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9

Intentional and incidental second language vocabulary learning: A reappraisal of elaboration, rehearsal and automaticity

Jan H. Hulstijn¹

Introduction

Most learners of a second language (L2) feel concerned with the burden of vocabulary learning and worry about the question of how to cope with the formidable task of learning thousands of words. This has been documented by a number of questionnaire, interview and case studies (Gu & Johnson, 1996; Jones, 1995; Lawson & Hogden, 1996; Porte, 1988; Sanaoui, 1995). Because of the sheer magnitude of the vocabulary learning task it is only quite natural that many L2 teachers feel uncertain about how to guide their students. Should they require their students to learn words intentionally, perhaps even by rote, or should they believe the rumours that intentional learning is not conducive to language learning? How much credence should they give to ideas like 'new vocabulary must be presented in context' and 'the best way to acquire vocabulary is by 'picking up' words incidentally, as a by-product of being exposed to large amounts of L2 input in

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reading and listening tasks'?

This chapter will look at what various theories have to say about incidental and intentional vocabulary learning. It will focus especially on three issues of key importance for L2 pedagogy, (1) the quality of information processing when an unfamiliar word is first encountered, (2) the quantity and quality of rehearsal activities needed for a word to be permanently available, and (3) the training of automatic access to word knowledge necessary for fluent language use. This last issue will receive special attention in this chapter as it appears to be neglected in current L2 pedagogy.

The chapter comprises three main sections. Section 1 provides some background information on vocabulary knowledge and learning, leading the way to sections 2 and 3, which form the heart of the chapter. Section 2 is concerned with theoretical, methodological and pedagogical uses of the notions of incidental and intentional vocabulary learning. Section 3 discusses the pedagogical implications of the considerations entertained in the two previous sections, with respect to (1) elaboration at initial exposure, (2) rehearsal, and (3) automaticity.

Vocabulary knowledge, learning and use

This section aims at providing some background information necessary for an understanding of the notions of incidental and intentional learning (section 2) and instructional practices with respect to elaboration, rehearsal and automaticity training (section 3). It does so by briefly addressing issues of vocabulary knowledge (1.1), vocabulary learning difficulty (1.2), vocabulary size (1.3), and automatic use of vocabulary (1.4).

What does it mean to know a word?

The dominant view on vocabulary knowledge, in a first (L1) and second language (L2), avails itself of the pervasive metaphor of a dictionary-like mental lexicon consisting of lexical entries. A lexical entry in the lexicon of the average adult, literate, native speaker contains semantic, pragmatic, stylistic, collocational, syntactic, categorial, morphological, phonological, articulatory and orthographic features. According to Levelt, Roelofs and Meyer (1998), the process of uttering a word proceeds along four stages: (1) conceptual preparation, (2) lemma selection (i.e. selection of syntactic information), (3) morphonological encoding, and (4) computation of a phonetic-articulatory gesture. The major rift in the system lies between the conceptual/syntactic domain (stages 1 and 2) and

the morphonological/articulatory domain (stages 3 and 4). Crossing the rift is not a trivial matter, illustrated by the well-known tip-of-the-tongue phenomenon, i.e. the momentary inability to retrieve the word form, given an already selected lemma.

The features of a lexical entry are intrinsically or associatively related to each other and to features of other entries while the strength of these relationships may vary (Aitchison, 1994, ch. 17; Levelt, 1989, ch. 6; Scherfer, 1994a). In the case of bilingual speakers, lexical features may also be connected between languages (Kroll & De Groot, 1997), but there is only one conceptual system common to both languages (Paradis, 1997).

Theories vary in their assumptions on how items in the mental lexicon are accessed for language use. According to Seidenberg (1995), there are two types of models, functional architecture-style models and connectionist models, differing in basic assumptions about how lexical knowledge is represented and processed. In functional architecture-style models, based on the dictionary metaphor, recognizing a word involves successfully "accessing" its entry in the mental lexicon, i.e. all its features are becoming available (total access), albeit in two stages (Levelt, 1993). In connectionist models, however, there can be partial activation of word knowledge because lexical knowledge is represented in a distributed way, allowing meanings, spellings, pronunciations etc. to be accessed as patterns of activation over sublexical features (Seidenberg, 1995). Thus, connectionists have dropped the metaphor of dictionary-like mental entries.

Entries are accessed through a process of activation spreading along their interconnections. An entry is accessed if the sum of positive impulses exceeds that of negative impulses to an extent sufficient to allow it to reach its activation threshold and all competitors have been sufficiently inhibited. Processes of activation and inhibition are, therefore, a matter of degree. Different entries will require varying amounts of activation, so it will be easier to recall some words than others (Paradis, 1997).

The acquisition of an entry's features in L1 is generally believed to take place in an incremental way (Nagy & Herman, 1987), consisting of the filling of various 'slots' of entries in the mental lexicon (De Bot, Paribakht & Wesche, 1997) but to date no specific claims have been made concerning the order in which L2 lexical features must or may be acquired². Beginning L2 learners, learning the first few hundred L2 vocabulary items, often appear to link the L2 word form directly to a corresponding L1 word form. In a later

² Meara (1993: 295) noted that "the study of the bilingual lexicon is just not well enough developed for it to be able to tell practitioners what to do in classrooms". Unfortunately, this statement still appears to be true.

stage, the L2 word form is directly linked to its meaning³. Thus, initially, L2 lexical entries are often coded as phonological or orthographic extensions of L1 lexical entries. This may explain why beginners have been found to confuse phonologically similar words more often and semantically similar words less often than do advanced learners (Henning, 1973). For any lexical entry, an individual's mental lexicon will often comprise both less and more than the information included in the corresponding lemma of a normal, monolingual, college dictionary. On the one hand, it may be less because the individual, even if he or she is a highly educated native speaker, may not know all the word's meanings and usages. On the other hand, it will be more because the average mental entry will exhibit various types of connections to other entries whereas the average dictionary's lemma will contain few, if any, cross-references.

How difficult is it to learn a new word?

There are many factors affecting the learning difficulty of words. Overviews are given by Nation (1990, ch.3), Laufer (1997), and Rodgers (1969). Two of these factors are worth mentioning in a chapter on elaboration, rehearsal and automatization. The first of these two factors is *codability* of the morphonological form of words. Word forms may differ in difficulty for coding and storing depending on the learner's prior phonotactic knowledge. When a L2 learner embarks on the learning of an entirely new language, morphonologically and phonetically unrelated to any language already known to him or her, he or she may experience great difficulties in storing isolated as well as clustered sounds or letters. Learning the first 15 content words of a new L2 language may take the beginning learner several hours. However, three months of daily study later, he or she may easily add another hundred new words to his or her medium-sized vocabulary in one hour simply because, by that time, letters and sounds are no longer encoded as single units but in now familiar chunks of phonemes, morphemes, syllables and prosodic patterns. The learner now implicitly knows which sequences and combination of elements are legal and which ones are not (see the chunking example of 'headache' in Ellis's

³ The dependency of L2 lexical items on L1 lexical items has traditionally been referred to with the term *subordinate* bilingualism (Weinreich, 1953). The direct linking of L2 forms to their meanings was either called *compound* or *coordinate* bilingualism: compound when an L2 word form and a corresponding L1 word form shared an identical meaning, coordinate when they shared similar but not identical and therefore essentially separate meanings. More recent theories, however, especially those adopting a connectionist approach, would not make a principled distinction between these three forms of bilingualism. Instead, they in principle allow for the existence of any connections between features of L1 and L2 lexical items at all levels of representation (concept, meaning, and form). However, the relative strength of these connections may increase and decrease over the course of the L2 learning process.

chapter in this volume; see also Ellis & Beaton, 1993).

Several studies have shown that repetition of L2 word forms in the form of overt or silent articulation, briefly held in working memory (the so-called 'phonological loop' in Baddeley's Working Memory Model, see Baddeley, 1997, ch.4) promotes their long-term retention. Papagno, Valentine, and Baddeley (1991) showed that preventing rehearsal practice by means of articulatory suppression (subjects tried to learn L2 words from a list of L1-L2 word pairs while repeatedly uttering the sound "bla") interfered with the learning of L2 vocabulary. Similarly, Ellis and Sinclair (1996) demonstrated that English students' acquisition of Welsh vocabulary and morphology was facilitated by encouraging learners to repeat utterances and was hindered by articulatory suppression⁴. Thus, the evidence of all these studies suggests that the codability and hence the memorability of the forms of new words is contingent upon the learner's prior familiarity with various aspects of the linguistic system.

The second subjective, knowledge-dependent factor affecting a word's memorability is the *arbitrariness of the form-meaning link*, i.e., arbitrariness in terms of existing lexical knowledge. If a new word appears to the learner as having a form unrelated to its meaning it will need more attention and mental elaboration than if it has a transparent appearance. For example, suppose someone was trying to coin a new word in the English language referring to a door made of opaque glass. Suppose, furthermore, this person considered three alternatives: 'fogdoor', 'rog' and 'dorricor', then clearly for people already familiar with the words 'fog', 'door' and 'corridor', 'fogdoor', being a nonarbitrary and transparent word form, would be easy to learn, while 'rog' and 'dorricor' would be more difficult to learn, 'rog' being a fully arbitrary word form, and 'dorricor' being what Laufer (1988, 1991) has called a 'synform', likely to be confused with 'corridor'.

How many words do L2 learners need to know?

Although, as has been argued by Hazenberg & Hulstijn (1996), it is unlikely that a principled answer to the question of how many words L2 learners need to know will ever be attained, there is sufficient empirical evidence that the receptive vocabulary of English-speaking university undergraduates is in the range of 14,000-17,000 words (Zechmeister, D'Anna, Hall, Paus & Smith, 1993). In the literature on L2 learning a receptive knowledge of 5000 base words is generally considered to be a minimal learning

⁴ It has been suggested that phonological-loop capacity, although increasing with practice, differs between individuals, thereby constituting an important, but often neglected component of language learning aptitude (Atkins & Baddeley, 1998; Carroll, 1986; Ellis & Beaton, 1993; Meara, 1993; MacWhinney, 1995).

target with respect to the comprehension of the main points of non subject-specific texts (Nation, 1990, 1993; Laufer, 1992)⁵. This may not be enough, however. Hirsh and Nation (1992) have convincingly argued that for such comprehension to be attained readers generally need to be familiar with 95 per cent of the words in a text. Hazenberg and Hulstijn (1996), in their study of text coverage and vocabulary knowledge, however, have given empirical evidence for the claim that if adults with secondary education want to be familiar with 95 per cent of the words contained in the large variety of non-specialist texts encountered in their daily lives, they must know at least 10,000 base words⁶.

Even more difficult than estimating required levels of receptive vocabulary knowledge is the estimation of the number of words that L2 learners need to know productively (Laufer & Nation, 1995). However, one could safely argue that the bottom line for speaking proficiency at what in the European context is commonly referred to as the Waystage Level (Van Ek & Trim, 1991) contains some 1,000 base words⁷. In conclusion, L2 learning objectives will almost always include receptive and productive knowledge of large numbers of lexical items; that is, learners must learn to activate components of lexical information in various directions: from orthographical or acoustic form to meaning, or from meaning to orthographic or phonetic form.

Skill in automatic word access

Knowing the meaning of a word form or knowing the word form belonging to a certain meaning is not enough. Learners learn words in order to be able to listen, read, speak and write. The basic facts of vocabulary use are:

- (a) Normal, fluent speech proceeds at a speed of two to three words per second (Levitt, 1989:22).
- (b) Humans have a capacity for consciously focusing their attention on only a very limited amount of information (Baddeley, 1997, ch. 6).
- (c) If speaking is to proceed at two to three words per second and only little information can be held under conscious attention, then the speech production process must largely

⁵ This figure pertains to Germanic and Romance languages and might not be valid for other languages. A base word is any word whose meaning cannot be predicted on the basis of its components. For instance, 'bright' is a base word but 'brighter', 'brightest', 'brightly', 'brightish', 'brightness' and 'brighten' are not. See Bauer & Nation (1993) for a full treatment of this issue.

⁶ The evidence produced by Hazenberg & Hulstijn (1996) pertained to the acquisition of the Dutch language. It is likely that a similar figure (roughly ten thousand base words) is required for learners of most other Indo-European languages, such as English and Spanish.

⁷ The 'Common European Framework of reference for language learning and teaching' (Strassbourg, 1998) distinguishes the following six levels: Breakthrough, Waystage, Threshold, Vantage, Effective Operational Proficiency, and Mastery.

take place automatically. Thus, in normal speech production, the speaker only pays attention to the message (the concepts) conveyed while leaving the processes of formulation and articulation to automatically operating modules.

(d) A similar state of affairs applies to the listener. For speech comprehension to be successful, word recognition processes have to take place automatically (at a speed of two to three words per second) so that the listener's attention can be focused exclusively on the interpretation of the information conveyed by the message.

(e) A similar argument also applies to reading (and to writing - although perhaps to a lesser extent). Normal fluent reading proceeds at a speed of 200 to 350 words per minute, i.e. three to six words per second (Rayner and Pollatsek, 1989: 440). Carver (1990:14) distinguishes five basic types of reading processes: scanning, skimming, rauding, learning and memorizing, with respective reading rates for college students of 600, 450, 300, 200 and 138 words per minute. Rauding, with an average rate of 300 words per minute, is the predominant reading mode, involving the recognition of all words and the integration of all words to comprehend the complete thought contained in each sentence.

(f) Many words do not consist of an uninflected lexical root but are composed of a root plus affixes (derivation) or of more than one lexical root (composition). Languages differ considerably in this respect. Thus, depending on the degree of agglutination of the language, speakers have to develop procedural skills to be capable of encoding and decoding multimorphemic words (Levelt, 1989: 186).

The conclusion to be drawn from these observations is that the processes involved in accessing lexical entries in the mental lexicon must take place automatically for communication to proceed efficiently.

"Automatic processes are executed without intention or conscious awareness. They also run on their own resources; i.e., they do not share processing capacity with other processes. Also, automatic processing is usually quick, even reflex-like; the structure of the process is 'wired in,' either genetically or by learning (or both). This makes it both efficient and, to a large extent, inflexible; it is hard to alter automatic processes. Since automatic processes do not share resources, they can run in parallel without mutual interference" (Levelt, 1989: 20-21).

Word recognition in reading is a process using orthographic information as its primary basis. Phonological representations emerge during the process of lexical access, and are either utilized (the so-called indirect route to lexical access) or not (Taft, 1993: 91). Word recognition takes place in an interactive way via the activation of sublexical units ranging from (components of) letters to morphemes. Activation passes both up and down the different levels of representation, as well as between orthographic and

phonological units at the same level (Taft, 1993: 119).

What is important to note in the present context of L2 learning, is that fluent word recognition during normal reading and listening, although it is an interactive process including top-down spreading of activation, takes place exclusively at *sublexical* levels, i.e., it is unaffected by the meaning of the word itself or of words in the immediate context. Only less skilled readers use contextual information in word recognition (Stanovich, 1980). When readers become more skilled their reliance on context decreases (Rayner & Pollatsek, 1989: 385-386). Only when a text is visually degraded (e.g., in the case of a poor-quality copy of a faxed or photocopied text) do skilled readers use contextual information in the same way as unskilled readers (Schwantes, 1981). Thus, in normal listening and reading, lexical access is *not* subject to top-down influence from syntactic and semantic processing; the processing of a word is largely driven by the input code itself rather than by contextual information (Cutler, 1995: 114; Seidenberg, 1995: 165).

Empirical evidence for the crucial importance of automaticity in L2 reading has been provided by Segalowitz (reviewed in Segalowitz, 1997 and in Segalowitz, in press) and Koda (reviewed in Koda, 1996). Segalowitz and his associates showed that inefficient word recognition reduces L2 reading performance in otherwise fluent bilinguals (Favreau & Segalowitz, 1983; Segalowitz, Poulsen, & Komoda, 1991). Koda (1996) argues that there is ample evidence for a causal relationship between word recognition efficiency and reading comprehension both in L1 and in L2. Her own research has demonstrated that the acquisition of L2 word recognition skills is facilitated by the degree to which L1 and L2 orthographic systems share structural similarities.

Many L2 course materials, following the view of Goodman (1971), play down the importance of automatic word recognition. Instead, they aim to train the transfer of higher-order, top-down comprehension strategies from L1 reading in order to compensate for any lack of L2 knowledge. Alderson (1984), however, advanced the so-called threshold hypothesis according to which knowledge of reading goals, text characteristics and reading strategies (such as inferring the meaning of unknown words from context), cannot compensate for a lack of language knowledge if the latter remains below a certain threshold level. Empirical evidence for the threshold hypothesis has been provided by Schoonen, Hulstijn and Bossers (1998)⁸. Thus, learning to apply reading strategies should

⁸ Meara (personal communication, December 1997) suggests that the breakdown of text comprehension due to a deficiency in word recognition could be investigated adapting traffic flow models. The basic idea is that the crash doesn't necessarily occur at the point where the problem manifests itself. Comprehension breakdown can occur at a site that is remote from the position of the most difficult words.

not take precedence over establishing a core of automatically accessible lexical items (Coady, 1997b; Huckin & Coady, 1999).

Fluency develops over time, primarily through extensive experience⁹. What is gained by such extensive practice is the automatization of many of the components underlying the skill. This automatization reduces the burden on short-term memory and facilitates the chunking of information into higher-level units (Segalowitz, 1997: 103). Ellis and Sinclair (1996) showed that as L2 learners hear and produce L2 words, they implicitly acquire knowledge of the statistical frequencies and sequential probabilities of the phonotactics of the L2. The more they repeat words, the more these are consolidated in long-term memory. Acquisition of fluency is influenced by frequency, recency, and regularity. The frequency effect is simply that of 'practice makes perfect' (Ellis & Laporte, 1997).

Incidental and intentional learning

In the literature on L1 and L2 vocabulary acquisition it has become customary to say (a) that most vocabulary items are acquired 'incidentally', that is, as a by-product of the learner being engaged in a listening, reading, speaking or writing activity, and (b) that few words are acquired by an act of 'intentional' learning, as in the learning of a bilingual vocabulary list (Coady, 1997a; R. Ellis, 1994; Hatch & Brown, 1995: 368; Nagy & Herman, 1985; Nation, 1990: 178; Schmidt, 1994; Shu, Anderson & Zhang, 1995; Sternberg, 1987). Some educationalists have therefore advocated the use of activities conducive to incidental vocabulary learning (i.e. massive reading and listening activities) while discouraging procedures of intentional vocabulary learning (Krashen, 1989). As will be demonstrated in section 2.2, this practice is based on an ill-informed understanding of the terms 'incidental' and 'intentional' learning. In a review of a wide variety of empirical studies which all claimed to have investigated 'incidental' learning of L2 vocabulary, Singleton (1999: 161) observes "Clearly, in order for the debate about incidental vocabulary learning to proceed with any degree of coherence in the future, a consensus will have to be reached about what is to be included and what is to be excluded under the term 'incidental'." This section intends to clarify the issue. Its main line of argument will be that

⁹ What fluency actually is also depends on one's theoretical standpoint (see Schmidt's chapter in this volume). Current psychological theories appear to agree that there is rigid, reflex-like automaticity at lower levels of information processing and more flexible, adaptive fluency at higher levels of processing (Segalowitz, in press).

- 1 theoretically, the distinction between incidental and intentional learning has become difficult to maintain;
- 2 methodologically, the distinction is essential for any researcher intending to design a vocabulary learning experiment;
- 3 pedagogically, the distinction may have something to offer provided that teacher and learner are aware of points (1) and (2).

Incidental and intentional learning in the psychological literature

Let us begin with a partly hypothetical example from L2 learning.

Example. We ask a group of L2 learners to read a L2 text (containing some presumably unfamiliar words) and then answer some comprehension questions. There are two reading conditions: Group 1 has the unfamiliar words glossed in the margin by means of L1 translations; Group 2 is given four alternative L1 translations in the margin (one correct and three incorrect translations), for each unfamiliar word and has to choose which one is the correct translation. The differences in information processing being manipulated are Meaning Given (Group 1) and Meaning to be Inferred (Group 2). Unexpectedly, students in both groups are tested afterwards with a recall test of the meaning of the unfamiliar words.

This is an example of incidental learning. If Group 2 was found to perform better than Group 1, one could conclude that inferral leads to better retention than simply being given a word's meaning¹⁰. However, if we told Groups 1 and 2 in advance that they would be tested on their knowledge of these words (whose meaning was given or had to be inferred), we would have invoked processes of intentional learning, whose effect may well have overridden the effect of incidental learning¹¹. Thus, telling or not telling students that they will be tested afterwards on their knowledge is the critical operational feature distinguishing incidental from intentional learning.

The use of the terms incidental and intentional learning in the psychological literature (not to be confused with the notions of implicit and explicit learning or with implicit and explicit memory, discussed in the chapters of Ellis en Schmidt) goes back to the beginning of the 20th century and has served experimental psychology a long time. Hundreds of experiments on incidental and intentional learning have been conducted. Classical readings are Ebbinghaus (1964), Postman (1964), McLaughlin (1965) and

¹⁰ See Hulstijn (1992) for details. That study shows that things are not as simple as suggested in this example.

¹¹ This was demonstrated in Experiment IV of the same study (Hulstijn, 1992).

Eysenck (1982).

In operational terms, incidental and intentional learning can simply be distinguished in terms of the use of prelearning instructions that either do, or do not, forewarn subjects about the existence of a subsequent retention test (Eysenck, 1982: 198). Two basic experimental methods have evolved in the study of incidental and intentional learning. The Type I design is characteristic of the earlier studies. Subjects in the incidental condition perform an orienting task on the stimulus materials but they are given no instructions to learn and they are unexpectedly given a retention test afterwards. Subjects in the intentional conditions are told in advance that they will later be tested. Early research, in the first few decades of the century, aimed at demonstrating (1) that incidental learning did indeed exist and (2) that intentional learning was superior to incidental learning. In the Type II design, which was adopted in most later studies, all subjects are instructed to learn some of the stimuli that are presented to them; but additional stimuli, which subjects are not told to learn, are presented at the same time. Retention of these additional stimuli is unexpectedly tested afterwards. Thus, in the Type II design subjects are their own controls, serving both under intentional and incidental conditions of learning, being exposed to two categories of stimuli, while expecting to be tested on only one of these. Also, in the example at the beginning of this section, learners serve under an intentional condition as far as they read the text in order to prepare for answering the upcoming comprehension question, but they simultaneously serve under an incidental condition in that they are being exposed to unfamiliar words (with or without glosses) without expecting to be tested on their retention of these words.

Until about 1965, hundreds of experiments were conducted in order to investigate the effect on learning of (1) the manipulation of stimulus materials, and (2) intrasubject differences (e.g. age). While the distinction between incidental and intentional learning is fairly straightforward in operational terms, psychologists have had long-standing problems in coming to grips with conceptual definitions and have debated the underlying conceptual issues for many decades. As McGeoch (1942: 304) already noted, one cannot prove that subjects in incidental conditions did *not* have a motive, self-instruction, or 'set' to learn. McGeoch's point was that it was hazardous to assert that there is incidental learning in an absolute sense¹². Postman (1964), whose work marked the end of the 'Dark Ages' of memory research (Eysenck, 1982: 198), accepted McGeoch's point. He

¹² Similar debates have emerged more recently concerning the questions of whether there exists such a thing as completely unattentional learning or virtually implicit learning. Different performance on different tasks, such as implicit and explicit memory tasks, need not necessarily be attributed to different underlying systems (see Schmidt's chapter in this volume).

abandoned the dichotomous distinction between incidental and intentional learning while focusing on the "functional relations between the instruction stimulus on the one hand and measures of learning and retention on the other" (p. 185), acknowledging the important role of the orienting task (p. 188) and the meaningfulness of the stimulus materials (p. 191) in this functional relationship. Thus, to return to our example, for Postman it would be important to study the interaction between various instructions (e.g., 'after reading, hand in the text to the teacher and summarize the text in very broad terms' vs 'after reading, hand in the text to the teacher and summarize the text in as much detail as you can') and the meaningfulness of the unfamiliar words (presence vs absence of marginal glosses).

A major turn in this debate came when psychology witnessed, in the 1960s and early 1970s, a shift from the behaviourist paradigm towards the cognitive paradigm. Cognitive psychologists were more interested in the nature of the way in which subjects process stimulus information than by the difference in learning outcomes caused by the presence or absence of an advance warning that a retention test will be administered afterwards. A seminal paper by Craik & Lockhart (1972) has been of considerable influence. It generated a renewed interest in incidental learning with the introduction of the concept of 'depth of processing'. Craik & Lockhart argued that the chance that some piece of new information will be stored into long-term memory is not determined by the length of time that it is held in short-term memory but rather by the shallowness or depth with which it is initially processed. They further postulated several levels of processing depth. For instance, processing the meaning of a new lexical item takes place at a rather deep level whereas processing the phonological form takes place at a rather shallow level. Craik and Lockhart were initially successful in providing evidence that semantic processing of lexical items resulted in higher retention than phonological or orthographical processing. The levels of processing theory, however, was challenged, refined and modified, and eventually even abolished, in the succeeding years. Two of the problems were: (1) What exactly constitutes a 'level' of processing, and (2) How do we know that one level is 'deeper' than another? For instance, can 'nonsemantic' processing tasks still be meaningful activities? In other words, to be meaningful, an orienting task need not involve thinking about the meaning of a word; it could just as well involve thinking about its pronunciation or spelling.

Craik and Tulving (1975) suggested that what is critical to retention is not simply the presence or absence of semantic encoding, but the richness with which the material is encoded. A major obstacle facing all proposals resides in the difficulty of providing an unambiguous, operationable definition of any notion proposed as a replacement for depth

of processing, be it 'encoding specificity', 'distinctiveness of encoding' 'degree of elaboration', 'cognitive effort', 'degree of richness', etc.¹³. Yet, cognitive psychologists remained unified in their view that "memory performance is determined far more by the nature of the processing activities engaged in by the learner than it is by the intention to learn per se" (Eysenck, 1982: 203). Thus, although researchers of knowledge representation, information encoding and retrieval, attention, and memory have not yet succeeded in providing adequate theoretical explanations of phenomena of human learning and memory in terms of quality (type) and quantity (duration and frequency) of information processing (see the chapters by Schmidt, Ellis, Harrington, Robinson and DeKeyser in this volume), they all agree that processing new lexical information more elaborately (e.g. by paying careful attention to the word's pronunciation, orthography, grammatical category, meaning and semantic relations to other words) will lead to higher retention than by processing new lexical information less elaborately (e.g. by paying attention to only one or two of these dimensions). This is true not only for intentional but also for incidental learning. Thus, incidental learning will be more successful with more than with less elaborate processing¹⁴.

Incidental and intentional learning in L2 pedagogy

As the terms incidental and intentional learning have been in use for almost a century, witnessing a behaviourist-cognitive paradigm shift and, subsequently, a fundamental evolution within the cognitive paradigm, it is not surprising that the meanings of these terms have changed accordingly. Currently, in the applied domains of L1 and L2 pedagogy, incidental vocabulary learning refers to the learning of vocabulary as the by-product of any activity not explicitly geared to vocabulary learning, with intentional vocabulary learning referring to any activity aiming at committing lexical information to memory.¹⁵

Influential in this respect have been publications by Nagy and Anderson (1984),

¹³ Overviews of the course of this debate over the years are given in many psychology textbooks. A lucid description is given by Zechmeister & Nyberg, 1982, Ch. 12. Baddeley, 1997, provides a more recent and up-to-date review.

¹⁴ Note that it is therefore perfectly possible for learning to be both incidental and involving *explicit memory*. When a L2 reader encounters a new word in a L2 text and looks up the meaning of this word in a dictionary solely for the purpose of comprehending the current text (and not for the purpose of vocabulary learning) this mental event can be categorized both as incidental learning, as defined in the present chapter, and as involving explicit memory and conscious attention, as defined in Schmidt's chapter. However, *explicit learning*, as defined by Schmidt, will normally take place under conditions of intentional learning.

¹⁵ This subsection will be limited to the use of incidental and intentional learning in the *vocabulary* learning literature. In Hulstijn (forthcoming), the two terms are also discussed in the context of *grammar* learning.

Nagy, Herman and Anderson (1985), and Nagy and Herman (1987). These researchers showed that American high school students know between 25,000 and 50,000 words, or even more (Nagy & Anderson, 1984: 324)¹⁶. They argued that such a large number of words cannot have been learned solely by means of explicit vocabulary instruction; rather, most words are learned in an incremental way through repeated encounters during extensive reading¹⁷. Nagy, Herman and Anderson (1985: 234) acknowledge that it is still an open question how all this incidental learning takes place¹⁸. As possible causes they mention the contribution of conversation with adults or peers, watching television, classroom discussion, school reading and free reading. Yet the pedagogical thrust of their argument has been that vocabulary growth is largely determined by reading and that students must be encouraged to spend much time on reading: "Incidental learning of words during reading may be the easiest and single most powerful means of promoting large-scale vocabulary growth" (Nagy & Herman, 1987: 27). It is this message that most other educationalists have concentrated upon, neglecting the acknowledgement of Nagy et al. (1985) and Nagy (1997) that it is an open question how incidental learning takes place.

The vocabulary-acquisition-through-reading argument is a default argument: because relatively few words are explicitly taught, most words are acquired from reading. "This argument is far from airtight" (Nagy, 1997: 70). It may well be that the explosive growth of vocabulary between the ages of 6 to 16 (in countries where young people go to school during these years) is not solely the result of reading for pleasure but rather stems from a variety of oral and written tasks which not only expose students to new words and concepts, but also force them to process this lexical information repeatedly. In other words, instructional programmes of most subject matter, knowledge and skill avail themselves of language, and hence vocabulary, as their primary vehicle. Although this

¹⁶ These figures are substantially higher than the estimations of Zechmeister et al. (1993), referred to in section 1.3. The discrepancy is mainly due to differences among investigators in conservativeness concerning the operationalization of the notion of 'word'. Nagy and his associates count different word meanings as different words more readily and count semitransparent derivations and compositions (such as 'casualty' vs 'casual', and 'sidewalk' vs 'side' and 'walk') more readily as separate words than do Zechmeister et al. (see Nagy, 1997 for a discussion of this issue).

¹⁷ Meara (1997) suggests that the rate of incidental vocabulary expansion through extensive reading may vary with proficiency: a low, high, and low rate respectively at beginning, intermediate and highly advanced proficiency levels. Meara also considers the role of learner and language variables as potential intervening factors in the rate of expansion. Nagy (1997:76) points to some differences in this respect between L1 and L2 incidental vocabulary expansion: (1) L2 learners usually have to learn at a faster rate than the 'natural' rate of L1 acquisition, (2) early stages of L2 acquisition involve a relatively small number of high frequency words, for which there is a greater pay-off instructionally, and (3) L2 learners encounter unfamiliar words (and word meanings) at a greater rate than L1 learners and may therefore have a greater need to use context (and learn words incidentally).

¹⁸ Landauer & Dumais (1997) have proposed a formal theory, the Latent Semantic Analysis (LSA) theory, to simulate incidental vocabulary learning from reading.

vocabulary is learned 'incidentally', i.e., through the performance of subject-related tasks, these tasks often require learners to process words elaborately and repeatedly¹⁹. Hence, since it is the quality and the frequency of the way in which new words are processed that determine their acquisition, it may be too simple to conclude that the only thing students need is extensive reading.

Another influential paper, with a catching title lending itself readily as a slogan for L1 and L2 pedagogy ("Most vocabulary is learned from context"), written by an influential psychologist (Sternberg, 1987), has also contributed to the recommendation of extensive reading. However, Sternberg deals in quite some detail with the cognitive processes, contextual cues, and moderating variables which determine incidental vocabulary acquisition. Sternberg warns that presentation of words in context and hence extensive reading is not enough. Students need theory-based instruction concerning the role of the processes, cues and moderating variables involved (p. 96). In other words, vocabulary acquisition will benefit from reading only when readers consciously engage in inferring the meaning of unfamiliar words, and when the text does contain cues allowing the meaning of unfamiliar words to be inferred. Or, as Prince (1996: 489) has put it: "effective learning of words requires a stage in which the word is in fact isolated from its context and submitted to elaborative processing."

Nagy's and Sternberg's claims have been widely referred to in the L2 pedagogic literature on vocabulary learning. They have led, however, to various pedagogical interpretations (Coady, 1997b; Huckin & Coady, 1999). Some educationalists claim that students will learn all the vocabulary they need from context by reading extensively (Krashen, 1989). Others, however, while acknowledging the usefulness, even necessity, of extensive reading, have emphasized the importance of making L2 learners aware of their vocabulary learning task and of teaching explicit strategies for vocabulary learning (Ellis & Sinclair, 1989; Hulstijn, 1997; Oxford & Crookall, 1989; Sökmen, 1997) as well as of the importance of teaching the linguistic principles of the target language's lexical system (e.g. Carter & McCarthy, 1988; Lewis, 1994). In most published teaching materials for learners at beginning and intermediate levels (textbooks, multimedia software), a selected core vocabulary is explicitly taught and rehearsed through a wide variety of techniques and activities (as illustrated in publications such as Allen, 1983; Gairns & Redman, 1986; Morgan & Ronvoluceri, 1986; Taylor, 1990; Nation, 1990, 1993; Nation & Newton, 1997; Scherfer, 1994b). Coady (1993) advocates explicit teaching of a

¹⁹ Corson (1997) emphasizes the role of group work and other dialogue activities in class ("talking about text"), providing the necessary elaboration on and reconceptualization of word meanings, for adolescents to increase their vocabularies.

base vocabulary at an early stage of acquisition, which should be learned to the point of automaticity, with contextual learning during the later stages.

Concerning the use of the labels incidental and intentional learning, when L2 educationalists advocate incidental vocabulary learning while devaluating the role of intentional learning, what they probably mean is that the former procedure leads to information processing of a higher quality, and hence to better retention, than the latter procedure. However, as this section has tried to demonstrate, this is not necessarily the case. One could think of an incidental task (i.e. a task without forewarning that a retention test will follow) allowing learners to process new vocabulary only superficially or even skip new words altogether (e.g. 'read the following text and summarize its contents in about five sentences') and one could think of an intentional task (i.e. a task with forewarning of an upcoming retention task) forcing learners to process new vocabulary elaborately (e.g. 'read the following text, look up the meaning of any words you don't know in your dictionary, summarize the text's contents in about five sentences, and learn the new words looked up. You will later be tested on your knowledge of the words in this text'). The last ten years have witnessed the publication of a number of studies giving empirical evidence for the claim that L2 vocabulary acquisition during reading will be substantially enhanced when learners' attention is oriented towards unfamiliar words, e.g., when the meaning of unfamiliar words is given by means of marginal glosses or has to be looked up in a dictionary, or when reading is combined or supplemented with a simple fill-in exercise (Chun & Plass, 1996; Hulstijn, 1992, 1993; Hulstijn, Hollander & Greidanus, 1996; Hulstijn & Laufer (1998); Hulstijn & Trompeter (1999); Jacobs, Dufon & Fong, 1994; Knight, 1994; Krantz, 1991; Laufer & Osimo, 1991; Laufer & Shmueli, 1997; Mondria & Wit-de Boer, 1991; Paribakht & Wesche, 1996, 1997, 1999; Watanabe, 1997)²⁰. Huckin and Coady (1999: 183-184) refer to a number of empirical studies

²⁰ Most of the experiments conducted by Hulstijn and his associates on incidental vocabulary learning were designed with only an immediate posttest to measure retention of word knowledge; they did not include one or more delayed posttests. Vocabulary learning experiments containing no delayed posttest(s) have been criticized on methodological grounds by Wang, Thomas & Ouellette (1992). However, the present author is of the opinion that a distinction should be made between measuring the effect of information processing *during* initial exposure to new (lexical) information (e.g. incidental vocabulary learning during the performance of a L2 reading comprehension task) and measuring the effect of presence or absence of information processing *after* initial exposure (e.g. whether or not, and if, how and how often, words encountered during reading are encountered again, e.g. through rehearsal). If the aim of the investigation is to assess incidental learning taking place *during* initial exposure, an immediate posttest is all one needs. Obviously, people tend to forget information without additional exposure or rehearsal and therefore, under such circumstances, performance on a delayed posttest will generally be lower than performance on an immediate posttest. This fall in performance, however, is irrelevant from a theoretical perspective (when the research question focuses on the differential effect of various types of information processing during initial exposure) and trivial from an educational perspective (because all teachers and learners know that rehearsal is highly recommendable for successful long-term retention of information). Delayed posttests, therefore,

suggesting that attention for new words is governed in large part by task demands.

As will be further illustrated in the next section, in L2 pedagogy it is important to design tasks which focus learners' attention on vocabulary learning and to make them aware of the importance of efficient vocabulary learning strategies. From an educational point of view, simply encouraging learners to spend much time on reading and listening, although leading to some incidental vocabulary learning, will not be enough in itself²¹.

To sum up, the labels incidental and intentional learning no longer reflect a major theoretical distinction. It is the quality and frequency of the information processing activities (i.e. elaboration on aspects of a word's form and meaning, plus rehearsal) which determine retention of new information, far more than the question of whether learners are forewarned of an upcoming retention test or the question of whether they process lexical information without or with the intention to commit it to memory. Thus, both the experimental researcher and the language teacher can still make use of the labels in their methodological and educational senses, but they must be aware of the fact that neither the presence or absence of a post test nor the presence or absence of a learning intention determine the retention of information.

Pedagogic Consequences

This section is concerned with the pedagogic consequences of the psycholinguistic insights mentioned in the two previous sections. It will examine the role of elaboration, rehearsal and automatization in the attainment of vocabulary knowledge and use. The recommendations in this section are based on the view, exposed in the previous section, that, from an educational (as opposed to a theoretical) point of view, incidental and intentional vocabulary learning should be treated as *complementary* activities which deserve *both* to be practised.

Vocabulary learning activities

are appropriate only if the research question focuses on what happens with information *after* initial exposure under various conditions of rehearsal or re-exposure.

²¹ As Schmidt (this volume) observes, N.C. Ellis (1994) claims that attention (but not awareness) is necessary and sufficient for learning the perceptual aspects of word forms, whereas learning word meanings requires both attention and explicit awareness. This difference, however, may be of little practical value because, as has been argued at the end of section 1.2, for words to be useful tools for language learners and users, they must be represented in their users' mental lexicons as *combinations* of formal and semantic information. Thus, successful acquisition of words in this combinatory sense will almost always require attention *and* awareness.

As was mentioned in section 1, most teaching materials for L2 learners at beginning and intermediate levels explicitly teach and rehearse a target core vocabulary of up to around 2,000 high-frequency words, to be selected on the basis of frequency and range and perhaps also on some secondary criteria such as coverage, availability, centre of interest, and difficulty/learnability (Nation & Waring, 1997; O'Dell, 1997). Many current multimedia language learning programs have built-in components dealing with vocabulary learning, offering opportunities

- to look up various kinds of lexical information in an electronic vocabulary list;
- to paste this information into a personal vocabulary data base;
- to organize such a personal list into several categories (such as 'well known & not in need of further practice', 'known but still in need of occasional practice', 'not yet known well enough & in need of frequent practice');
- to offer a variety of vocabulary exercises (using an algorithm which repeats incorrectly answered items at shorter intervals than items correctly answered);
- to offer vocabulary tests with immediate feedback on performance;
- to offer learners the opportunity to request additional rehearsal of words felt not well known.

However, most L2 learners have to learn large numbers of words beyond a core vocabulary, words to which they are not frequently exposed during normal reading or listening activities. For the retention of these words it is necessary that learners are made aware of the nature and extent of their formidable word learning task and are taught effective strategies for coding and memorizing new words (e.g., Bogaards, 1994; Carr & Mazur-Stewart, 1988; G. Ellis & B. Sinclair, 1989; Esser & Nowak, 1990; Harley, 1995; Hatch & Brown, 1995, ch. 15; Hulstijn, 1997; Lewis, 1994; Oxford & Crookall, 1989; Scherfer, 1994a, 1994b; Schmitt, 1997).

A well-known technique, to be applied when learners encounter an unfamiliar word while reading a L2 text, is to figure out the meaning of an unfamiliar word while using various inferencing strategies, such as analyzing the word's form and using contextual information (Nation & Coady, 1988; Nation, 1990, ch. 10). This is a useful activity because it requires learners to process the relevant information elaborately, and elaborative processing is potentially conducive to retention (section 2). It is now common practice to make the teaching of such elaboration techniques an integral part of the L2 learning curriculum (e.g. Brown, 1994;). However, as has been pointed out by some researchers (e.g. Coady, 1997b; Hulstijn, 1997; Lawson & Hogden, 1996; and the sources referred to in these papers) elaborating on a new word's meaning in itself may not suffice to have it available for later access. High quality information processing when a word is

first encountered as such is not predictive of retention outcomes. Rather, as some word forms are less codable and more arbitrary than others (see section 1.2) they need deliberate rehearsal.

A classic and approved rehearsal technique is to write down a word's form (its orthographic form) on one side of an index card, while writing all other information at the reverse side, and to review the cards (in varying order) at regular intervals (Mondria & Mondria-de Vries, 1993; Wallace, 1982: 61). The information at the reverse side may include information concerning:

- * morphology (gender, flexion, derivation, composition);
- * pronunciation and prosody;
- * meaning(s), including the word's translation in L1;
- * typical examples of usage;
- * any associations, common as well as bizarre, general as well as personal, verbal as well as non-verbal, that may strengthen the word's codability and memorability.

Many L2 learners will find it cumbersome to carry around index cards for rehearsal. Good alternatives are a loose-leaf, alphabetically ordered vocabulary note book or a personal, electronic data base on a (preferably portable) PC. The advantage of an electronic data base over a hard copy note book is that it allows (depending on the software) multiple orderings of its entries and the establishment of inter-entry linkages, whereas the hard copy note book allows only one ordering (usually the alphabetical order). The ideal software program would combine the function of a personal lexical data base (to be stored with lexical information by the learner himself/herself) with the function of a drill master, providing opportunities for rehearsal while keeping a record of the learner's performance and putting each lexical entry in categories such as 'well known', 'known but still in need of regular rehearsal', 'not known and in need of frequent rehearsal'.

Rehearsal regimes

Landauer and Bjork (1978) distinguish between the repetition of new information (e.g. when a L2 learner is being exposed to a target word repeatedly, beyond his or her own volition), and the testing of new information (e.g. when a L2 learner, after having encountered a target word, has deliberately decided to test him or herself repeatedly). In a name-learning experiment using college students, these researchers found that uniform spacing was better in the former case and a pattern of increasing intervals in the latter case. The educational implication of this finding would be that incidental vocabulary

learning benefits from regular and frequent exposure whereas intentional vocabulary learning benefits from self tests with increasing intervals.

Studies by Bloom and Shuell (1981) and Dempster (1987) on L2 vocabulary learning have shown, not surprisingly, that if some 40 vocabulary items (consisting of a L2 word form and a L1 translation) had to be learned in a single learning session, massed presentation or practice (e.g. the presentation of each target item three times immediately after each other) had much less effect than did spaced presentation²². Furthermore, 'maintenance rehearsal' in short-term memory (as when one repeats a name or telephone number, thereby continuing to prime an existing representation) does not lead to long-term learning, in contrast to 'elaborative rehearsal', involving the formation of connections between the new information and information already known (Baddeley, 1997: 123). Quite remarkable in this respect are the investigations of Bahrick and his associates and relatives (Bahrick, 1984; Bahrick & Phelps, 1987; H.P. Bahrick, L.E. Bahrick, A.S. Bahrick & P.E. Bahrick, 1993). Bahrick (1984) first conducted a cross-sectional study among 800 Americans who had learned Spanish in high school or college. The results show that Spanish vocabulary will be recallable for more than 25 years if the vocabulary is not lost during the first 5 years following training. Bahrick and Phelps (1987) then conducted a longitudinal study involving 35 individuals who learned and relearned 50 English-Spanish word pairs under ten different retraining regimes. For instance, in condition 1, subjects were administered six retraining sessions on the same day in which they had first learned the words, whereas in condition 10, subjects were administered seven retraining sessions with 30-day intervals. Approximately 8 years after the termination of training, subjects' retention was tested. Recall was 15%, 8% and 6% for subjects who had trained with intervals of 30, 1 and 0 days respectively. The results of this study clearly demonstrate that retention probability is greatly enhanced for words that are well encoded in one or two presentations and are subsequently accessed several times at intervals of 30 days. In the study published in 1993, the four members of the Bahrick family report the results of a 9-year longitudinal investigation conducted on themselves. Each of the four subjects learned six sets of 50 English-French or English-German word pairs (300 words in total). Relearning sessions were administered at intervals of 14, 28 or 56 days and continued for 13 or 26 sessions, yielding a 3 x 2 factorial design. Retention was tested for 1, 2, 3 or 5 years after training had terminated. The results show that

²² For details concerning optimal block sizes per training session for the learning of bilingual word lists see the monumental study of Crothers and Suppes (1967). Vocabulary block size refers to the number of word pairs per training session. Crothers and Suppes found that, generally, either the largest or the smallest block size are optimal.

retention benefited from both independent variables. Best retention, 5 years after termination of relearning, was attained when words had been retrained with 56-day intervals (60%), and worst retention was attained when words had been retrained with 14-day intervals. This result was offset, however, by a slower acquisition under the 56-day regime than under the 28 and 14-day regimes.

Although the validity of the Bahrick studies is limited because subjects in the two longitudinal studies did not use the L2 during the long duration of the investigation, and the number of words to be learned was relatively small, the studies provide support for the suggestions that optimal retention will be attained if new vocabulary is initially rehearsed with frequent intervals (e.g. one day apart) and with intervals gradually becoming longer until they are approximately one month apart.

Mathematical models simulating word knowledge gains under various assumptions, suggest that there are at least two independent factors determining learning/forgetting curves: the time interval between trials for a particular word, and the number of interfering words (personal communication, dr. T. Chessa, Psychology Department of the University of Amsterdam). Learning/forgetting curves are further determined by word characteristics (e.g. concrete words are better retained than abstract words, see section 1.2) and by a retrieval practice effect: words correctly remembered on one test are more likely to be remembered than words not remembered but followed by feedback (Meara, 1989). In an incidental vocabulary learning study, in which EFL learners read an English novel and were subsequently surprised with a vocabulary test, Horst, Cobb & Meara (1998) obtained some evidence suggesting that learners with larger vocabulary knowledge profitted more from reading the novel than learners with smaller vocabularies, suggesting that the 'rich get richer'.

Pimsleur (1967) proposed a L2 vocabulary memory schedule according to which the learner should be reminded of the new word with intervals increasing in length by a factor of two, i.e. after approximately 5 sec., 25 sec., 2, 10 and 50 minutes, 5 hours, 1 day, 5 days, 20 days. Bjork (1988) proposed the following retrieval practice for the maintenance of knowledge: "A nearly immediate first rehearsal could be followed by additional rehearsal at successively longer delays (...). In principle, if one were able to do so, one should schedule each successive retrieval just prior to the point where one would otherwise lose access to the item in memory" (p. 399)²³.

²³ Bjork quotes the following verse, written by the famous psychologist Ulric Neisser during a conference:
"You can get a good deal from rehearsal
If it just has the proper dispersal.
You would just be an ass
To do it *en masse*: Your remembering would turn out much worsal."

Obviously, for any particular word there is no way of knowing when the point of losing access would be reached, because words differ in learning difficulty. But the gist of the recommendation is clear: distributed practice with increasing intervals after correct retrievals and short intervals after incorrect retrievals generates much higher retention than does massed practice (Baddeley, 1997: 112-113) and "items that are difficult to learn should be overlearned to ensure long-term retention (Atkins & Baddeley, 1998: 549).

The computer, obviously, must be considered as a welcome aid in the implementation of a well-designed rehearsal regime, since, as Van Bussel (1994) demonstrated, it can be easily programmed to keep track of the learner's performance on every individual word, retesting less well known words more often than well known words. Nation and Waring (1997) stress the importance of achieving a balance between meaning-focused, form-focused and fluency-focused rehearsal activities (see also Gatbonton & Segalowitz, 1998; Segalowitz & Gatbonton, 1995).

Rote learning and learning by heart

At this point, it is appropriate to address the much-debated issue of 'rote learning' (as in the learning of lists of isolated L2/L1 word pairs) and 'learning by heart' (as in memorizing a poem or dialogue). If by rote learning is meant repetition of information without understanding the meaning of the information being repeated, then rote learning will hardly have a useful place in the L2 curriculum. However, to the extent that rote learning implies that information is repeated with an understanding of its meaning, it may certainly have a place, among many other information processing techniques geared towards repetition with understanding. Affected by the behaviourist-cognitivist paradigm shift of the 1960s, most authors of publications on L2 pedagogy in the last 25 years hold rote learning in abhorrence²⁴. This is illustrated by a memorable statement of Stevick,

²⁴ Behaviourists investigating verbal learning, however, did not equate language learning with reflex-type habit formation. They considered habit formation by classical conditioning of limited applicability to language learning (Anisfeld, 1966). Even the famous Benton Underwood, who conducted innumerable verbal learning experiments, considered the picture of a subject in a rote learning experiment as being a *tabula rasa* as archaic. Rather, the subject "actively calls upon all the repertoire of habits and skills to outwit the investigator" (Underwood, 1964: 52). And John B. Carroll, psychologist and long-time investigator of L2 learning, who personally witnessed and actively co-executed the behaviourist-cognitive paradigm shift, sees 'automatization' and 'habit formation' as being essentially the same thing. Initial coding, according to Carroll (1986: 107), involves the putative cognitive event of 'noticing'. Over time, as the number of occasions on which a given regularity is noticed increases, the speed and accuracy of any responses that depend on this regularity also increase. "Such increases are referred to by the term 'habit formation'; they may also be described in terms of automatization (Schneider & Shiffrin, 1977)" (p. 107). Carroll then quotes from Schneider and Shiffrin (1977), calling their description of an 'automatic process' "particularly apt as a description of the formation of linguistic habits" (*ibidem*).

quoted with approval by Lewis (1994: 118): "If you want to forget something, put it in a list". This unqualified rejection of rote learning of information kept in a list format, however, may be unwarranted. For instance, suppose a learner has encountered some new vocabulary items in a meaningful reading or listening task and has done all of the following: tried to infer their meaning, checked these inferences by consulting a dictionary, and listed the word forms (along with other relevant lexical information) in a personal note book. It would then only be profitable for him or her to regularly consult that list and rehearse its contents. That is, although it would not make sense to learn the entire list (so that the learner could spontaneously recall all items in the listed order), it would make sense to learn each individual item on the list.

If one were to conduct a study comparing the effect of learning isolated word pairs versus the effect of learning words in contexts deemed to be 'functional' (e.g. in a real-life communicative situation) one would fall victim to the same error as was made some fifty years ago in studies comparing incidental and intentional conditions of learning (see section 2.1). The technique or task as such will not be decisive; its effect will rather be determined by the nature of the information processing, and that may vary within techniques and tasks²⁵. Thus, to take two examples from past and current L2 classroom practice, to have L2 learners learn a dialogue by heart (even if in a mimicry fashion, cf Rivers, 1967:183-184) or to have L2 learners learn a L1-L2 list of isolated vocabulary items, may be effective or ineffective to the extent that learners realize what they are doing. If a dialogue were learned by heart and followed by later role play (enacting the situation), or if the words of a list were rehearsed and followed up by a communicative task in which they were to be used meaningfully, then there is no reason why these activities should be condemned.

Skill in automatic word access

As was explained in section 1.4, it is not enough to 'know' a word; one must also be able to use word knowledge quickly in order to be able to listen or speak at a speed of two to three words per second and to read at a speed of three to six words per second. The training of automaticity appears to be a neglected component in many current L2 curricula. This may be caused by the following two trends in current L2 pedagogy:

1. The claim that language learning is primarily driven by the processing of large

²⁵ It is important to keep this in mind in interpreting the ongoing debate concerning the task-based approach. It is not the task itself but rather the information processing activities with which it is being executed that must be taken into account in order to assess its usefulness.

quantities of new, but level-appropriate input which will therefore hopefully be 'comprehensible' at the so-called 'i plus one' level (Krashen, 1981, 1982). This means that new input should ideally contain many familiar elements as well as some new elements whose meaning and function may become clear with the help of the familiar ones. On this basis L2 specialists and material writers encourage L2 learners to proceed with considerable speed through the chapters and lessons of their course materials and not to reprocess old materials too extensively. Learners are urged not to worry too much if not all the contents of one lesson have been mastered or not all the exercises and tasks of one lesson have been completed before the next lesson is embarked upon. Learners are assured that acquisition proceeds, not in an instantaneous but in an incremental fashion and that many words and other linguistic elements not yet acquired will recur in later lessons.

2. The claim that for the comprehension of a text read or heard it is not necessary to know all the words, that it is in fact very likely that L2 learners will be exposed to authentic reading or listening texts containing many unfamiliar words for a considerable time, and that it is therefore important to develop intelligent, task-appropriate comprehension strategies to compensate for their lack of vocabulary knowledge. Examples of such compensatory strategies are: concentrating on familiar words deemed to be relevant, activating background knowledge, inferring the meaning of unknown words from the verbal and nonverbal context, as well as consulting authoritative sources such as dictionaries, teachers, native speakers and other experts.

Pedagogic practices based on both these claims are important and welcome ingredients of any up-to-date L2 curriculum and their theoretical foundations are sound in principle. But, as so often in educational practice, they run the risk of being over-emphasized and applied to the detriment of other sound principles. As for the first trend of pushing for a certain speed in the presentation of new input, this should not mean that rehearsal of 'old input' for the benefit of training automaticity should be abandoned. And the second trend, of making top-down inferring strategies at the word, text and nonverbal context levels an integral part of the L2 curriculum, should not mean that the training of automatic word recognition at sublexical levels should be abandoned. It is in this *complementary* spirit that the practical suggestions in the following subsection are recommended.

Training tasks for automatic word recognition in listening and reading, or processing at the 'i minus one' level

Units of most L2 course materials for students at beginning and intermediate levels are normally constructed around a listening or a reading text. Such a text usually contains a number of new elements (words, expressions for certain speech acts, discourse features, grammatical structures, intonational patterns), most of which are exploited in various ways (explanations, exercises) after their presentation. Normally these texts, together with a number of comprehension questions, are presented as a listening or reading comprehension task. Thus it is a comprehension task that normally provides the setting in which students encounter and explore the new elements. After this exploration, students proceed to other tasks and seldom return to the text from where they started. Yet, for the sake of training automatic word recognition, it would be desirable that students be repeatedly exposed to the original text thereafter, not only while working on the current unit (which began with the original text) but also when they have moved on to later units. In the case of a listening text, the instruction could be formulated as 'Now that you are familiar with all the elements of this text, train yourself to recognize *all* the words in it. Pay attention to how the words sound in concatenated speech. (In normal speech, words are pronounced without pauses in between. A word may sound a little different each time, depending on the preceding and following words [assimilation] and on speaker factors such as accent and emotional state.) Play the text, utterance by utterance, and check whether you recognized every word in it by consulting the printed text. A simple way of doing this is by whispering every word to yourself or by counting the number of words. If an utterance is too long to do this, cut it up into sections short enough for you to remember. Do this as long as is necessary. In the end you should be able to understand *every* word without looking at the printed text.'

Rereading or relistening to an old text will seldom be motivating to students because it does not contain any new information and therefore does not arouse their curiosity. Ideally, each unit of the course materials should therefore contain at least one 'new' listening and one 'new' reading text which contains only 'old' words and constructions but which has the advantage over 'old' texts in that it has the appeal of new information²⁶. Some publishers have published reading materials graded at levels of increasing vocabulary difficulty. These readers lend themselves excellently for the purpose of increasing reading speed (for writing and selection guidelines, see Hatch & Brown, 1995: 408-412). Much less common, unfortunately, are such graded texts in aural form. For some foreign languages, however, there is a monthly magazine with articles on a wide variety of topics, including topics of the day, produced in both a written and an

²⁶ However, it must be acknowledged that as soon as such a 'new' practice-for-automaticity text containing 'old' elements is repeated, its semantic content is not 'new' to the students either.

aural format. Texts should contain as little vocabulary beyond the 2,000 most frequent words as is possible to just remain interesting and appealing.

Reading or listening to 'new' texts containing 'old' elements, a type of input processing at the 'i minus one' level (a phrase suggested by, among others, Day & Bamford, 1998, in contrast to Krashen's famous 'i plus one' input), might boost students' motivation by giving them the experience of being able to understand (almost) everything (almost) effortlessly upon a first encounter, just like hearing or reading a text in L1. Thus, instead of being boring, automaticity training in the form of hearing or reading 'new' texts containing 'old' elements should give students experiences of pleasure and satisfaction, thereby combining business with pleasure. Some of the following tasks, designed to foster reading speed, might be manipulated to do just that:

* *Tell the difference.* Learners listen to a text and have the printed text simultaneously available. However, the printed text deviates now and then from the oral input: some words have been (a) deleted, (b) added, or (b) substituted by another word. Both the oral and the written input are grammatical, however. The text should not contain unfamiliar words. Learners have to spot the deviations. This forces them to read quickly (i.e. in the speed of the speech delivery)²⁷.

* *Silent reading.* Learners silently read *short* texts (e.g. interesting newspaper clippings of approximately 200 words) during the first five minutes of a class period. Then follows a brief discussion of maximally five minutes, *not* focusing on vocabulary but on learners' opinion. At the end of the class period the text will be read once again, silently, in only two minutes.

* *Fun reading.* Learners are given assignments for extended reading *at their linguistic level* (e.g. using so-called 'graded readers'). They must be given a wide variety of topics to choose from. The texts should not be too long. Learners are given rewards that they themselves perceive as a real reward.

* *Bimodal input.* Learners watch television programs both spoken and subtitled in L2 (so-called 'bimodal input'). Repetition is highly recommendable. Learners are forced to read with the speed of subtitle presentation.

* *Reversed subtitling.* Learners watch television programs spoken in their L1 but undertitled in L2. This is called "TV with reversed subtitles". Repetition is highly

²⁷ Examples:

Learners hear "You must do this very fast" but hear "You must do this fast".

Learners hear "You must do this fast" but hear "You must do this very fast".

Learners hear "You must do this very fast" but hear "You must do this quickly".

commendable. Learners are forced to read with the speed of subtitle presentation.

Conclusion

There is some confusion in current L2 pedagogy concerning the question of what to adopt and what to reject of behaviourist and cognitive psychology and to what extent the principles of these two paradigms can or cannot coexist. The present chapter aimed to give a balanced answer to this question as far as vocabulary learning is concerned. What L2 pedagogy can and should adopt from cognitive psychology is the basic proposition that it is the nature of information processing which primarily determines retention (*elaboration*). The more a learner pays attention to a word's morphological, orthographic, prosodic, semantic and pragmatic features and to intraword and interword relations, the more likely is it that the new lexical information will be retained. It is not important whether the learner does so with the explicit intention to commit the information to memory and not to forget it (*intentional learning*) or with the intention to use the information for the successful completion of a listening, reading, speaking or writing activity (potentially resulting in *incidental learning*). Thus, encountering new words in context and extensive reading, as advocated in current L1 and L2 pedagogy, are neither necessary nor sufficient for efficient vocabulary expansion. Readers should apply a variety of decontextualization skills and write down the lexical information encountered during reading.

Rich, elaborate processing, however, is not enough either. New information will seldom leave a lasting trace in memory if not frequently reactivated. Reactivation of high frequency words will occur naturally when learners frequently engage in listening, reading, speaking and writing activities. The reactivation of targeted low-frequency words encountered during extensive reading, and subsequently written down on index cards, in a hard-copy notebook or in a computer program, must take place by means of deliberate *rehearsal* activities, because the likelihood of these words reoccurring soon during normal extensive reading activities is too small. Deliberate vocabulary rehearsal should begin with short intervals and level off at approximately monthly intervals.

In order to attain *automaticity* in accessing high frequency words, it is important that learners are exposed to reading and listening texts which contain only familiar words (the 'i minus one' level). Rereading a text until a speed of 300 words per minute is reached while the contents of the text is comprehended should be a major learning target. Similarly, learners should relisten to oral texts until they recognize all words.

'Intentional learning', 'rehearsal', 'practice', 'drill', and 'automaticity' are terms

which often elicit negative connotations among L2 specialists, being associated with the superficial parroting of meaningless stimuli, as in practices based on behaviourist psychology. However, several decades of psycholinguistic research have made it clear that lexical information simply must be reactivated regularly for it to remain quickly accessible. Therefore, these terms deserve to be updated in the jargon of the L2 specialist, albeit with the note that the nature of the processing during a rehearsal event will determine the likelihood of the information being rescued from the fate of oblivion. With this proviso in mind, it is legitimate to conclude that 'intentional vocabulary learning' as well as 'drill and practice' must have a place in the L2 curriculum, complementary to (not instead of) the well-established principles of incidental and contextual learning. Fortunately, as section 3 has tried to show, there are plenty of ways of making intentional learning and drill & practice activities interesting and appealing, with the help of the (multimedia) computer serving in a role for which it is well suited, namely that of the ideal slave, stuffed with the most precious of all resources: human imagination.

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