Evidence from Research on Amnesics: The Implications on Implicit Learning and Second Language Acquisition

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Abstract

In the psychological field, increasing attention has been focused recently on the area of implicit learning. In general terms, the phrase implies learning that is independent of conscious awareness and recollection. More specifically, it refers to the ability to learn incidentally new complex information. To measure this ability, implicit learning tasks have initially been conducted on normal subjects, but lately they have also been investigated from a neuropsychological perspective. It has been shown that amnesic patients who are

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severely impaired in explicit memory tasks (such as recall or recognition) show normal performance in various implicit learning situations. Linguistically, this kind of evidence has been of particular interest to the debate on the nature of second language acquisition. I start with an introduction on the distinction between implicit and explicit memory in (1); data from implicit learning tasks on amnesics is reviewed in (2); what conclusions can be drawn from this data about the nature of implicit learning in (3); the implications on Second Language Acquisition (SLA) in (4). Section (5) is the conclusion.

1. Implicit and Explicit Memory

One important division to be established relevant to implicit learning is that between implicit and explicit memory. Explicit memory is supposedly characterized by a conscious intentional attempt to retrieve a specific event or episode. Implicit

memory, on the other hand, refers to performance on tasks that do not require deliberate recollection of prior experience (e.g. word completion and fragment identification). Conscious awareness plays a major role in this distinction. Amnesics are an intriguing area of research because it has been found that, global amnesia, for example, affects performance on explicit memory tasks, while leaving implicit memory intact. For our purposes in the current discussion, emphasis will be given to evidence from implicit learning tasks.

2. Nature of Evidence: Implicit Learning Tasks:

An examination of the implicit literature reveals a great variety of paradigms. In order to understand the properties of implicit learning tasks, it is useful to consider them in contrast to those that investigate explicit learning. Explicit retrieval tasks (such as recall and recognition) require intentional reference to the episode of the study. Implicit retrieval tasks, on

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the other hand, do not require this intentional access; rather, learning is inferred from a change in behaviour attributed to the study episode.

Although it is obviously not possible to give an exhaustive account of the various tests run on amnesics in such a paper, I shall discuss the evidence from some of the most commonly investigated tasks in the following section.

2.1 Repetition Priming Tasks:[1] Word-Stem Completion

Graf et al (1985) asked amnesics and normal subjects to study a list of words, and then presented them with three-letter stems. Some subjects were asked to complete the stems with any words while others were asked to complete it with a word from

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[1] Repetition priming refers to the change in speed, accuracy, or bias in processing a previously experienced stimulus relative to a current appropriate baseline. Several repetition priming tasks have been conducted on amnesics, where the subjects' memory for material that has been previously experienced is shown, even though they do not consciously remember having recently studied the material. Implicit learning is shown by the subjects responding more rapidly and accurately to repeated stimuli than to new material.

the studied list. It was supposed that the presentation of a word
in the study-list would strengthen the pre-existing letter-to-
word associations in both amnesics and normals. However,
when asked to give only stem completions that were on the
study list, amnesics could not. They also exhibited large
numbers of intrusion errors. It has been suggested that this
result implies that amnesics are unable to monitor or suppress
competing words that the stem cue evokes.

This evidence suggests that reliance on implicit memory
alone does not permit the control (increase or suppression) of
competition influences from other words, an essential skill in
recognition and in production. Mapping a concept onto the
appropriate word requires inhibition of other words competing
to express that concept. It appears that explicit knowledge is
required for such a task.

2.2 Learning Novel Information: The Ability to form Generalizations

On the other hand, evidence opposing this conclusion has also been found. Amnesics have been shown to exhibit equal degrees of priming in the perceptual identification of pseudo-words, as do normal controls. Such results were found for the amnesic patient H.M., who showed normal perceptual priming with pronounceable pseudo-words in an experiment by Keane, Gabrieli, Mapstone, Johnson and Corkin (1995).

Even more interesting is a finding by Keane, Gabrieli, Noland and McNealy (1995), who found normal perceptual priming of orthographically unpronounceable strings of three-to-five consonants in amnesics.

Both these results seem to point to the possibility of achieving a degree of implicit learning.

2.2 Vocabulary Learning: New Information and Pre-existing Knowledge

Hirst, Phelps, Johnson and Volpe (1998) attempting to teach an amnesic a second language also conducted an interesting experiment. The amnesic patient, C.S., was given lessons in French. She demonstrated an unimpaired ability to learn this second language.

This suggests that the recognition and access of already-existing vocabulary can be achieved through implicit processes. (However, generalization is difficult in this case, because C.S. had a previous knowledge of Spanish, English and Italian, so she could have been building on her previous knowledge of these languages)

2.3 Skill Learning: Improvement of Reading Speed

Musen and Squire (1993) presented normal and amnesic subjects with novel compound words such as *gumpark* and jamdirt. A list of such compounds were read during ten study trials and then read again during a final test trial, either as the studied pair or as rearranged pairs (gumdirt, jampark). Compared to reading new words in compounds, the old words in compounds were read faster by both normals and amnesics. Moreover, the reading advantage for old studied pairs over rearranged pairs for amnesics was of equal degree to that of normals.

This type of evidence suggests that implicit learning of novel material could be achieved to a level sufficient to be identified in an implicit test such as reading speed, but only after sufficient repetition.

However, the strongest evidence for the important role of implicit learning comes from artificial grammar experiments.

2.4 Artificial Grammar: Judgement Tasks

In these tasks, amnesics first have to learn letter strings generated by a finite-state grammar. After the study phase, they were informed that the letter strings had been composed on the basis of a complex system of rules. Finally at the test phase, subjects had to classify new letter strings as grammatical depending on whether or not the strings corresponded to the rules. Implicit learning is inferred by the degree to which the amnesics' judgements are influenced by their knowledge of the pattern behind the string. In such an experiment by Meulemans and Van Der Linden (1997), results showed that the amensics could classify grammatical and non-grammatical test strings at an above-chance level although unable to report, sometimes even partially, the rules of the grammar.

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Thus, it appears that subjects manifestly learned something from the task, without being able to report explicitly the rules underlying the grammar, or to account for their performance. This seems to indicate that implicit learning can take the form of implicit knowledge of the pattern or structure underlying an input.

In other artificial grammar learning tasks, learning has been shown to take place even after letter sets or symbol sets are changed, or when stimuli are presented in different sensory modalities. (Berry and Dienes, 1993).

However, the following evidence shows the insufficiency of implicit learning in certain skills, crucial to language acquisition.

2.5 Learning Novel Information: The Inability to form Generalizations

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An important experiment is that of Glisky, Schachter and Tulving (1986) who attempted to show that amnesics could learn new meanings to familiar words. Both amensics and controls were taught certain commands on a computer. Although the amnesics were able to reach the level of the controls (though after much more repetition), when they were asked questions with the same content but differing in form from those they had received during training, they could not respond. It seems that for learning new material, it is essential to be able to form generalizations, and this seems to require the existence of a declarative memory.

2.6 Absence of Novel Semantic Associations

Following a study of unrelated paired nouns in sentences; amnesics and controls were asked to identify single test words quickly flashed sequentially in pairs. The noun pairs in the test were either intact or rearranged from the studied sentences.

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Both amnesics and controls showed repetition priming in identifying individual old words better than new words. However, although normal controls showed clear facilitation in identifying second words followed by the studied first words (compared to rearranged pairs), amnesics showed no such facilitation due to intact pairs. (Paller and Mayes, 1994) That is, they showed little to no associative priming.

This evidence suggests that implicit learning is not sufficient to form novel associative relations between two semantically unrelated words.

2.7 Long -Term Retention of Implicit Memory

One major question in the research arena has always been: Even if amnesics can learn new information, will it be retained over the long term or not? This question is important because if the answer were positive, then it would demonstrate that it might be possible to learn a second language, or aspects of it,

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through implicit learning (given that amnesics have only this capacity available to them, and no explicit learning mechanism).

Studies with amnesic patients have raised intriguing possibilities that patients may be able to consolidate new information into long-memory. Cave and Squire (1992) have demonstrated that their patient exhibited long-term priming over a period of seven days, using pictorial stimuli.

Although this evidence suggests (at the level of perceptual priming at least), that long-term consolidation may occur, it highlights the contribution of explicit memory toward performance in tasks designed solely to stimulate explicit memory.

2.8 Summary of Evidence

The above implicit tests show that there is reasonably preserved implicit memory in amnesic patients, which can lead

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to implicit learning. They show intact repetition priming, lexical decision, word-fragment, or word-stem completion, and category-exemplar generation (other implicit tasks conducted concern enhanced reading speed, picture-fragment completion and semantic priming). In particular they seem to show intact repetition priming. It seems that amnesic patients can have a normal or near normal capacity for implicit learning (through implicit retrieval) of many classes of information, despite profoundly impaired explicit learning.

We shall now try to use the above evidence to define some of the properties that characterize implicit learning.

3. Nature of Implicit Learning

It can be deduced that implicit learning:

(a) Is an inductive, incidental process.

(b) is not a result of constructive hypothesis testing.

(c) Responds to the patterns, or rule structures in the stimuli.

(d) Involves an element of abstraction. (In other words, it depends not only on the superficial features of the learning material. This abstraction process could concern the relation between elements, or the ''rules' governing a system. (artificial grammar task)

(e) Some consolidation into long-term memory does take place, although not much is known about the mechanism underlying this.

4. Implications for Second Language Acquisition

The above evidence (and other similar evidence) from amnesics about the nature of implicit learning, has given rise to speculations about the ability to learn implicitly new complex information, such as a second language. Questions have often been raised on the possibility that people can "absorb" knowledge from the environment without awareness of the learning process.

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On the one hand, the evidence from artificial grammar tasks is very encouraging. The ability of subjects in artificial grammar experiments to understand the regularities that underlie the strings suggests that it is possible for L2 learners to extract knowledge of the rules that govern the surface forms by an implicit system of analysis.

On the other hand, the fact that amnesics were unable to remember explicitly new pairs of associated words implies that acquisition of a new vocabulary is an explicit process.

Likewise, the difficulty they find in developing novel conceptual information, and creating new semantic links, indicates that in acquiring and processing meanings, explicit learning is involved.

In particular, the inability of patients to monitor competition effects from other words during recognition and production (section 2.1) is strong evidence that language

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production requires explicit declarative memory. Most important of all, it seems to require (a) the ability to form generalizations and (b) the ability to associate between different kinds of information. It appears that both these skills have to be performed through explicit learning.

5. Conclusion

Evidence from other experimental studies in SLA has also investigated the possibility of internalising explicitly learned knowledge about certain grammatical structures received through overt explanations and teaching rules into implicit mental representations. For example, it has been found that French learners of English were unable to internalise the explicit knowledge they received about adverb-placement into a mental representation. (Schwartz, B., and Gubabla-Ryzak, M. 1992)

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In order for implicit learning to be regarded as a process that can be applied more extensively to second language acquisition, future research will need to show that monitoring competition effects, forming generalizations and integration of different information can be achieved implicitly without the intervention of consciousness.

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