CHAPTER 15

Foreign language vocabulary learning

Word-type effects during the labeling stage

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This chapter reviews the results of a set of experiments that examined foreign-language (FL) vocabulary learning by late learners, exploiting the paired-associate-learning (PAL) paradigm. The effects on acquisition and retention of the concreteness and frequency of the native-language (L1) words, the (phonotactical) typicality of the FL words, and the cognate relation between the L1 words and their FL translations were studied. To determine long-term retention a retest took place one week after learning. The results showed substantial effects of concreteness, typicality and cognate status: More concrete, typical, and cognate words were learned than abstract, atypical, and non-cognate words, respectively. Learning was also better for frequent than for infrequent words, but this effect was relatively small. Furthermore, the retest indicated that the words acquired best during the learning phase were also those retained best: The forgetting functions were steeper for abstract, atypical, and non-cognate words than for concrete, typical, and cognate words. We explain these effects in terms of differential pre-experimental long-term memory knowledge (concreteness and frequency), phonological short- and long-term memory (typicality), and a retrieval cue that exists for cognates but not for non-cognates (cognate status).

1. Introduction

Until the last decade of the 20th century, vocabulary received relatively little attention both in research on foreign-language (FL) learning and in the FL classroom. Due to the growing awareness that vocabulary plays a pivotal role in effective FL use, this situation has changed over the past 20 years and vocabulary learning has since become a widely studied research topic. One of the common research methods of FL vocabulary learning is paired-associate learning (PAL). This paper reports the results of a set of PAL experiments performed in our laboratory, always with late, adult learners as participants. PAL experiments on FL vocabulary

learning only deal with the very initial stage of learning, in which new names (the FL words to learn) are assigned to extant concepts, namely, the concepts associated with the FL words' translations in the learners' native language (L1). We will call this stage the "labeling" stage. Because the two terms in a pair of word translations seldom share all aspects of meaning, this parasitic use of the L1 word meanings in FL vocabulary learning inevitably leads to a strong semantic "accent" in the targeted foreign language. Through subsequent naturalistic exposure to this language (e.g., by extensive reading), the inherited L2 meanings will gradually evolve towards the targeted ones.

Below we first briefly explain the PAL method and the materials, participants and testing used in the various studies from our laboratory. Next, we present an overview of the data thus obtained, focusing on the effects of the various stimulus characteristics that were manipulated in these studies on learning. Finally, we will discuss the results in terms of pre-experimental long-term memory knowledge and phonological-short term memory.

During the training phase of a PAL experiment on FL learning, pairs of stimuli are presented to the learner. In the "picture-word association" version of the method, one of the terms in each stimulus pair is an FL word to be learned and the second is a picture depicting its meaning. In the "word-word association" version the paired terms presented during training are two words: an L1 word and its FL translation. The amount of learning that has taken place during training is subsequently tested, usually with a "cued recall" task, of which two versions occur: In "receptive" cued recall the FL words are presented as stimuli (the "recall cues") and the participants have to produce their translations in L1; in "productive" cued recall the L1 terms of the translation pairs serve as recall cues and the corresponding FL words have to be given.

In all, we ran 12 PAL experiments in our laboratory, seven of which have been published (de Groot 2006; de Groot & Keijzer 2000, four experiments; Lotto & de Groot 1998; Van Hell & Candia Mahn 1997) and five still awaiting to be reported on. All experiments focused on the effects of one or more manipulations of the stimulus materials on both the acquisition and retention of the FL vocabulary to learn. These manipulations concerned the L1 words in the translation pairs presented for learning, the FL terms in these pairs, and the relation between the lexical forms of an L1 word and its FL translation. Specifically, the stimulus variables manipulated across the studies were cognate status (whether or not the two terms in a translation pair share phonology and/or orthography), concreteness (whether an L1 word – but thus also its FL translation – refers to a concrete entity or to an abstract concept), word frequency (whether the L1 word in a translation pair is commonly used or occurs infrequently instead), and phonotactic typicality (a

measure of the degree in which the phonological structure of an FL word to be learned resembles the sound structure of the learner's L1 words).

The participants in our studies were always university undergraduates with Dutch as their native language and considerable prior experience in learning foreign languages. In all studies word-word PAL was used. Lotto and de Groot (1998) compared word-word PAL with picture-word PAL, and Van Hell and Candia Mahn (1997) compared word-word PAL with the keyword method (see there for details). The other studies all used word-word PAL only. In two of the published studies (de Groot 2006; de Groot & Keijzer 2000) and in all of the unpublished ones, the FL words to be learned were not words from a natural language but nonword letter strings that we made up ourselves. Using such artificial words as the foreign vocabulary to be learned enables the systematic manipulation of some of the variables under study (cognate status and phonotactic typicality). Finally, de Groot (2006) and all unpublished studies also looked at the effect of various types of background music (vocal and instrumental; classical and modern) on learning and retention, but this manipulation and its effects will be ignored in the ensuing discussion. It suffices to say here that, generally, the music variable did not modify the effects of the stimulus variables.

The stimulus sets presented for learning were generally quite large, often containing between 60 and 80 translation pairs, and within each set a number of the present stimulus variables were orthogonally manipulated. In a few cases (all concerning unpublished studies) smaller sets were used because, within one and the same experiment, the participants had to learn more than one set of foreign words (the reason being that in these studies the music variable was manipulated within subjects, which forced the use of different learning sets in the different music conditions). In all but one of the experiments the complete training session was split up in a number of sub-sessions, each consisting of one or more learning rounds (mostly two) followed by a cued recall test, receptive or productive (but always of the same type in one and the same experiment). In each learning round all PAL stimuli were presented once in a random order on a computer screen, the FL and L1 term of a stimulus appearing next to one another. During testing the recall cue (the FL term of the PAL stimulus in receptive testing; the L1 term in productive testing) appeared on the screen and the participant produced its translation orally or remained silent whenever the translation was not known. An experimenter sat next the participant and noted down the actual response or, when the translation was unknown, a score indicating a missing response.

The number of learning trials per stimulus during a complete training session varied between two and six, it most often being six. Of course, the presentation frequency of a translation pair during training will determine how strongly a new FL word will become rooted in long-term memory. The number of recall

Table 1. Effects of concreteness (Con), cognate status (Cog), typicality (T), and frequency (F) averaged across all recall tests taken during the training session. All effects are given in percentages

Exp	Structure	Con	Cog	T	F	TT	NS	M
HCM	LLT-R	11.0	–	–	–	R	60	–
LG	LLLT1-LLLT2	–	12.4	–	3.6	P	80	–
GK1	LLT1-LLT2-LLT3-R	20.3	16.3	–	–	P	60	–
GK2	LLT1-LLT2-LLT3-R	15.5	18.9	–	–	R	60	–
GK3	LLT1-LLT2-LLT3-R	16.6	–	–	-0.7	P	60	–
GK4	LLT1-LLT2-LLT3-R	16.8	–	–	2.8	R	60	–
G	LLT1-LLT2-LLT3-R	13.5	–	13.6	3.7	R	64	+
U1	LLT1-LLT2-R	16.8	–	15.6	7.7	R	64	+
U2	LLT1-LLT2-R	26.0	16.0	–	–	P	60	+
U3	LT1-LT2-LT3-R (3x)	11.0	–	8.0	8.0	R	3x24	+
U4	LT1-LT2-LT3-R (3x)	12.0	–	6.0	7.0	R	3x24	+
U5	LT1-LT2-LT3-R (2x)	14.4	–	22.0	2.5	P	2x32	+

Exp = experiment (HCM = Van Hell & Candia Mahn 1997; LG = Lotto & de Groot 1998; GK = de Groot & Keijzer 2000; G = de Groot 2006); U1 through U5 = five unpublished experiments; Structure = structure of the experiment (L = a round of learning in which all PAL stimuli were presented once; T = a round of testing, in which either the L1 term or the FL term of all PAL stimuli were presented as recall cue; R = delayed retest about one week after learning). TT = type of testing (P = productive, with the L1 term as recall cue; R = receptive, with the FL term as recall cue); NS = number of different PAL stimuli. Note that U3, U4, and U5 encompassed 3 (U3 and U4) or 2 (U5) sub-experiments in each of which a relatively small stimulus set was trained, a different set in each sub-experiment. M = contains (+) or does not contain (–) at least one condition with background music (in addition to a silent condition, which was always present).

tests during training varied between one and three. We will refer to the recall tests that were taken during the training session as "immediate" tests. In all cases except one (Lotto & de Groot 1998), a "delayed" retest was held about one week after training. No relearning of the new vocabulary prior to this retest occurred. Table 1 provides a summary of the specifics of all 12 experiments: their structure, the stimulus variables that were included, the type of testing, and the number of PAL stimuli in the learning set. A dash in the columns for the four stimulus variables indicates that the variable was not included in that particular study; a value in these columns concerns the effects of that specific stimulus manipulation, to be detailed below.

2.   Word-type effects on vocabulary acquisition and retention

In all studies two types of analyses (ANOVAs) were performed on the recall scores obtained during testing (to be included in the analyses a response had to be completely correct; in fact, in the vast majority of the cases in which the participants actually produced a response it was fully correct). The goal of one of these types (the "learning" analyses) was to see how learning developed over the subsequent sub-sessions encompassed by the training phase. In an example experiment with three immediate tests, each following one or more learning trials per PAL stimulus, and with two stimulus manipulations, say, concreteness and cognate status, a 2 (concreteness; concrete vs. abstract) by 2 (cognate status; cognates vs. noncognates) by 3 (tests; Test 1 vs. Test 2, vs. Test 3) would thus be performed. The purpose of the second type of analyses (the "forgetting" analyses) was to be able to determine the extent of forgetting that had taken place in between acquisition and retesting one week later. These analyses were based on the recall scores obtained in the last one of the immediate tests taken during acquisition and in the retest a week later. With this type of analysis we could not only determine the overall degree of forgetting that had occurred in between acquisition and retesting, but also whether different types of words might be differentially susceptible to loss. The forgetting analysis associated with the above example experiment would have been of the type 2 (concreteness) by 2 (cognate status) by 2 (immediate Test 3 vs. the delayed test one week later).

In all studies substantial effects of cognate status, L1 concreteness, and FL (phonotactical) typicality on learning were obtained: The recall scores on the immediate tests were higher for concrete words than for abstract words. Similarly, they were higher for cognates than for noncognates, and higher for typical than for atypical FL words. Across the various studies the magnitude of the concreteness effects, collapsed across all immediate tests taken during training, varied between 11% and 26% (note that the *effects* concern the difference between the percentages correct recall for concrete words on the one hand and abstract words on the other hand). Similarly, immediate recall, collapsed across the various test sessions, was between 12% and 19% higher for cognates than for noncognates, and it was between 6% and 22% higher for typical than for atypical FL words. In contrast to these effects, the effect of L1 word frequency did not materialize in all experiments and, if it did, it was always relatively small, varying between 2.5% and 8%, and was not statistically reliable in all cases. But whenever it occurred, it was in the same direction: Recall scores were higher when the new FL words had been paired with high-frequency L1 words during training than when paired with infrequent L1 words. All word-type effects obtained in all experiments are presented in the middle columns of Table 1.
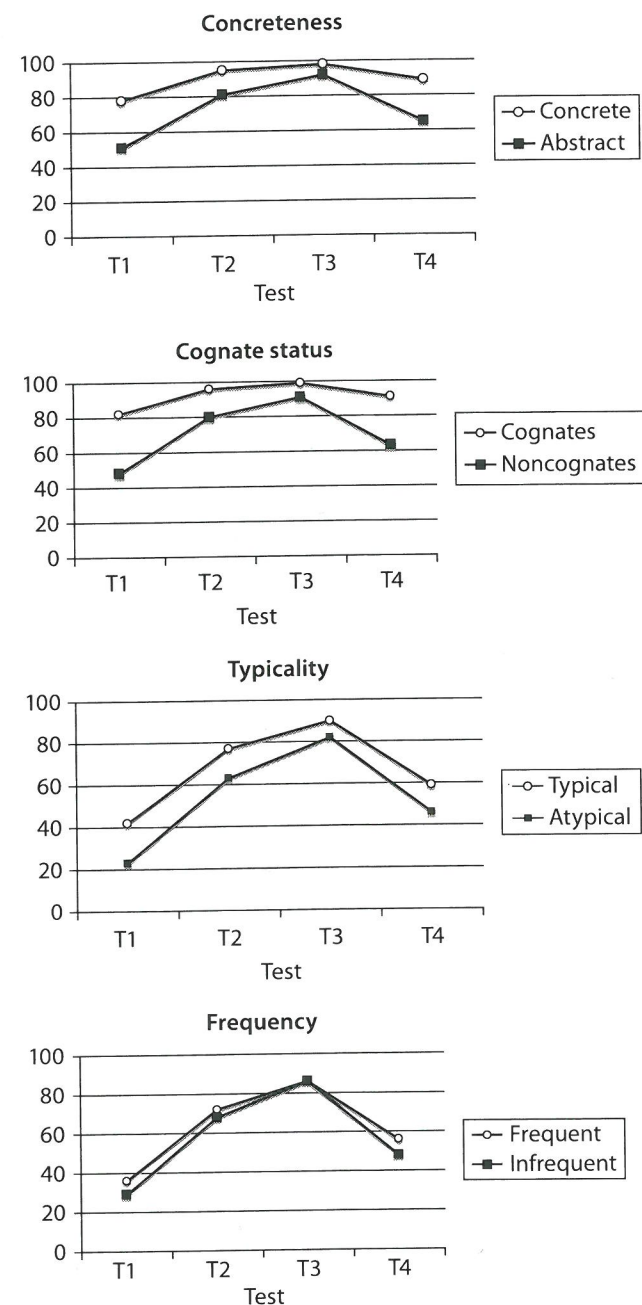
Figure 1. Immediate recall after 2 (T1), 4 (T2), and 6 (T3) learning trials per L1-FL word pair, and delayed recall one week after learning (T4)

Figure 1 shows the recall scores after two (T1; T for Test), four (T2), and six (T3) learning trials per translation pair. It also shows retention one week after training (T4). The data regarding the concreteness and cognate-status manipulations are taken from de Groot and Keijzer (2000); those from the typicality and frequency manipulations from de Groot (2006). They are based on receptive testing (with the FL words as the recall cues) and all scores shown in Figure 1 are representative of those occurring across the different studies. All four word-type variables behaved exactly the same: Their effects are especially large during the earliest stage of learning, after which abstract words, noncognates, atypical FL words, and FL words paired with infrequent L1 words gradually catch up with concrete words, cognates, typical FL words, and FL words paired with frequent L1 words, respectively. A comparison of the recall scores at T3, immediately following the last training sub-session, and at T4, the delayed test, shows that the words with the lower acquisition rates are most susceptible to forgetting: The forgetting functions are relatively steep for abstract words, noncognates, atypical FL words, and FL words paired with infrequent L1 forms during learning. This pattern of differential forgetting occurred in all experiments but two (Experiments HCM and U5 being the exceptions).

3. Explaining the data

3.1 Concreteness and word frequency

The effects of cognate status and FL typicality are intuitively the most obvious, because both concern aspects of the new forms to be learned. The effects of L1 concreteness and frequency are more surprising, because the FL word forms paired with concrete or frequent L1 words during learning do not systematically differ from those paired with abstract or infrequent L1 words, respectively. This observation suggests that knowledge structures that already exist in memory at the onset of learning must somehow cause the effects of frequency and concreteness.

De Groot and Keijzer (2000) suggested two possible causes of the concreteness effects. Both of them assume that differences between the stored meanings of concrete and abstract words in memory underlie the effects, and both are based on the assumption that acquisition rate and retention depend on the amount of information stored in the memory representation of the FL word's translation in L1: The more information stored in the L1 memory representation, the more opportunity the learner has to attach the to-be-learned FL word onto it. One account is in terms of dual-coding theory (e.g., Paivio 1986). This theory assumes two memory representations for concrete words, one in a verbal system and a

second in an image system. For abstract words only a verbal representation is hypothesized. In this set-up, the representations of concrete L1 words provide two points of attachment for the new FL word whereas abstract L1 words provide just one. Note that this account assumes qualitatively different memory representations for concrete and abstract words: the presence of an image representation for the former but not the latter.

The second account only assumes a quantitative difference between the memory representations of concrete and abstract words. It hypothesizes an "amodal" memory system in which all knowledge is stored in one and the same type of information units that do not bear any resemblance with the input that led to their storage, and that does not distinguish between an image and a verbal system. Irrespective of whether the stored information was acquired through, for instance, perceiving an object or reading or hearing about it, the ensuing memory units all have the same format. However, the number of such amodal information elements in memory is thought to differ between concrete and abstract words, the former containing more of them than the latter (Kieras 1978; Van Hell & de Groot 1998). As a result, once again more points of attachment exist for concrete words. A plausible cause for the larger number of stored information units for concrete words is that their referents can be perceived by the senses and that this leads to the storage of information (about the referents' form, color, smell, the sounds they make, etc.). This source of information is not available for abstract words.

A study that has used the "continued free word association" task, where the participants are asked to give as many word associations as possible to each of a series of stimulus words in a certain time unit, has provided evidence that the representations of concrete words indeed contain more information than those of abstract words: More associations per unit time were given to concrete words than to abstract words (de Groot 1989). In this study also slightly more associations were given to frequent words than to infrequent words, although this difference was much smaller than the difference between concrete and abstract words. This finding suggests that the effects of L1 word frequency can be accounted for in the same way: Because the representations of frequent words contain more information elements than those of infrequent words, the former provide more opportunities to fix the FL word forms onto them.

However, a second source of the L1 frequency effects must be considered. The reason a particular word is encountered relatively often in print (or speech) is that it expresses a familiar concept. In other words, word frequency is confounded with concept familiarity and, therefore, concept familiarity may somehow underlie the observed effect of L1 word frequency. Familiar concepts may be stored in denser representations than unfamiliar concepts, so that ultimately again differential information density may cause the effects. Alternatively, equal amounts

of information (numbers of knowledge units) may be stored for familiar and less familiar concepts, but the information stored for the former may on average be more strongly rooted in memory. Plausibly, it is easier to fix new knowledge (i.e., the FL word forms) onto well-consolidated memory structures than onto less stable structures. According to both accounts, just as the effects of word concreteness, the frequency effects would result from differences in the memory representations of different types of words.

3.2   FL typicality

There is evidence to suggest that a specialized component of working memory, the "phonological loop" or "phonological (short-term) memory" (STM), plays an important role in learning the phonological forms (the names) of new words, both native and foreign. The loop is specialized for retaining verbal information over short periods of time and consists of a phonological store and a rehearsal process. The former holds information in phonological form and the latter safeguards the stored phonological forms from decaying for the duration of rehearsal. While the new phonological forms are kept in the store, more permanent memory representations are constructed (see, e.g., Gathercole & Thorn 1998, for a review).

One source of evidence that phonological STM is involved in learning the phonological forms of new vocabulary comes from studies that have shown a relation between the ability of young children to repeat nonwords on the one hand and native and foreign vocabulary acquisition on the other (e.g., Gathercole & Baddeley 1989; Service 1992). In these studies the ability to repeat nonwords served as a signature of phonological STM capacity. Children who were good at repeating nonwords were shown to be better at learning new vocabulary than children performing relatively poorly on the nonword-repetition task. Other support has come from a neuropsychological case study of Baddeley, Papagno and Vallar (1988), in which a woman whose phonological STM was impaired due to a stroke turned out to be completely unable to learn nonwords that were paired with words. Yet further evidence emerges from studies that examined the effect on learning unfamiliar phonological forms of a number of experimental manipulations that are known to affect the workings of the phonological loop. One of these is "articulatory suppression". In a situation of articulatory suppression the learners have to utter a sound (e.g., "bla") continuously during learning. This disrupts rehearsal and short-term storage of the L1-FL stimulus pairs and, consequently, the construction of durable memory representations. Papagno, Valentine and Baddeley (1991) showed that learning under articulatory-suppression instructions resulted in lower recall scores than learning in a control condition where the learners performed a control task (finger-tapping) while learning.

If learning vocabulary requires the rehearsal of new phonological forms, not only the learners' phonological STM capacity should predict learning success, but a relationship should also hold between the "pronounceability" of the learning material and recall scores: New words that are easy to pronounce (and thus to rehearse) should be learned faster and retained better than new words hard to pronounce. Ellis and Beaton (1993) obtained evidence that such is indeed the case: They observed a negative correlation between the time taken to pronounce new vocabulary and recall scores. A similar finding was obtained by Gathercole, Martin and Hitch (in Gathercole & Thorn 1998), who varied the degree of "word-likeness" of the nonwords in a set of word-nonword pairs presented for learning. Wordlike nonwords had a sound structure that resembled the sound structure of the learners' native-language words, whereas non-wordlike nonwords were alien to the learners. Recall scores were higher for the former than for the latter. Both studies thus suggest that the more readily new vocabulary can be pronounced, the more easily it will be learned. It is likely that it is this relationship which underlies the effects of typicality observed in our studies: FL words that obey the phonotactic rule system of the learners' native language (the typical nonwords above) are presumably more easy to pronounce and, thus, to learn than words that do not conform to the L1 phonotactical rule system (the atypical nonwords).

Note, however, that new forms that are wordlike (typical), more so than new forms that are non-wordlike (atypical), resemble the L1 phonological word forms already stored in long-term memory prior to the onset of learning. It is well-known that long-term learning does not exclusively rely on phonological STM but that information in long-term memory is addressed and exploited during learning FL as well (see, e.g., Cheung 1996, and the above account of the effects of L1 concreteness and frequency; and see Baddeley et al. 1998, for a discussion). Plausibly, therefore, the effects of FL typicality are the joint results of the effect of typicality on phonological short-term memory and of the exploitation of phonological long-term memory knowledge during the learning process.

3.3 Cognate status

Vocabulary acquisition is not a "one-shot" process, in which a learning trial either results in full learning of the new word or leads to no stored information on the word whatsoever. Instead, every encounter with a word in speech or print is likely to leave some trace of new knowledge in memory. This incremental view of word learning provides one of two plausible (*not* mutually exclusive) explanations of the effects of cognate status: By definition, cognate translations share parts of their form, whereas noncognate translations have dissimilar forms. The implication is that in the case of cognate translations there are fewer form aspects to learn than when learning noncognate translations. Consequently, full form knowledge of an FL cognate word will be reached at an earlier moment in time, after fewer acquisition trials, than full form knowledge of a noncognate FL word.

A second explanation locates the effects of cognate status in the retrieval stage and not in the learning process itself: Because of the form overlap between the L1 and FL terms in cognate translation pairs and the absence of form overlap in the case of noncognate pairs, a cognate, but not a noncognate, as recall cue will provide a strong hint as to what its translation might be.

3.4 Differential forgetting

As we have seen, more of the words that were relatively easy to learn were still remembered one week after training than of the words that were relatively hard to learn. In other words, permanent representations were formed in long-term memory for more of the former types of words than of the latter types, despite the fact that all types of words were equally often presented during training. In only two of the 12 experiments (HCM and U5 in Table 1), all types of words were equally susceptible to forgetting. It is noteworthy that both these studies were among those in which the PAL stimuli were presented relatively few times during training (two and three times, respectively). This suggests, perhaps unsurprisingly, that all words, also the easy ones, require a minimum number of learning trials to form a permanent representation in memory and that with a presentation number below this minimum at the most a temporary representation can be formed (see Atkinson 1972, who explicitly makes the distinction between these two types of memory representations). Two further studies in Table 1, U3 and U4, which as U5 presented the PAL stimuli three times during training, *did* show the common pattern of differential forgetting for easy and difficult words. Plausibly, the different forgetting patterns in U3 and U4 on the one hand and U5 on the other hand relates to the fact that the former two used receptive testing whereas the latter used productive testing. Of the two types of testing, productive-cued recall is known to be the more demanding, among others because successful recall requires complete knowledge of the newly learned forms whereas receptive-cued recall requires distinguishable but not necessarily complete knowledge. This suggests that the permanent representations formed for easy words after three learning trials may still be incomplete and that to form complete representations more learning trials are required.

4. Conclusion

At a practical level the present research provides suggestions for the sequencing and rehearsal-frequency of the various types of words in the FL classroom (see de Groot 2006, and de Groot & Keijzer 2000, for details). At a theoretical level it suggests that the initial "labeling" stage of FL vocabulary learning is affected by the information density, strength, and identity of pre-experimental long-term memory knowledge and by the nature of the FL labels: do they promote easy phonological STM coding? Do their phonological forms resemble the phonological knowledge structures already stored in long-term memory? Do they resemble the corresponding L1 translations? Finally, the present research suggests that different types of words require different numbers of learning trials to form permanent (instead of temporary) representations in memory.

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