# The Role of Consciousness in Second Language Learning [1]

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*This paper summarizes recent psychological research and theory on the topic of consciousness and looks at three questions in second language learning related to the role of consciousness in input processing: whether conscious awareness at the level of 'noticing' is necessary for language learning (the subliminal learning issue); whether it is necessary to consciously 'pay attention' in order to learn (the incidental learning issue); and whether learner hypotheses based on input are the result of conscious insight and understanding or an unconscious process of abstraction (the implicit learning issue). I conclude that subliminal language learning is impossible, and that noticing is the necessary and sufficient condition for converting input to intake. Incidental learning, on the other hand, is clearly both possible and effective when the demands of a task focus attention on what is to be learned. Even so, paying attention is probably facilitative, and may be necessary if adult learners are to acquire redundant grammatical features. The implicit learning issue is the most difficult to resolve. There is evidence for it, as well as for a facilitative effect for conscious understanding, but accounting for implicit learning may entail abandonment of the notion of unconscious 'rules' of the type usually assumed in applied linguistics.*

## 1. INTRODUCTION

One of the more controversial issues in applied linguistics concerns the role of conscious and unconscious processes in second language learning. On the one hand, there are many who believe that conscious understanding of the target language system is necessary if learners are to produce correct forms and use them appropriately. In this view, errors are the result of not knowing the rules of the target language, forgetting them, or not paying attention. There is little theoretical support for the most traditional form of this view; no current theory posits the conscious study of grammar as either a necessary or sufficient condition for language learning. However, Bialystok (1978) has provided a theoretical framework that allows a role for conscious knowledge, and Rutherford and Sharwood Smith (1985) have argued that 'consciousness-raising', drawing learners attention to the formal properties of language, facilitates language learning.

Others firmly believe that language learning is essentially unconscious. Seliger has claimed that 'obviously, it is at the unconscious level that language learning takes place' (Seliger 1983: 187). Krashen (1981, 1983, 1985) has elaborated a theory that rests on a distinction between two independent

processes, genuine learning, called 'acquisition', which is subconscious, and conscious 'learning', which is of little use in actual language production and comprehension.[2] Gregg, one of Krashen's harshest critics, who opposes Krashen's claim that 'learning' can never become 'acquisition', agrees that most language learning is unconscious and asks, 'but then, does anybody disagree?' (Gregg 1984: 94).

A third commonly held position is that the issue of consciousness should be avoided altogether in a theory of language acquisition. McLaughlin, Rossman, and McLeod (1983) argue against Krashen's 'learning-acquisition' distinction because it rests on what they consider to be the unsupportable distinction between conscious and unconscious knowledge. In a recent discussion of explicit and implicit knowledge, Odlin recommends divorcing these concepts from the 'notoriously slippery notion of "consciousness"' (Odlin 1986: 138).

While there is no consensus on the role of consciousness in second language learning, it seems to me that the most common attitude towards consciousness is one of skepticism. This may be partly attributable to pre-existing biases. None of us have been isolated from the major intellectual trends of the 20th century, most of which until recently have been hostile to serious consideration of the role of consciousness in behavior.

The most influential arguments against any role for consciousness in behavior and learning were originally put forth by behaviorists, who were committed to elimination of the concept from psychological explanation. The basic behaviorist position is that consciousness is epiphenomenal, playing no causal role in human life.[3] Behaviorists argued at other times that consciousness is a meaningless, prescientific term, a view expressed by some philosophers (Rey 1983), and originated the objection that consciousness cannot be scientifically investigated. Because conscious experience is subjective, external observation is impossible, and introspection is discounted as being 'notoriously' unreliable (Lyons 1986; Nisbett and Wilson 1977; Seliger 1983).

Others have advanced the view that conscious states and processes are simply less significant and less interesting than unconscious phenomena. The views of Freud and Chomsky have been especially influential. Freud's most general claim, that unconscious mental processes are complex and ubiquitous (Freud 1915), is widely accepted and is clearly supported by contemporary research in cognitive psychology (Bowers and Meichenbaum 1984; Kihlstrom 1984). In the second language field, strongly influenced by Chomsky (1965, 1980, 1986), it is virtually an article of faith that what is acquired is an implicit (i.e. unconscious) mental grammar that is most clearly reflected in learner intuitions about sentences, less directly in learner performance, and least directly in learners' conscious beliefs and statements about their use of language (Coppieters 1987; Bialystok and Sharwood Smith 1985; Liceras 1985).

Nevertheless, the time may be right for serious reconsideration of the phenomenon of consciousness and the role it may play in language learning. In psychology, the decline of behaviorism was associated with widespread recognition that consciousness is an important concept for the explanation of

psychological phenomena (Mandler 1975), and consideration of the role of consciousness in cognition and learning has been respectable for the past two decades. The mainstream point of view in current cognitive psychology does not support the position that subjective awareness is epiphenomenal, and it is frequently claimed that learning without awareness is impossible (Brewer 1974; Dawson and Schell 1987; Lewis and Anderson 1985).

The thesis of this article is that the notion of consciousness is useful because it ties together such related concepts as attention, short term memory, control vs. automatic processing, and serial vs. parallel processing. A concept of consciousness is also probably necessary in order to resolve a number of otherwise intractable issues in second language learning. I will claim that conscious processing is a necessary condition for one step in the language learning process, and is facilitative for other aspects of learning.

It is not my purpose to deny the important role of unconscious processes in language comprehension and production. When we read or listen to an utterance in our native language or in a second language in which we are fluent, we become aware of its meaning but are seldom aware of any part of the complex decoding processes that precedes awareness. There is a large body of psycholinguistic evidence supporting the role of such processes and the mental structures on which they operate (Jackendoff 1987), but there is much less research that pertains directly to questions of language *learning*. The approach taken here will be to assume that both conscious and unconscious processes are involved in second language learning, and to assess the contributions of each. In order to do so, we must have a clearer idea than we usually do of what we mean by *conscious* and *unconscious*, together with a number of associated terms. Section 2 deals with definitions, attempting to unravel the various ways in which we might take the question of whether second language learning is conscious or unconscious. Section 3 summarizes some theories of consciousness, and Section 4 examines the evidence related to three questions in second language learning.

## 2. DEFINITIONS: DIMENSIONS AND DEGREES

In everyday language, *consciousness* has several senses and is often used ambiguously. In scientific discussion also, conflicts of opinion are often due as much to terminological vagueness as to substantive disagreement (White 1982). In order to understand the numerous issues related to second language learning, it is necessary to distinguish carefully several senses of the term: consciousness as awareness, consciousness as intention, and consciousness as knowledge.[4]

### 2.1 *Consciousness as awareness*
In both common usage and theoretical treatments of the topic, consciousness is commonly equated with awareness (Battista 1978; Rotner 1987). Many writers on the subject have recognized that there are degrees or levels of awareness (Baruš 1987; Battista 1978; Bowers 1984; James 1890; Lunzer 1979;

Natsoulis 1987; Oakley 1985b; O'Keefe 1985; Tulving 1985). Various levels may be distinguished, but for the purpose of this paper, three are crucial:

*Level 1: Perception*. It is generally believed that all perception implies mental organization and the ability to create internal representations of external events (Oakley 1985b; Baars 1986). However, perceptions are not necessarily conscious, and subliminal perception (discussed in Section 4.1) is possible.

*Level 2: Noticing (focal awareness)*. Bowers (1984) points out the crucial distinction between information that is perceived and information that is noticed. When reading, for example, we are normally aware of (notice) the content of what we are reading, rather than the syntactic peculiarities of the writer's style, the style of type in which the text is set, music playing on a radio in the next room, or background noise outside a window. However, we still perceive these competing stimuli and may pay attention to them if we choose. Perhaps the clearest example of dissociation between perception and noticing is the phenomenon of 'blind-sight' (Bowers 1984; Natsoulis 1982; White 1982), in which patients with damage to the visual cortex are able to discriminate between visual stimuli at above chance levels, but have no awareness of seeing anything at all, suggesting that different parts of the brain are responsible for the detection of stimuli and for consciousness of them (Bowers 1984).

There are a variety of terms for what I am calling noticing, including *focal awareness* (Atkinson and Shiffrin 1968; Kihlstrom 1984), *episodic awareness* (Allport 1979), and *apperceived input* (Gass 1988). What these constructs have in common is that they identify the level at which stimuli are subjectively experienced.

Noticing thus refers to private experience, although noticing can be operationally defined as availability for verbal report, subject to certain conditions. These conditions are discussed at length in the verbal report literature (Ericsson and Simon 1980, 1984; Færch and Kasper 1987), but two are particularly relevant for the present discussion. The lack of a verbal report cannot be taken as evidence of failure to notice unless the report is gathered either concurrently or immediately following the experience. There are also conscious experiences that are inherently difficult to describe. We may notice that someone has a regional accent without being able to describe it phonetically, or notice a difference between two wines without being able to describe the difference. When problems of memory and metalanguage can be avoided, verbal reports can be used to both verify and falsify claims concerning the role of noticing in cognition.

*Level 3: Understanding*. Noticing is the basic sense in which we commonly say that we are aware of something, but does not exhaust the possibilities. Having noticed some aspect of the environment, we can analyze it and compare it to what we have noticed on other occasions. We can reflect on the objects of consciousness and attempt to comprehend their significance, and we can experience insight and understanding. All of this mental activity—what we commonly think of as *thinking*—goes on within consciousness. Problem solving

belongs to this level of consciousness, as do metacognitions (awareness of awareness) of all types.

## 2.2 *Consciousness as intention*

The most common ambiguity in use of the term consciousness is between passive awareness and active intent. When we say that we have done something *consciously*, we often mean that we did it intentionally. We also speak of conscious efforts, attempts, and strategies, referring to the volitional, deliberate nature of the action. Bialystock (1981a) restricts the conscious strategy of 'practice' to deliberate attempts by a learner to increase exposure to the language outside of class, excluding practice in the classroom, over which the learner has little control.

It is important to maintain the distinction between consciousness as awareness and consciousness as intentional behavior, because the two are often dissociated. Intentions may be either conscious or unconscious (Baars 1985), and we often become aware of things we do not intend to notice.

## 2.3 *Consciousness as knowledge*

White (1982) points out the common assumption that to know something is to be conscious of it. White argues that experiential consciousness and knowledge are not at all the same thing. White also warns that the contrast between conscious and unconscious knowledge is conceptually unclear when different authors are compared, since the ambiguities of consciousness are combined with those of *knowledge*—equally difficult in psychological terms.

It is unfortunate that most discussion of the role of consciousness in language has focused on distinctions between conscious and unconscious knowledge, because the confusion warned against by White is readily apparent. Chomsky discusses the distinction in terms of the following sentences:

1 John is too stubborn to talk to him.
2 John is too stubborn to talk to.

According to Chomsky (1986: 263–73), native speakers of English know, consciously, that *John* is the subject of *talk* in 1 but not in 2 and that *him* in 1 may not refer to John. In Chomsky's current theory, these facts about English are a reflection of much more fundamental principles of universal grammar, which are unconscious. Chomsky suggests that they are *cognized* rather than known, relating cognization to *implicit* as opposed to *explicit* knowledge, terms already in widespread use.

The distinction made by Chomsky in this case is very different from the ways in which the terms explicit and implicit are used in the second language field. Chomsky's example has to do with whether facts about the language can be confirmed through introspection, whereas the distinction in second language research is usually based on whether a learner is able to articulate a rule of the language (Bialystok 1978, 1979, 1981b; Gregg 1984; Krashen 1979, 1981; Odlin 1986; Sharwood Smith 1981). In addition, the explicit/implicit contrast

surely represents a continuum (Bialystok and Bouchard Ryan 1985; Karmiloff-Smith 1986). Whatever point on the continuum is considered to differentiate implicit from explicit knowledge will largely determine the extent to which second language knowledge is said to be conscious or unconscious, but a careful reading of the second language literature indicates no consensus on where the line is to be drawn (see Odlin 1986 for review).

Another common distinction between knowledge types is between declarative knowledge (knowledge of facts) and procedural knowledge (knowledge 'how'), used to perform cognitive skills (Bialystok and Bouchard Ryan 1985; Sharwood Smith 1981; Sorace 1985). Some authors theorize that all procedural knowledge develops from declarative knowledge and requires awareness in the early stages (Anderson 1982), while others do not (Lewicki *et al.* 1987; Reber *et al.* 1985). Bialystok and Bouchard Ryan (1985) and Bialystok and Sharwood Smith (1985) consider the two dimensions to be independent: declarative knowledge develops along a continuum from unanalyzed to analyzed, whereas procedural knowledge varies along a continuum from controlled to automatic.

For many, the ambiguities of 'conscious' and 'unconscious' mean that other terms are preferred, but the available technical terms are not necessarily more precisely defined.[5] While these ambiguities cannot always be avoided, it should now be clear that whether second language learning is conscious or unconscious is not one question, but may reflect several different contrasts:

(1)  Learning is sometimes said to be unconscious when the learner is not aware of having learned something. This is an interesting notion, based on the concept of reflexive self-consciousness, but not one on which there has been much research.[6]

(2)  The conscious/unconscious learning contrast may refer to awareness at the level of noticing. In this sense, unconscious learning means 'picking up' stretches of speech without ever noticing them. This is a crucial issue, which I will refer to as the subliminal learning question: is it possible to learn aspects of a second language that are not consciously noticed?

(3)  Conscious and unconscious learning may be distinguished on the basis of intention and effort. This is the incidental learning question: if noticing is required, is such noticing automatic or must learners consciously pay attention?

(4)  The contrast may also be made with reference to awareness at the level of understanding. In this sense, unconscious learning means the unconscious induction of principles, rules, or algorithms, whereas conscious learning means the establishment of such principles based on insight. This is the issue of implicit learning: can second language learners acquire rules without any conscious understanding of them?

(5)  Conscious learning may also be taken to refer to intentions at a more global level, learning according to a deliberate plan involving study and other intentional learning strategies. Unconscious learning, by contrast, may be seen

as an unintended by-product of communicative interaction. Of course, such learning might still involve noticing and understanding.

(6) Finally, conscious learning may be referred to the issue of conscious knowledge; can learners say what they appear to 'know'? This might be called the articulate report question.

While most discussion in the second language literature deals with the last two of these questions, the remainder of this article will be concerned primarily with the basic issues of subliminal, incidental, and implicit learning.

## 3. THEORIES OF CONSCIOUSNESS
There is no theory that is uncontroversial, but almost all theories of consciousness attempt to explain what I have called noticing and the systems that give rise to it.

### 3.1 Consciousness in information processing theories
The basic postulate of information processing theories is that humans are limited capacity processors of information (McLaughlin *et al*. 1983; Posner and Klein 1973). The notion of consciousness in information processing theories is associated in one way or another with this notion of a limited capacity system. There are three main variants on this general theme: consciousness is identified with the contents of a limited capacity memory system, with a limited capacity information selection system, or with a limited capacity central executive.

The notion of consciousness as a limited capacity memory system is explicit in a number of models that attempt to define input processing in terms of a series of different storage structures. A composite representation of such a system is presented in Figure 1.
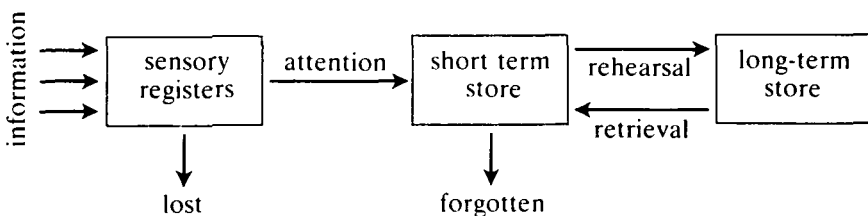


Figure 1: Consciousness in a multistore model of memory (after Kihlstrom 1984)

Most multistore theories of memory specify three components: a bank of buffer stores or sensory registers that accept information from different modalities for analysis by a variety of (unconscious) pre-attentive processes; a crucial second component, variously known as primary memory (Waugh and Norman 1965), short term store (Atkinson and Shiffrin 1968) or working memory (Baddeley 1986); and a final store, secondary or long term memory.[7]

There are numerous multistore models of memory, with important differences among them, so that Figure 1 oversimplifies the picture in many ways. However, there are two points shared by these models that are relevant for the present discussion. First is the identification of short term memory with consciousness. Kihlstrom (1984) suggests that in most multistore models, the terms *consciousness*, *focal awareness*, and *short term store* may be taken as essentially equivalent. A second point of agreement among these models is the claim that processing in short term memory is necessary for permanent storage. Anything that is not processed into short term memory is 'forever consigned to oblivion' (Kihlstrom 1984: 165). Once in short term memory, information that is not further encoded into long term memory is also lost. If consciousness is indeed equivalent to the short term store, this amounts to a claim that storage without conscious awareness is impossible.

Other information processing models relate consciousness to attention, the control process that transfers information into focal awareness. Attention is often viewed as a switchboard, gate, or filter that prevents us from being overwhelmed by the complexity of input (Broadbent 1982; Posner and Klein 1973; Posner and Snyder 1975; Kahneman and Treisman 1984). Other theories describe attention as a limited resource (Wickens 1984), sometimes identified with effort (Kahneman 1973) or psychic energy (Csikszentmihalyi 1978; Tart 1975). Other metaphors are spatial; the idea of a limited 'span' of attention suggests something close to the concept of working memory (Anderson 1985).

The concept of attention as a resource leads to a distinction between two modes of information processing, based on the degree to which two tasks can be performed concurrently (Wickens 1984). Tasks that rely on automatic processes do not require attention and can operate in parallel. Control processing, associated with novice behavior, cannot be carried out concurrently with other demanding tasks. Most theories assume that skilled behaviors begin as controlled processes and gradually become automatic through practice.

There are many issues in the field of attention which are relevant to a theory of the role of consciousness in learning (Parasuraman and Davies 1984), but for the present discussion it is important to know the degree to which control processing is identified with consciousness. If such an identification is justified, what do theories of attention say about the relationships among attention, controlled processes, and learning?

Most models of control and automatic processing clearly identify control with consciousness. Posner and Snyder (1975: 82), for example, contrast 'automatic activation processes which are solely the result of past learning' with 'processes which are under current conscious control'. On the other hand, the influential model of Shiffrin and Schneider (1977) is equivocal on this point. As for the relationship between attention and learning, control processing is also identified with learning, not only because the transition from control to automatic processing is in itself a form of learning, but also because storage in long-term memory seems to require control processing (Fisk and

Schneider 1984; Shiffrin and Schneider 1977; Schneider, Dumais, and Shiffrin 1984).

Finally, some information processing theories see consciousnes as an internal programmer or executive control center (Carr 1979; Norman and Shallice 1988; Reason 1984; Shallice 1978). What is limited is the capacity to coordinate mental activity. Norman and Shallice (1986) identify consciousness with a supervisory attentional system that is called on when planning is called for or at critical decision points.

## 3.2  A global workspace theory

In general, information processing approaches stress the importance of awareness, although those that emphasize automatic processing imply that a great deal of mental life functions independently of consciousness (Hasher and Zacks 1984). This point of view has been developed much further by Baars (1983, 1985, 1986, 1988), whose theory of consciousness is exemplified in Figure 2.
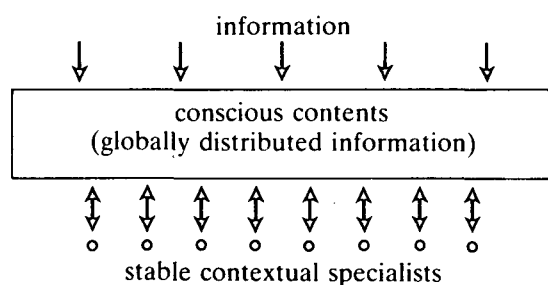


*Figure 2: Consciousness as a central information exchange (after Baars 1983)*

The central ideas of Baars's theory are those of distributed information processing, in which control is distributed among a large number of specialized processors and a global workspace or central information exchange. The best metaphor for consciousness, according to Baars, is not a powerful executive, but a broadcasting station that accepts input from various sources and provides information to a large number of viewers. Conscious experience results when interaction between an input pattern and unconscious contextual constraints results in a coherent and stable representation that is then displayed to any processor that can make use of it (Baars 1983: 72).

The theory of consciousness proposed by Baars incorporates many ·of the notions contained in other theories, and is similar to a neural theory of mind proposed by O'Keefe (1985).[8] Baars's model also has numerous similarities to Fodor's (1983) theory of modular input systems. The major difference between the two theories lies in Fodor's claim that input systems are innately specified,

which appears to rule out all aspects of particular languages that are not innate (a question Fodor never directly addresses). Baars's specialized processors include those that have been learned, and can accommodate both native and second language processing systems. In fact, a global data base operating in conjunction with specialized processors may be an ideal learning device, since the entire configuration can be used to develop new processing systems. A crucial element in Baars's most recent version of his theory is his emphasis on the point that conscious experience is always informative, and that conscious events trigger adaptive processing in the nervous system. Learning begins with the realization that something is to be learned, progresses through a series of stages that establish a context for understanding new material, and concludes with the new material fading out of consciousness as it becomes itself a part of the unconscious context that shapes the interpretation of future events (Baars 1988).

In sum, theoretical approaches to the understanding of consciousness have associated consciousness with such varied constructs as working memory, attention, control processing, and information exchange between otherwise autonomous processors. At the same time, all of these theories are in several senses talking about *roughly* the same thing. All identify consciousness with on-line phenomenological awareness. And all are compatible with the view that consciousness separates mental life into two fairly distinct spheres (Baars 1988; Carr 1979; Gardner 1985; Norman 1986; Schneider 1985). Unconscious processes, attributed to specialized systems operating in parallel, are not limited by short term memory capacity. They are not under voluntary control and are difficult to modify, but are fast, efficient, and accurate, and are responsible for skilled performance and most details of cognitive processing. Consciousness is the experiential manifestation of a limited capacity central processor, and is therefore slow, inefficient, mostly serial, and effortful. However, conscious processing is partially subject to deliberate control, and can be used for setting goals and for troubleshooting. Finally, all theories of consciousness specify a crucial role for consciousness in dealing with novel information, novice behavior, and learning.

## 4. CONSCIOUSNESS AND SECOND LANGUAGE LEARNING

The remainder of this article is limited to discussion of the role of consciousness in second language learning based on input processing, both for reasons of space and because it can be argued that consciousness is primarily associated with the input side of the nervous system (Baars 1988). Three issues are to be discussed: (1) the process through which input becomes intake, related to the issues of noticing and subliminal perception; (2) the degree to which the learner consciously controls the process of intake, the incidental learning question; and (3) the role of conscious understanding in hypothesis formation, the issue of implicit learning.

One result of this focus on input is that I will have little to say about important issues related to the role of consciousness in second language production:

whether conscious grammatical knowledge can be used to initiate utterances, the role of monitoring in a more general sense, the deployment of consciousness in conversation and narrative (Chafe 1980), and the role of planning in inter-language production (Crookes 1988). The arguments presented here are also limited to adult language learning, because virtually all the research I will cite is based on adult learning, and I offer only a few brief comments on the status of my arguments with regard to child L1 or L2 learning.

## 4.1 Intake, noticing, and subliminal perception

... the only linguistic material that can figure in language-making are stretches of speech that attract the child's attention to a sufficient degree to be noticed and held in memory. (Slobin 1985: 1164)

While the concept of intake is crucial to second language learning theory, there is no consensus on the definition of intake. Krashen apparently considers intake synonymous with comprehensible input, simply 'that subset of linguistic input that helps the acquirer acquire language' (Krashen 1981: 102), an external variable. This is quite different from Corder's original definition of intake:

... input is 'what goes in' not what is *available* for going in, and we may reasonably suppose that it is the learner who controls this input, or more properly his intake. This may well be determined by the characteristics of his language acquisition mechanism ... (Corder 1967: 165)

Corder's definition is not totally satisfactory either, since he manages to contradict himself within two sentences, suggesting that the learner controls intake and does not control intake (the acquisition mechanism does). In addition, a satisfactory treatment of intake needs to take into consideration the fact that it is unlikely that all input used in the comprehension of message meaning also functions as intake for the learning of form (Sharwood Smith 1986: Gass 1988; Færch and Kasper 1986; Van Patten 1985, 1987). Slobin (1985) also recommends distinguishing between the processes involved in converting speech input into stored data that can be used for the construction of language, what Chaudron (1985) calls preliminary intake, from those used to organize stored data into linguistic systems, what Chaudron calls final intake.

This section concerns preliminary intake, for which I propose the following hypothesis: intake is that part of the input that the learner notices.

At this stage of my argument it makes no difference whether the learner notices a linguistic form in input because he or she was deliberately attending to form, or purely inadvertently. If noticed, it becomes intake. It should also be clear that I would object to any attempt to modify the claim in the direction of 'subconscious noticing'. Within the conceptual framework outlined here, that expression is oxymoronic, unless it means spontaneous noticing, again referring to incidental learning.

There is almost a complete lack of evidence in the second language literature which is directly relevant to the hypothesis, since second language researchers

have never asked learners to provide systematic information on what they notice while learning languages that could be compared to what they can be shown (by other measures) to have learned. The only data I am aware of comes from a study I have published with Sylvia Frota (Schmidt and Frota 1986) analyzing my own acquisition of Brazilian Portuguese. Several years ago, I spent five months in Brazil. Shortly after arrival, I took a five week course (50 hours) in Portuguese, but for the remainder of the time depended on learning through interaction with native speakers. I kept a journal, and arranged to be tape recorded in conversation at approximately one month intervals. Frota analyzed the tapes for various aspects of my acquisition of Portuguese, after which we compared the data from the two sources, my subjective comments on what I thought I was learning and the verified record of the taped conversations. We also looked in my class notes and texts to see what I had been taught, and transcribed my interlocuter's speech on the tapes as a sample of input.

We found a remarkable correspondence between my reports of what I had noticed when Brazilians talked to me and the linguistic forms I used myself. We compared my performance on 21 verbal constructions, 14 of which I had been explicitly taught. We found (not unexpectedly) that the fact that a particular verb form had been taught did not guarantee that it would appear in my output. We next looked at the speech of my interlocuter, to determine the frequency of these verbs in input (or at least the sample available to us). Forms that never appeared in the input did not appear in my speech, and those that were frequent in input were more likely to show up in my production than those that occurred in input only a few times. However, presence and frequency in input did not account for the whole story, and there were verb forms that appeared in input that I never produced. A search of the diary notes indicated that the forms that I produced were those that I noticed people saying to me. They were found in my diary, minimally in the form of things said to me that I wrote down, and usually with more extensive comments.

There were numerous other cases (discussed at length in Schmidt and Frota 1986) in which it was possible to match the emergence of new forms and constructions in Portuguese on tape with comments in my journal, and to identify the apparent source of innovation as something very specific that someone had said to me that had caught my attention, such as the following example:

Journal entry, Week 21 . . . I'm suddenly hearing things I never heard before, including things mentioned in class. Way back in the beginning, when we learned question words, we were told that there are alternate short and long forms like *o que* and *o que é que*, *quem* or *quem é que*. I have never heard the long forms, ever, and concluded that they were just another classroom fiction. But today, just before we left Cabo Frio, M said something to me that I didn't catch right away. It sounded like French *que'est-ce que c'est*, only much abbreviated, approximately [kekse], which must be *(o) que (é) que (vo)cê* . . .

Journal entry, Week 22. I just said to N *o que é que você quer*, but quickly: [kekseker]. Previously, I would have said just *o que*. N didn't blink, so I guess I got it right . . .

In this particular case, it is very clear that these forms had been present in comprehensible input all along. *É que* variants of question words were used by my interlocuter on all the conversational tapes; 43 percent of all question words on the first tape are of this type. I heard them and processed them for meaning from the beginning, but did not notice the form for five months. When I finally did notice the form, I began to use it.

The Schmidt and Frota study provides strong evidence for a close connection between noticing and emergence in production. However, the study does not show that noticing is sufficient for learning. There are cases in which my interlocuter used a particular grammatical form in a question on tape and I repeated it in my answer, suggesting that I noticed its use momentarily, but never used it again. In such cases, a plausible suggestion is that I did not process the form sufficiently deeply to ensure retention (Craik and Lockhart 1972). The study does not conclusively demonstrate that noticing is necessary for intake, either. Of the 21 verbal constructions that we looked at, there was one, the conditional, that I produced occasionally and that is never mentioned in my diary. It was present in input, and I suspect that I did notice it, but either did not remember it long enough to write it down or just had no particular reason to record such an utterance.

Because of memory constraints, failure to report retrospectively that something has been noticed does not demonstrate that the event was not registered in conscious awareness at the time of the event (Ericsson and Simon 1980; White 1980). Therefore, the primary evidence for the claim that noticing is a necessary condition for storage comes from studies in which the focus of attention is experimentally controlled.

The basic finding, that memory requires attention and awareness, was established at the very beginning of research within the information processing model. In shadowing tasks, in which a subject repeats word for word (shadows) the information to one ear, people are very good at focusing attention on one channel, and the information presented to the unattended channel is simply lost (Cherry 1953; Kahneman and Treisman 1984). However, recall for unattended information is good if shadowing is discontinued immediately after a target item is presented. This suggests that unattended material makes it into short term memory, but since there is no opportunity to selectively attend and notice, it cannot be processed into long term memory (Bowers 1984).

The common belief that everything impinging upon the senses is preserved somewhere in memory is probably unwarranted folk psychology, but this is not to say that information that is not noticed is not processed, since there needs to be a great deal of pre-perceptual processing before any stimulus can be noticed. In addition, there have been numerous experiments indicating that unattended stimuli can influence behavior. Corteen and Wood (1972) showed that shock-associated words presented to the unattended channel could elicit galvanic skin responses. Marcel (1983) has shown that subliminally presented words that the subject does not 'see' can prime semantic associates. Eich (1984) has reported experiments in which pairs of words were both presented to the unattended

channel, one of which was ambiguous (for example, *fair* or *fare*) while the other biased its less common interpretation (for example, *taxi*). Recognition of both members of the pairs was poor, but in a spelling test, subjects were biased in the direction of the disambiguated meaning.

Such experiments demonstrate the reality of subliminal perception (Ceci and Howe 1982; Dixon 1971, 1981; Kahneman and Treisman 1984), but they do not demonstrate subliminal *learning*. Experiments demonstrating subliminal processing use stimuli that are already well known: native language words, letters of the alphabet, and so on. Reviewing a great number of such studies, Ericsson and Simon (1984), and Underwood (1976, 1982b), have concluded that all such effects involve the activation of existing memory structures, not the creation of new ones. Familiar stimuli may be processed subliminally, because habitual encodings are automatic and do not depend on limited capacity, but unfamiliar stimuli cannot.

While a few researchers have claimed that subliminal learning has been demonstrated in recent experiments, these claims are not convincing, since in all such cases the experimental design makes it impossible to separate what was not noticed from what may have been noticed but quickly forgotten due to the competing demands of the experimental task.[9] The existing data are compatible with a very strong hypothesis: you can't learn a foreign language (or anything else, for that matter) through subliminal perception.

## 4.2  Incidental learning vs. paying attention

The transition from the initial state to the steady state takes place in a determinate fashion, with no conscious attention or choice. (Chomsky 1986: 51)

If noticing is required in order to learn language form, the question then arises of how noticing takes place (Crookes 1988). Put another way, what (or who) controls what is noticed? Is conscious effort necessary?

Chomsky's rejection of any role for conscious attention or choice in first language learning rests on the assumption of uniform and complete learning by all children. This argument cannot be made for second language learning, but arguments from determinacy in another form, the existence of natural orders and developmental sequences, may be seen by some as eliminating any role for learner controlled attention in second language learning. White (1987) argues that the second language learner's internal grammar defines what becomes intake, and that 'learners are able unconsciously to focus on input relevant to i+1' (White 1987: 96).[10]

It seems to me that natural orders and acquisition sequences do not pose a serious challenge to my claim of the importance of noticing in language learning, and that they constrain, but do not eliminate the possibility of a role for selective, voluntary attention. It is important to know whether the principles that explain orders and sequences are purely formal and independent of those that determine what learners notice, or whether they are part of the same story. There are grounds for supposing that availability for noticing and stages of L2

development are closely related, and that formal linguistic considerations provide·part of the explanation but by no means all of it:

(1) Expectations are generally recognized in the psychological literature as important determinants of perceptibility and noticeability, facilitating the activation of particular psychological pathways (Kahneman and Treisman 1984). On the other hand, writers since William James (1890) have noted that *unexpected* events often capture our attention. The best theoretical resolution of this is provided by Baars (1983), who proposes that events remain unconscious if they are either uninterpretable in the current context or so stable as to be part of the context.

For second language learning, innate universals and expectancies based on both the native and target language may all act as unconscious contextual constraints on what is noticed. It also seems plausible that instruction may have a priming effect, increasing the likelihood of noticing features in input through the establishment of expectations.

(2) Frequency, which (*ceteris paribus*) increases the likelihood of an item being noticed in input, has been claimed to predict the order of acquisition of English morphemes in L2 development by Larsen-Freeman (1976).

(3) Perceptual salience is cited as a basic determinate of L1 acquisition by Slobin, who reports that children have particular difficulty with grammatical morphemes that are bound, contracted, asyllabic, unstressed, or varying in form (Slobin 1985: 1164). In Schmidt and Frota (1986), we observed that a number of the forms I noticed late were phonologically reduced, and some were thus rendered homophonous with other morphemes. Henrichsen (1984) has shown that phonologically reduced morphemes that are ambiguous (for example, *who'd* as *who had*, *who did* or *who would*) are especially troublesome to ESL learners.

(4) Skill level, including the automaticity of processing ability may be a factor influencing noticeability. Mandler (1979) proposes that the acquisition of a new syntactic structure in L1 development depends on the routinization of previous structures. Kihlstrom (1984) suggests that another relevant factor may be an individual's acquired skill at dividing attention between competing tasks, as may be the case for 'super-monitors' who appear to have little difficulty attending to both grammatical form and communicative meaning in second language processing.

(5) Task demands are a powerful determinant of what is noticed (Ericsson and Simon 1984; Kahneman 1973; Kilhstrom 1984), and provide one of the basic arguments that what is learned is what is noticed. Ericsson and Simon report that an extensive literature on tasks supports the conclusion that the information committed to memory is essentially the information that must be heeded in order to carry out a task (Ericsson and Simon 1984: 118). In such cases, it really does not matter whether someone intends to learn or not; what matters is how the task forces the material to be processed (Anderson 1985).

Van Patten (1985, 1987) has argued that second language learners must focus on meaning when attending to language input, so they can acquire forms only when processing for meaning is automatic and freed resources can be devoted to communicatively less informative aspects of input. Taking a functional view, Sato (1986) does not draw so sharp a distinction between content and grammatical form, but suggests that conversational interaction (as a particular task type) makes some function-to-form and form-to-function mappings more salient than others.

It is clear, therefore, that language learners are not free to notice whatever they want whenever they want and that a number of factors influence notice-ability. Still, learners do have some leeway. Studies in selective listening, such as the shadowing experiments, show that it is possible to direct attention voluntar-ily to one source of information, while ignoring another. Hulstijn and Hulstijn (1984) have shown that it is possible for language learners to allocate their attention to either information content or linguistic form in production, and a recent study by Van Patten (1987) deals with attention to form vs. content in input processing.

Attention theorists have typically included such concepts as intentions (specific and temporary) and dispositions (more global and enduring) within 'attentional policy' (Kahneman 1973; Kilhstrom 1984). In Schmidt and Frota (1986) we claimed that those who notice most learn most, and it may be that those who notice most are those who pay attention most, as a general disposition or on particular occasions. It is possible that selective attention may relate to some grammatical features and not others. Pienemann and Johnston (1987) propose that developmental features can be explained by speech processing demands, whereas what they call 'variable features' are subject to the voluntary allocation of processing resources. It is also possible that various affective factors may be involved, but there is reason to be cautious about their role. There may be an important distinction between factors like concern for accuracy (Purcell and Suter 1980), which can be directly linked to attention to form, and things like attitudes towards native speakers, which cannot (Kaplan and Shand 1984).

Finally, a word about children. It is commonly observed that children learn the rules of grammar as a by-product of trying to communicate (McLaughlin et al. 1983), and just as commonly noted that adults may fail to learn grammar through communicative interaction (Schmidt 1983). Yet adults are not incapable of incidental learning (see point 5 above). One possibility is that children and adults alike can learn incidentally (without trying) when task demands force attention on specific information, but that children notice such information even when the task does not require such noticing. There is some evidence in support of this interpretation from studies of the development of metacognition in children. A series of studies reported by Miller (1985) used an incidental learning task[11] in which a child views a row of cards, each of which has a drawing of an animal and a household object. The child's task is to remember the locations of the animals. After several trials, the child is unexpectedly asked

to try to match up each animal with the household object that appeared with it on the card. With increasing age, the recall of the locations of the animals improves, showing an increase in the ability to selectively attend. The ability to remember the animal-object pairings stays the same or decreases slightly with age until age 13, when it begins a decline that continues for several years.

Ceci and Howe (1982) report a number of other experiments in support of the hypothesis that the major change from child to adult consciousness is a shift from a passive mode that includes an open awareness of the environment, to a more controlled mode that includes the strategic allocation of attention. It is intriguing to note that the age range during which this shift takes place approximates to the sensitive period for language acquisition. If developmental cognitive changes of this sort are irreversible, we would predict incomplete acquisition of form by adults to the extent that they do not deliberately attend to form, especially for redundant and communicatively less important grammatical features. Because children have less control over the spotlight of attention, they may not be able to avoid noticing these communicatively less important grammatical features, and in that sense may acquire grammar unconsciously.

### 4.3 *Implicit learning vs. learning based on understanding*
Language learning involves more than reproducing from memory what one has noticed and locally understood on particular occasions. Once learners have taken in some part of the input, something goes on in the learner's mind that goes beyond the data presented, a process variously described as generalization from instances, hypothesis formation, or the induction of linguistic rules. The crucial question is whether such learning depends on unconscious processes of induction and abstraction, or whether learning languages requires insight and understanding.

From the perspective of generative linguistic theory, especially its more recent variants, it is difficult to see how conscious understanding could play an important role in this process. Language learners are often said to be engaged in the sophisticated enterprise of constructing a theory of the language they are learning, starting with certain innate assumptions about the abstract representation of language, looking for certain crucial data, and adding, deleting, and reorganizing rules also requiring reference to abstract structures (Hyams 1986; White 1987). Since there is no evidence that learners are consciously engaged in such an abstract enterprise, it is assumed that such reasoning goes on unconsciously, in an inaccessible code (Karmiloff-Smith 1986).[12]

A very different point of view has been advanced by a number of cognitive psychologists, who argue that there is no learning without awareness. This argument is typically presented as a refutation of the behaviorist's claim that both classical and operant conditioning are established without the mediation of conscious awareness. The most thorough review of the literature is that of Brewer (1974), who culled from several thousand experiments in the behaviorist literature (most of which assumed that subjects were unaware)

approximately two hundred that attempted to assess subject awareness. Brewer identified a number of paradigms that bear on the question of whether human subjects make automatic, unconscious responses, or develop conscious hypotheses and expectations about an experiment. The experiments reviewed by Brewer supported the predictions of a cognitive theory emphasizing the role of understanding: aware subjects conditioned; unaware subjects did not. Dawson and Schell (1987) have reviewed more recent studies in classical conditioning, and Ericsson and Simon (1984) have discussed other studies that claim learning without awareness, coming to the same conclusion: adult humans do not learn without awareness.[13]

Still, many psychologists continue to have reservations (Hayes and Broadbent 1988; Lewicki, Czyzewska, and Hoffman 1987; Nissen and Bullemer 1987), and experiments designed to test the role of awareness in learning often produce inconclusive results. The controversy between Reber and Dulany illustrates this best. Reber and his colleagues (Reber 1976; Reber et al. 1980) exposed subjects to strings of letters generated by a miniature artificial grammar. Subjects acquired the ability to make accurate judgements about the well-formedness of novel strings, but were unable to articulate the rules of well-formedness. Reber concluded that implicit learning is a natural product of attending to structured stimuli, and that the resulting knowledge is encoded in the form of unconscious abstract representations. Dulany, Carlson, and Dewey (1984) replicated these experiments, and then asked subjects to explain the reasons for each decision. They concluded that subjects had acquired personal sets of conscious rules, each of limited scope, and that these rules predicted the judgments of grammaticality on novel test strings. In subsequent publications (Reber, Allen, and Regan 1985; Dulany, Carlson, and Dewey 1985) each party has found the other's methodology faulty and their argumentation unconvincing.

There is not much evidence on which to base an evaluation of the question of implicit rule acquisition in second language learning. There is evidence that giving learners explicit rules helped in an experimental study (van Baalen 1983), and the results of larger scale studies also slightly favor an explicit focus on grammar (Chaudron 1988). At the most general level, studies of the global role of instruction in second language learning indicate that it is facilitative, but such studies do not say whether such effects are due to increased learner understanding as a result of instruction, or increased salience of forms leading to awareness only at the level of noticing.

Only a few studies have compared the performance of aware and unaware second language learners. Seliger (1979) tested monolingual and bilingual children, and adult ESL learners for their use of the a/an allomorphs of the indefinite article and their ability to verbalize the rule underlying their performance. Seliger found no relationship between performance on the task and having a rule. Hulstijn and Hulstijn (1984) assessed second language learners' awareness of the two Dutch word order rules, and found that learners with explicit knowledge had significantly higher performance scores, but that

learners who were unable to formulate the rules performed at better than chance levels on one of the two structures tested. In a similar study, Grigg (1986) compared ESL learners' performance with their ability to state the rules for three structures, plural -s, article, and relative pronoun markers, and found partial support for the hypothesis that rule knowledge would have no effect on performance. Each of these studies was designed to investigate whether consciously known linguistic rules play a role in language production, rather than the degree to which insight may be involved at the point of learning. They are not direct tests of whether language learning requires awareness in the process of learning.[14]

We have even less evidence based on the more powerful design of comparing individual learners' particular hypotheses with their own performance, although there is anecodatal evidence that what learners do can sometimes be explained by what they understand the rules of the target language to be (Johnston 1987; Sorace 1985). Schmidt and Frota (1986) constitutes the most thorough investigation of the relationship between understanding and learning using this design, since we were able to match my understanding of target language forms with what I did at particular points in time. In general, that study supports the hypothesis that improvement in second language performance follows on the heels of understanding. We report numerous cases in which understanding led to correct production and misunderstanding was reflected in deviant performance.

There are some mysterious cases in our data, however. The most interesting concerns the choice of aspect for past tense verbs. In Portuguese, any past tense verb may appear in either perfect or imperfect aspect. I believed that I used two rules of thumb for aspectual choice—use imperfect for *used to* and for making excuses—but these principles account for very few of my uses of the imperfect in the data. I was told some more complex rules for aspectual choice in class, but decided to ignore them, and did not even write them down.

Because I had no principled basis for aspect choice, I was surprised to find that I performed reasonably well, with better than 80 percent accuracy on all taped conversations. A possible conclusion, one that most second language researchers would not hesitate to make, is that I had acquired considerable unconscious knowledge of a complex system. However, a closer look at the data indicates that this overstates the case.

Frota and I looked at the distribution of particular verbs in my production, and found that in almost all cases I used particular verbs consistently in only one aspect. While I was unaware that I used a lexical strategy for aspect, that does not make a case for learning without awareness. But why a particular aspect for each verb? We found that the inherent lexical semantics of individual verbs could explain my choices. I used inherently stative verbs in the imperfect, and nonstatives (especially punctual verbs) in the perfect. But we also found a high correlation with input frequency, suggesting that I may have produced just those forms that I noticed on particular occasions.[15] In the final analysis, it is not possible to choose between this rather prosaic explanation and the loftier assumption of an unconscious semantic preference.[16]

The best example of implicit language learning that I can find in the literature concerns French gender. According to Tucker, Lambert, and Rigault (1977), native speakers of French are unable to describe the basis for their gender classifications, and are not aware that French gender is variably predictable on the basis of the phonological ending of the noun; for example, all words ending in -ation are feminine, whereas those ending in -oire are almost evenly distributed between masculine and feminine. Tucker, Lambert, and Rigaud also found that when native speakers assigned gender to rarely occurring and invented nouns, there was remarkable agreement between the distribution of judgments and what would be predicted on the basis of frequencies of masculine and feminine nouns with the same endings in the *Petit Larousse*. Tucker *et al*. also found evidence for the facilitative effect of explicit knowledge in a classroom experiment in which they provided second language learners with information on the regularities of gender assignment.

Tucker, Lambert, and Rigaud report that grammar books for French children contain no clues that gender is predictable by phonological shape, so how do they learn the rules? It is possible that French speakers are aware of regularities at some point and later do not remember the stages they passed through while acquiring the language. It is also possible that, having noticed a large number of examples in input, learners might have unconsciously abstracted from the data a set of implicit rules. A third possibility is that learners accumulate a storehouse of related forms in memory, but never appreciate the significance of noun endings for gender and never do make an inductive leap to abstract rules, either consciously or unconsciously.

Connectionist theories of information processing such as parallel distributed processing (Rumelhart and McClelland 1986), suggest this last idea. The central claims of PDP are that information exchange occurs through the inter-actions of a large number of simple units within neural networks, and that learning takes place through the strengthening and weakening of interconnec-tions in response to the frequency of examples encountered in input. The result of such learning is a network of units that acts *as if* it knew the rules, but the rules themselves exist only as association strengths distributed across an entire network. They are not explicitly represented in the system as abstract principles, and do not guide or control lower level processes. A PDP explanation of French gender assignment would be that speakers assign gender under simultaneous pressure from all gender/stem pairs in memory, with each pair given an associa-tion strength based on experience.

In one sense, it does not matter whether one posits unconscious rules or a network of examples exerting their respective associative weights; the output is the same and is based on unconscious knowledge in both cases. However, connectionist models are appealing, because they are consistent with the developing view that there is a qualitative difference between conscious and unconscious thought processes. In this view, only conscious processing is associated with problem solving through sequential reasoning and the abstraction of generalizations from data (Norman 1986). On the other hand, the

processing of frequency information and the resolution of probabilistic constraints are often considered to be particular strengths of unconscious mind (Hayes and Broadbent 1988; Hasher and Zacks 1984).

## 5. CONCLUSIONS

I have claimed that subliminal language learning is impossible, and that intake is what learners consciously notice. This requirement of noticing is meant to apply equally to all aspects of language (lexicon, phonology, grammatical form, pragmatics), and can be incorporated into many different theories of second language acquisition. Theories of parameter setting in second language learning, for example, can easily incorporate the suggestion that whenever 'triggers' are required to set parameters, these must be consciously noticed. (Whether one such trigger can result in a cascade of related syntactic changes is a variant of the implicit learning question.)

What learners notice is constrained by a number of factors, but incidental learning is certainly possible when task demands focus attention on relevant features of the input. This suggests a fruitful area of research for those who are interested in task-based language teaching, to supplement research that has been carried out to determine the degree to which task characteristics affect message comprehension. Incidental learning in another sense, picking up target language forms from input when they do not carry information crucial to the task, appears unlikely for adults. Paying attention to language form is hypothesized to be facilitative in all cases, and may be necessary for adult acquisition of redundant grammatical features. In general, the relation between attention and awareness provides a link to the study of individual differences in language learning, as well as to consideration of the role of instruction in making formal features of the target language more salient and facilitating input encoding.

The issue of implicit second language learning is the most difficult question to resolve, because it cannot be separated from questions concerning the plausibility of linguistic theories. Recent psychological theory suggests that implicit learning is possible, but is best characterized as the gradual accumulation of associations between frequently co-occurring features, rather than unconscious induction of abstract rule systems. Moreover, even under the assumption that implicit second language learning is possible, there is no reason to accept the null hypothesis that awareness does not affect second language learning, that understanding is epiphenomenal to learning, or that *most* second language learning is implicit.

Clearly, there is a need for much more research into what learners are conscious of as they learn second languages. There are probably several reasons why the role of unconscious learning has been, in my opinion, exaggerated. Assertions that second language learning is essentially unconscious may contain hidden assumptions, for example, that second language learning is, by definition, the establishment of an unconscious grammar and that, *a priori*, conscious experience cannot influence unconscious mental structures. Overestimation of

unconscious factors is also fostered by lack of sensitivity to the many construals of *conscious* and *unconscious*, by limiting the study of second language learning to the most abstract principles of grammar, and by emphasizing economy of description and assuming that the best linguistic description is also the best psychological description. However, the primary reason that we have under-valued the role of consciousness in second language learning is that we have simply not done much research to assess sensitively what learners notice and what they think as they learn second languages. Like behaviorists who assumed that their subjects left their mental faculties outside the laboratory door, we have assumed learner ignorance more often than we have attempted to investigate learner awareness.

<div align="right">(Received July 1988)</div>

NOTES
¹ This is a revised version of a paper presented at the Second Language Research Forum, Honolulu, 3–6 March 1988. I am grateful to Graham Crookes and an anonymous reviewer for helpful comments on an earlier draft.

² I enclose the terms 'learning' and 'acquisition' in quotes when referring to the set of distinctions Krashen makes between the two, and elsewhere use *learning* and *acquisition* as essentially equivalent.

Krashen apparently intends no distinction between *subconscious* and *unconscious*. It is commonly assumed that *subconscious* must be a technical term, part of a well-defined and generally accepted three-way distinction (conscious: subconscious: unconscious), but it is not. For most writers who use the term, subconscious is synonymous with unconscious, but preferred because it avoids the psychoanalytic connotations of unconscious mind (Tart 1975).

³ The behaviorist rejection of any causal role for consciousness (and mental phenomena in general) is one possible resolution of the mind-body problem, a philosophical issue that is beyond the scope of this paper. Non-behaviorists have also taken epiphenomenalist positions. Jackendoff distinguishes between 'computational mind' and 'phenomenological mind', and argues that causation is unidirectional from the former to the latter. Jackendoff expresses his own dissatisfaction with the resulting conclusion that 'consciousness is not good for anything' (Jackendoff 1987: 26), maintaining it primarily to avoid a philosophy of interactionism, which he finds himself constitutionally incapable of accepting.

⁴ Another basic sense of *consciousness* is as a state. Waking consciousness may be contrasted with other states such as coma, dreaming, and nondreaming sleep, alcohol and chemical intoxication, and states evoked through meditation (Tart 1975). Although there has been some interest in the effect of hyponosis and the relaxed state induced by baroque music on second language learning, these concerns are not central to current theories.

⁵ The distinction between control and automatic processing also suffers from definitional problems. *Automatic* may refer to tasks executed without awareness, actions initiated without intent, the way in which attention may be drawn automatically to something, or tasks performed without interfering with other tasks (Norman and Shallice 1986). The first three of these meanings correspond to similar ambiguities of the term *unconscious*. Schneider, Dumais, and Shiffrin (1984) point out that of the many characteristics proposed to distinguish between automatic and control processing, none provides a necessary and sufficient basis for distinguishing the two types of processing.

<sup>6</sup> 'Self-awareness' and 'self-consciousness', the recognition that thoughts and feelings belong to the self, has preoccupied philosophers more than psychologists (Rotner 1987). Awareness and self-awareness can be dissociated, and self-consciousness disappears when one is deeply absorbed in an activity. Tulving (1985) distinguishes between 'knowing consciousness' and 'self-knowing consciousness', suggesting that the former is required for declarative memory and the latter for episodic memory.

<sup>7</sup> Craik and Lockhart (1972) argued that learning involves processing material through increasingly deeper stages. This approach is sometimes taken to mean that there is no simple dichotomy between short and long term memory. For my purposes, this controversy is somewhat beside the point, since shallow and elaborate processing are both assumed to take place within working memory or consciousness.

<sup>8</sup> In O'Keefe's (1985) model, consciousness is identified with the operation of the septo-hippocampal system, which acts as an interface between different sets of modular neural structures. Baars (1988) identifies consciousness with a more general collection of brain structures, the extended reticular activating system. Neurological studies have uncovered a number of brain structures related to consciousness, but there is nowhere we can point to definitively as the locus of conscious mind.

<sup>9</sup> Kellogg (1980) had subjects perform mental multiplication while faces were presented as secondary stimuli. This was followed by an unanticipated recognition test for the faces. Introspective ratings were used to assess the degree to which subjects were aware of having attended to the faces. Recognition of the faces following the dual-task condition was much worse than after a single task condition in which only pictures were presented, but still better than chance.

The problem with asserting that encoding of the faces was unattended is that it cannot be assumed that the multiplication task consumed all available attention when the secondary stimuli were presented in a different modality, even though Kellogg attempted to control for this factor by instructing subjects to 'visualize' the mathematics problems. Kellogg maintains that the study demonstrates storage without awareness, because introspective ratings were not correlated with performance in the dual task condition, but concedes that subjects might have been aware of the process while it was occurring but unable to keep a mental log of their noticings because of the demands of the dual-task situation.

<sup>10</sup> It is not clear whether Chomsky and White use 'unconsciously' to mean 'without awareness' or 'without intent', but arguments from determinancy are primarily relevant for the latter.

<sup>11</sup> There are two basic experimental paradigms for the study of incidental learning. In one paradigm, experimenters measure the amount of learning that takes place when learners are instructed to learn the material (intentional) vs. learning that takes place without instructions to learn (incidental). In the other paradigm, subjects are given a task and later assessed for their learning of information that is central or incidental to performance of the task. Learning that is attributable to the attentional demands of the task is called incidental in the first paradigm, but not in the second.

<sup>12</sup> In UG accounts of learning, the thought processes attributed to learners are typical of conscious reasoning of the highest order; learners are said to 'assume', 'realize', 'notice', 'know', 'discover', 'recognize', 'distinguish', 'analyze', and 're-analyze' linguistic facts and principles. The problem is not that learners are incapable of realizing, discovering, etc., but that the objects of these psychological predicates are claimed to be abstract syntactic representations that learners surely do not consciously conceptualize. For example, in Hyams's (1986) influential account of how children acquire the appropriate setting of the

pro-drop parameter for English, what the child must discover is that AG does not equal PRO. This is not expressible as a thought that children could have consciously, without losing the linguistic generalization that is the heart of the theory. O'Grady (1988) has proposed a much simpler account, based on the interaction of a small number of simple grammatical notions with experience, with no reference to inborn syntactic parameters or abstract representations. O'Grady's account depends on the child noting a difference between infinitival and inflected verbs, something they could indeed notice consciously.

[13] There are many experiments in the psychological literature that *claim* learning without awareness, but Brewer (1974), Dawson and Schell (1987) and Ericsson and Simon (1984) do not find any of them convincing. The most common problem in such experiments is the use of insensitive measures of awareness. Studies that are most likely to result in false negatives include those that ask only global questions and those that assess awareness at the end of long series of trials. Subjects may also be incorrectly classified as unaware when they do not have the metalanguage necessary to express their awareness, or when the experimenter's concept is actually not required to define what has been learned.

[14] Methodological cautions also need to be noted with regard to these studies. The Seliger experiment does not show that the subjects had any productive implicit rule. The marked form *an* appears surprisingly late in acquisition, and even adults do not produce it consistently. Since all of the test items were commonly occurring nouns, it is difficult to imagine that subjects had never heard *an apple, a car*, etc., and quite possible that those who correctly produced *an apple* were just those who had attended to and noticed the article in input.

Grigg's study suffers from an overly restrictive definition of awareness. Grigg scored as correct only those responses that matched a pre-set rule statement for each target structure, and admits that this may not have allowed scope for subjects to express their understanding. The Hulstijn and Hulstijn study assessed awareness more sensitively, lending weight to the finding that of the three studies, only this one found a clear relation between awareness of rule and performance.

[15] The correlation between my aspectual choices and stativeness was higher than the correlation with input frequency, but noticing depends on more than input frequency. The greatest discrepancy between input frequency and output was in my choice of past forms of the copulas *ser* and *estar*. The perfect of *ser* was most common in input, while I overwhelmingly favored the imperfect of *estar*. My failure to use the perfect of *estar* is attributable to the fact that the form *estive* can be reduced to *tive*, homophonous with the perfect of *ter* ('have'); although I noticed the form, I always interpreted it as 'have'. As for the forms of *ser*, I commented in my journal that I did not understand how a supposedly permanent state of affairs could be made past tense in either aspect.

[16] In Schmidt and Frota, we concluded that 'the operations of the cognitive organizer, the language-creating faculty, are not accessible to conscious awareness . . .' (Schmidt and Frota 1986: 311). I now think this concedes too much. There is one other case in my Portuguese data which I think does represent a truly unconscious process, my creation of a non-existent lexical item, *marida* for 'wife'. The only other support for unconscious learning presented in that article was the fact that I was unaware that I omitted articles and copula, examples of ignorance of error rather than of learning without awareness.

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