6 Memory and written storage

Understanding how we store information in the memory and why certain chunks of it seem to 'stick' while others slip away is obviously a matter of concern to anyone whose work involves helping others to learn. For language teachers this knowledge should help to establish classroom procedures that will promote more effective learning and retention of new language items.

These are the issues we will be considering in this chapter, but first a word about the organisation of the chapter. The first section is devoted to theoretical aspects of memory but is both brief and selective. We have tried to define and outline only those aspects of memory that are particularly relevant to the later discussion, and provide the necessary background to allow a more objective assessment of certain classroom activities. The sections on classroom suggestions and written storage take up the practical aspects more explicitly but also contain descriptions of scientific experiments that we have found interesting and relevant to classroom teaching.

THEORETICAL ASPECTS

6.1 Types of memory

Most readers will be familiar with the experience of looking up a telephone number and then repeating it to themselves for the time it takes to sit down and dial the number. As luck would have it, this is invariably the occasion for somebody to ask a distracting question with the result that the number is forgotten and has to be looked up all over again. Equally familiar and irritating is when you need the same number twenty-four hours later and find that you are quite unable to remember it.

These experiences reflect the widely recognised view among psychologists that with verbal learning the ability to hold information over brief periods (usually up to thirty seconds in duration) demands fairly constant repetition, and any distraction or interruption is likely to severely impede that ability. Moreover, it has been established that our capacity for short term retention is remarkably consistent, and that most people experience

some breakdown in retention as soon as the number of items or chunks of information exceeds seven.

This type of memory, known as *short term memory*, is clearly different from *long term memory*, which is our capacity for recall of information minutes, weeks and years after the original input. Furthermore the difference is not simply one of duration. Unlike short term memory which is limited in capacity, long term memory is seemingly inexhaustible and can accommodate any amount of new information. Not surprisingly this additional information can only be stored at a price; it is generally acknowledged that we need to work much harder to commit information to long term memory, and the type of repetition we described as being essential to short term retention may not be adequate for long term retention.

Some readers may feel uneasy about this last comment, as it would seem to contradict an experience we have all shared, namely the ability to remember certain information either by means of repetition, or with no conscious attempt to learn it at all. This certainly does happen, and the distinction between short term retention and long term retention is not always clear-cut. Information entering short term memory may pass quite effortlessly into long term memory, and some learners may find repetition a very effective way of transferring information into long term memory. Later in the chapter we will take up the issue of repetition in more detail; at this stage we will simply acknowledge it has a role in long term learning but reiterate the importance of more thorough processing and systematic organisation as the basis for effective long term retention.

6.2 Organisation of the mental lexicon

In part A of this book, we looked at the relationships between lexical items and other linguistic considerations such as pronunciation, grammatical values, derivation, spelling, etc. All this information is stored in the brain, so we should now examine *how* this data is organised and stored.

Our 'mental lexicon' is highly organised and efficient. Were storage of information haphazard, we would be forced to scan in a random fashion to retrieve words; this simply is not feasible when one considers the speed at which we need to recognise and recall. Furthermore, it is extremely improbable that we organise words in the brain as a dictionary does. Imagine you were trying to recall the word 'nozzle', for instance. It is unlikely that you would retrieve the word 'noxious' (which appears next to 'nozzle' in the *LDCE*) in place of the target word.

Some very interesting experiments carried out by Brown and McNeil

(1966) exemplify this point forcefully and give us clues about lexical organisation. The experimenters gave testees definitions of low frequency vocabulary items and asked them to name the item. One definition was, 'A navigational instrument used in measuring angular distances, especially the altitude of the sun, moon and stars at sea'. Some testees were able to supply the correct answer (which was 'sextant'), but the researchers were more interested in the testees who had the answer 'on the tip of their tongues'. Some gave the answer 'compass', which seemed to indicate that they had accessed the right semantic field but found the wrong item. Others had a very clear idea of the 'shape' of the item, and were often able to say how many syllables it had, what the first letter was, etc. It seems, then, that these systems are interrelated; at a very basic level, there appears to be a phonological system, a system of meaning relations and a spelling system.

One way in which researchers investigate how the mental lexicon is organised is by comparing the speed at which people are able to recall items. It is generally accepted that if certain types of prompts can be answered more quickly than others, then this will reflect the lexical system. Freedman and Loftus (1971) asked testees to perform two different types of tasks:

e.g. 1 Name a fruit that begins with a p.
2 Name a word beginning with p that is a fruit.

Testees were able to answer the first type of question more quickly than the second. This seems to indicate that 'fruits beginning with p' are categorised under the 'fruit' heading rather than under a 'words beginning with p' heading. Furthermore, experimenters discovered in subsequent tests that once testees had access to the 'fruit' category, they were able to find other fruits more quickly. This seems to provide further evidence that semantically related items are 'stored together'. Most researchers (albeit from varying viewpoints) appear to agree that items are arranged in a series of associative networks. Forster (1976, 1979) put forward the theory that all items are organised in one large 'master file', and that there are a variety of 'peripheral access files' which contain information about spelling, phonology, syntax and meaning. Entries in the master file are also held to be cross-referenced in terms of meaning relatedness.

We also have to consider other variables which affect storage. One important factor here is *word frequency*; items which occur most frequently are also easily recognised and retrieved. Imagine a pile of cards, each representing an item of vocabulary. In this system, the most frequently used items are 'at the top of the pile', and therefore easier to retrieve. *Recency of use* is another variable, and, to return to the analogy of the pile, one can imagine words more *recently* used being at the top. These variables are concerned with the use of items, but it is also impor-

tant to consider when items were first *learnt*. Imagine a pile of words organised chronologically: the words learnt on the first day of a course would be at one extreme and those most recently learnt at the other.

Clearly, native speakers do not acquire all their vocabulary in lexical sets, but rather acquire items in a haphazard, chronological fashion, generally in a fairly predictable order of frequency. However, native speakers have many years in which to build up a comprehensive lexicon, whereas foreign learners are limited in this respect. Exploiting our present knowledge of storage systems to the full should allow us to attempt to speed up the learning process and facilitate storage. This will be true whether we are trying to clarify associative networks, classify by categories or organise the vocabulary syllabus in a way which will assist the contribution of frequency and recency of use and other variables. We will discuss the practical implications of this in the second part of this chapter.

6.3 Why do we forget?

In spite of the efficiency of these various organisational networks in the memory, we still suffer lapses when we are unable to remember something that we thought was well established in our long term memory. Why does this happen?

One theory of forgetting suggests that information stored in the memory falls into disuse unless it is activated fairly regularly. In other words, we need to practise and revise what we learn otherwise the new input will gradually fade in the memory and ultimately disappear. This is called the *decay theory*.

In opposition to this theory is the notion of *cue-dependent forgetting*, which asserts that information does in fact persist in the memory but we may be unable to recall it. In other words, the failure is one of retrieval rather than storage. Evidence for this theory resides in a number of experiments. In one of these, subjects were given lists of words to learn and then tested on their powers of recall. Later they were tested again, only this time they were given relevant information to facilitate recall. For example, if a list contained the words 'sofa', 'armchair' and 'wardrobe', the subjects would be given the superordinate 'furniture' as a cue to help them. These experiments showed that recall was considerably strengthened by appropriate retrieval cues, thus suggesting that the information was not permanently lost but only 'mislaid'.

In addition to the theories of decay and cue-dependent forgetting there is further evidence that any significant mental activity undertaken before or after periods of learning can also account for poor learning and retention. The activities undertaken prior to learning may have a detrimental

effect on our ability to absorb new input, while activities undertaken after periods of learning can interfere with the effective consolidation and retention of new input. How long this interference persists is difficult to determine but the effects are likely to be most acute in the hours immediately preceding or following periods of learning. This contrasts with 'decay' which is obviously more significant in accounting for memory failure over a long period of time.

One final point about forgetting is the rate at which we forget. It is generally believed that of the information we forget, eighty per cent is lost within twenty-four hours of initial learning. This may help to explain why testing activities carried out the day after input may yield rather distressing results, while further testing activities carried out a week later appear quite satisfactory. This rate of forgetting clearly has implications for revision and recycling which will be discussed later.

As language teachers, our main concern is to ensure that what is taught will be permanently retained in long term memory, so it is clearly a matter of some importance that classroom activities take account of these various theories, and strive to combat decay and interference while developing and facilitating efficient retrieval systems.

PRACTICAL IMPLICATIONS

6.4 Meaningful tasks

Recent trends in methodology have stressed the need for meaningful activities in the classroom. There are a variety of reasons for this, among them the swing towards realism and authenticity and the need to engage learners in activities which will enable them to be more self-reliant. Equally important here is the fact that more meaningful tasks require learners to analyse and process language more deeply, which helps them to commit information to long term memory. The theory that a student's 'personal investment' has a very positive effect on memorisation is one that many teachers and learners will intuitively agree with.

An experiment by Wilson and Bransford provides an interesting insight here. In this experiment, three different groups of subjects were used. The first group were given a list of thirty words and told that they would be tested on their ability to recall the words. The second group were given the same list of words and told to rate each word according to its pleasantness or unpleasantness; they were *not* told that they would be tested on their ability to recall the words. The third group were given the list and asked to decide whether the items on the list would be important or unimportant if they were stranded on a desert island. They too were *not* told that they would be tested on these items. The results of

the tests showed a similar degree of recall between groups one and two, while group three recorded the highest degree of recall. This experiment illustrates several important points:

1 That the intention to learn, however laudable, does not in itself ensure that effective learning will take place.
2 That subjects are more likely to retain verbal input (i.e. commit new items to long term memory) if they are actively engaged in a meaningful task that involves some kind of semantic processing, and provides a unifying theme to facilitate *organisation* in the memory.

To test some of these assertions, you could try the following experiment with your class. Divide the class in half and send one half out of the room. Tell the remainder that they must learn the following group of words:

aubergine (+ mother-tongue equivalent in all cases)
courgette leek cabbage
celery swede beetroot

(If any of these vegetables are not found in your country, you could change the item for another vegetable which will be familiar to your students although a new item for them in English.) Then instruct the second group that they must list the items in order of personal preference. At the end of the lesson, after an intervening activity, you could test both groups on their ability to recall the items.

Guided discovery is another way in which teachers can engage the students' interest and involve them in a level of semantic processing which should promote more effective learning and retention. An important qualifying statement here is that the students have the means to perform the learning task, otherwise they will become frustrated and lose motivation.

Consider the following methods of presenting the item 'to swerve'.

1 The teacher explains that 'swerve' is a verb and means to change direction suddenly. He exemplifies this on the board with the sentence 'the car swerved to avoid the child', and then conducts some drilling of the example sentence.
2 The teacher asks the question, 'Why would you swerve in a car?' The students are then supplied with dictionaries to look up the word 'swerve' and told to write their answer on a piece of paper.

The first presentation is probably quite adequate to convey the meaning of 'swerve', but the second approach may be more memorable for the learners. Not only does it involve an element of guided discovery, but it also engages the students in a degree of semantic analysis i.e. what causes somebody to swerve; this is not required of them in the first presentation.

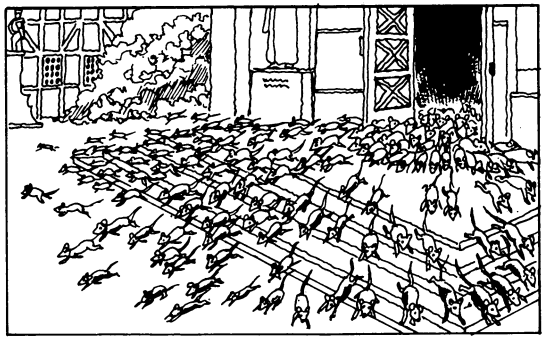
6.5 Imagery

Teachers often make extensive use of visual images in the classroom for illustrating meaning. One further advantage of this is that our memory for visual images is extremely reliable and there is little doubt that objects and pictures can facilitate memory. Equally obvious is that it is easier to conjure up a mental image of a concrete item than an abstract one; try, for instance, to 'image' the following: 'bottle', 'dog', 'truth', 'life'. You will probably have had no difficulty with the first two, but it is extremely difficult to supply a visual image for 'truth' and 'life'.

Our ability to produce mental images has led to a memory technique known as the *key word technique*. It consists of associating the target word with a word which is pronounced or spelt similarly in the mother tongue, but is not necessarily related in terms of meaning.

e.g. *Rathaus* (German, meaning 'town hall') sounds like 'rat house' in English.

The learner then conjures up a visual image of a lot of rats coming out of his local town hall, for instance. It appears to aid memory if the meaning and the key word are made to interact, as in the case above.



Some claims are also made that the more bizarre the image, the easier it will be to recall, but the evidence for this is unconvincing. We feel that this type of 'mnemonic' or memory aid has a very limited application. It may be particularly useful for certain types of learners (who may use it without prompting in any case) and we suspect that many learners make use of this in the very early stages of learning a language for a handful of items. The results of classroom trials (Fuentes, 1976) seemed to indicate that the use of key words did not produce higher recall than any other type of memory technique, including rote learning. We also feel that, if used exclusively, it approaches vocabulary learning in a very one-dimensional way and in effect fails to take into account most of the linguistic problems discussed in chapters 2 and 3, much in the same way as a traditional translation equivalent vocabulary list.

6.6 Rote learning

Another memorisation technique which has a long history in language learning is rote learning. This involves repetition of target language items either silently or aloud and may involve writing down the items (perhaps more than once). These items commonly appear in list form; typical examples being items and their translation equivalent (e.g. door = *die Tür*), items and their definitions (e.g. nap = short sleep), paired items (e.g. hot–cold, tall–short), and irregular verbs. A common practice is for the learner to use one side of the list as prompts and cover the other side in order to test himself.

In the early stages of language learning, repetition gives the students the opportunity to manipulate the oral and written forms of language items, and many learners derive a strong sense of progress and achievement from this type of activity. For this reason it can be very valuable. It may also be a very legitimate means of transferring items into long term memory where there is a direct mother-tongue equivalent and very little semantic coding is involved in the learning process. For universal paradigms such as days of the week, or for irregular verbs (as long as the meaning of the verb is known), a mechanical learning activity of this type may be quite useful.

However, earlier in this chapter we indicated that a far deeper level of processing is required to commit items to long term memory and we illustrated the type of processing that will be involved. In addition, lists of translation equivalents may be counter-productive for learners, as memorisation of this type may delay the process of establishing new semantic networks in a foreign language.

6.7 Recycling

The importance of recycling previously presented lexis is a direct consequence of the theories of forgetting, discussed in an earlier section. If memory traces do gradually fade in the memory without regular practice then it is clearly necessary that we create opportunities in the classroom for students to practise what they have learnt. And given that other learning activities will interfere with effective retention of new lexis, we should try to ensure that practice is carefully spaced and that students are not being overloaded with too much new lexis at any one time. This will be a function of the course designer as much as the teacher, but only the teacher can accurately measure the extent of recycling or the pacing of new input that will be appropriate for their students on a daily or weekly basis. With regard to the theory of cue-dependent forgetting, it will also be a function of recycling that students are being

asked to locate items in their long term memory. Developing effective retrieval systems may not require lengthy practice and can easily be incorporated into the lesson by way of 'warmer' activities at the beginning. The teacher could, for example, give the students an appropriate retrieval cue for vocabulary presented in the previous lesson and see how many items the students can recall. Alternatively he could present the students with disparate items presented over several lessons and ask the students to organise them into different categories. Both activities are helping to assist the process of subjective organisation so essential to effective retention and recall.

As mentioned earlier the rate of forgetting also has implications for the recycling of lexical input. If eighty per cent of what we forget is lost within twenty-four hours, there is a strong argument for revising new language items one day after initial input. In *The Brain Book* (1979), Peter Russell actually sets out a revision schedule to ensure that new material is permanently recorded. His timetable is as follows:

1 A five-minute review five to ten minutes after the end of a study period.
2 A quick review twenty-four hours later.
3 A further review one week later.
4 Final reviews one month later and then six months later.

Such a detailed plan of campaign is unrealistic for most lexical items, unless teachers are fortunate enough in having course designers who have integrated systematic lexical recycling into the prescribed syllabus. However, it should still be possible for teachers to incorporate some of this organised recycling into their lessons. We have already advocated the regular use of warmer activities at the beginning of a lesson to aid recall and develop retrieval systems; in addition we would recommend that teachers try to include a quick review of important lexis one to two days after initial input. This should help to compensate for any decline in the memory trace, and combat the effects of interference which crowd the memory with new information, making it difficult to locate previously learned lexis. With regard to further recycling, weekly or monthly progress tests (the choice depending on course duration and intensiveness) are probably the easiest and most practical way of ensuring some check on previously learned lexis.

One final point about recycling is that it is not just a matter of quantity but also of quality. Although teachers provide example sentences for new lexical items they are not in the habit of illustrating the item with three or four different examples. They might argue that it would be too time-consuming to present so many examples, and in any case why give four examples when one will do? The problem of time is inescapable and there is a danger that varied examples can be overwhelming for the students and lead to more confusion than understanding. In the long term, though, students will find it easier to retain and retrieve an item

from long term memory if they have been exposed to it through a number of different contexts. And this will be just as true for your own understanding of vocabulary teaching. Imagine reading this book four times. You may learn something on the second reading that you missed on the first, but you are unlikely to gain very much on the third or fourth readings. Compare that with reading four different books on the same subject where you have the opportunity to meet similar subject matter but each time seen from a slightly different point of view. Initially this may be confusing but eventually you will gain far more insight and depth of understanding, and this in turn will fix the ideas more permanently in your long term memory. Following the restricted contextualisation of new lexis for initial teaching purposes, it will therefore become a function of recycling to expand the context range of an item and so facilitate retention and recall.

6.8 Written storage systems for learners

Traditionally, most learners were encouraged to list vocabulary items as they were learnt in a chronological order. The most common way of indicating meaning was to assign a mother-tongue equivalent to each item – our French vocabulary notebooks looked something like this:

L'arbre (m) = the tree
léger (adj) = light
écouter (v) = to listen
etc.

Although this system gives us a very basic form of information about the most common meaning of an item as well as its part of speech and gender, the organisation represents a very one-dimensional view of language. It does not reflect the types of associations we have just discussed, and an arrangement like this is likely to present hurdles to the learner rather than facilitating the learning process. Lack of contextualisation will encourage the learner to assume that *léger* could be used in the context of 'a light room' (i.e. the opposite of dark) and this would be quite wrong. Moreover, this system of storage is not flexible; it does not allow for later additions or refinements as one's knowledge of the uses and derivatives of an item increases, and gives us no indication here of the pronunciation of the items. A more comprehensive framework is given below and it is important to encourage students to store items

with the relevant information. They should also leave space so that they can add to the entry where need be:

murder (n) + (v) /ˈmɜːdə/ = to kill somebody by plan or intention against the law *

e.g. Jack the Ripper murdered lots of women.

*or a translation

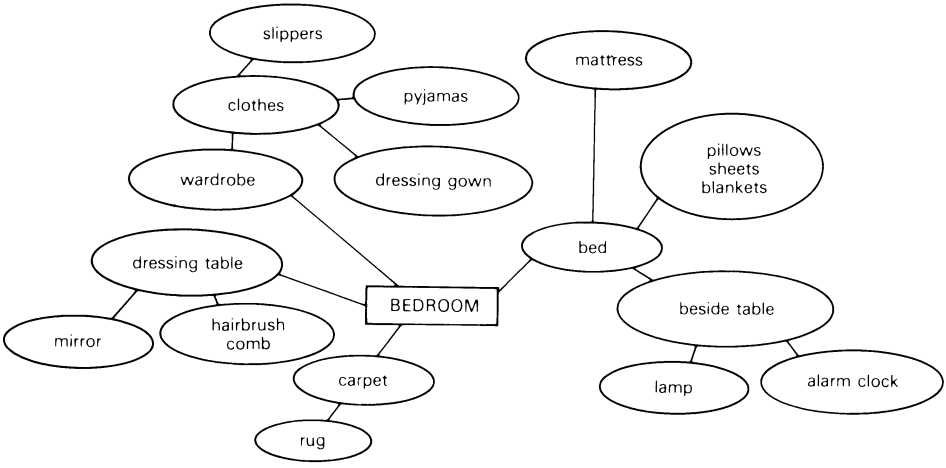
PERSONAL CATEGORY SHEETS

Learners can store new vocabulary as it arises on appropriate category sheets which they can keep in a ring binder or on separate pages of a notebook. The sheets could have headings such as topic areas or situations, these headings being selected by the student himself. As he acquires new vocabulary, he can add to the sheets and cross-reference them where necessary. He will have to decide where to categorise and when to open a new category sheet. The information given on these sheets (i.e. meaning, perhaps translation, part of speech and an example) should be comprehensive as suggested above.

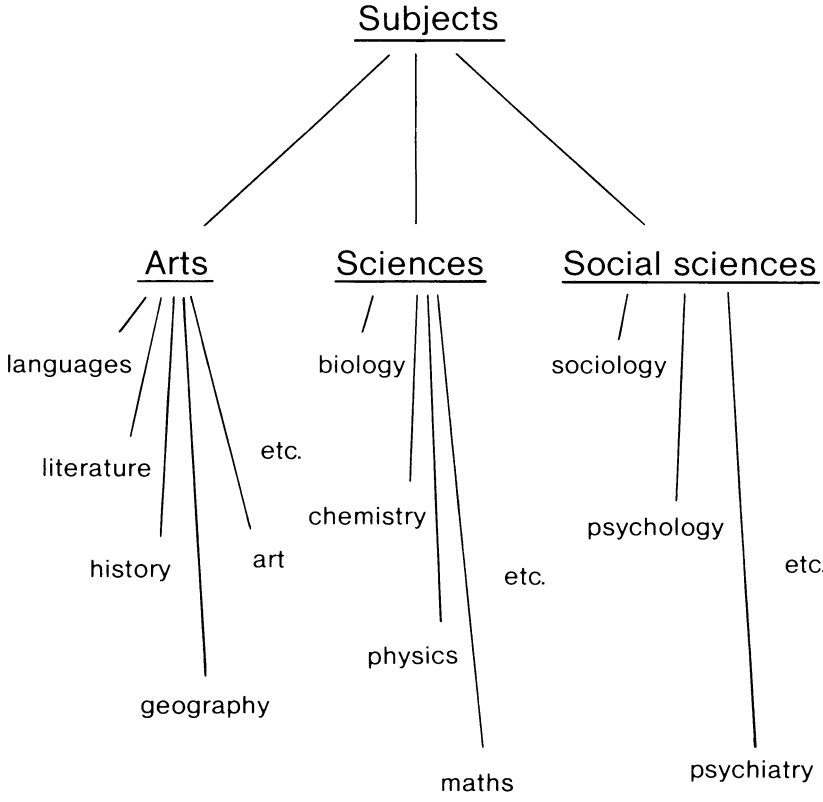
It is also possible for learners to use index cards; each card would contain information about lexical items and their derivatives, and the cards could be filed thematically. This is perhaps a rather cumbersome practice in the classroom, but may well suit individual learners for home use.

USING VISUALS

We mentioned the uses of diagrams and word trees in chapter 2 when discussing the teaching implications of sense relations. Visuals are an extremely useful framework for storage of lexis, and they can be used to highlight the relationships between items. Word field diagrams are of interest here and the example below (from *Use Your Dictionary*, Underhill, 1980) could be used as a testing activity by omitting some of the items. Learners could also be asked to organise their own diagrams of this type.



Trees can be used too:



Students can also be asked to categorise items; for example, putting the hyponyms in a list under the appropriate superordinate term:

e.g. strawberry, onion, potato, cherry, pineapple, pear, carrot, cauliflower, peach, pea, celery

Fruit	*Vegetables*

Dictionaries often give useful visuals which enable students to do this type of exercise.

The grid which follows could be done on the blackboard by the students themselves, after which they can copy down their own personal record of it. Alternatively, it can be done as a group or homework activity by giving the students only one column of information (perhaps the first) and asking them to supply the rest.

Profession	*Place of work*	*Duties*
surgeon	hospital/clinic	to operate on people to treat medical problems
mechanic	garage	to repair cars, lorries, etc.
plumber	buildings/houses	to put in and repair: – water pipes e.g. in bathrooms, kitchens, – central heating
foreman	factory/worksite	to supervise other workers
photographer	studio or anywhere	to take photos, commercially or artistically and to develop and print them
lawyer	office/law courts	to advise people about the law to represent them in court

(Based on a similar type of grid in *Vocabulary Learning: the use of grids*, P. D. Harvey, *ELT Journal*, July 1983.)

Giving students pictures with objects to label is clearly an effective form of storage; most course books contain useful visuals of this type and labelling can be a class or homework activity. Many students (not only children) enjoy drawing and it is worth exploiting this where possible as a storage device. It has the advantage both of the 'personal investment' of having drawn and labelled an item as well as being a simple and effective indication of meaning. (Whether the drawings are good or not is irrelevant; what matters is that they should be recognisable to the learner.)

ALPHABETICAL INDEX

Another way in which a learner may wish to organise items is alphabetically; the advantage of this is that it constitutes a 'personal dictionary' or record of items learnt up to that moment. This can be helpful for situations in which a learner *recognises* an item he has met before and entered in his storage system, but perhaps cannot remember its meaning or how it is used. However, if he has the *meaning* in his head but cannot remember how to express it, this system will not be at all helpful. An alphabetical card index could be compiled as a group effort by the class and teacher, and the index box kept in the classroom for the students to refer to when necessary. This could then provide useful backup for the personal category sheets (see above). Having a joint class index file will enable both teacher and learners to keep track on lexical items covered and provide simple materials for quick revision activities.

LABELLING

An amusing form of written storage which will also provide a great deal of inbuilt revision is labelling objects. Encourage your students to invest in a large packet of small adhesive labels, and as they learn new items of vocabulary, they can write them in phonemic script and roman script on to labels which they then stick to the appropriate objects in their homes. Every time a student opens his wardrobe door, for instance, he will see a label giving him the English version. Clearly, objects in the classroom can be labelled in the same way.

RANDOM ITEMS

A useful vocabulary revision activity is to write on the blackboard a number of vocabulary items which your students have learnt during the last few lessons. Jumble the words so that they do not appear on the blackboard in listed categories. Ask students to work alone to categorise the items into three or four groups. It is best if this type of organisation

is subjective at least in the initial stages; it is important to allow the learners to make their own decisions about how they wish to arrange the items. Their groupings may be grammatical or semantic; they may wish to group items by colour, shape, function, pleasantness or unpleasantness, activity, etc. Once the students have organised the vocabulary in their own way, ask them to explain their grouping to the class or to discuss this in small groups. This can be a useful way of checking that the students have understood the items as well as providing an opportunity for them to store and organise subjectively.

SUMMARY

One aspect of storage which we have not mentioned so far is the way in which most learners note down lexical items as they occur i.e. chronologically. We are all familiar with the situation where a learner is trying to recall a lexical item and can probably remember approximately where on the page he wrote it, who his teacher was (if he has more than one) and, if a recently taught item, which day he first focussed consciously on it. In fact, we have almost certainly all experienced this first-hand. This reflects one aspect of memory which we should not neglect; our ability to recall items is often sparked off by trying to cast our minds back and visualise the time and place where we learnt something.

This chronological organisation is not incompatible with other forms of storage, such as categorical organisation, so we are not suggesting that this should be discouraged. The more systems a learner makes use of and the greater the exposure to target items, the easier it will be to retrieve from a variety of sources. Noting items chronologically in lessons and transferring this information to category sheets or card indexes at home seems a very worthwhile activity, and may suit certain types of learners. However, to be realistic, some learners may not be prepared to organise items in different ways, so the most helpful guidance teachers can give here, is to show learners how to be systematic whatever system they adopt. Being thorough about the information they record (as suggested at the beginning of this section) is one way. In addition, learners who wish to record items chronologically should be encouraged to keep one section of their notebook or file for vocabulary; to begin a new page for each separate lesson, to date each page and where possible to give it a heading. As organisation is the key to memory, this is an important part of teaching your students how to be efficient learners.