CONSCIOUSNESS IN SECOND LANGUAGE LEARNING: PSYCHOLOGICAL PERPECTIVES ON THE ROLE OF CONSCIOUS PROCESSES IN VOCABULARY ACQUISITION

Nick Ellis
University College of North Wales

Abstract
This article reviews research related to conscious and unconscious processes in L2 and Ll vocabulary acquisition. Firstly it presents a summary conceptual analysis of the different aspects of vocabulary acquisition. After demonstrating that most vocabulary acquisition typically comes as a result of incidental learning, it next considers three research areas: (i) the associations between vocabulary and academic intelligence, (ii) implicit memory, (iii) global amnesia. These diverse areas all reveal a dissociation whereby the recognition and production aspects of vocabulary learning rely on implicit learning, but meaning and mediational aspects of vocabulary heavily involve explicit, conscious learning processes. The operations of the input and output (I/O) lexical modules are briefly described, followed by an analysis of the explicit cognitive systems for mediation with semantics and conceptual systems. Finally the pedagogic implications of these findings are outlined.

Introduction

There are now many demonstrations of the dissociation between unconscious and conscious processes of learning. This division roughly parallels that between practical or tacit intelligence and academic or explicit intelligence. The research priority that necessarily follows from such distinctions is to determine which of human cognitive capabilities are acquired implicitly and which learned explicitly. This question is both of theoretical and practical pedagogic importance since teaching interventions are of less relevance to implicitly learned skills but are essential to explicitly learned ones.

Nowhere has the role of consciousness been more a matter of debate than in the realm of human language skills, both in native (Ll) and second (L2) languages (Ellis, in press a). Radical swings in the history of L2 teaching methodologies reflect this schism (see Kelly, 1969and R. Ellis, 1990 for reviews). Traditional 'Grammar-translation' methods emphasised study by literacy and translation and had an explicit bias with formal explanation of L2 rules and a deductive approach to learning. Come the Second World War the Behaviourist Zeitgeist in America led to Structural Approaches and Audiolingual methods which outlawed the teaching of metalinguistic rules and which regarded L2 as just another specific domain to be understood by general laws of learning - L2 acquisition involved discrimination and generalisation from structured examples by analogy not analysis, i.e. implicit, inductive learning through patterned practice. By the 1960s critics began to observe that these methods produce fluent but flawed speakers (e.g. "Audiolingual methods have been teaching speech but not language", Donaldson, 1971, p. 123) and explicit instruction of grammatical rules was reintroduced in the Cognitive Code Method, 'a modified, up-to-date translation theory' (Carroll, 1966, p. 102), which held that perception and awareness of L2 rules precede their use. In the 1970s and 80s the pendulum swung back to Naturalistic methods (Krashen, 1982, 1985). Krashen's underlying theory, the Input Hypothesis, is a non-interface position in that it posits that adults can subconsciously acquire languages and they can consciously learn about language. But in this view learning cannot be converted into acquisition; subconscious acquisition dominates in L2 performance, and conscious learning is used only as a Monitor, i.e. as an editor to correct output after it has been initiated by the acquired system. Thus in Krashen's Monitor theory implicit acquisition of L2 is the essential aim of instructional programmes. Currently the pendulum is yet again in swing: in the light of analyses of the disappointing abilities of graduates from 'grammar-free' foreign language (FL) programmes (Gomes da Torre, 1985) there are new ca1ls for a return to explicit methods (Kingman + Cox Reports for English, 1988, 1989; James, 1986).

Such swings in educational practice make it clear that there is no simple answer to the question of whether language acquisition reflects conscious or unconscious processes. There are two major causes of this continuing contention. The first is the 'slipperiness' of the term 'consciousness' both in its constitutive definitions and in their operationalisations (McLaughlin, 1990; Schmidt, this volume). The second is that 'language learning' is equally poorly defined, mainly because of its numerous facets. Researchers really need to be clear in what they are talking about with regard both consciousness and language, hence this symposium whose aim is a theoretical overhaul of our concepts in effort after clarity and standardisation.

Our particular difficulties in these respects are far from unique. As Sigmund Freud

(1915) wrote:

> "The view is often defended that sciences should be built up on clear and sharply defined basal concepts. In actual fact no science, not even the most exact, begins with such definitions. The true beginning of scientific' activity consists rather in describing phenomena and then in proceeding to group, classify and correlate them.... It is only after more searching investigation of the field in question that we are able to formulate with increased clarity the scientific concepts underlying it, and progressively so to modify these concepts so that they become widely applicable and at the same time consistent logically. Then indeed, it may be time to immure them in definitions."

However, perhaps now, after several decades of work relating to these matters, it is time to try to clean house, to clarify our definitions thus to begin the resolution of the particular issue of the role of consciousness in language acquisition.

In his useful introductory paper Schmidt provides an analysis of constitutive definitions of 'consciousness'. He makes a number of recommendations towards standardization of use of theoretical terms. While we an might quibble with the minutiae of his analyses, his general argument is both sound and wide-ranging, and we should consider his counsel if only because he has had the temerity to attempt the task. His suggestions are as follows:

Incidental learning (Consciousness as intentionality) should be used to refer to describe situations where individuals learn without intent to learn, or when individuals learn one thing when their primary objective was to do something else. In the past this has often been referred to as unconscious learning. Schmidt adds the rider that it is important not to assume without independent evidence that either the process or the product of such learning is unconscious in any other sense.

Learning without attention (Consciousness as the product of attention) should be reserved for learning that can be shown to have taken place without any allocation of attention, voluntary or involuntary.

Explicit learning (Consciousness as awareness) is to be used when the learner has online awareness, formulating and testing conscious hypotheses in the course of learning. Implicit learning describes when learning takes place in the absence of these processes; it is an unconscious process of induction resulting in intuitive knowledge that exceeds what can be expressed by learners.

Explicit instruction (instructed learning) should be reserved for situations where subjects

are told about or taught rules in experimental studies or in the c1assroom.

Explicit memory (Consciousness as control) refers to situations where recall involves a conscious process of remembering a prior episodic experience. In contrast, implicit memory is where there is facilitation of the processing of a stimulus as a function of a recent encounter with the same stimulus but where the subject at no point has to consciously recall the prior event.

I will therefore adopt these terms in reviewing research concerning the involvement of conscious processes in one small area of language learning, that of vocabulary acquisition. I have chosen this because its small size might make it a more tractable problem. Even so, at first sight even this better definable area is still far from resolved with respect the involvement of unconscious and conscious processes. However, I will demonstrate that with precise notions of the different aspects of vocabulary acquisition we can, to use Freud's terms, 'group, classify and correlate them', and that when we do a clear picture emerges. I will argue that vocabulary acquisition as a whole reflects both conscious and unconscious processes, but that there is a sharp dissociation whereby the recognition and production aspects of vocabulary learning rely on unconscious processes, whereas meaning and
mediational aspects of vocabulary heavily involve explicit, conscious learning processes.
Space restrictions limit the amount of supporting detail that I can present here, a more complete treatment is given in Ellis (in press b).

Current applied linguistic theories of vocabulary acquisition range from 'unconscious' positions to those which hold that learners should be explicitly taught large amounts of vocabulary. Krashen (1989) exemplifies the unconscious position. His Input Hypothesis assumes that we acquire language by understanding messages and the following quotation demonstrates that he holds it to be unconscious in all of Schmidt's respects [added in' square brackets]: "language is subconsciously acquired - while you are acquiring, you don't know you are acquiring [implicit learning] your conscious focus is on the message, not form [learning without attention]. Thus, the acquisition process is identical to what had been termed 'incidental learning.' [incidental learning] Also acquired knowledge is represented subconsciously in the brain - it is what Chomsky has termed 'tacit knowledge'. [intuitive knowledge & implicit memory]" (Krashen, 1989, p. 440). At the other extreme there is a history of attempts to collate lists of a core vocabulary which teachers are recommended to use to decide which words and meanings should be taught first (e.g. West's 1953 General Service List of 2,000 words) [explicit instruction]. In parallel there have been developments of a wide diversity of methods for explicit [intentional, attentive, explicit] vocabulary learning instruction (see Carter, 1987; Nation, 1987 for reviews).

What is the language practitioner to make of all of this? How can both of these positions be tenable? Does vocabulary come naturally and unconsciously or must it be taught and learned? Or else, what are the aspects of vocabulary that are amenable to instruction and study?

What is it to learn a word?

What is it to learn a new word? Minimally we must recognise it as a word and enter it into our mental lexicon. But there are several lexicons specialised for different channels of Input/Output (I/O). To understand speech the auditory input lexicon must categorise a novel sound pattern (which will be variable across speakers, dialects, etc.) to read the word the visual input lexicon must learn to recognise a new orthographic pattern (or, in an alphabetic language, learn to exploit grapheme-phoneme correspondences in order to access the phonology and hence match the word in the auditory input lexicon) to say the word the speech output lexicon must tune a motor programme for its pronunciation; to write it the spel1ing output lexicon must have a specification for its orthographic sequence. We must learn its syntactic properties. We must learn its place in lexical structure: its relations with other words. We must learn its semantic properties, its referential properties, and its roles in determining entailments. We must learn the conceptual underpinnings that determine its place in our entire conceptual system. Finally we must learn the mapping of these I/O specifications to the semantic and conceptual meanings.

The source of vocabulary

We have not been explicitly instructed in the vast majority of the vocabulary that we know, nor indeed have we looked up these words in dictionaries - most vocabulary is learned from context (Sternberg, 1987).

Saragi, Nation & Meister (1978) asked adults to read Anthony Burgess' novel, "A Clockwork Orange". This contains a number of novel words from a Russian-based slang called nadsat. There are 241 nadsat words in the novel and they are repeated on average 15 times. The subjects were simply asked to read the book (which crucially did not contain a dictionary of these words). A few days after finishing they were given a surprise test covering 90 nadsat words. Considerable vocabulary acquisition had taken place - subjects had picked up some 45 new words simply by reading a novel.

People who read more know more vocabulary. This relationship between print exposure and vocabulary appears to be causal in that it holds even when intelligence is controlled (Stanovich & Cunningham, 1992).

There is thus no doubt that reading affords vocabulary acquisition. It is an ideal medium for it. Moderate-to-low-frequency words - precisely those words that differentiate between individuals of high and low vocabulary size - appear much more often in common reading matter than they do in common speech. And there is opportunity for the reader to study the context, to form hypotheses at leisure and cross validate them, to have time to infer meanings. The word is frozen in time on the page, whereas in speech it passes ephemerally.

However, without further experimentation it is impossible to resolve whether this vocabulary acquisition from context reflects implicit learning, incidental learning, or even explicit learning without explicit instruction. Contra Krashen (1989), it does not follow that vocabulary has been subconsciously acquired from the fact that we have not been taught the vast majority of the words that we know. That we have not been taught vocabulary does not entail that we have not taught ourselves. It is quite possible, e.g., that there is some benefit to vocabulary acquisition from the learner (i) noticing novel vocabulary, (ii) selectively attending to it, and using a variety of strategies to try (iii) to infer its meaning from the context and (iv) to consolidate the memory for that new word.

Studies of vocabulary acquisition from reading demonstrate that neither dictionary look-up nor explicit instruction is necessary for vocabulary acquisition, The remainder of this paper analyses the degree of involvement of conscious learning processes in different aspects of vocabulary acquisition.

In brief, the evidence that will be presented for unconscious processes in the acquisition of I/O (receptive/productive) aspects of vocabulary includes:

- Child first language vocabulary development is essentially ubiquitous (following the frequency distribution of implicit learning systems).
- Child first language vocabulary development is relatively insensitive of 'academic intelligence' (it does not correlate with explicit learning abilities).
- Read vocabulary is so well preserved in dementia that it is taken as an index of premorbid IQ (in loss it thus behaves like implicit memory abilities).
- Repetition priming effects in lexical decision and word identification tasks demonstrate implicit vocabulary I/O activation (implicit memory).
- Priming studies show that I/O lexical modules for bilingual individuals are independent (like modularised implicit memory systems).
- Amnesics who are deficient at explicit memory abilities show normal lexical priming effects for both old and new lexical items (implicit memory).
- Effects of word regularity and the proportions of 'friends and enemies' demonstrate implicit acquisition of grapheme<->phoneme correspondences and spelling patterns for processing written vocabulary (implicit learning).

- Spoken word production is like other motor skins in that it is affected by frequency and statistical regularities in the subcomponent phonotactic sequences (implicit learning).
- Analyses of effects of exercise, practice, frequency of use, and life-span practice show that vocabulary acquisition, like implicitly-acquired skins, conforms to the power law of learning (implicit learning and implicit memory).
- Connectionist (Parallel Distributed Processing) modelling is a medium for investigating implicit learning in humans. Such models of conceptual, vocabulary, morphology, and reading and spelling acquisition can an reproduce to a remarkable degree the characteristics of people learning language - behaviours previously assumed to be characteristic of rule-governed systems even though the connectionist nets do not contain explicit rules (imp1icit learning).

The evidence that will be presented for conscious processes in the acquisition of meaning aspects of vocabulary includes:

- When peop1e are assessed for their understanding of vocabulary there are high correlations between academic IQ and, respectively, reading ability and adult breadth of vocabulary (correlations with explicit learning and memory abilities)
- Free recall studies show that conceptual systems for vocabulary in bilinguals are interdependent (like explicit memory influenced by a widfe range of conscious, cognitive factors).
- The difficulty human amnesics (who demonstrate normal implicit memory in the absence of explicit, episodic memories) have in acquiring vocabulary-concept pairings (explicit memory).
- Explicit memory for words is affected by Depth of Processing (explicit memory).
- The effectiveness of explicit, deep processing, mediational strategies (semantic and imagery elaboration) in vocabulary learning (explicit learning and memory).
- The effectiveness on vocabulary acquisition of training in such metacognitive strategies word-analysis or inferring meanings from contexts (explicit learning and memory).

Vocabulary and intelligence

We can assess the degree of involvement of conscious learning processes in vocabulary acquisition by considering between distribution of this variable in the population and its correlation with 'intelligence' (since intelligence rests have been developed to primarily measure explicit; conscious learning abilities). Because implicit learning is a more basic form of learning it shows a different population distribution: evolutionarily older systems display less variation than new ones. Consider the innate skill of walking - just about everyone on the globe learns to do it at roughly the same time and moves through the same motor milestones on the way. Its ubiquity supportive evidence for it being an implicitly learned skill which the brain is pre-programmed to acquire and refine. Chomsky used the same argument to support the idea that language is an independent faculty separate from non-linguistic cognitive abilities: "As far as we know, the development of human mental capacity is largely determined by our inner biological nature. Now in the case of a natural capacity like language, it just happens, the way you learn to walk. In other words language is not really something you learn. Acquisition of language is something that happens to you; it's not something that you do. Language learning is something like undergoing puberty. You don't learn to do it; you don't do it because you see other people doing it; you are designed to do it at a certain time." (Chomsky, 1988, pp. 173-174).

Notwithstanding wide variation in intelligence, just about everyone learns to talk their L1. Lenneberg (1967, pp.156-157) suggests that children with non-verbal IQs as low as 30 (i.e. more than 99.99% of people) can still complete the single word stage of language. If we are simply interested in vocabulary aspects of language acquisition, there is plenty of evidence that the input/output of vocabulary is relatively independent of intelligence. Thus, for example, children severely mentally retarded as a result of hydrocephalus, may talk excessively with impressive vocabularies, even though their speech lacks content (Taylor, 1959; Hadenius, Hagberg, Hyttnäs-Bensch & Sjögren, 1962; Ingram & Naughton, 1962; Cromer, 1991 for review). Hadenius et al. coined the term 'cocktail-party syndrome' for the condition since there was a "peculiar contrast between a good ability to learn words and to talk, and not knowing what they are talking about" (p. 118).

In contrast with mere I/O, when the criterion of vocabulary knowledge additionally involves the understanding of words, i.e. the mapping between lexical, semantic and conceptual domains, then there are, of course, strong correlations between academic intelligence and vocabulary size. Learning disabled children produce particularly low scores on the Vocabulary sub test of the WISC-R (The Wechsler Intelligence Scale for Children) where children have to demonstrate an understanding of words by defining them (Kaufman, 1979). At ages between 6 and sixteen, WISC-R vocabulary scaled scores correlate an impressive 0.69 with full scale Stanford-Binet IQ (Wechsler, 1976). Mill-Hill Vocabulary Test scale scores correlate with Raven's Matrices ('non-verbal') IQ 0.60 in people under 30 years old (Table SPM I, Raven, Court & Raven, 1983). W AIS-R vocabulary scaled scores reliably correlate at greater than 0.80 levels with full scale W AIS-R IQ (Wechsler, 1981).

Taken together, these studies clearly reveal different, separable components of vocabulary acquisition. I/O processing neither correlates highly with cognitive mediational components nor with intelligence, yet these latter two abilities 'are inextricably interrelated.

Priming studies of monolingual implicit and explicit memory systems

Word recognition and word naming are faster if you have recognised or named that word within the last day. This occurs whether you explicitly remember having read the word before or not, and thus it demonstrates implicit memory - the tuning of the lexicon by experience. This is the basis of the main technique for studying implicit memory, repetition priming, i.e. facilitation of the processing of a stimulus as a function of a recent encounter with the same stimulus. Repetition priming has been observed on a variety of tasks that do not make explicit reference to a prior study episode - the subject at no point has to consciously recall the prior event. The tests most commonly used in priming research are lexical decision, word identification, and word stem completion. On the lexical decision task subjects have to rapidly decide whether a particular letter string is a word (e.g. watch) or not (e.g. wetch) priming is reflected by a decreased latency in the making of a lexical decision on the second presentation of a letter string relative to the first. The word identification test measures the minimum exposure necessary for correct recognition of the word. Priming is indexed here by a lower minimum exposure for repeated words. On word completion tasks, subjects are given a word stem (e.g. tab for table) and are instructed to complete it with the first appropriate word that comes to mind. Here, priming is reflected by an enhanced tendency to complete test' items with words exposed on a prior study list.

Perhaps the clearest evidence for the separation of implicit I/O lexical systems from semantic aspects of vocabulary comes from the interaction of depth of processing and the types of operation that we ask subjects to do with words. I will review later the many demonstrations that led Craik and Lockhart to propose a Depth of Processing theory of learning and memory whereby the more subjects analyse material semantically and the more they elaborate upon its meaning, the better they will recall it in long-term tests of explicit memory (recognition and recall tasks). Jacoby and Dallas (1981) showed subjects a list of familiar words and had them perform either a study task that required elaborative processing (e.g. answering questions about the meaning of the target word) or a shallow study task that did not require elaborative processing (e.g. deciding whether or not the target word contained a particular letter). Explicit memory for the words was subsequently tested by yes/no recognition and implicit memory was assessed by savings in word identification tests. Recognition performance was higher following elaborative study than non-elaborative study. However, implicit memory was unaffected by the study manipulation: priming effects on word identification performance were about the same following the elaborative and non-elaborative tasks. Graf, Mandler and Haden (1982) report a similar pattern of results by using free recall as an index of explicit memory and stem completion as a measure of implicit memory. Taken together, experiments of this type (see Schacter, 1987 for review) clearly demonstrate that word identification operates according to implicit memory principles - it is affected by mere exposure and the frequency thereof. But explicit memory for words is clearly affected by the depth of processing and the degree to which subjects analyse their meaning.

Priming studies of bilingual implicit and explicit memory systems

The same dissociation can be found in the contrast between studies of implicit and explicit memory in bilinguals (Durgunoglu and Roediger, 1987; Heredia & McLaughlin, 1992). Concern over the organisation of the bilingual brain has a long history: Is there a single memory store for both languages (the interdependence or compound model) or a separate store for each (the independence or co-ordinate model)? The interdependence model assumes that items or concepts are stored in the bilingual's memory in the form of language-free concepts with a single conceptual or semantic representation subserving the two lexical entries. Evidence for the interdependence model typically comes from tests of explicit memory tasks, e.g. free recall experiments where exposure to the same concept in different languages is additive. The independence model contends that bilinguals' memory is organised with one memory for each language, with information in one language not readily available to the other system. Evidence foe the independence view typically comes from implicit memory tasks such as word identification or stem completion tasks (e.g. Kirsner, in press; Kirsner, Smith, Lockhart, King & Jain, 1984). Kolers in 1966 suggested a resolution to this debate, a compromise whereby bilinguals have neither separate nor shared memories: some information is restricted to the language of encoding while some is accessible to both linguistic systems. He has been proved correct in the light of subsequent evidence.

Durgunoglu and Roediger (1987) investigated implicit and explicit memory in bilingual subjects. Subjects saw words twice either in (a) English, (b) Spanish, or (c) once in both languages. They saw other words in (d) English and Spanish and also had to generate images of their referents, or (e) saw the same word twice in Spanish and generated the English equivalent in writing. These latter two conditions require more elaboration and a greater depth of processing. Explicit memory for the words was tested with free recall, implicit memory with word-fragment completion in English. In free recall (i) the language studied was unimportant, and (ii) elaborations such as generating a translation or forming an image of the referent facilitated recall. In word-fragment completion (i) if the study language matched the test language fragment completion rates were significantly higher than the rate for non-studied control items; if the study language did not match the test language the fragment completion rates did not differ from the non-studied items, and (ii) elaboration during study did not improve word-fragment completion rates.

These results again emphasise the distinctions between implicit, data driven I/O modules which are language specific, and an explicit, conceptually driven cognitive system which supports the semantics and concerts which both languages describe. In bilinguals, implicit memory systems are independent, but there is one compound explicit memory for the conceptual representations for words in their two languages.

Evidence from global amnesia

Further evidence for the dissociations between explicit and implicit learning comes from studies of global amnesic patients (e.g. Korsakoff's syndrome) who, as a result of hippocampal, limbic system, or basal forebrain lesions, show normal implicit learning yet total anterograde amnesia for explicit and episodic memories (Strauss, Weingartner & Thompson, 1985 see Schacter, 1987 for review) The perennial anecdotal evidence for this comes from Claparede (1911) who reported that he once shook hands with a female Korsakoff patient while concea1ing a pin in his band. This caused the patient some pain, and when he returned a few minutes later and offered his band again, she refused to shake it. Her avoidance continued, even though she could give no explanation of why she was avoiding him. In this case implicit learning (behaviour which is changed as a result of a previous encounter) is preserved in the absence of any conscious, explicit recollection of the event. Anterograde amnesia can inform us about the normal processes of vocabulary acquisition.

The first experimental investigations of a patient (H.M.) with severe and selective anterograde amnesia were conducted by Milner (Scoville & Milner, 1957; Milner, 1966). H.M. had intractable epileptic seizures which were finally treated by surgery which involved bilateral resection of the medial temporal lobes and ablation of the anterior two thirds of the hippocampal complex, the uncus, the amyglada and the hippocampal gyrus. Unfortunately damage to these limbic structures (found naturally in Korsakoff''s syndrome which can result from chronic alcoholism) causes profound amnesia (Dudai 1989; Squire, 1992).

H.M. like other pure cases of anterograde amnesia had normal recall of events that occurred before his brain damage and his short-term memory was normal. His prior semantic knowledge, inc1uding that of vocabulary and concepts, was preserved as was evidenced by his continued high IQ and his lack of symptoms of language disability. But he had no memory for episodes that occurred after the operation. Experimental demonstrations of his severe learning difficulties inc1uded: (i) his failure when presented with twelve faces and asked to select those that he bad seen from a larger array after a delay of only 90 seconds filled with a distractor task, (ii) he was unab1e to learn a sequence of digits or light flashes that was longer than his short-term memory span despite repeated presentations, (iii) he failed on detailed recall of a complex drawing. Such findings are now taken as diagnostic of cases of anterograde amnesia.

Memory for a recent event can be expressed explicitly, as conscious recollection, or implicitly, as a facilitation of test performance without conscious recollection. Surprisingly, while amnesics such as H.M. show a serve deficit in explicit memory, they can learn implicitly, as evidenced by practice effects. They show normal classical conditioning; they can acquire motor skills such as mirror drawing as fast and as well as normal individuals; they show good perceptual 1earning (e.g.. reading text in a mirror) and they show normal performance on tests of priming which are taken to indicate normal implicit memory abilities (Kirsner, in press; Schacter, 1987; McCarthy & Warrington, 1990).

So what does study of amnesia tell us about vocabulary acquisition and use? If amnesia is properly characterised as a deficiency in retrieval dependent on conscious voluntary procedures (explicit memory) while automatic procedures (implicit memory) are preserved (Schacter, 1987), then their successes at using and 1eaming vocabulary inform us about the degree to which vocabulary learning is implicit. So what can they do in these respects?

Lexical access

1. Amnesics retain prior learned vocabulary and concepts and can access them normally.

They have no difficulty on vocabulary or naming tests, and their reaction times have been shown to be quite normal on word-retrieval tasks (Meudell, Mayes, & Neary, 1981).

2. They show normal facilitation in repetition priming experiments involving pre-existing memory representations such as common words or linguistic idioms

Warrington & Weiskrantz (1982) demonstrated that amnesics showed effects of repetition in naming, category identification (e.g., object/animal), and generation of opposites (e.g. black/white). Subjects were presented with target words and asked to respond as quickly as possible. On a second presentation of the same stimuli in these tasks, the reaction times of both the amnesics and the control subjects were. faster, therefore showing facilitation.

Thus the recognition of pre-existing vocabulary and the access of known spoken or written word forms for expression relies upon automatic, implicit processes.

Learning new lexical units or word forms

3. Amnesics cannot explicitly recall new nonwords.
They cannot even explicitly recall words.

4. Amnesics sometimes show implicit memory for novel words.

The evidence on this is mixed. In the priming experiments described above, amnesics showed normal priming for items with pre-existing unitary memory representations such as common words which they would have known before trauma. What about priming for nonwords that do not have any pre-existing representations as units in memory? If they show priming here it would demonstrate that recognition units at least for the word forms (i.e. logogens) are automatically set up for novel vocabulary as implicit memories which simply result from experience.

Squire (1992) reviews evidence of priming in amnesics which involves the acquisition of new information:

(i) Speeded perception of a novel visual shape is a laboratory analogue of learning a new script or a new ideogram (e.g. a new Kanji). Normal subjects and amnesic patients improve their ability to reproduce novel line patterns independently of their ability to recognise these patterns as having been presented previously (Musen & Squire, in press; Musen & Treisman, 1990). Gabrieli, Milberg, Keane and Corkin (1990) also show that H.M. exhibits this effect. Normal and amnesic subjects exhibit priming of unfamiliar visual objects, again independent of recognition memory performance (Schacter, Cooper, & Delaney, 1990).

(ii) One laboratory parallel of leaning the visual form of new word in a known script is reading nonwords (of course, this task ignores any semantic aspects of vocabulary). Amnesic patients show normal practice effects in the acquisition of reading skill for regularly repeating nonwords (Musen & Squire, 1991).

It therefore appears that the implicit learning capabilities of amnesic patients are sufficient to allow new pattern recognition networks to be established for the visual forms of new language, whether this involves a new script or new words in a known script. Both of these tasks also involve output modules - written copying of new shapes, spoken production of new words. Given that amnesics show a wide range of implicit learning of new motor routines, it seems likely that they show similar facilitation in their language output modules. However, it must be remembered that all of this implicit learning occurs in the absence of any explicit recall of the words.

Accessing known conceptual associations

5. Amnesics show normal explicit learning of word pairs that are highly related.

Winocur and Weiskrantz (1976) showed that while amnesics' paired associate learning of unrelated word pairs was severely deficient, their performance on semantically highly related word pairs (chair-bench, wealth-fortune, etc.) was normal. They can make use of prior semantic associations in explicit learning but, as will be demonstrated below, they cannot explicitly learn new associations.

6. Amnesics show normal repetition priming effects of already known highly related paired associates.

Gardner, Boller, Moreines, and Butters (1973) showed Korsakoff's amnesics and controls a categorised word list. When subjects were later given category cues and asked to state the first category member that came to mind in a free association task, both amnesics and controls showed equivalent amounts of priming. Similar confirmation of priming of prior relations comes can be found in Schacter (1985) where amnesic patients showed normal levels of priming after studying a list of common idioms (e.g. sour-grapes) and then writing down the first word that came to mind on being given the stimulus word (sour- ?).

It seems therefore that implicit processes are sufficient to allow activation of pre-existing semantic associations. Furthermore, at least to a degree, amnesics' normal implicit input module activation, their normal implicit access of prior semantic mediations, and their normal implicit output module activation can allow near normal performance on explicit recall of highly related word pairs (though their performance rapidly deteriorates as the semantic associations of the two words becomes less strong - see Schacter, 1985).

Learning new conceptual associations

7. Amnesics are severely deficient at explicit recall of new pairs of associated words.

HM scored zero on this when the test required him to explicitly generate the second word of a previously studied pair when he was presented at test with the first. Generally, verbal paired associate learning of this type is very hard for amnesics even if they already know the words in question but are being asked to form a new association between them.

To the extent to which vocabulary acquisition is learning of this type (e.g. that aardvark - isan – armadil ....., 'what's an aardvark?'), then this deficit in amnesia tells us that this type of vocabulary acquisition is explicit. Recognition or recall of new semantic associations requires explicit memory.

8. Amnesics do not seem able to implicitly acquire novel semantic associations.

The semantic priming experiments discussed in 6 above involved implicit activation of pre-existing memory associations between highly related word pairs. What about the priming of novel word associations, a laboratory analogue of implicit leaning of new meaning relations? Again, the evidence on this issue is mixed.

There were some early claims for normal priming of novel associations in amnesics. Moscovitch, Winocur and McLachlan (1986) assessed this with a task involving reading degraded pairs of unrelated words and observed normal priming of novel associations in amnesics. Schacter and Graf (1986) found that some amnesic patients - those with relatively mild memory disorders - showed normal implicit memory for a new association between unrelated words (e.g. study bell-cradle, test bell-cra?), whereas severely amnesic patients did not show such implicit memory for new associations. However, Squire's (1992) review concludes that later studies (e.g. Cermak, Bleich, & Blackford, 1988; Mayes & Gooding, 1989; Shinamara & Squire, 1989) demonstrate that amnesics do not exhibit this effect reliably.

Moscovitch et al. (1986) suggested that memory impaired patients could establish novel associations in a single trial on the basis of results from procedures where novel word pairs were presented one at a time, the subjects were asked to read as quickly as possible either (i) the same words that had already been presented, (ii) a new set of words pairs, or (iii) the old words presented in a recombined fashion in new pairs. The evidence that an association had been made between the word pairs was that the recombined word pairs were read more slowly than the repeated pairs. However, the effect was small and has proved difficult to replicate. In a recent improved study by Musen & Squire (1990) recombined word pairs were read just as quickly as old word pairs suggesting that the priming effects were at an input lexical level rather than a declarative associative one.

The weight of the evidence is that amnesics' implicit learning is not sufficient to allow new associations between two semantically unrelated words and Squire (1992) suggests that subjects may need to access a link: between the two words that was formed declaratively (explicitly) at the time of study in order to do this.

Combining an of these aspects: amnesics' learning of new L1 concepts and their labels

Several studies have addressed amnesics' learning of new labelled concepts. Gabrieli, Cohen and Corkin (1983, 1988) have shown that H.M. and a small group of other amnesic patients were unable to learn by means of rote repetition the meaning of ten English words that they did not know before.

However, amnesics can be taught new vocabulary by means of a clever technique of vanishing cues which capitalises of their preserved implicit learning abilities. Glisky, Schacter and Tulving (1986) taught amnesics a substantial amount of novel computer vocabulary by this method which is a variant of priming procedures. At the start the patient was presented with a definition (e.g. 'to store a program') and the name of the command that enables that to happen ('SAVE'). On the next trial the definition was repeated, but only the first letter of the command (as in stem-completion tasks) was presented. If the patient could not answer, a second letter was presented, and so on until a correct response occurred. On the next trial the definition was presented again, alongside a fragment of the command containing one less letter than that needed for successful recall on the previous trial; thus, if a subject had been successful with sav-, he or she would see sa- on the next trial. Such learning was, of course, slow compared to controls, and acquisitions were relatively inflexible. But nonetheless, the results were impressive in that all the patients were able to learn the appropriate commands for 15 different definitions without any cues being available. Similarly Dopkins, Kovner, and Goldmeyer (1990) have shown that Korsakoff amnesics could acquire a conceptual interpretation of a new colour name ('bice') but their conceptual information did not reach the same level of abstraction as that of controls and moreover it was not integrated with the rest of their colour knowledge.

Consider vocabulary learning, like paired-associate learning and other typical associative learning tasks using explicit instructions to memorise. These results suggest that amnesic patients with hippocampal damage may eventually be able to acquire new associations, by means of numerous repetitions, as in the development of a habit. But this is far from normal learning. Their rate of learning is grossly slow in comparison with normal subjects and the acquired knowledge is abnormal in other respects as well. For example, even after the knowledge is acquired, it is still relatively inflexible, i.e., accessible only when exactly the same cues are presented that were used during training. For amnesics -it really is akin to parrot fashion learning - the patients have learned to produce a response, not to retrieve items from memory. Typically they can speak new vocabulary in the same way that a parrot can. By contrast, normal subjects learn quickly because they can apply a totally different strategy to the learning of new conceptual links. They can quickly memorise because they have an explicit, cognitive system of learning new associations which involves hippocampal and other limbic brain structures.

Conclusions

What can we conclude about vocabulary acquisition from studies of amnesics who seem to retain implicit, automatic systems of learning in the absence of explicit, declarative learning?

1. They show normal implicit learning of the perceptual aspects of novel word forms. Thus input modules for recognising novel word forms are tuned by experience and therein new pattern recognition units (input logogens) develop simply, implicitly, and automatically as a result of frequency of exposure. (Of course, in all of these studies the learners have paid attention to the stimuli, there is no evidence here for learning without awareness).
2. They show normal implicit learning of new motor habits and the motor aspects of novel word forms that are necessary for language production. Thus output modules for producing

novel word forms are similarly tuned by experience and new pattern recognition units therein (output logogens) also develop simply, implicitly, and automatically as a result of practice.

3. They are severely deficient at developing new conceptual information, at making new semantic links. In-between the implicit modules for receiving and producing language there is a conceptual system which operates according to cognitive principles, not those of habit. Vocabulary acquisition is as much concerned with meanings as it is word forms, and explicit learning is involved in acquiring and processing meanings.

What has been preserved in amnesia are the various, special purpose, relatively inflexible memory systems that permit one to behave differently as a result of experience, although usually only gradually over many trials. These deal with the abstraction of statistical regularities in the world (for perceiving new word forms) and our own behaviour (for producing new word forms). But amnesics' brain lesions do not produce loss of awareness without impairing some domain of information processing; they are unable to learn by means of the explicit cognitive system which is concerned with word meanings and which links input and output modules.

Neuroanatomical aspects of explicit, episodic, cross-modal memories in vocabulary representation

What of the neuroanatomy of all of this? Is it possible to bridge linguistic, cognitive and neuropsychological evidence and theory at an anatomical level of analysis? The following tentative speculations are at least consistent with current knowledge of brain function.

Mishkin & Appenzeller (1990) and Squire (1992 review research on the role of circuits involving the limbic system and structures linked to it (the hippocampus, amygdala, diencephalon [thalamus and mamillary bodies], prefrontal cortex. and basal forebrain) in the formation of long term memories in monkeys. These are the same structures which are damaged in cases of human amnesia. Animals with normal occipital and infero-temporal lobes but damaged hippocampus and amygdala can perceive visual patterns normally, but had impaired long-term episodic memories for visual stimuli. Furthermore, damage to these structures resulted in a global anterograde amnesia - these animals were equally impaired on touch recognition. Damage to the limbic system leaves old memories largely intact but prevents the normal development of explicit memory for new information. Thus it appears that while the occipital and inferotemporal lobes might subserve perception and be the locus of pre-existing LT visual memories, the subcortical memory circuits must engage in a feedback whereby after a processed sensory stimulus activates the hippocampus (and possibly the amygdala), the memory circuits play back on the sensory area, strengthening and so perhaps storing the neural representation of the sensory event that has just taken place. The amygdala is a kind of crossroads in the brain with extensive connections with all the sensory systems in the cortex and also deeper into the brain to the hypothalamus which is thought to be the source of emotional responses. Monkeys with amygdala damage cannot form LT cross-modal memories - they cannot for example learn to relate the touch of an object with its sight. Because they are also slow in learning to relate an object to reward. Mishkin & Appenzeller suggest that the amygdala allows association between stimuli and their emotional associations.

The conceptual meaning of a word is a conspiracy of perceptual memory traces. Think on the word 'Grandmother'. In so doing you awaken (whether consciously or not) your memories of all of the times you saw her, you heard her voice, you felt the touch of her hand and smelt her characteristic perfume. You remember the happy times and the sad. Conceptual meanings draw on rich cross-modal associations. Damage to the limbic structures which subserve these processes may thus deny the formation of these conceptual associations. This damage also prevents the formation of explicit LT memories between the perception of a word and the perceptual memories of its co-occurring referent.

The implicit language modules and their role in vocabulary acquisition

I/O modules are domain specific - e.g. visual word perception is not primed by prior listening. When automatised they are 'informationally encapsulated' (Fodor, 1983) - there are no top-down influences on the operation of input modules, and they are cognitively impenetrable we have no conscious inklings into how they operate. They work automatically - e.g., as evidenced by the Stroop effect it is hard not to read a word (Stroop, 1935). Typically they are acquired by means of implicit learning: the underlying structure of a complex stimulus environment is acquired by a process which takes place naturally, simply and without conscious operations. Simple attention to the stimulus domain of words suffices for implicit learning mechanisms to induce statistical or systematic regularities in this input environment. And so our lexical systems become tuned to regularities in orthography (letter units and sequential letter probabilities), to regularities in phonology (phonemes and phonotactic sequences), to regular patterns of grapheme-phoneme and phoneme-correspondences, to high frequency words over low frequency ones, etc. And input modules recognise, and output modules produce, high frequency patterns faster as a result. The "golden rule of sensori-motor learning is much repetition" (Seibert, 1927, p. 309) - the more patterns are repeated, the more frequent they are, the better they are acquired. This is the sort of learning that connectionist models do very well, and frequency, recency, and regularity are the driving forces which tune such systems (Gasser, 1990; McLelland & Rumelhart, 1986; Broeder & Plunket, in press).

If we test vocabulary knowledge by tasks like lexical decision or word naming, which fairly cleanly tap I/O modules, then words which have a high frequency in the language, i.e. words which have had considerable life-span practice, are processed concomitantly faster. Kirsner & Speelman (in press) and Kirsner (in press) propose a life-span practice model to explain these frequency effects whereby lexical performance in children and adults, both in LI and L2, can be explained simply by reference to the power law of learning which Anderson (1982) uses to explain the relationships between practice and performance in the acquisition of cognitive skills generally, be they of sensory or motor nature. In so doing Kirsner is proposing that these lexical effects can be adequately explained in terms of general principles of implicit learning and skill acquisition without recourse to specifically 'lexical models'.

So it is practice that makes perfect in the input and output modules and these effects are clearly seen at both word and intra-word levels. Ellis (in press, b) further considers these effects of practice on statistical regularities specific to particular I/O modules.

The explicit conceptual system and its role in vocabulary acquisition

This section will demonstrate that, in contrast to the I/Os of vocabulary acquisition, explicit learning processes are essential for acquiring the semantic and conceptual aspects of vocabulary. In 1932 Bartlett, one of the founders of modern psychology, stated that "memory is an effort after meaning". A more recent statement of this theme is the Levels of Processing framework of Craik and Lockhart (1972). In this model information can be encoded in multiple forms: e.g. in terms of semantic, phonemic, or visual features; in terms of verbal associates, or as an image. Information processing moves from a sensory level of analysis, through pattern recognition to semantic enrichment. Craik and Lockhart suggest that "memory trace persistence is a function of depth of analysis, with deeper levels of analysis associated with more elaborate, longer lasting, and stronger traces" (Craik and Lockhart, 1972, p. 675). Levels of Processing holds that shallow processing like oral rehearsal does not lead to long-term retention but deep processing, whereby semantic associations are accessed and elaborated, does.

Bower and Winzenz (1970) confirmed the usefulness of the two deep strategies of semantic and imagery mediation. Subjects learned to associate 15 arbitrary pairs of words (e.g. horse-cello) under one of four conditions: (i) Repetition: they were asked to verbally rehearse each pair, (ii) Sentence Reading: subjects saw each pair of words in a simple sentence, and were told to read it and use it to associate the two critical words, (iii) Sentence Generation: subjects were shown each pair of words and asked to construct and say aloud a meaningful sentence relating the two words, (iv) Imagery: subjects were asked to visualise a mental picture or image in which the two referents were in some kind of vivid interaction. The mean recall results in each condition were as follows: Repetition 5.6, Sentence Reading 8.2, Sentence Generation 11.5, Imagery 13.1.

Deep processing mediational strategies are thus highly effective in long-term L1 learning. They are equally useful in L2 vocabulary learning:

Imagery mediation using keyword methods

Atkinson and Raugh (1975) compared learning of FL vocabulary by means of keyword mnemonics with a control condition in which subjects used their own strategies. Keyword condition subjects were presented with a Russian word and its English translation together with a word or phrase in English that sounded like the Russian word. For example, the Russian word for battleship is linkór. American subjects were asked to use the word Lincoln, called the keyword, to help them remember this. Subjects who had used the keyword method learned substantially more English translations of Russian words than the control group and that this advantage was maintained up to six weeks later.

In this method the first stage of recalling the meaning of a foreign word involves the subject remembering the native keyword which sounds like the foreign word. The second stage involves accessing an interactive image containing the referent of the keyword and 'seeing' the object with which it is associated (this is the equivalent of the Imagery mediation condition of Bower & Winzenz, 1970). By naming this object the learner accesses the native translation.

Although it is a highly effective technique (see Levin & Presley, 1985 for review), it does have some limitations: (i) it is of little use with abstract vocabulary and keywords of low imageability, (ii) it is much less effective in productive vocabulary learning than in learning to comprehend the L2 (Ellis & Beaton, 1993 a, b) because imagery association in the keyword technique allows retrieval of the keyword which is merely an approximation to the L2 form. The technique does not have any in-built 'mnemonic tricks' to help spelling or pronunciation. For effective productive vocabulary learning the keyword technique must be complemented with repetitive practice at producing the L2 word forms. In sum, imagery mediation does not contribute to the lexical productive aspects of L2, but it does forge L1-L2 linkages.

Semantic mediation

(a) Using keywords

Sometimes FL words just remind us of the native word, a factor which usually sterns from the languages' common origins or from language borrowing. Thus the German Hund (dog) may be more easily retained than the French chien because of its etymological and sound similarity with the English hound. Such reminding, whether based on orthography, phonology, etymology or 'borrowing' (e.g. 'le hot-dog') typically facilitates the learning of that FL word.

If the reminding is not naturally there, one can create it using keywords and semantic rather than imagery mediation. By simply remembering the keyword and the native word in a mediating sentence it is possible to derive the translation (the equivalent of the Sentence Generation condition of Bower & Winzenz, 1970).

(b) Deep Processing and Elaboration

Beck, McKeown, and Omanson (1987) advocate that learners focus on the meaning of the new word and that they should act upon this meaning in a way that is considered integrative in relation to already existing semantic systems. They are thus urging students to be, in Craik and Lockhart's terms, deep processors. Crow and Quigley (1985) evaluated the effectiveness for ESL students of several such semantic processing strategies (such as the 'semantic field' approach where subjects manipulated synonyms along with the target words in meaningful sentences) and found them to be superior to 'traditional methods' over long time periods.

It can be advantageous to combine an of these aspects of (a) use of keyword reminders and (b) elaborative processing. Brown and Perry (1991) contrasted three methods of instruction for Arabic students' learning of English vocabulary. The keyword condition involved, presenting the new word, its definition, and a keyword, and learners were given practice in making interactive images; the semantic condition presented the new word, its definition, two examples of the word's use in sentences, and a question which they were required to answer using the new word; the keyword-semantic condition invo1ved an of these aspects. A delayed testing over a week later demonstrated that the combined keyword-semantic strategy increased retention above the other conditions.

Metalinguistic strategies for inferencing

Sternberg (1987) presents a thorough analysis of learning vocabulary from context. He identified three basic subprocesses: selective encoding (separating relevant from irrelevant information for the purposes of formulating a definition), selective combination (combining relevant cues into a workable definition), and selective comparison (relating new information to old information already stored in memory). He categorised the types of available cue and the following moderating variables: (i) the number of occurrences of the unknown word, (ii) the variability of contexts in which multiple occurrences of the unknown word appear, (iii) the importance of the unknown word to understanding the context in which it is embedded, (iv) the helpfulness of the surrounding context in understanding the meaning of the unknown word (e.g. an equivalence cue such as 'an ing is a low-lying pasture' is most effective, a spatial cue such as 'the cows grazed the ing in the shadows of the surrounding mountains' is more effective than a temporal cue such as 'at dawn the cows grazed the ing' for a spatial concept, etc.), (v) the density of unknown words (too high a proportion of unknown words will thwart attempts to infer meaning). Subjects trained in use of these moderating variables or given practice in the processes of inferencing from context showed marked gains over control subjects in vocabulary acquisition from texts in a pretest-posttest design similar to the Clockwork Orange studies mentioned above.

Not only does such training promote inferencing from context, but also this active derivation of meaning [explicit learning] makes the vocabulary more memorable. Thus Hulstijn (1992) provides experimental support for a Levels of Processing hypothesis of vocabulary acquisition whereby inferred word meanings were retained better than those given to the reader through the use of marginal glosses.

Interim summary

Taking these results together it is clear that it truly matters what learners do in order to acquire the meaning of a new word. Successful learners use sophisticated metacognitive knowledge to choose suitable cognitive explicit learning strategies appropriate to the task of vocabulary acquisition. These include: inferring word meanings from context, semantic or imagery mediation between the FL word (or a keyword approximation) and the L1 translation, and deep processing for elaboration of the new word with existing knowledge.

Conclusions

Learners must acquire the I/O of new vocabulary: the pronunciation elements and their compounds in the tongue as well as the graphemes and their patterns of orthographic combination in the script. There are specialised modules, the input and output lexicons, which acquire the word forms and regularities of the surface form of language by implicit learning processes. Like other sensory or motor skin systems, these modules do so automatically and they are tuned by practice - by frequency, recency, and regularity. To the extent that vocabulary acquisition is learning these surface forms of language then vocabulary acquisition is an implicitly acquired skill. In saying this I am not denying that the tunings of these systems cannot be guided by practice governed by explicit knowledge. In the same way that verbal declarative knowledge can coach the learner driver Cease off the accelerator, down with the clutch, etc.'), so it can the learner speller ('i before e except after c...'). In the early stages of any skill we use conscious declarative knowledge on the way to automatization. But essentially we learn to drive by driving itself, just as we learn to spell on the job of spelling or speak by speaking. In the main, these aspects of vocabulary acquisition reflect incidental learning.

However, the function of words is meaning and reference. And the mapping of I/O to semantic and conceptual representations is a cognitive mediation dependent upon explicit learning processes. It is heavily affected by depth of processing and elaborative integration with semantic and conceptual knowledge. Metacognitively sophisticated language learners excel because they have cognitive strategies for explicitly inferring the meanings of words, for enmeshing them in the meaning networks of other words and concepts and imagery representations, and mapping the surface forms to these rich meaning representations. To the extent that vocabulary acquisition is about meaning, it is an explicit learning process.

For any learning environment to be effective it must cater to an of these aspects. The I/O systems are tuned by practice, so the programme must encourage this as much as possible. There is little doubt that naturalistic settings provide maximum opportunity for exposure and motivation.. Reading provides an ideal environment for the implicit acquisition of orthography, and also, in individuals tutored in metacognitive and cognitive skills for inferring meanings from contexts, explicit acquisition of meanings. But many are the times when we have discovered a word's meaning, either from text or from a dictionary, only for it to fade from our memory. Explicit, deep, elaborative processing concerning semantic and conceptual/imaginal representations prevents this. Learners can usefully be taught explicit skills in inferencing from context and in memorising the meanings of vocabulary.

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