlled for these two word categories.

While loss of first language vocabulary could be due, at least partly, to lack of practice and length of time since a particular vocabulary item had been used, it is also possible that interference from the second language is responsible for inaccessibility of first language items. In particular, there is a high degree of similarity, or what could be called "semantic overlap", between translation equivalents in the first and second language. This overlap is even stronger than that for within-language synonyms. Thus, interference on first language words, where the translation equivalent has been acquired in the second language, may be strong. This interference should be stronger than if other second language vocabulary had been acquired that are not translation equivalents of known first language words.

The majority of studies on L1 loss emphasize overall proficiency in the second language as an important factor responsible for decreasing proficiency in the first language, while interference has

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been a predominantly psychological term. Language interference can indeed be a reason for losing access to the vocabulary items in the individual's native language. The role of interference has been discussed in psycholinguistic studies on L1 loss (Klatter-Folmer, 1997), but its mechanism has not been broadly explored. However, there are a few studies which seem relevant for the present research.

One of the earlier studies on bilingual development of a child (Leopold, 1939) suggested that one of the reasons for "mortality of words" in the child's vocabulary might be a struggle with synonyms: some words are abandoned as synonyms from another language take their place. The same finding was reported in a recent longitudinal case study with an English–Finnish bilingual child (Kravin, 1992). "Word mortality", as it was used by the researcher, concerned those Finnish words which were replaced by English equivalents in Finnish sentences. It remains unclear, however, whether the replaced Finnish words could be accessed in other linguistic tasks, or whether they were permanently lost from memory. The same would be true for Clyne and Pauwels's (1997) study which reported numerous examples of English replacements in the Dutch speech of their informants, but associated those replacements with a renewal of the Dutch vocabulary due to changes in the linguistic and social environment of the immigrant community in Australia. The approach taken in the present study was to view interference from acquisition of vocabulary items in the second language as a possible cause of forgetting their translation equivalents in the first language.

Degree of first language loss may also be a function of the amount of exposure to the second language. A number of studies looked into the correlation which may exist between first language loss and second language acquisition (Merino, 1983; Kravin, 1992; Mayor, 1992; Kenny, 1996; Soesman, 1997), or between first language loss and the amount of contact with the native language (Hakuta and D'Andrea, 1992). However, just a few studies on L1 loss looked into the process of L1 changes since the moment an individual lost active contact with the L1 environment and started acquisition of the second language (Kaufman and Aronoff, 1991). Most of them were conducted on subjects who had been staying in the L2 country for many years and the data on L1 loss was based on comparing the registered level of L1 proficiency at the moment of the study with a hypothetical initial level the subjects might have had when they moved to a new country (Altenberg, 1991; Levine, 1996; Schaufeli, 1996; Ammerlaan, 1997; Soesman, 1997).

In this respect, the present investigation is somewhat unique, not only because it reflects L1 changes from the very first moment when the subject came to the L2 environment, but also because it shows the process of L1 loss in a pure attrition situation where the subject's L1 input was effectively ceased and only second language input received. A further difference of the present study is in its emphasis on second language acquisition as a factor in first language forgetting. In the present study, both processes were longitudinally measured over a period of one year. Word accessibility was measured in timed picture naming tasks. Decreased accessibility of certain words in subject's first language production may be reflected not only in failure to produce the target word, but in long latencies to correctly recall the word, which justified the use of timed retrieval tasks in recent studies on L1 loss (Hakuta and D'Andrea, 1992; Soesman, 1997). Only production skills were tested in this study.

The loss of linguistic knowledge, like the loss of any other knowledge stored in our long-term memory, has been a rather controversial issue. It is difficult to differentiate between what was truly lost from the memory and what is temporarily inaccessible due to retrieval problems (Ammerlaan, 1997). There is also a debate in the literature about whether the terms "attrition" (Ammerlaan, 1997) or "loss" (de Bot, 1999) should be used to define a decline of linguistic skills in a person's first language. Thus, a less ambiguous term, forgetting, will be used in the present paper. Psychological theories of forgetting account for the permanent loss of some information from our memory (decay theory) as well as the temporary problem with accessing other information (interference, or retrieval failure theory). Forgetting, as it is used in this study, can be defined as an actual erasure of certain words from memory, as well as the problem with retrieving certain items due to their low accessibility. In the long run, both processes will lead to a decrease in the person's overall proficiency in his (her) native language.

Subject

The present case study was based on the year-long monitoring of a subject that might be ideal for research on L1 forgetting. This kind of subject may be called a "deserted island" in the sense that a person's exposure to the native language is effectively ceased. The acquisition of a new language with no L1 input may result in a fast process of L1 forgetting.

A Russian orphan, S., was nine years old when she was adopted by an English-speaking family and brought to the USA in May 1997. Her Russian (L1)

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had been well developed by that time and her fluency in Russian paralleled that of her Russian-speaking peers. An assessment of fluency in the native language was based on records from the Russian school and the orphanage. Her English (L2) was non-existent at the time when she entered the USA. Over 13 months of monitoring the child, the exposure to Russian had been limited to the researcher's brief monthly visits (about 30 min. each) and occasional telephone conversations at the early stage of the child's adaptation to the new environment. At that time, the author had to act as an intermediate communicator between her, speaking no English, and her parents, knowing no Russian (about 30 min. a month). This roughly constituted about an hour in all for S.'s monthly exposure to Russian. Three months after she came to the USA, help over the phone was no longer required, i.e., another 30 minutes of contact with Russian were eliminated. Beyond the session, S. did not feel like speaking Russian to the author. Other than that, there was no exposure to the first language. Accidental contact with Russian speakers was hardly possible due to the absence of a Russian-speaking community in the city where the study was conducted.

In September 1997, S. started the third grade in a regular American school, and by the end of the first semester, her English proficiency was evaluated at the first grade level. This means that it had not yet paralleled that of her English-speaking peers, but demonstrated great progress in L2 acquisition. By the end of her first academic year, her English proficiency almost met the third grade requirements. By January 1998, S. could read English, which allowed testing L1 accessibility using a task with L2 blocking (see blocking task). The child's attitude to languages had dramatically changed, from initial reluctance to accept English as a dominant language to the final unwillingness to speak Russian to the author a year later, when S. started to admit that she had already forgotten Russian. The qualitative analyses reported in this paper were based on the data collected over the one-year monitoring period.

Method

Three types of picture naming tasks were used in the present study: a standard picture naming task in Russian followed by the same task in English, picture naming in a non-specified language (free language choice), and picture naming in Russian where stimuli had English written labels (blocking task). For the simplicity of discussion, these tasks will be referred to as picture naming, free choice, and blocking tasks, respectively (see Table in Appendix).

Materials

All three tasks were based on the same set of stimuli, that is, color flash cards depicting objects and actions. Pictures represented basic concrete objects, like bread, boots, children, pencil, money, flower, etc., and actions performed by singular and plural agents, like drink, write, cry, etc. The pictures were pre-tested on two Russian children (seven and ten years old) who had recently arrived in the USA and lived in a Russian-speaking family. This served to eliminate any ambiguity or cultural specificity in the interpretation of the depicted concepts. However, the first session showed that a few action pictures (e.g., clapping, baking) were found ambiguous by the subject and their naming had to be cued. Those words were later excluded from the study and their data was not analyzed. In all, there were about 90 object pictures and 90 action pictures used in the present study.

Procedure

A session usually involved 70 pictures: 40 pictures for the picture naming task (20 object pictures, 20 action pictures), 20 pictures for the free choice task (only object pictures), and 10 pictures for the blocking task (only object pictures). Concepts representing concrete objects were classified as nouns while concepts representing actions were classified as verbs in the interpretation of the results. Pictures used for one task were never used for the other two tasks within the same session. The number of pictures used in each task remained the same across all sessions. In the picture naming task, object pictures were followed by action pictures.

Picture distribution for each session was the following. In the picture naming task, half of the pictures were always new (i.e., those which were not used in any of the three tasks in the previous session). The remaining half were pictures from the tasks used in the previous session, i.e., predominantly from the free choice and blocking tasks as well as some pictures from the naming task. In the free choice and blocking tasks, pictures used in one session were never used for the same task in the following session, e.g., pictures used for the free choice task in session 6 would not be used for the same task in session 7, or pictures used for the blocking task in session 6 would not be used for the same task in session 7. Instead, either pictures which were not used in any task in the previous session or those pictures which were used for the other two tasks in the previous session were used. For example, the blocking task in session 7 would have any pictures used in sessions 2–6 of the

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picture naming task or pictures from the free choice tasks of session 6. The alternation of pictures across tasks and sessions was aimed at testing word accessibility under different conditions.

The language order in the picture naming task remained the same across all sessions, i.e., first all pictures were named in Russian, then the same pictures were named in English. A three-minute break was allowed between the Russian and the English part of the session. The blocking task was conducted only in Russian, while the free choice task allowed the subject to name the pictures in the language of her choice. The tasks were administered in the same order across all sessions, i.e., first the picture naming, then the free choice, and finally, the blocking tasks were offered.

Response times were recorded with a standard digital stopwatch. The counter was started when the researcher presented a picture and stopped after the subject articulated the first sound in naming the picture. All sessions were recorded on tape to allow for an independent check of response times. It should be acknowledged, however, that the lack of any advanced measuring technique might result in the inadequate accuracy of the reaction time data. Thus, in the present research, it should be taken as an additional measure in the interpretation of the data rather than a primary indication of L1 forgetting.

The presentation of a picture lasted until it was named, rejected as "forgotten", or until the pause was too long (e.g., 20,000 ms) to expect any recall, then another picture was presented. In the psycholinguistic literature on monolinguals, extremely long reaction times are often discarded from the analyses (Jescheniak and Levelt, 1994). However, as much longer reaction times were expected in this unique attrition situation, longer latency was allowed for naming the picture. As the results indicated, the majority of responses did not exceed 10,000 ms in the present study. The words which were not recalled were never named by the experimenter to avoid the possibility of better L1 retention due to an additional L1 input. The answers were tape recorded and later transcribed.

Picture naming task

The picture naming task was offered consistently in this study (i.e., sessions 2–8). The obtained data was interpreted in terms of the percentage of L1 lost items and L2 learned items, and also in terms of accessibility of the vocabulary in the two languages, which is reflected in the reaction time data. The percentage of forgotten items and the response times taken to correctly name the pictures were used as dependent variables in plotting the forgetting curves. The data from this task was also interpreted in terms of two different word categories, i.e., nouns and verbs. The other two vocabulary tasks, free choice and blocking, were introduced in the later sessions (4 -8) when the level of L2 proficiency had become high enough to expect a shift in the language preference (free choice task) or L1 blocking (blocking task) in the experimental setting.

Free choice task

The task was to name the pictures as fast as possible in the language of the subject's choice. The purpose of this task was to compare the preference in naming the concepts in a particular language with the L1 accessibility of the same concepts in the picture naming task. Moreover, it was aimed at testing a shift in language preference which might occur with time.

Blocking task

This experimental task on vocabulary accessibility could be compared with the Stroop task widely used in experimental psychology (Fournier, 1975; Glaser, 1993). In the Stroop task, the participant usually has to respond to one stimulus component, the target, according to a certain rule. The other stimulus component, the distractor, must be ignored. In this study, the subject was presented with a set of object pictures with English printed names. The subject was asked to name the pictures in Russian, ignoring the names printed in English. The English labels, or distractors, were intended to provide additional L1 blocking. The RT taken to recall the target word in this task was compared with the RT on retrieving the same word in the picture naming task offered in the preceding or following sessions. It was expected that the analysis of the data might contribute to a better understanding of the process of L1 blocking due to an extensive exposure to the L2 environment. However, it should be acknowledged that this task would be feasible only if S. could read an L2 label. Since reading skills were not tested in either language in the present study, it is possible that the absence of a blocking effect on some of the words could be attributed to S.'s unfamiliarity with the spelling of an L2 name of the picture.

Results

General trends

The results from the picture naming task were plotted on two separate charts: one (Figure 1) shows

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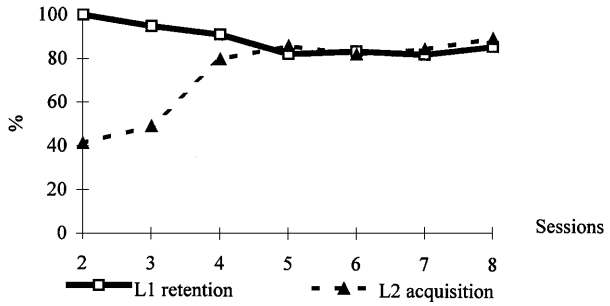


Figure 1. L1 retention vs. L2 acquisition (%)

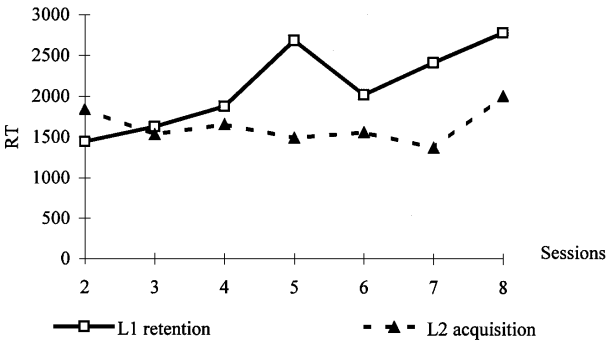


Figure 2. L1 retention vs. L2 acquisition (RT)

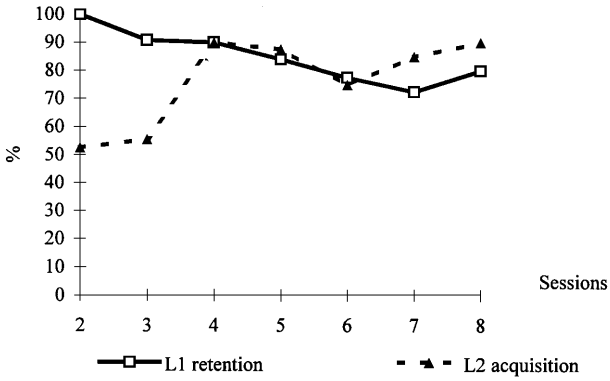


Figure 3. Nouns: L1 retention vs. L2 acquisition (%)

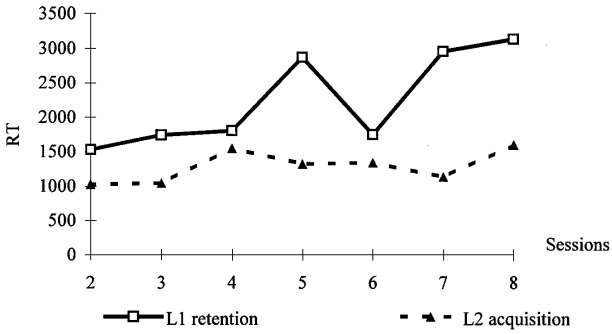


Figure 4. Nouns: L1 retention vs. L2 acquisition (RT)

the amount of L1 retention and L2 acquisition across the seven sessions when the task was offered, another (Figure 2) shows reaction time registered at each session for both languages.

The analysis of the forgetting curve with respect to the acquisition curve (Figure 1) shows that L1 retention gradually decreases for the first four sessions and then stabilizes, while L2 acquisition sharply increases between sessions 3 and 4 and then remains almost unchanged. The inspection of the RT curve (Figure 2) shows that L1 retention is characterized by an irregular increase, i.e., it becomes slower with time, while L2 acquisition has a flat pattern and does not change across sessions. The latter might come from the fact that English (L2) was always offered second, which might have facilitated the lexical access of L2 words after the concepts had already been named in L1.

Also, the last session (8) shows a slight increase in the amount of L1 retention, which was inconsistent with the author's expectations. This result could be explained by the fact that S. had a very high motivation to do her best during the last session. It could come from the fact that at the beginning of the session she was thanked for her participation in the study and given a nice present. Thus, motivation to do her best in both languages to please the experimenter could partially account for this unexpected result. Also, the slower RT on that session for both language tasks could come from S.'s being more careful in correctly recalling the words.

In general, the analysis of the curves showed that the rate of L1 forgetting is slower than the rate of L2 acquisition and has a smoother pattern. As to the RT pattern, it seems to be consistent with the general trends, i.e., decrease in the amount of language retention/acquisition is accompanied by slower RT, whereas increase in the amount of retention/acquisition results in faster RT. Moreover, the RT trend for L2 acquisition is more regular than for L1 retention. In order to see what might have affected the general patterns of the above curves, the data was broken down into nouns and verbs and each word category was examined separately.

Nouns versus verbs

Separate graphs represent L1 retention vs. L2 acquisition of the two word categories: Figure 3 illustrates nouns, and Figure 5 represents verbs. In addition, Figure 4 shows RT on nouns, whereas Figure 6 illustrates RT on verbs.

The comparison of L1 retention with L2 acquisition curves of the noun category shows that both the retention and acquisition patterns resemble those of

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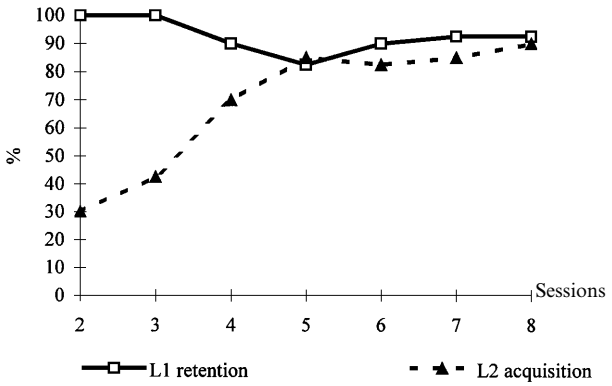


Figure 5. Verbs: L1 retention vs. L2 acquisition (%)

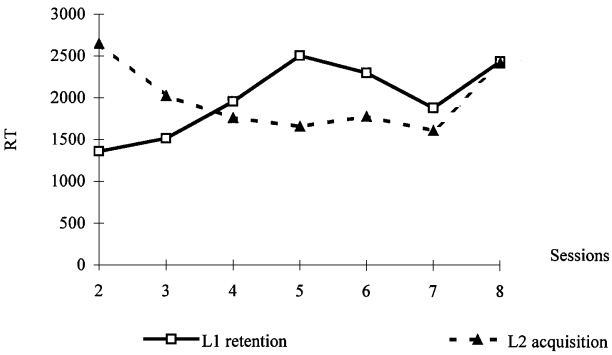


Figure 6. Verbs: L1 retention vs. L2 acquisition (RT)

the general curves discussed above, i.e., L1 retention on nouns gradually decreases across sessions, while L2 acquisition sharply increases between sessions 3 and 4, and then remains almost unchanged. As to the RT data, it yielded an even more irregular pattern for L1, indicating slowing down with time. RT on L2, on the contrary, shows a consistently flat pattern.

The graphs representing retention/acquisition of verbs (Figs. 5 and 6) differ from those on nouns. As the curves indicate, there is a delay in verb acquisition compared to noun acquisition, which eventually reaches the noun level in session 5 and then it seems to stabilize and remain flat. L1 verbs, on the contrary, demonstrate good initial retention until there is a drop in retention between sessions 3 and 5, and then the curve remains almost unchanged. The RT curves show that the RT on L2 verbs in the early sessions (2–3) is slower than on L1 verbs, and then it becomes faster and remains almost unchanged till the last session; while the RT on L1 verbs, though not as irregular as it is on nouns, increases across sessions. The highest L1 forgetting in session 5 is accompanied by the slowest RT. The cross-category comparison suggests that verbs were better retained and acquired more slowly than nouns for the first two sessions, and their ultimate L1 retention in session 8 was higher than that of nouns, though the process of L2 verb acquisition paralleled that of the nouns in the last session.

Across item analysis

The focus of across item analysis was to see whether there were any specific categories of words which showed faster forgetting, like low vs. high frequency words, cognates, etc., and whether there was a correlation between acquisition of the vocabulary items in L2 and forgetting of their translation equivalents in L1. This analysis will be limited to nouns, since they revealed more interesting and regular results than verbs.

There were 83 nouns chosen for analysis. The words which were never named in L1 across all sessions and tasks were excluded from the analysis. The inspection of the data was aimed at revealing those words which were not retrieved in a few test sessions (i.e., in more than two), those which showed a significant RT increase across all sessions (more than 3,000 ms), and those which demonstrated an unusual retrieval pattern. Three categories of words showed the highest vulnerability to forgetting in the present case study: high frequency words, cognates, and what is called here "semantically convergent" pairs (i.e., lexical items in the two languages that seem equivalent but do not share the same semantic distribution).

Word frequency

One of the concerns of the present study was to see whether there was a difference in vocabulary decline in terms of its frequency. However, three things should be acknowledged here. First, the frequency analysis of the data was based on examining only those nouns which did not fall into two other categories of vulnerable words (i.e., cognates and semantically convergent pairs) where the mechanism of forgetting might have a different nature. Second, the distinction between low and high frequency words in the present study was arbitrarily based on the frequency range of 20, which gave about 27 low frequency words (frequency range of 1–20), compared to 40 high frequency words (frequency above 20, that was 20–610 in this case). Finally, the analysis of the word frequency for the Russian words (Zasorina, 1977) and their English translated equivalents (Kucera and Francis, 1967) revealed the same groups of words which can be roughly classified as high and low frequency words. The frequency ranges referred to above were based on the frequency of the English equivalents.

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Table 1. *Word frequency and word accessibility*

Word frequency	No recall in L1	Preferred to be named in L2	Poor word accessibility in L1 (RT longer than 3,000 ms)	L2 label (not acquired)
High-frequency (20 and above) – 40 words	11 words (28%)	21 words (53%)	12 words (30%)	1 word (3%)
Low frequency (1–20) – 27 words	5 words (19%)	9 words (33%)	8 words (30%)	7 words (26%)

Table 1 illustrates the data on the words in terms of the frequency of their occurrence, frequency of their forgetting (how many words were not recalled in the picture naming task or were preferred to be named in L2 in a free choice task), and poor accessibility which is reflected in slow RT across all sessions. Moreover, the information on how many words acquired their L2 labels for each frequency category is also given in Table 1.

The analysis of the nouns in Table 1 indicates that high frequency words were more often not recalled in at least one session or preferentially named in L2 than low frequency words, though the accessibility in terms of RT remained the same across the two categories. On the other hand, the percentage of words which were never learned in L2 was higher for low frequency words. It might be hypothesized that acquisition of the L2 labels for high frequency words affected the accessibility of the L1 translation equivalents in this study.

Cognates

Another group of words vulnerable to forgetting was cognates. Cognates, as defined here, are words which retain the same semantic meaning and similar phonology in two languages. There were a few nouns in the study which could be considered cognates: [*ti:ger*] – tiger, [*fla:g*] – flag, [*raketa*] – rocket, [*zebra*] – zebra, [*maska*] – mask, [*telefon*] – telephone, [*tri*] – three, [*kot*] – cat, and three words which can be considered non-direct cognates (whale, duck, lion), or as they are called here ''near-cognates'', which will be discussed later.

It should be mentioned that one of the cognates [*flag*] – flag was always named in Russian with a diminutive suffix ''-*ok*'' which made it sound different from its English counterpart (cf. *flazok*- flag). It was surprising to find forgetting in this particular case where a direct cognate turned into a word phonologically less related to its English equivalent and yet showed a retrieval problem. Table 2 represents retention/acquisition of cognates reflected in different tasks.

The general overview of Table 2 shows that most cognates were not retrieved in Russian, were replaced by their English equivalents, or were hard to access (the latter are seen from the RT data). For example, the cognate word ''flag'' was named in Russian after a 3880 ms pause and was again named in Russian in the English part of the test (session 2). In the next session, it was correctly named in both languages, but the RT for the Russian and English words was different, i.e, 1970 ms and 810 ms, respectively (session 3). Then there was no recall of the word in Russian, but it was correctly named in English (session 4). The transcription of that session shows that the subject attempted to say the word in English in the Russian part of the test, but eventually rejected it and admitted that she did not know the word. In session 5, the word was named in Russian after a 7,720 ms pause and it was named much faster in English (1,120 ms). In session 6, the word was again not recalled in Russian, but it was correctly named in English (690 ms). Session 7 shows that the Russian name for ''flag'' was not retrieved, and this time it was named in the wrong language in the English part of the test (650 ms). It is interesting to notice that though it was named in Russian, this time it did not have a diminutive suffix -*ok* which S. always used for naming this concept in Russian. But the phonetic pattern of the word was undoubtedly Russian. The last session (8) showed a much longer RT (6,630 ms) for recalling the name in Russian than in English (470 ms).

In order to illustrate cognate forgetting, each cognate was matched with a non-cognate word which was of the same frequency range. For example, the cognate words ''flag'' (frequency 16) and ''tiger'' (frequency 7) were matched with the non-cognate words ''pen'' (frequency 18) and ''turtle'' (frequency 8), respectively. Non-cognates demonstrated good retention across all sessions. An across cognate analysis has shown that in 37% of cognate instances the

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Table 2. *Cognates across sessions*

Name/ RT(ms)	2	3	4	5	6	7	8
flag	L1: 3880	L1: 1970	L1: not retrieved	L1: 7720	L1: not retrieved	L1: not retrieved	L1: 6630
	L2 (L1): 1060	L2: 810	L2: 1560	L2: 1120	L2: 690	L2 (L1): 650	L2: 470
tiger	N/A	L1: 1500	L1: 2400	L1: 3150	L1: 3150	free choice – L2: 1280	L1: not retrieved
		L2: 810	L2: 1280	L2 (L1): 1100	L2: 1580		L2: 720
zebra	L1 (L2): 2680	L1:not retrieved	L1: not retrieved	L1 (L2): 780	L1: not retrieved	free choice – L2: 2130	L1: not retrieved
	L2: not retrieved	L2: not retrieved	L2: 630	L2: 780	L2: 680		L2: 680
mask	L1: 6750	L1: 3840	N/A	N/A	N/A	free choice – L2: 1120	L1: 3930
	L2: not retrieved	L2: 1500					L2: 750
rocket	N/A	L1: 1800	N/A	free choice – L2: 3340	N/A	L1: 4390	L1: 3250
		L2: not retrieved				L2: error (''planet'')	L2: not retrieved
telephone	N/A	N/A	free choice – L2: 880	N/A	N/A	L1: 690	L1: 1250
						L2: 720	L2: 680
three	N/A	N/A	L1: 1340	L1: 1840	N/A	N/A	free choice – L2: 4320
			L2: 1720	L2: 980			
cat	L1: 1150	L1: 1400	L1: 1250	L1: 3030	free choice – L1: 4480	L1: 2960	L1: 1530
	L2: 600	L2: 820	L2: 1310	L2: 1240		L2: 910	L2: 720

Notation in Tables 2, 3, 4: the data was taken from the picture naming task unless indicated otherwise. Where the word was retrieved in the wrong language the indication of this language is given in parenthesis, e.g. L1 (L2) means that the word was named in English (L2) instead of Russian (L1) in the Russian part of the test. RT is given for the instances the word was named, and N/A means that the word was not included in the set of pictures used in that particular session.

L1 names were not recalled, were named in the wrong language, or were less accessible than their L2 counterparts (see the data from the free choice task), while none of the equal frequency non-cognate words were reported lost or named in the wrong language, and only 4% of those words were preferred to be named in L2 in the free choice task. The RT analysis showed that L1 cognate names were retrieved slower than their L2 counterparts, e.g., the mean RT for the Russian cognates was 3,300 ms (cf. 1,865 ms for non-cognates) and for the English cognates it was 1120 ms (cf. 1,332 for non-cognates). Furthermore, in the case of cognates, S. frequently indicated that she did not know the word in Russian before she could actually articulate it in Russian. Also, confusion with cognates affected not only L1 but also L2, though the latter had far fewer instances of retrieving the word in the wrong language (19%).

There were three other words which cannot be called direct cognates, but nevertheless should be mentioned here. One of them is the word [*lev*], which is not a close phonologically related word since it shares only one onset phoneme with the English equivalent ''lion''. It was one of the first words S. forgot very fast and easily replaced with the English ''lion''. It is unclear whether she found that the English ''lion'' sounded so familiar to her that she did not even notice that it comes from the wrong language or whether there was another reason for such a fast erasure of the Russian name for this

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Table 3. *Near cognates across sessions*

Name/ RT (ms)	2	3	4	5	6	7	8
dolphin (whale)	N/A	L1: 1600 (*kit*)	free choice – L2: 1720 (dolphin)	blocking – L1 (*delfin*): 1290	L1: 2060 (*delfin*)	L1: 6750 (*delfin*)	L1: 870 (*delfin*)
		L2: not retrieved			L2: 4750 (dolphin)	L2: 880 (dolphin)	L2: 630 (dolphin)
lion	L1: 1590	L1 (L2): 2600	L1 (tigr): 2400	L1 (L2): 1970	free choice – L1 (tigr): 1720	L1 (L2): 3150	free choice – L2: 3440
	L2: 1060	L2: 1060	L2: 2690	L2: 1040		L2: 1120	
duck (goose)	N/A	L1 (L2): 8410	L1 (L2): 890	L1: not retrieved	blocking – L1 (*gus*): 2870	L1 (L2): 3530	L1: not retrieved
		L2: 600	L2: 880	L2: 750		L2: 690	L2: 1880

concept and its complete replacement by the English equivalent.

Another word listed as a near-cognate in this study is ''duck''. The subject used to name it ''goose''. Russian [*gus*] is a cognate of English ''goose''. Because these concepts are closely related, there was some within category confusion in trying to access the right word. And the last word included in the category of near cognates is the word [*kit*] (whale) which was named correctly in L1 only once, in session 2 when it was not yet acquired in L2. Then it was incorrectly named in L2 as ''dolphin'' (session 3) and since then in both languages it was called as [*delfin*] (L1) / ''dolphin'' (L2), which are direct cognates.

The overall picture with near-cognates resembles that of cognates (Table 3): the words were not recalled in Russian, were replaced by the L2 equivalents, or were preferred to be named in L2. However, the comparison of the RT data for the two languages yielded a difference which was not as big as for cognates (3,230 ms in L1 and 2,090 ms in L2). Since the nature of the confusion with the near cognates could be different from that of the real cognates, it is necessary to be careful in the interpretation of these results.

Furthermore, the analysis of cognates and near cognates in this study showed that the earlier the English word was acquired (e.g., ''flag'', ''tiger'', ''duck'', ''lion'') the faster its Russian equivalent became inaccessible or got confused with its L2 counterpart. In contrast, the later acquired cognates in L2 (e.g., ''mask'', ''rocket'', ''dolphin'') seemed not to affect the retention of the L1 equivalents. However, the early acquisition of the English ''cat'' did not impair retention of the Russian [*kot*], which contradicts the above statement. Moreover, it is unclear whether the English counterparts for two other cognates, ''telephone'' and ''three'' had been acquired at the earlier stage of L2 acquisition, since they were introduced and named in L2 for the first time only in session 4.

Semantically convergent pairs

Another interesting group of words vulnerable to forgetting was the semantically convergent pairs of words, or, as defined earlier in this paper, lexical items in the two languages that seem equivalents but do not share the same semantic distribution. For example, in Russian one word stands for two concepts (i.e., a convergent pair), like table-desk [*stol*], watch-clock [*chasy*], ladder-staircase [*lestnitza*], bed-crib [*krovat*], float-swim [*plavat*], while in English there is a clear lexical distinction between the members of each pair (i.e., divergent pairs). There were two sets of so-called semantically convergent pairs used in the study. Although the finding based on the comparison of two lexical pairs may seem insignificant, it is worth mentioning here. Table 4 illustrates the data on these words.

The analysis of the two sets of semantically convergent pairs shows that one of the words in each pair, that is ''clock'' and ''stairs'', was reported lost, at least in one of the sessions, while their counterparts, that is ''watch'' and ''ladder'', showed good retention in L1 with faster RT in their retrieval. Comparing the above two examples, it is interesting to notice that the L2 name which was acquired first

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Table 4. *Semantically convergent pairs*

Name/RT (ms)	2	3	4	5	6	7	8
clock	L1: 1160	L1: 980	L1: (L2) 5220	L1: 7680	N/A	free choice – L1: 8700	L1: not retrieved
	L2: not retrieved	L2: 1720	L2: 810	L2: 880			L2: 2400
watch	L1: 780	L1: 760	L1: 3130	free choice – L1: 5030	L1: 1120	L1: 2380	L1: 2130
	L2: not retrieved	L2: "clock": 3200	L2: not retrieved		L2: 2790	L2: not retrieved	L2: 1630
stairs	N/A	L1: 970	L1: 960	L1: 1530	N/A	L1: not retrieved	L1: 9100
		L2: not retrieved	L2: 2500	L2: 3000		L2: 720	L2: 3940
ladder	L1: 910	L1: 1310	N/A	free choice – L2 ("stairs"): 3530	L1: 750	free choice – L1: 1030	L1: 780
	L2: not retrieved	L2: not retrieved			L2: not retrieved		L2: 5380

was initially ascribed to both concepts in the English part of the test (e.g., "watch" and "clock" would be named "clock"), then only one concept was named with this word in English, and it was this concept which was not eventually retrieved or which was hard to access in Russian.

Unfortunately, at the onset of the study, no predictions were made as to whether semantically convergent pairs might happen to be susceptible to forgetting, and thus no other complete pairs were included in the set of stimuli. As a result, it can be only speculated that a long RT in recalling the name [*stol*] for "desk" (8,750 ms in session 7) and a preference to name this concept in English (session 5) might come from the same problem. However, absence of another member of the pair ("table"), which would be also called [*stol*] in Russian, does not provide additional evidence to the above finding.

Level of language activation

The data obtained in the free choice task was plotted on two separate graphs: one shows the percentage of words chosen to be named in each language (Figure 7), and another represents RT data on the recall in each language (Figure 8). As seen from Figure 7, accessibility of the two languages remained almost the same across five sessions, with Russian (L1) showing a little better activation than English (L2) until the last session when there was a drop in Russian and increase in English activation. However, the analysis of the RT data (Figure 8) reveals a much slower RT on naming the concepts in Russian in all but one session. And the last session (8) showed that the RT on Russian words slowed tremendously compared to English, which suggests that activation of the Russian words was much harder than English. Also, there were more words named in L2 in that session.

The analysis of the data showed no specific pattern of language activation. The first rough analysis suggested that there might be some trend. That is, the activation of a language for naming a picture might have resulted in naming a few items in the same language before switching to another language where the sequence would repeat again. However, in 21% of picture naming instances in this task, a word would be recalled in a language that would be different from the language of both the preceding and succeeding words. A closer look at the data and its comparison with the data from the picture naming task suggested that the recall of the word in a particular language could be determined by the level of familiarity with the concept in L2. In other words, the better the word was learned in L2 the more likely it was to be recalled in L2. On the other hand, those words which had not yet acquired L2 equivalents or were not yet well learned in L2 were more likely to be named in L1.

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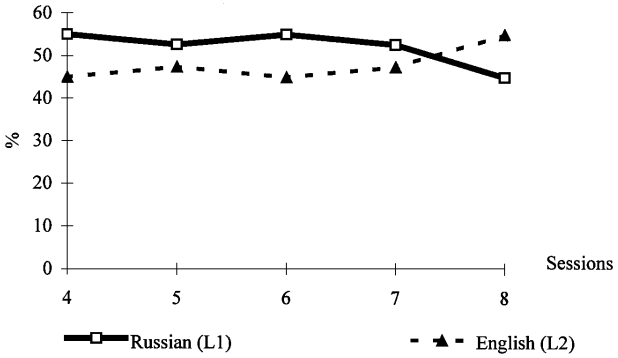


Figure 7. Language activation (%)

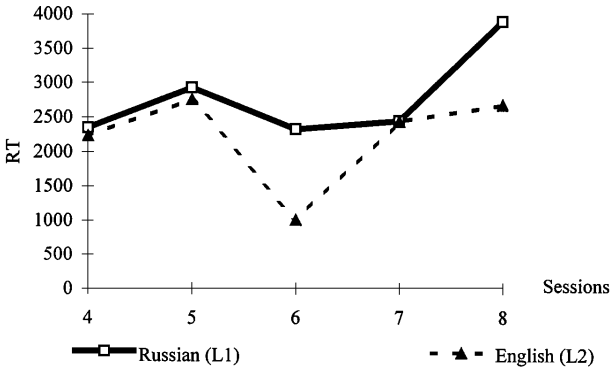


Figure 8. Language activation (RT)

Blocking effect

Twelve words were chosen for analysis of a blocking effect. Ten words out of twelve demonstrated an increase in RT in the blocking condition and two words ("airplane" and "dress") did not show any blocking effect (Table 5). As mentioned earlier, there is a possibility that S. could not yet read all the words in English, which might make the access of these words unaffected by the provided L2 blocking. Since reading skills in either of the two languages were not tested in the present study, this rather speculative interpretation will have to suffice. The insignificant amount of data received in the blocking task provides some evidence that a greater L2 interference can provide a strong blocking effect on access to the native language. The ability to read an L2 label might aggravate the retrieval of the L1 equivalent for the same concept when an L2 printed name is presented.

Discussion

Before the results are discussed, it should be emphasized that the present study was based on data obtained from a single subject. The absence of a significant subject group or a controlled group to compare the results with makes it highly problematic to draw hard conclusions, and thus the findings should be interpreted with care.

Table 5. *Blocking effect*

Name	RT with "block"	RT on same word without "block"
airplane	840	840
brush*	5,780	880
camel*	970	880
children*	4,720	1,210
cup*	6,410	4,690
dress	1,150	1,530
elephant*	3,600	2,040
fork*	2,970	860
hammer*	720	690
money*	11,310	2,600
pencil*	2,790	1,870
shirt*	3,190	436

*words which showed blocking effect

The results of the study indicate that L1 forgetting can indeed be associated with L2 acquisition. This is consistent with the findings in the earlier studies (Merino, 1983; Kravin, 1992; Mayor, 1992; Kenny, 1996; Soesman, 1997). The rate of L1 forgetting was slower than that of L2 acquisition and had a smoother pattern. However, the critical time periods remained the same for forgetting and acquisition. Moreover, decrease in the amount of language retention/acquisition was accompanied by slower RT, whereas increase in the amount of retention/acquisition resulted in faster RT.

It would be of interest here that a follow-up session, conducted two years after S. came to the USA and one year after the data for this study had been collected, revealed a tremendous decline in L1 vocabulary retention. About 60% of the vocabulary items used in the study were not retrieved, and the remaining 40% were retrieved after an extremely long pause (more than 10–15 sec.). Production skills severely deteriorated and comprehension was no longer intact. This might have further implications for future studies on L1 loss. That is, provided the uniqueness of the subject and attrition situation, a two year monitoring period would be preferable with comprehension tasks included in the second half of the observation period.

The separate analysis on two grammatical categories, nouns and verbs, suggested that their trends of L1 retention and L2 acquisition might follow different patterns, with a delay in verb acquisition/forgetting compared to nouns. However, eventually both trends fit the same general picture, where L2

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acquisition and L1 forgetting increase with time. The nature of this difference is uncertain and may partially be attributed to the faster acquisition of L2 nouns compared to verbs. The present finding calls for further research.

The across-item analysis revealed a few vulnerable groups of words: high frequency words, cognates, and semantically convergent pairs. Contrary to findings in the previous studies on L1 loss (Leyen, 1984; Hakuta and D'Andrea, 1992; Ammerlaan, 1997; Soesman, 1997), high frequency words were less accessible than low frequency words with more exposure to the second language. The literature review did not reveal any evidence that high frequency words may become more affected by forgetting than low frequency words. However, the subject of this study demonstrated a very good retention of vocabulary which might be considered low frequency with respect to other items used in this study, e.g., words like camel (1),[1] owl (2), hammer (9). In contrast, high frequency words like flower (23), shirt (27), bread (41), cup (45), box (70), boat (72), money (265), door (312), were not recalled, at least once, or were extremely hard to access.

A more detailed analysis of the data has shown that all words reported as not recalled in L1 or those words which took long RT to be retrieved in L1 were the words that acquired their L2 equivalent very early in this study. In contrast, the words retained better in L1 were those which were never learned in L2 or were acquired at the last session. The acquisition of the L2 label in the present study happened to overlap with so-called "word frequency".

However, it should be acknowledged that the present study looked at the word frequency from a perspective different from that taken in other studies. Consequently, these findings are not intended to argue with those of the earlier studies. Since the subject of the present study did not have any exposure to the first language environment after she moved to the USA, it can be assumed that low frequency and high frequency words in Russian had the same zero amount of usage. In such a unique situation, it would be surprising to expect that a certain category of words might be forgotten faster than another category due to their infrequent use or disuse. On the contrary, all categories were placed in an equal non-use setting, i.e., both high and low frequency words were never used beyond the session time. Thus, an argument that low frequency words in L1 might be lost faster than high frequency words due to their low frequency use does not seem to be relevant to the present study.

[1] Word frequency (Kucera and Francis, 1967).

Forgetting of low frequency words reported in other studies was found among bilinguals who still had L1 and L2 input, though the extent of exposure to the languages was not equal. In such a situation, low frequency words may disappear faster than high frequency words due to infrequent use of these words in L1. However, the acquisition of those low frequency words in L2 had never been tested in the previous studies. Thus, it remains unclear whether there was any correlation between the forgetting of certain low frequency words in L1 and the acquisition of their equivalents in L2, or not. Did the participants know those words in L2 and no longer need the L1 label due to its infrequent use, or did they simply lose access to the lexical label of an object in L1 without having learned a new name in L2? The answer to this question is not provided by the earlier studies on L1 loss. Longer retention of some low frequency vocabulary in the reported case study may be related to a certain delay in acquisition of L2 translated equivalents for the low frequency concepts.

The data on cognates showed that words semantically and phonologically related in the two languages demonstrated poor accessibility in L1, i.e., they frequently got replaced by their L2 equivalents, required an extremely long time to be correctly named in L1, or were admitted by the subject to having been forgotten. This finding is in line with the argument provided by de Bot (1999) that cognateness may cause problems in lexical access and is not necessarily facilitative in retrieval of those L1 words which happen to be cognates of their L2 counterparts. The present study also suggests that those L1 cognates that acquired their L2 equivalents early in the study caused more retrieval problems than those L1 cognates which were acquired later in time.

An unexpected finding of the present study relates to the so-called semantically convergent pairs, or pairs of semantically related concepts lexically undistinguished in one language and distinguished in another. Confusion with the correct naming of the L1 convergent concept (e.g., "lestnitza" for both "ladder" and "stairs", or "chasy" for both "watch" and "clock") was associated with the acquisition of one of the labels for the L2 semantically divergent pair. The explanation of retrieval problems with such words reported in the present study may be found in the conceptual hypothesis discussed in one of the recent studies on L1 loss (Schoenmakers-Klein Gunnewiek, 1997). According to this hypothesis: "language loss and lack of acquisition are expected to take place in those instances where there are differences between the conceptual realities of L1 and L2, i.e., instances in which these realities do not coincide.

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In such cases, change will take place in the direction of L2, leading to deviations in L1'' (p. 101).

In other words, it could be hypothesized that a new notion of distinction acquired in L2 might have been transferred to the L1 semantically convergent pairs. This might account for poor accessibility of one of the members in the L1 concept pair. The inaccessible L1 item was the one which was acquired faster in L2 and then falsely recognized as lexically different from its L1 counterpart. However, the latter finding calls for further research.

To summarize, the results of the cross-item analysis suggested that the role of L2 interference in the forgetting of L1 vocabulary may be strong. This interference might be particularly strong when a subject has no L1 input and is immersed in the L2 environment. Under such extreme conditions of L1 disuse, L2 seems to replace L1 especially in the immediate and daily type of context. The longitudinal testing of L2 acquisition and L1 retention of the same set of vocabulary items revealed a rather intriguing finding, that decrease in accessibility of the first language vocabulary items may be related to the acquisition of their translation equivalents in the second language. This may find support in the earlier studies (Leopold, 1939; Kravin, 1992) which associated L1 ''word mortality'' with the replacement of certain vocabulary items in L1 with their translation equivalents in L2. Unfortunately, the empirical data on such replacement is sparse, nor is there much in the way of theoretical explanations of this phenomenon.

However, it would be relevant to mention here the results of a controlled laboratory study which was encouraged by the present research (Isurin and McDonald, 2000). The study was undertaken to explore retroactive interference as a possible explanation of forgetting of first language vocabulary after intensive exposure to a second language. Specifically, in the experiment, participants learned a first list containing foreign language vocabulary items. The recall of that vocabulary was tested after the learning phase and re-tested after a second list was learned. A second list containing words in a different foreign language consisted of either translation equivalents of the first list or totally different vocabulary. More retroactive interference was found with those participants who learned translation equivalents on their second list than with those who learned different semantically non-overlapping vocabulary. Moreover, the analysis of what was called the ''replacement ratio'' showed that there was indeed a higher forgetting ratio when the translation equivalent was learned than when it was not. Thus, successfully acquiring a translation equivalent in L2 makes it more likely that a person will forget the same item in L1. The effect of semantic similarity directly affects the item in question.

The general conclusion derived from the results of the present case study is that in a pure attrition situation, where a person loses any contact with L1, the process of L1 forgetting might be directly determined by L2 acquisition, and accessibility of lexical items in L1 might be affected by the acquisition of L2 equivalents for the same concepts. The present findings call for further research on L1 forgetting in both naturalistic and experimental settings.

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Appendix

Schedule of tasks across sessions

Session	Task
1. June, 1996. The subject is nine years old (a month since S. came to the USA, two weeks after S. started a summer camp)	no vocabulary tasks applied
2. September, 1997 (S. started school)	picture naming
3. December, 1997	picture naming
4. January, 1998	1. picture naming
	2. free choice
5. March, 1998	1. picture naming
	2. free choice
	3. blocking
6. April, 1998	1. picture naming
	2. free choice
	3. blocking
7. May, 1998	1. picture naming
	2. free choice
	3. blocking
8. June, 1998 S. is ten years old	1. picture naming
	2. free choice
	3. blocking

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