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The Learning of Foreign Language Vocabulary

ABSTRACT This chapter reviews experimental research into learning foreign language (FL) vocabulary, focusing on direct methods of teaching, such as keyword mnemonics, paired association learning (including rote rehearsal), and picture association learning. We discuss the relative effectiveness of these methods, the constraints in using them, and the way they interact with other factors, most notably the amount of experience a learner has had with learning foreign languages. We review research that shows that some types of words are easier to learn than others and discuss the reasons why this might be so. We also discuss the important role that good phonological skills play in successful FL vocabulary learning and review preliminary research that suggests that background music may be beneficial for some FL learners but detrimental for others. Finally, acknowledging the fact that FL learning via one of the direct methods discussed only provides the starting point for FL word learning, we discuss more advanced stages of the full-fledged learning process.

Learning a language, native or foreign/second,¹ involves the learning of a number of language subsystems, including the language's grammar, phonology, and vocabulary. Although vocabulary is obviously of crucial importance to the language learner, foreign language (FL) teachers as well as FL researchers have until recently treated vocabulary as less central to FL learning than grammar and phonology. (See Boyd Zimmerman, 1997, who provides a historical overview of instruction methods for FL teaching, starting at the end of the 18th century, and explains why vocabulary was often neglected in these methods.) Yet, it has been claimed "that native speakers can better understand ungrammatical utterances with accurate vocabulary than those with accurate grammar and inaccurate vocabulary" (Widdowson, 1978, in Boyd Zimmerman, 1997, p. 13). A corollary of this claim is that the chances of getting one's basic needs fulfilled in an FL environment are substantially larger if the FL learner possesses some well-chosen basic vocabulary in that language than when he or she masters the language's grammar flawlessly, a fact that presumably all FL learners who have tried

to make themselves understood in an FL environment are willing to accept (and that is acknowledged by publishers of travel guides, which almost without exception include a carefully selected vocabulary of the language spoken in the country to be visited).

The pivotal role of vocabulary in FL use is also demonstrated in studies that have looked at the relation between FL reading comprehension and FL vocabulary knowledge (e.g., Laufer, 1992, 1997; Nation, 1993). These studies have shown that FL vocabulary knowledge is a good predictor of success in reading in the FL, a finding that echoes the strong relation that has long been known to exist between native language vocabulary knowledge and vocabulary skills (including fast, automatic access of word knowledge in memory) on the one hand and reading in one's native language on the other hand. This relationship has formed the basis of a number of influential models of reading and reading disability (e.g., Perfetti & Roth, 1981; Stanovich, 1980).

The core assumption of these models, supported by a wealth of data, is that fast and automatic

access to the words stored in the reader's mental lexicon is a prerequisite of fluent reading. If word recognition fails (because the word encountered is unknown to the reader or because it is known but cannot be accessed rapidly or automatically), reading comprehension breaks down. The reason is that, in the case of laborious, nonautomatic word recognition, precious attentional capacity (precious because only a limited amount of attentional capacity is available at any moment in time) has to be allocated to figuring out the word and its meaning, leaving too little of the remaining attentional capacity to be allocated to higher level processes, such as finding the antecedent for a pronoun.

On acknowledging the importance of vocabulary knowledge and fast access to and retrieval of this knowledge for fluent FL use, teachers and FL learners appear to face an immense and daunting task. A language contains many tens of thousands of words, far too many to teach and learn via a method of direct teaching. Moreover, for each word, ultimately seven types of information have to be learned: phonological and orthographic, syntactic, morphological, pragmatic, articulatory, idiomatic, and semantic information (Schreuder, 1987).

The majority of these words have multiple meanings. It has been suggested that the number of meanings per word amounts to 15 to 20, none of which—contrary to what is often thought—can be singled out as the word's "basic" or "real" meaning (Fries, 1945, in Boyd Zimmerman, 1997). Add to this the fact that word meanings are not stable but instead, just as a language's phonology, develop gradually over time (see Pavlenko, chapter 21, this volume), and it can easily be imagined that the teaching and learning of a full-fledged FL vocabulary is an impossible task that may discourage both teachers and learners of FL and direct their efforts to more manageable components of FL knowledge instead.

However, several studies indicated that familiarity with a relatively small, carefully selected, number of words suffices for adult language comprehension (Laufer, 1992; Nation, 1993; see Hazenberg & Hulstijn, 1996, for a review). Nation argued that a vocabulary of the 3,000 most frequent word families (about 5,000 lexical items; but see Bogaards, 2001) provides around 95% coverage of written texts in English, which should enable an adequate level of comprehension of these texts (but see Hazenberg & Hulstijn, 1996). This point of view has clear implications for FL learning: If the FL learner needs to attain an initial vocabulary of "only" a few thousand words, direct (explicit) vo-

cabulary instruction becomes a feasible means of instruction. The remaining vocabulary can subsequently be learned implicitly, similar to the way native speakers and early bilinguals acquire vocabulary from an early age (e.g., Ellis, 1995) and through extensive reading in the FL.

This chapter focuses on research that has employed direct methods of FL vocabulary teaching (or, from the learner's viewpoint, on direct methods of FL vocabulary *learning*) in (primarily) experimental settings. The first section discusses the various methods used and their effectiveness and constraints. The next two sections focus on the differential learning effects that have been obtained with different types of words. A description of these word-type effects precedes a discussion of plausible theoretical explanations of their occurrence.

A considerable amount of recent research points at the importance of good phonological skills in vocabulary learning. This work constitutes the topic discussed in the next part of this chapter. It is followed by a section that shows that much more is involved in FL vocabulary learning than just storing the FL word's name in memory. The final two sections discuss, first, a topic of obvious pedagogical importance, namely, the beneficial or detrimental effects that background music may have on FL vocabulary learning and, second, a number of the causes of the large differences in FL vocabulary learning outcomes and learning ability that exist across studies and between groups of FL learners and individual FL learners.

Direct Methods of Learning Foreign Language Vocabulary

Keyword Mnemonics

A well-known, imagery-based instruction method for the learning of novel vocabulary, including FL vocabulary, is the keyword method. The keyword method is a mnemonic technique in which learning is divided into two steps. In the first step, one learns to associate the novel word (e.g., *mariposa*) to a keyword (e.g., *marinade*). A keyword is a word in the native language that looks or sounds like the novel word that must be learned. In the second step, the learner creates a mental image in which both the keyword and the first language (L1) translation (here "butterfly") of the novel word interact (e.g., a butterfly swimming in the marinade). The keyword mnemonic thus establishes

both a form and a semantic connection (by means of the interactive image) between the novel word and its L1 translation. After learning, presentation of the novel FL word will elicit the keyword, which in turn will evoke the interactive image between the keyword and the novel word, after which the learner can produce the L1 translation.

The keyword method may seem a rather laborious procedure for learning FL vocabulary. Many studies have found, however, that the keyword method facilitates foreign vocabulary learning and enhances recall in comparison to rote rehearsal (in which the novel word and its L1 translation are subvocally repeated) and unstructured learning (in which learners may choose their own strategy; for reviews, see Cohen, 1987; Hulstijn, 1997; Pressley, Levin, & Delaney, 1982). Beneficial effects of the keyword method on learning and immediate recall of FL vocabulary have been obtained in a wide variety of languages, including Chinese (Wang & Thomas, 1992), English (Elhelou, 1994; Rodríguez & Sadoski, 2000), German (e.g., Desrochers, Wieland, & Coté, 1991), Russian (Atkinson & Raugh, 1975), and Tagalog (e.g., Wang, Thomas, & Ouellette, 1992).

The keyword method has been successful in a wide variety of settings, including laboratory experiments (as in Atkinson & Raugh, 1975) and studies in more natural settings, often a classroom (Levin, Pressley, McCormick, Miller, & Shriberg, 1979; Rodríguez & Sadoski, 2000). The method benefited FL vocabulary learning and recall of learners of various ages, ranging from children (e.g., Elhelou, 1994; Pressley, Levin, & Miller, 1981) to elderly learners (Gruneberg & Pascoe, 1996).

The keyword method's success can be illustrated by the classical study of Atkinson and Raugh (1975), which instigated a wealth of studies on keyword mnemonics. These authors had university students learn 120 Russian words on three consecutive days (40 words a day). The learners, all native speakers of English with no prior knowledge of Russian, received instructions to follow the keyword method or were instructed to use any learning method they wished. Atkinson and Raugh found that keyword learners outperformed the own-strategy learners on all recall tests.

A second striking example concerns a study by Beaton, Gruneberg, and Ellis (1995), who studied the 10-year retention of a FL vocabulary of 350 words learned by a 47-year-old university lecturer via the Linkword Italian course. In this course, subsequently published by Gruneberg (1987, in Beaton et al., 1995), the keyword method of vo-

cabulary learning is integrated with basic grammar. After 10 years, without any use of Italian, this person remembered 35% of the previously learned FL vocabulary, and after 10 minutes of relearning, added an additional 93 words to the list of recalled words. Although the learner's performance in acquiring Italian could have been facilitated by his knowledge of other languages, including French, Spanish, German, and Greek, and long-term retention with other instruction methods has not been evaluated, the amount of vocabulary retained after so long is still remarkable.

Theoretical explanations of the benefits of the keyword method point toward an important role of imagery. According to the dual-coding theory of Paivio and colleagues (e.g., Paivio, 1986; Paivio & Desrochers, 1981), the keyword method enhances learning and recall because the method uses both the verbal system and the image system in human memory. During learning, both a verbal and an image code are encoded in memory. Assuming that these codes have additive effects, retrieval of the FL word is facilitated because there are two memory codes for the learning event, either of which can support recall. An alternative explanation was proposed by Marschark and his colleagues, who suggested that imaginal processing facilitates recall by increasing the relative relational value and distinctiveness of the information generated during learning (Marschark, Richman, Yuille, & Hunt, 1987; Marschark & Surian, 1989).

Although many studies reported positive effects of the use of keyword mnemonics in FL vocabulary learning, the findings of other studies suggested that the method may not be effective under all conditions. Questions that have been raised pertain to the long-term benefits of the keyword method and intentional versus incidental learning conditions, its usefulness for certain word types, the effects on retrieval speed, the benefits for experienced learners, and its usefulness for receptive and productive learning and recall. These findings potentially constrain and qualify the general applicability of this method. We discuss each of these topics next.

Durability of Memory Traces In the majority of studies reporting long-term benefits of the keyword method, the delay interval between learning and testing is typically manipulated within subjects: Each subject is tested both on the immediate test and on subsequent delayed tests. In a series of studies, Wang and Thomas questioned the viability of this approach for measuring long-term effects of

the keyword method because the immediate test potentially provides an additional learning trial or allows testing the adequacy of retrieval paths (Wang & Thomas, 1992, 1995; Wang, Thomas, & Ouellette, 1992). They examined the long-term effectiveness of the keyword method by treating the delay interval as a between-subjects variable, testing some learners immediately after study and others only after a delay of several days. Their manipulation also changed the learning set from intentional learning instructions (in which the learners know in advance that their newly acquired knowledge will be tested after learning) to incidental learning instructions. Wang and Thomas convincingly showed that, under these conditions, long-term forgetting is greater for keyword learners than for rote learners (Wang et al., 1992; Wang & Thomas, 1992, 1995; but see Gruneberg, 1998). The poorer retention for keyword learners observed by Wang and Thomas may have surfaced because of the between-subjects manipulation, which prevented additional learning or retrieval rehearsal on the immediate test.

The Role of Word Type A second potential constraint on the applicability of the keyword method concerns the diversity of the words presented in these studies. In most keyword studies, the FL vocabulary items are concrete words, referring to easily imaginable concepts. This sample of words does not represent adult vocabulary knowledge and language usage faithfully. Moreover, the exclusive use of concrete words may have overestimated the merits of the keyword method: Creating an interactive image between the keyword and the L1 equivalent of the novel FL word, a crucial step in the keyword method, is likely to be easier for concrete words (e.g., *butterfly*) than for abstract words (e.g., *duty*). Ellis (1995) even conjectured that the keyword method would be of little use in learning abstract vocabulary.

However, the few studies that explicitly tested the applicability of the keyword method to words that varied in imageability or concreteness did not seem to substantiate this idea (Delaney, 1978; Pressley et al., 1981; Van Hell & Candia Mahn, 1997; cf. Ellis & Beaton, 1993a). For example, Van Hell and Candia Mahn presented abstract and concrete FL words to keyword learners and rote learners. They found that concrete words were learned and remembered better than abstract words under rote rehearsal instructions (as is commonly found; see the word-type effects discussed in the next part of this section). However, the advantage of

concrete words over abstract words was not notably larger under keyword instructions.

Another type of FL words that may be less suitable for learning via the keyword method is cognates. Remember that the keyword is an L1 word that looks or sounds like the to-be-learned FL word. In learning cognates, for instance, for the Spanish word *rosa*, the most obvious keyword would be its translation, here *rose*. The keyword method thus seems an unnecessarily laborious and ineffective method for learning cognates, particularly considering the large advantage that cognates have over noncognates in the more straightforward learning methods of word association and picture association learning (see the detailed discussion of the role of word type in FL vocabulary learning).

Retrieval Speed In the keyword literature, the benefits of learning are typically expressed in terms of the percentage or proportion of correctly recalled words, often measured in a cued recall task. In the cued recall task, one of the elements in a pair (the cue) is presented during testing, and the participant is asked to come up with the other element of the pair. In the cross-language variant of the cued recall task, as frequently applied in FL vocabulary learning studies, the cue is a word in one language, and the element to come up with is its translation in the other language; the cross-language version of the cued recall task is thus essentially a word translation task. The cued recall retrieval measure expressed as percentage of correctly recalled words is assumed to reflect the items successfully encoded in long-term memory during learning. However, as discussed in this chapter, fluent language use is determined not only by retrieval accuracy, but also by the speed with which a word can be retrieved from memory. Nearly three decades ago, Atkinson (1975) raised a similar point. He assumed that FL learning via the keyword method would not slow subsequent retrieval of the learned FL words as compared to methods in which word retrieval is less complex, like rote rehearsal.

Remarkably few studies, however, have examined the effect of keyword instruction on FL word retrieval speed (see Van Hell & Candia Mahn, 1997, and Wang & Thomas, 1999, for exceptions). In two experiments, Van Hell and Candia Mahn examined retrieval speed by comparing retrieval times of keyword and rote learners for newly learned FL words in a timed cued recall task. Performance was assessed in three tests: immediately after the learning phase, after a 1-week delay, and after a 2-week delay. In all tests, they observed

considerably shorter retrieval times for rote learners than for keyword learners (with the differences ranging between 452 and 966 ms). The faster retrieval times for rote learners were not compromised by poor recall performance. Rather, the proportion of correctly recalled words of rote learners was higher than (Experiment 1) or equal to (Experiment 2) that of the keyword learners. Wang and Thomas (1999) corroborated these results by measuring response times via a timed recognition task (treating the delay interval as a between-subjects factor).

Together, these findings showed that keyword learners need more time to retrieve the newly learned words from memory than rote learners do, suggesting that the retrieval of newly learned words may be slowed by the use of keyword mnemonics. Moreover, it appears that the keyword does not become superfluous, but is still used as a retrieval cue well after learning (cf. Atkinson, 1975). This may impede an important goal of FL learning, namely, the attainment of verbal fluency.

The Role of Experience in Foreign Language Learning A fourth factor that may constrain the applicability and suitability of the keyword method concerns the learner's amount of FL learning experience. In the majority of keyword studies, the participants were inexperienced FL learners. Studies using more advanced learners suggested that these learners may benefit less from keyword mnemonics than inexperienced learners do. Levin et al. (1979), Moore and Surber (1992), and Hogben and Lawson (1994) used learners who had followed FL classes for at least a year and observed that the typical beneficial effects of keyword mnemonics were less robust with more advanced learners of the target language. These findings were extended by Van Hell and Candia Mahn (1997) to another group of experienced learners, namely, multilingual language users with a considerable amount of experience in learning FL vocabulary (i.e., in English, French, and German), but who had no prior knowledge of the target language, Spanish. In these learners, keyword instructions were less effective than rote rehearsal instructions in both immediate and delayed recall.

These studies suggested that keyword mnemonics are relatively ineffective in experienced FL learners, both advanced learners of the target language and inexperienced learners of the target language who had experience with learning a number of other FLs. Apparently, there is no single most effective way of FL vocabulary learning, but a

particular type of learner benefits most from a particular learning method. (Another experimental result that substantiates this claim is presented in the section *The Effect of Background Music on Learning Foreign Language Vocabulary*.)

Direction of Testing Another factor that may qualify the benefits of the keyword method concerns the direction of recall. Most keyword studies have used a "receptive" cued recall task in which the newly learned FL word is presented and the L1 translation must be produced; this task corresponds to "backward" word translation (see, e.g., De Groot, Dannenburg, & Van Hell, 1994). The reverse task, "productive" cued recall (or "forward" translation), is used less frequently. Ellis and Beaton (1993a) found that keyword mnemonics are effective for receptive recall, but less so than rote rehearsal instructions for productive recall.

In conclusion, numerous studies reported the beneficial effect of using keyword mnemonics in FL vocabulary learning. Yet, a drawback of the method is that it seems to impede word retrieval after learning, and that its success is constrained by a number of factors, including the learners' experience with FL learning and the type of words to be learned. One of the learning methods discussed in the next section, the word association method, does not suffer from these constraints.

Paired Associate Learning

Two other common methods used in FL vocabulary learning studies are versions of a general learning method that has been used in verbal learning and memory research for decades, namely, the so-called paired associate paradigm. In studies employing this method, pairs of stimuli are presented during learning. At testing, the cued recall task is often employed; one of the elements in a pair (the cue) is presented, and the participant is asked to come up with the second element of the pair. Alternatively, whole pairs are presented at testing that were or were not presented as such during learning, and the participants are asked to indicate whether the presented stimulus pair is "old" (presented during learning) or "new" (not presented during learning; "recognition"). The stimuli as complete pairs, and the separate elements within a pair, may vary on many dimensions, such as the modality of presentation (e.g., auditory or visual) and the nature of the stimuli. Line drawings of

common objects or the objects themselves, nonsense shapes, words of various grammatical categories, nonsense combinations of letters, single letters, numerals, and, indeed, foreign words have been used as stimulus materials in paired associate studies (see Runquist, 1966, for an early description of the essentials of the method).

The two versions of this general paradigm that have often been used in FL vocabulary learning research are the word association and picture association methods. In the word association method, the paired associates presented during learning are two words, one a native language word and the second its translation in the target FL. The FL words to be learned may be actual words in a natural language or invented, artificial words that do not occur as such in any natural language. In the latter case, the FL word to be learned may be a letter sequence that is formed according to the orthographic and phonological systems of the learner's native language but that carries no meaning (a "pseudoword") or an orthographically or phonologically "illegal" letter string that does not follow the orthographic or phonological rule systems of the learner's native language (a "nonword"). In the picture association method, one of the elements in the study pairs is the targeted FL word and the second is a picture (or a line drawing) depicting the referent of this word. Typically, in both these methods the words are presented visually, but in word association (and for the FL words in the picture association condition), auditory presentation is a feasible alternative as well and may indeed sometimes be the only option (when the learners are illiterate).

The term *word association method* is used here to stress the fact that, in this method, two words are paired in each learning trial. The term is neutral with respect to the exact learning strategy the participants actually use. Often, no specific instructions regarding which strategy to adopt are given to the participants, a learning setting that is also referred to as *unstructured learning*. Under these circumstances, learners report the use of various learning strategies (e.g., associating the two words in the pair; rehearsing them silently; detecting similarities between the words in a pair; forming mental images of the words; constructing sentences containing the words in the pair; inventing memory aids; De Groot & Van den Brink, 2004); different participants in the same experiment may use different strategies, but individual participants may also replace a strategy employed early in the learning episode with a new strategy. In other studies, the

instructions are somewhat more specific. For instance, in studies employing the rote learning technique, the participants are instructed to rehearse and memorize the presented materials silently (this is how the term was employed above).²

Of the two paired associate learning methods, the word association technique can be applied more widely than the picture-word association method. As pointed out, the success and applicability of the keyword method, although effective in many circumstances, is constrained by a number of factors. One of these is the fact that the method is not optimally suited for the learning of abstract words and is unsuitable for learning cognates. The picture association technique suffers from one of these constraints as well and to an even larger extent than the keyword method: Whereas with some effort it is possible to employ the keyword method in learning abstract words (Van Hell & Candia Mahn, 1997), it is virtually impossible to depict abstract words, which by definition cannot be experienced by the senses, including the eye. (Unlike the keyword method, there is no restriction to limit the picture association method to noncognates.)

The word association method does not suffer from any of these constraints; it can be used, and indeed has been used, to study the learning of concrete and abstract words and cognates and noncognates (and frequent and infrequent words, but this variable also does not constitute a constraint for the picture association and keyword methods). The pertinent studies and the effects found are discussed in the section on word type effects.

Why then, if its applicability is restricted to the study of only a subset of words in a language, is the picture association method used at all? An important reason presumably is that it lends itself rather naturally to study vocabulary learning in young children because the method closely resembles a common form of L1 vocabulary acquisition in these children, namely, the association of a word with the corresponding object in the child's environment. Experimental data collected by Wimer and Lambert (1959) suggested that this association of the to-be-learned FL word with environmental objects and events is a relatively effective FL vocabulary learning method for adult learners as well, but a more recent study (Lotto & De Groot, 1998) refuted this claim (see the section Individual Differences in Learning Foreign Language Vocabulary for details).

When the picture-word association method is used with very young children, it can only be exploited in an auditory form (presenting a picture

with the spoken form of its FL name) because these children will typically still be illiterate. Whereas visual presentation of the FL word is an option for young children who have just passed the very initial stages of learning to read, it is not a recommended mode of presentation for this learner group either. The reason is that, for these children, word reading has not been automatized yet and therefore coming up with the correct sound structure of the visually presented words (via the written forms) often constitutes a real challenge to them. This cognitive limitation cannot be ignored in studies of vocabulary acquisition because it is a well-established fact that generating the phonological forms of visually presented words by means of overt or subvocal speech is an essential component of successful vocabulary acquisition (see The Role of Phonology in Foreign Language Vocabulary Learning section).

Learning Words in Context

In the FL vocabulary learning methods discussed above (i.e., keyword learning, rote rehearsal, word association learning, and picture association learning), the newly learned words are presented in highly impoverished contexts. Language users, including FL learners, typically perform in contextually richer situations. This evokes the idea that an FL word may be better learned in a larger, more meaningful linguistic context like a sentence. In the field of FL vocabulary learning studies using direct instruction methods, the question whether such learning is more effective using restrictive contexts, as in the studies discussed above, or using a larger linguistic context has received relatively little empirical attention (but see, e.g., Moore & Surber, 1992; Prince, 1996). One prerequisite of learning FL vocabulary in an FL sentence context is that the FL learners have a basic level knowledge of the FL language that should be at least sufficient to understand the sentence context.

Prince (1996) examined more advanced FL learners who had studied the FL (English) for 5 to 8 years and instructed them to learn new FL words in either a sentence context condition or a word association condition. He found that more words were recalled with word association than with sentence context instructions. It should be noted, however, that recall of the relatively weak learners (but not of the more advanced learners) in the word association condition was notably poorer when measured via a sentence completion task than via a cued recall task. This finding suggests that FL

learners may differ in the extent to which they can successfully transfer new vocabulary learned via contextually restricted methods (here via word association) to more meaningful and contextually richer FL situations.

Word-Type Effects

Word-Type Effects on Learning

Words vary on a number of dimensions. For instance, words may refer to concrete objects or to abstract entities (the variable concreteness); they may share (a large part of their) visual or auditory form with their translation in another language (cognate status); they may be used often or rather sparsely in speech and writing (frequency); they may be morphologically simple or complex (morphological complexity) or may differ in structural complexity for other reasons (e.g., they may contain more or less-complex consonant clusters).

The effect of some of these variables, most notably concreteness, cognate status, and word frequency, has been studied frequently in bilingual representation studies, which focus on the way translation pairs are represented in bilingual memory (e.g., as "compound," "coordinate," or "subordinate" structures in the words of Weinreich, 1953/1974, or as "word-association" or "concept-mediation" structures in the terminology of Potter, So, Von Eckardt, and Feldman, 1984; see De Groot, 1993; Kroll, 1993; and Kroll & Tokowicz, chapter 26, this volume, for reviews). The tasks most commonly employed in these studies are word translation (e.g., De Groot et al., 1994), word association (e.g., Kolers, 1963; Van Hell & De Groot, 1998a), and semantic priming across languages (e.g., De Groot & Nas, 1991; Keatley, Spinks, & De Gelder, 1994).

In contrast to the bilingual representation studies, relatively few FL vocabulary learning studies have manipulated word-type variables, even though doing so is likely to provide relevant information on the learning process and the ensuing memory representations. Furthermore, results of such studies may inform FL curricula, especially the sequencing of the vocabulary to be learned by the students (e.g., Meara, 1993).

A plausible reason why only a few of these learning studies varied word type is that typically the word set presented for learning in these studies consisted of rather few words, too few to contain a

sufficiently large number of each type (e.g., concrete noncognates) to obtain reliable effects of the variables concerned. For instance, studies by Cheung (1996), Papagno, Valentine, and Baddeley (1991), and Wimer and Lambert (1959) presented only three, eight, and nine words, respectively, for which an FL word was to be learned.

As the representation studies, the few FL vocabulary learning studies that manipulated word type showed reliable effects of two of the above variables: word concreteness (De Groot & Keijzer, 2000; De Groot & Van den Brink, 2004; Ellis & Beaton, 1993b; Service & Craik, 1993; Van Hell & Candia Mahn, 1997) and cognate status (De Groot & Keijzer, 2000; Ellis & Beaton, 1993b; Kroll, Michael, & Sankaranarayanan, 1998; Lotto & De Groot, 1998). For some of these studies, namely, those that have employed an orthogonal (not a correlational) design, it is possible to determine the actual size of the effects. These analyses show that the effects are substantial: Across the relevant studies, the magnitude of the concreteness effects varies between 11% and 27%, meaning that the recall scores are from 11% to 27% higher for concrete words than for abstract words (De Groot & Keijzer, 2000; De Groot & Van den Brink, 2004; Van Hell & Candia Mahn, 1997). Similarly, the magnitude of the effect of cognate status varies between 15% and 19% when highly experienced FL learners were the participants in the vocabulary learning studies (De Groot & Keijzer, 2000; Lotto & De Groot, 1998). When less-experienced FL learners served as participants, the cognate effect even appears to be substantially larger (about 25% in a receptive testing condition and about 50% in a productive testing condition; Kroll et al., 1998, p. 383).

Acknowledging the fact that fluent use of a FL not only requires that FL knowledge (here, the knowledge of FL vocabulary) is stored in memory, but also that this knowledge is accessed and retrieved rapidly (see also the section on keyword mnemonics), the five studies that employed an orthogonal design measured retrieval times as well. The results of these analyses generally converged with the analyses on the recall scores, although fewer of the effects were statistically significant. But, whenever a significant effect occurred, its direction strengthened the conclusions drawn from the analyses of the recall scores. That is, responses to concrete words and cognates were generally faster than those to abstract words and noncognates, respectively.

A third variable that has been manipulated in some of the above studies is word frequency.

Compared to the effects of word concreteness and cognate status, the effect of this variable is not robust. If it occurs at all in a particular study, it is rather small (effects of 3% to 7% in De Groot & Keijzer, 2000; De Groot & Van den Brink, 2004; and Lotto & De Groot, 1998), and in two of these studies (De Groot & Keijzer, 2000; De Groot & Van den Brink, 2004), this small effect (with better performance for high-frequency words than for low-frequency words) was attributable to a subset of the items only.

The FL vocabulary learning studies discussed in this section employed different methods of FL learning. As mentioned, Van Hell and Candia Mahn (1997) contrasted the keyword method and rote rehearsal; De Groot and Keijzer (2000) and De Groot and Van den Brink (2004) used the word association technique; and Kroll et al. (1998) and Lotto and De Groot (1998) contrasted the word association and picture association methods. Maybe the most noteworthy word-type effect reported in these studies combined is the finding by Kroll et al. and Lotto and De Groot that an effect of cognate status not only materialized in the word association condition, but also in the picture association condition. What is more, the cognate effect was equally large in these two conditions. The reason to qualify this finding as noteworthy is that it is generally assumed that the form relation between translation equivalent terms underlies the effects of cognate status in both representation and learning studies. But of course, a word and a picture representing this word do not share any form similarity.

The effect of cognate status in the picture-learning condition thus suggested that the presentation of a picture activates the corresponding L1 word form (Lotto & De Groot, 1998, pp. 58–59), and that the learner then recognizes the similarity between the generated L1 word form and the to-be-learned FL word form accompanying the picture. This awareness then somehow (see the section Cognate Status for more detail) facilitates the learning of the new form. In theory, the form concerned could be phonological, orthographic, or both because the two elements within the cognate pairs used in these studies are typically similar both in spelling and in phonology, and the learner's recognition of either type of relationship might facilitate learning. Lotto and De Groot, however, argued that the forms involved presumably are the phonological forms (see the original reference for details). Furthermore, they noted that such a conclusion fits in nicely with the results of a number of related studies that all suggested an important role for phonology

in learning FL vocabulary, even when the learning materials are presented visually (e.g., Baddeley, Papagno, & Vallar, 1988; Papagno et al., 1991; Van Hell & Candia Mahn, 1997; see The Role of Phonology in Foreign Language Vocabulary Learning section for a more detailed discussion).

Word-Type Dependent Forgetting

The goal of FL vocabulary learning is to install durable, not transient, representations in memory. At least two studies suggested that this goal is not met equally often for all types of words, but that instead more forgetting occurs for the types of words that are the most difficult to learn (De Groot & Keijzer, 2000; De Groot & Van den Brink, 2004). When the participants of these studies were retested about a week after initial learning (without further learning), it turned out that more forgetting had occurred for abstract words than for concrete words, and that more forgetting had occurred for noncognates than for cognates. These results converged with the findings of Bahrick and Phelps (1987), who showed (at a global level, without examining the performance for different types of words) that, 8 years after learning, retention was best for words that had required the fewest learning trials to obtain criterion performance during learning.

Note that this does not imply that manipulations that increase the difficulty of a learning task lead to more forgetting. In a FL vocabulary learning study using the word association method, Schneider, Healy, and Bourne (2002) found that increasing the difficulty of learning during the initial phase (i.e., through learning procedures involving the more difficult L1-FL direction rather than the reverse direction, mixing rather than blocking semantic categories, or no pretraining of FL words) leads to poorer learning and immediate retention, but not to inferior delayed retention, transfer, and relearning. Importantly, in Schneider et al.'s study, the difficulty of the learning conditions pertained to the difficulty of learning procedures rather than of the FL materials to be learned, as in the work of De Groot and Keijzer (2000) and De Groot and Van den Brink (2004). In other words, concrete words and cognates may be better retained than abstract words and noncognates, respectively, but FL words learned under difficult learning procedures may be better retained than those same words when learned under easy learning conditions.

Explaining the Word-Type Effects

Concreteness

Effects of concreteness are ubiquitous in studies on first and second/foreign language learning and language processing. For instance, the concreteness effect observed in the FL vocabulary learning studies discussed above has a parallel in L1 acquisition, in which concrete words are acquired earlier than abstract words (e.g., Brown, 1957; Schwanenflugel, 1991). The questions remain what causes these effects and whether all effects of this variable, both in L1 acquisition and in FL learning and both in language acquisition/learning and in language processing, can be parsimoniously attributed to the same source or whether different causes underlie the various manifestations of the effect.

For instance, a likely cause of the concreteness effect in L1 acquisition is that acquiring concrete words is often supported by the tangible, visible, audible, or palpable presence of the corresponding objects in the child's surroundings, whereas this sensory information is by definition missing for abstract words. If this explanation holds, a different explanation of the concreteness effect in FL vocabulary learning has to be provided because, in none of the pertinent studies discussed, the entities to which the to-be-learned concrete words referred were present in the learning environment (although these objects may have been imagined by the participants, a process that may have caused or contributed to the effect).

De Groot and Keijzer (2000) suggested two possible causes of the concreteness effect in FL vocabulary learning; both attribute the effect to differences between the memory representations of concrete and abstract words. Both explanations assign a critical role to the amount of information concerning the L1 word that is stored in memory: The more information that is stored, the more opportunity the learner has to anchor the to-be-learned FL word form onto it and therefore the more successful learning is. One of these explanations is in terms of dual-coding theory (see also the section on keyword mnemonics), which assumes two memory representations for concrete words, one in the verbal system and one in the image system, whereas only one, stored in the verbal system, is assumed for abstract words. Note that this state of affairs implies that dual-coding theory assumes qualitatively different memory representations for concrete and abstract words.

The second explanation is in terms of the differential informational density of memory representations for concrete and abstract words within an amodal, monolithic memory system (De Groot, 1989; Kieras, 1978; Van Hell & De Groot, 1998b; Van Hell & Sjarbaini, 2004). Within this framework, the memory representations of concrete and abstract words are only assumed to differ quantitatively, not qualitatively: Those of concrete words are assumed to contain more information elements than those of abstract words (see De Groot, 1989, for experimental support). Again, this allows more anchoring opportunities in the case of learning a FL word form for concrete L1 words. Lotto and De Groot (1998) proposed this same explanation for the (relatively small) frequency effect in FL vocabulary learning that has sometimes (but not reliably) been obtained.

This explanation of the concreteness effects in FL vocabulary learning cannot account for the analogous effects in L1 vocabulary acquisition by toddlers. The reason is that the former effects result from differences in memory structures for concrete and abstract words that presumably reflect the outcome, not the beginning, of the L1 acquisition process. At the onset of L1 vocabulary acquisition, representations are not likely to exist in memory for either concrete words or abstract words; in other words, at that stage concrete and abstract words do not differ with respect to their memory representations; the buildup of memory information for both types of words presumably starts from scratch. A plausible explanation for the concreteness effect in L1 vocabulary acquisition was already provided above: Only the acquisition of concrete words, not that of abstract words, is supported by the perceptual presence of these words' referents in the child's environment.

Cognate Status

Lotto and De Groot (1998) and De Groot and Keijzer (2000) suggested three possible sources for the superior FL vocabulary learning performance for cognates, considering both the learning stage (storage) and the testing stage (retrieval) as possible loci of the effect. The first explanation extends a view of bilingual memory representation that assumes shared representations for cognates, but language-specific representations for noncognates (Kirsner, Lalor, & Hird, 1993; Sánchez-Casas, Davis, & García-Albea, 1992; see also Sánchez-Casas & García-Albea, chapter 11, this

volume). In fact, a cognate relation between two words is considered a special case of a morphological relation that may exist between words within the same language and that is reflected in the joint storage of morphologically related words in memory. According to this view, bilingual memory, just as monolingual memory, is organized by morphology, not by language. For instance, a French-English bilingual has one memory representation containing both the English words *marry*, *marriage*, and *married* and the French words *marier* and *mariage* (Kirsner et al., 1993). If true, the learning of a FL word that shares a noncognate relation with the corresponding L1 word involves creating a new entry in memory, whereas learning a cognate word may only involve adding new information to, or adapting, a representation already stored there prior to the learning episode. The latter process may be less demanding than the former, causing the learning advantage of cognates over noncognates.

A second possible cause for the cognate advantage is that in the case of learning a FL cognate, which shares form with its translation, less has to be learned than when a noncognate FL word has to be learned. Finally, because of the form overlap between cognate translations and the absence of such overlap in the case of noncognates, when a cognate is presented as the testing stimulus, it will constitute a strong cue for the retrieval of its translation equivalent in the target language. These three suggested causes of the effects of cognate status do not have to be mutually exclusive, but may all contribute to the effect.

Word-Type Dependent Effects on Forgetting

The differential forgetting of concrete words and cognates on the one hand and abstract words and noncognates on the other suggests that, in terms of Atkinson (1972), immediately after training abstract words and noncognates are in a *T* (for temporal) state relatively often. This means that the newly learned word is only known temporarily, and that subsequent learning of other words will cause interference, causing forgetting of the previously known word. The second state Atkinson distinguishes is a *P* (permanent) state for newly learned words that have gained a permanent status in memory immediately after training. The data suggest that concrete words and cognates have reached a *P* state relatively often at the conclusion of the training phase. A third possible state that

words presented for learning can be in, and that abstract words and noncognates are in relatively often immediately after training, is the *U* (unknown) state. Of course, distinguishing between these three retention states only concerns a rephrasing of the effects obtained, not an explanation. A true explanation may ultimately be provided in terms, again, of differential memory representations for different types of words (e.g., being embedded in a denser representation and, as such, being linked to a relatively large number of information elements in memory might render a newly learned FL word relatively immune to forgetting).

The Role of Phonology in Foreign Language Vocabulary Learning

The cognate effect observed in the picture association learning condition in the work of Lotto and De Groot (1998) and Kroll et al. (1998) suggested that participants generated the names of the presented pictures during learning (see Word-Type Effects on Learning). This was regarded as support for the view that phonology plays an important role in FL vocabulary learning. Gathercole and Thorn (1998) reviewed the relevant literature and provided overwhelming support from various sources for this view.

For instance, Papagno et al. (1991) showed that an experimental technique called *articulatory suppression* disrupts the learning of FL vocabulary (although suppression had little effect on meaningful paired-associate learning in L1). The articulatory suppression technique involves the repeated uttering of a sound (e.g., *bla*) while learning the paired associates consisting of, say, an L1 word and its FL translation. Suppression interferes with the phonological recoding of visually presented items, thus preventing their short-term phonological storage. Furthermore, suppression interferes with "subvocal" rehearsal, a process that is deemed necessary for transfer from short-term memory into long-term memory.

Service (1992), in a 3-year longitudinal study of Finnish children learning English as a FL, showed a close relationship between the children's ability at the start of the program to repeat presented pseudowords and their grades in English at the end of the program. Subsequent work (Service & Kohonen, 1995) suggested that this relationship was mediated by English vocabulary knowledge. Pseudoword repetition is assumed to involve phonological mem-

ory, and the level of accuracy at which the task is performed is thought to reflect phonological-memory skills and capacity. Therefore, these data also suggest a relation between phonological memory and FL vocabulary learning. This conclusion is strengthened further by neuropsychological evidence: Baddeley et al. (1988) showed that their patient P. V., who had a reduced phonological store capacity, was unable to repeat back pseudowords longer than three syllables and to learn auditorily presented pseudowords paired with real words.

The important role of phonology in FL vocabulary learning is further supported by studies using experienced FL learners. Papagno and Vallar (1995) observed that polyglots performed better than nonpolyglots in phonological memory tasks and in FL paired associate learning, suggesting a relation between phonological-memory capacity and FL vocabulary learning.

Van Hell and Candia Mahn (1997) observed that experienced FL language learners benefited more from rote rehearsal learning than from keyword learning. They proposed that subvocal rehearsal of the FL word and its translation activates phonological codes, and that experienced learners in particular benefit from using phonological information in learning novel FL words. Specifically, experienced FL learners not only may have better phonological memory skills (as suggested by Papagno and Vallar's 1995 study), but also may possess more refined long-term knowledge of phonological structures. For example, the experienced FL learners in Van Hell and Candia Mahn's study had all learned the subtle, yet important, differences in the pronunciation of the cognate *hotel* across the Dutch, English, French, and German languages. This fine-grained and broad repertoire of phonological knowledge, along with better phonological memory skills, may make experienced FL learners more receptive to the phonological information novel FL vocabulary contains and may thus guide and facilitate the learning of novel FL words.

Finally, the "typicality" of the FL words to be learned affects their learning; that is, if the sound structure of the to-be-learned words conforms to the phonotactic rules of the learner's native language, learning is more successful than when phonotactically alien FL words are presented for learning. Gathercole, Martin, and Hitch (in Gathercole & Thorn, 1998) varied the nonwords in word-nonword pairs on "wordlikeness" (in terms of sound structure) and demonstrated that more wordlike nonwords than non-wordlike nonwords were learned. Similarly, immediately after learning,

De Groot and Van den Brink (2004) obtained recall scores that were 14% higher for phonotactically typical nonwords than for phonotactically atypical nonwords. Furthermore, a week after learning, more forgetting had occurred for the latter. (This is yet another demonstration of the earlier finding of De Groot and Keijzer, 2000, that words hard to learn are more easily forgotten than words relatively easy to learn.) All these findings converge on the conclusion that, during the learning of FL vocabulary, phonological codes are generated and used to support the learning process: The typicality effect is likely to arise from the fact that the generation of phonological codes is easier for phonotactically typical words than for atypical such words.

Baddeley, Gathercole, and Papagno (1998) proposed a model of the phonological loop that accommodates the findings of the studies discussed above (and those of many other studies; see Baddeley et al., 1998; Gathercole & Thorn, 1998). The phonological loop, a component of the multicomponent model of working memory, is specialized in the retention of verbal information over short periods of time. The phonological loop includes a phonological store (which holds information in phonological form) and a rehearsal process (which serves to preserve decaying representations in the phonological store).

The primary function of the phonological loop is to mediate language learning by providing a temporary storage of unfamiliar phonological forms (novel words) while more permanent memory representations are constructed. It is proposed that the phonological loop and long-term knowledge of the language operate in an interactive manner. Relevant for FL vocabulary learning is the assumption that the phonological loop function in FL learning is enhanced by instructions that emphasize subvocal rehearsal, as in rote rehearsal (e.g., Ellis & Beaton, 1993a; Van Hell & Candia Mahn, 1997), and is disrupted by articulatory suppression (e.g., Ellis & Sinclair, 1996; Papagno et al., 1991).

Baddeley et al. (1998) proposed that the phonological loop function may vary across individuals. Specifically, the natural talent of polyglots, or gifted language learners in general, for learning language may arise from an excellent phonological loop function. (See also Michael and Gollan, chapter 19, this volume, for a discussion of other aspects of working memory, such as working memory capacity, that may play pivotal roles in becoming proficient FL users.)

Freeing and Fine-Tuning the Newly Learned Foreign Language Words

The storage of durable representations for the newly learned FL word forms in memory by means of any of the learning methods discussed above—keyword mnemonics, rote rehearsal, word association learning, or picture association learning—is only a first step toward establishing an FL word representation that resembles a native speaker's representation of this same word and that enables the access (in comprehension) and retrieval (in production) of this representation in a way that resembles these processes in a native speaker. So far, the new representation consists of little more than an extra element—the FL word label—attached to (or embedded in) the representation for the corresponding native language word. At this learning stage, when this new word form is encountered by the FL learner in actual FL speech or writing, he or she can only come to grips with it by assigning it the meaning of the corresponding L1 word.

There is evidence to suggest that, during the very initial stages of learning, this process of L1 meaning assignment proceeds indirectly via the L1 word form (Chen & Leung, 1989; Kroll & Curley, 1988; Kroll & Sholl, 1992; Kroll & Stewart, 1994; Sholl, Sankaranarayanan, & Kroll, 1995; cf. Weinreich's 1953/1974 subordinate type of bilingualism; see also Kroll & Tokowicz, chapter 26, this volume). Similarly, during FL language production, the retrieval of the FL word form is assumed to start with the activation of the meaning representation of its translation in L1 and then to "pass through" the L1 form representation before the FL form is retrieved and produced. Soon after, with increasing FL experience, the FL word form starts to become functionally detached from the corresponding L1 word form representation and to access meaning as directly as the corresponding L1 word does.

A number of studies have suggested that such "freeing" of the FL word form from the L1 word form starts very early on in the FL learning process for this word (Altarriba & Mathis, 1997; De Groot & Poot, 1997; Potter et al., 1984). Ultimately, retrieval of this word form in FL will no longer exploit the L1 word-form representation at all (cf. Weinreich's, 1953/1974, "coordinate" bilingualism).

Assigning FL words the meaning of the corresponding L1 words, either indirectly via the L1

word forms or, later, directly would imply the use of a strong “semantic accent”; the reason is that translation “equivalents” seldom share all aspects of their meaning: The meaning aspects specific to the word in L1 would be implied when using its L2 (second language) equivalent (see MacWhinney, chapter 3, this volume, for other types of L1 transfer in FL learning). Highly technical words possibly constitute the only exception to the apparent rule that the meanings of a word and its closest translation do not overlap perfectly (Fries, 1945, in Boyd Zimmerman, 1997, p. 11), although for particular classes of words (concrete words) the overlap in meaning between the two languages is larger than for other classes (abstract words; emotion words).

For this reason, De Groot (1992; see also Van Hell & De Groot, 1998a) proposed the “distributed feature” model of bilingual lexical representation as an alternative to the more common “localist” models. In this model, word meaning is represented in memory as a set of semantic features, some of which are shared between a pair of translations, whereas others are unique to either the L1 word or the FL word. Translations of concrete words share more of these semantic features than translations of abstract words (see Kroll & Tokowicz, chapter 26, this volume, for further details).

Furthermore, assigning a FL word the meaning of “its” translation equivalent entails the flawed assumption that a word has only one meaning, whereas the truth is that words typically have many different meanings (some claim from 15 to 20 in English; Fries, 1945, in Boyd Zimmerman, 1997, p. 11), some of which are related, but others apparently are unique. Which of a word’s many meanings should be assigned to it when it is encountered in speech or reading depends on the context of use.

This plethora of meanings and shades of meaning words may have and the context dependence of word meaning have frustrated the attempts by many to obtain exact definitions of words and have led others to accept the view that “word meanings cannot be pinned down, as if they were dead insects. Instead, they flutter around elusively like live butterflies. Or perhaps they should be likened to fish which slither out of one’s grasp” (Aitchison, 1987, p. 40). Or, in the words of Labov (1973, in Aitchison, 1987): “Words have often been called slippery customers, and many scholars have been distressed by their tendency to shift their meanings and slide out from under any single definition” (p. 40). In keyword mnemonics, word association learning, and picture association learning, only one of this plethora of meanings is singled out (either by the

stimulus itself, e.g., the picture of a mug, or by the learner), leaving all remaining meanings of the FL word yet to be learned through other means.

Insight into learning the meaning of words in more advanced FL vocabulary learning was provided by Bogaards (2001). He studied the learning of new meanings for known words and for combinations of known words in learners of French, all native Dutch speakers, who were in their fourth year of learning this FL in high school. The results of this study (see the original reference for details) suggest that both previously learned word forms and word meanings may promote the learning of new meanings for familiar forms and expressions comprised of familiar forms.

In sum, for ultimate use of a FL word in a nativelike way, the FL word form must provide access to meaning and be retrieved from conceptual representations directly, bypassing the form representation of its L1 translation. The meaning that is initially associated with the FL word (the meaning of its L1 translation) must gradually be narrowed (to get rid of the unique L1 meaning parts), extended (to also cover the unique L2 meaning parts or be used in multiword expressions) and refined such that it covers all of its FL meanings and captures the specific connotations of each.

Needless to say, gaining such a detailed level of FL vocabulary knowledge requires extensive practice of the FL words in contexts varied enough to acquaint the learner with the finesse of all their meanings. Apart from extended immersion in an environment in which the FL is the dominant language, only extensive reading in that language is likely to provide that outcome. The initial, flimsy representations set up via the direct instruction methods discussed here provide no more than the means to bootstrap into this time-consuming learning process, but as such are extremely valuable.

The Effect of Background Music on Learning Foreign Language Vocabulary

When performing cognitively demanding tasks, some people prefer a quiet environment, claiming to be hindered by noise, including music, whereas others seem not to be bothered by a certain noise level or even prefer (a particular type of) background music while performing the task, claiming to perform better under those circumstances. This observation, if confirmed and understood in

rigorous research, has obvious pedagogical implications as it might, for instance, inform teachers about how to create the optimal learning environment in the classroom and advise students with respect to the most effective circumstances to do their homework. Of course, the potential impact of well-controlled studies into this topic reaches far beyond the classroom because cognition is involved in the majority (if not all) tasks to be performed by humans, even tasks performed automatically most of the time.

Acknowledging its potential importance, the effect of background music (and other types of noise ignored in the present discussion) on task performance has been a topic of study by several groups of researchers, most notably applied psychologists, cognitive psychologists, and personality psychologists. The applied psychologists among these researchers primarily tried to find out whether music affects workers' satisfaction and morale or their productivity at work. The cognitive psychologists' goal was to look at ways in which music affects attention and processing in various tasks. The personality psychologists' focus was on the way music and different musical styles interact with individual differences in personality. See Furnham and Allass (1999) and Furnham and Bradley (1997) for a historical overview of this work.

The role of background music in learning has also received the attention of teachers and educators with an interest in a field of study carrying the esoteric name of *Suggestopedia*, a name based on a teaching method thus dubbed and introduced in Bulgaria by Lozanov (1978, in Felix, 1993). The innovative element this learning method introduced in the classroom was the systematic use of music in the instruction process. Especially, classical baroque music was thought to support the learning process. Felix (1993) reviewed the pertinent studies and concluded that positive effects of music played during learning have been reported for vocabulary learning and reading performance; that effects of music played during testing do not consistently occur; and that playing the same music during both learning and testing leads to the best achievement. The latter finding exemplifies the well-known phenomenon of "context-dependent" memory, that is, that test performance is better the more similar the circumstances under which testing occurs are to the circumstances present while learning (e.g., Godden & Baddeley, 1975).

De Groot and Van den Brink (2004) looked at the effect of background music on learning "FL words" (which in fact were pronounceable and

nonpronounceable nonwords) for a set of Dutch words. The participants were all drawn from the same population of relatively experienced FL learners. Half of them learned the FL words in silence; the other half learned them while part of the Brandenburg Concerto by J. S. Bach was playing in the background. During testing, no music was played to either group of participants. The results were promising, but not in all respects conclusive: The recall scores were higher (by 8.7%) in the music condition than in the silent condition, but this effect only generalized over items, not over participants. This finding suggests that only a subset of the participants in the music condition benefited from the presence of background music. It also suggests that the remaining participants in this condition also were not hindered by it because otherwise an overall null effect of the music manipulation might have been expected.

Studies by Furnham and Bradley (1997) and Furnham and Allass (1999) hinted at an exciting explanation of why the effect of the music manipulation did not generalize over participants. Inspired by Eysenck's (1967) theory that introverts and extraverts differ in their levels of cortical arousal, they predicted that background music might have a detrimental effect on cognitive task performance in introverts, but a beneficial effect on such performance in extraverts. Manipulating this personality trait, Furnham and Allass observed that introverts performed substantially better in the silent condition than in the (pop) music condition in a reading comprehension task and a recall task, whereas for extraverts exactly the opposite pattern of results was obtained. The detrimental effect of music for the introverts was larger in a condition in which the music played was complex than in a condition in which it was simpler. Again, this pattern reversed for the extraverts.

Furnham and Bradley (1997) also demonstrated an interaction between the introvert/extravert variable and the music variable on two cognitive tests, one a reading comprehension test and the second a memory test, and Daoussis and McKelvie (1986) showed a similar interaction in a study looking at reading comprehension. The results of the last two studies differed from those of Furnham and Allass (1999) in that music had a detrimental effect on the cognitive performance of introverts, whereas extraverts appeared immune to the effects of the music manipulation. But, all three studies converge on the same conclusion: The introvert/extravert personality trait plays an important role in the effects of background music on cognitive performance.

The authors of the three studies just discussed all turned to Eysenck (1967) to account for this intriguing interaction between the introvert/extravert personality trait and the presentation of music during learning. Eysenck posited that introverts have a lower neurological threshold of arousal and therefore experience greater arousal in response to lower-intensity stimulation than extraverts; this results in introverts' satisfaction at relatively low levels of stimulation. It was posited that in introverts optimum performance is reached at moderate levels of arousal. In contrast, extraverts require relatively high levels of arousal for optimal performance (Furnham & Allass, 1999, pp. 28–29). Presumably without awareness of this alleged underlying physiological cause, introverts and extraverts are apparently aware of the effect of background music on their study success because extraverts claim to play background music more often while studying than introverts (Daoussis & McKelvie, 1986; Furnham & Bradley, 1997).

This account of music effects on learning provides a possible explanation for the above finding by De Groot and Van den Brink (2004) that the effect of the music manipulation did not generalize over all participants. In that study, the introvert/extravert personality trait was not taken into account, and the participant sample most likely included both introverts and extraverts. The extraverts may have benefited from background music, causing the overall higher recall scores in this condition. The fact that a net positive effect of background music was obtained suggests that the introverts were neither helped nor hindered by background music.

The role of a number of other factors that may affect music's effect on learning success, such as music preference (see Etaugh & Michals, 1975, who studied the effect of this variable on reading comprehension), vocal versus nonvocal music (Belsham & Harman, 1977), and musical styles (e.g., classical, jazz, and popular; Sogin, 1988), is still largely unknown. The evident pedagogical implications of filling this knowledge gap on creating optimal learning environments warrant increased research efforts devoted to unraveling the relevant variables and their interactions.

Individual Differences in Learning Foreign Language Vocabulary

At various points in the preceding sections, we alluded to the existence of individual differences in

the learning of FL vocabulary, both differences between learner groups and differences within groups of learners. For instance, it was pointed out that advanced (experienced) learners of a particular target language benefit less from keyword mnemonics than less-advanced (inexperienced) learners of that language do (e.g., Moore & Surber, 1992), and that for multilingual language users, who have considerable experience with learning FLs, rote rehearsal is a more effective learning method than keyword mnemonics is (Van Hell & Candia Mahn, 1997). Lotto and De Groot (1998) obtained a similar result: They showed that multilingual language users, sampled from the same population as the participants in Van Hell and Candia Mahn's study, learned more FL vocabulary when a word association method was used than when the picture association method was employed.

In contrast, Wimer and Lambert (1959), comparing word association learning with object association learning (in which the word to be learned is paired with an object rather than a picture of that object), obtained better recall performance with object association than with word association. They concluded that "environmental events are more effective stimuli for the acquisition of foreign-language responses than are native-language equivalents for the new words, at least for the learning of a simple, basic vocabulary" (p. 35). The results of Lotto and De Groot (1997) and (if imaging objects plays the same role in learning as actual objects or pictures of actual objects do) those of Moore and Surber (1992) and Van Hell and Candia Mahn (1997) suggest that this conclusion does not hold for all groups of learners. Possibly, the participants in Wimer and Lambert's study were relatively inexperienced FL learners. If so, this combined set of studies would suggest that learner group and learning method interact such that, for experienced FL learners, the word association technique (or rote rehearsal, as one particular implementation of this technique) is more effective than learning techniques that employ the visual (imagined or actual) analogues of the FL words to be learned, and that for less-experienced learners the opposite holds.

The results of Kroll et al. (1998; Experiment 1) that, just as Lotto and De Groot (1998) contrasted word association and picture association learning, provide some direct support for this suggestion: Whereas Lotto and De Groot, testing experienced FL learners, obtained better results overall with word association learning than with picture association learning (82% correct for word association learning vs. 77% correct for picture association

learning; only productive testing was employed), Kroll et al., who tested less-experienced language learners, obtained the opposite pattern of results (78.5% and 39.5% correct for word association learning in receptive and productive testing conditions, respectively, vs. 82% and 42% for these testing conditions, respectively, following picture association learning; all data collapsed across a test condition that tested with picture stimuli and one that tested with word stimuli). That the participants in Kroll et al.'s study were less-experienced learners than those of Lotto and De Groot is strongly suggested by the far lower learning scores in the productive testing condition in the work of Kroll et al. than in that of Lotto and De Groot. Furthermore, to achieve an overall recognition accuracy of 70% in the (relatively easy) receptive testing condition, the data of only half of the participants (45 of 99) could be included in the analyses (see Kroll et al., 1998, pp. 379 and 381). In Lotto and De Groot (1998), to achieve at least 60% accuracy in the (relatively hard) productive testing condition (the only condition that they tested), only 8 of the 64 participants tested had to be removed from the analyses (p. 43).

The amount of FL learning experience is unlikely to be the only variable that interacts with the specifics of the learning environment. That other factors may be relevant as well was implicit in our discussion of the effect of background music on learning FL words. As shown, the relevant literature suggests that the personality trait introversion/extraversion interacts with a role of background music. We hypothesized that the pattern of results obtained by De Groot and Van den Brink (2004), who tested experienced FL learners exclusively, emerged from an interaction between this personality trait and the music manipulation. If that analysis is correct, the results of that study indicate that FL learning experience is only one of the factors that determine what the optimal learning circumstances are. In other words, the effects of FL learning experience and background music both suggest that there is no single optimal procedure of learning FL vocabulary, but that instead the optimal procedure depends on learner characteristics. Different learners may benefit most from different circumstances, and the same learner may benefit most from different circumstances at different stages of learning.

Differences in phonological knowledge and processes and other aspects of working memory, such as working memory capacity, were mentioned as yet another source of individual differences in

FL vocabulary learning (Baddeley et al., 1998; Papagno & Vallar, 1995; see also Michael & Gollan, chapter 19, this volume). As we have seen, phonological coding appears to play an important role in transferring newly learned words from transient memory stores into permanent memory, and the presence of fine-grained phonological knowledge in long-term memory may increase the learner's receptiveness to subtle phonological differences in the learning material.

Baddeley et al. (1998) suggested that the phonological loop function differs between individuals, and that gifted language learners are characterized by an excellent such function. The amount and subtlety of phonological information in memory is obviously a function of the amount of language experience, native and foreign, a learner has, so that ultimately language learning experience may underlie (a substantial part of) the effects of phonological skills on FL language learning. It remains to be seen whether, if all other things (such as language learning experience) are equal, a thing such as "talent" for learning FLs can still be identified.

Conclusion

This review of studies on FL vocabulary learning has highlighted some of the factors that need to be taken into account to gain a complete understanding of successful learning performance; it has only briefly touched on, or even completely ignored, other factors. For instance, much attention was devoted to contrasting the various direct FL vocabulary learning methods and pointing out their limitations and the ways they interact with learner characteristics such as FL learning experience and phonological skills. Similarly, the fact that various word characteristics determine the success of learning FL equivalents for L1 words and the way these effects can be explained were discussed at length.

We also reviewed at some level of detail the research that tries to resolve the dispute regarding the role that background music may play in FL vocabulary learning. Finally, some discussion was devoted to the later stages of FL vocabulary acquisition, in which the newly learned FL words are functionally detached from their L1 counterparts, and their meaning representations gradually develop toward those of L1 users of the FL concerned.

Other aspects of FL vocabulary learning received little or no attention, for instance, the role of

proximity of the to-be-learned FL to the learner's L1. This issue was only briefly touched on in the discussion of the effect of word typicality on learning performance. The larger the distance between L1 and the FL to be learned, the more FL word forms to be learned will be atypical for the learner, the more alien the meanings of the FL words will be to the learner, and the more mapping problems between elements in the L1 and the FL the FL learner will encounter. FL vocabulary learning studies that test a FL similar to the learner's L1 (or that test the learning of pseudowords, which by definition have phonological forms akin to the learner's L1) may overestimate learning performance as compared to testing more distant FLs. Such effects of language proximity/distance warrant a more thorough discussion than received here.

A further neglected topic concerns the large difference in performance that is typically obtained between productive and receptive testing conditions, with receptive testing producing better results. Mention was made of these two ways of testing newly learned FL vocabulary, but without providing theoretical accounts of this effect (see De Groot & Keijzer, 2000, pp. 43–45, for a discussion).

Finally, hardly anything has been said on the crucial differences between late FL vocabulary learning, which, albeit implicitly, was the topic of the present discussion, and early bilingual vocabulary acquisition (see De Houwer, chapter 2, this volume). These learning processes differ crucially because, in early bilingual vocabulary acquisition, as in L1 vocabulary acquisition, the acquisition of word form and word meaning proceed in parallel, whereas in late FL vocabulary learning, a meaning for the new word to be learned is already in place (although it requires adjustment; see the section Freeing and Fine-Tuning the Newly Learned Foreign Language Words). Future reviews of studies on FL vocabulary learning might shift the focus to these and other issues neglected here.

Notes

1. A *foreign language* is a language that is not a native language in a country. In North America, *foreign language* and *second language* are often used interchangeably in this sense. In British usage, a distinction between the two is often made, such that a *foreign language* is a language taught in school but not used as a medium of instruction in school, nor is it a language of communication within a country (e.g., English in France). In contrast, a *second language* is a language that is not a native language in the country, but is widely used as a medium of communication

(e.g., in education and government) and is used alongside another language or languages (e.g., English in Nigeria). In both Britain and North America, the term *second language* describes the native language in a country as learned by immigrants who have another first language (*Longman Dictionary of Language Teaching and Applied Linguistics*). In this chapter, we consistently use the term foreign language (FL) to cover all these usages, although most of the studies described concern the learning of a FL in experimental settings by learners whose native language is the dominant (and only official) language in the country where they live.

2. Note that the term *word association learning* should not be confused with the word association technique often employed in semantic memory research, in which the structure of semantic memory is revealed by presenting participants with words they know, and they are asked to provide the first word they think of after they are given a stimulus word.

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