1 Introduction

There is a fundamental question underlying second language (L2) acquisition since the inception of the field in the late 1960s and early 1970s: To what extent are first language (L1) and L2 acquisition similar? Part of this question is the extent to which L2 learning is explicit. A key role for explicit learning would point to a fundamental difference between L1 and L2 acquisition because researchers generally agree that children acquiring their L1 engage implicit learning processes. That is, children don't think about what they're learning; they don't consciously go about trying to learn grammar, sounds, words, and so on. In a certain sense, acquisition just happens to them as a by-product of their communicative interactions with the world around them.

On the other hand, it is a general belief (among teachers, laypeople, and some researchers) that L2 learners, especially adolescents and adults, must somehow engage explicit learning processes in order to acquire language. That is, they must consciously focus on grammar, sounds, and words in order to "internalize" language. However, others disagree with this general belief. The purpose of the present Element is to review some of the issues that are central to the conflicting ideas about explicit and implicit learning processes in L2 acquisition. It is our contention that the evidence weighs heavily on the side of implicit learning in L2 acquisition and that much of the debate about explicit and implicit learning involves problems in definitions of key constructs, methodological issues in research, and what one might consider not seeing the forest for the trees (i.e., there is some evidence that has been staring researchers in the face all along but gets ignored as researchers focus only on micro-studies conducted in laboratories).

The Element is divided into the following major sections:

- definitions and explication of key constructs, namely what learning is, what language is, and what acquisition is (Section 2);
- three possible positions: (1) L2 acquisition is largely or exclusively explicit in nature; (2) L2 acquisition is largely or exclusively implicit; (3) L2 acquisition involves both implicit and explicit learning (Section 3);
- whether or not explicit knowledge can become implicit knowledge (Section 4); and
- issues that confound the conclusions from such as noticing, laboratory research, Poverty of the Stimulus, and other approaches (i.e., approaches to the nature of language that are different from ours) (Section 5).

Finally, in Section 6 we offer concluding remarks and briefly touch on the relevance of the explicit/implicit learning issue for practitioners.

2 First, Some Definitions

2.1 Explicit and Implicit Learning

Learning is the internalization of some kind of data or information from the environment. The internalization of such data causes a change in an internal cognitive structure (e.g., VanPatten & Rothman, 2014). This definition is important as later we will enter into a discussion of the possibility that some aspects of language aren't learned at all; they fall out of what has been called the "human language faculty." In other words, some aspects of language aren't learned explicitly or implicitly because they are not internalized from the environment. In these cases, however, the processes by which such aspects of language get triggered are, by definition, implicit in nature.

Historically, L2 scholars have distinguished between explicit and implicit learning largely due to Reber's work on the primacy of implicit learning beginning in the 1960s (e.g., Reber, 1967). Well-known to scholars in this area, Reber examined how participants faired on a test of "grammaticality" after being exposed to strings of letters developed by what was called a Markovian Chain or a finite-state grammar. Sample strings of letters include TXS, TSXS, TSSXXVV, TSXXTVPS, PVV, PTTVPSPTVPXVPS, and PTVPXVPS. After exposure, participants judged both previously viewed and novel strings as to whether they were possible or not. Reber's conclusion (subsequently challenged but later supported) was that participants learn the "rules" of the finite-state grammar implicitly, as they were largely unable to say why strings of letters were grammatical or ungrammatical.

Interestingly, Reber did not actually define implicit learning directly in his original publications, instead referring vaguely to something that resembled statistical tallying (e.g., Ellis & Wuff, 2015; Rebuschat, 2015). It was not until 1993 that we find a definition: "Implicit learning is the acquisition of knowledge that takes place largely independently of conscious attempts to learn and largely in the absence of explicit knowledge about what was acquired" (Reber, 1993, p. 5).[1] In Reber's thinking, then, implicit learning is defined in opposition to explicit learning. Reber began examining explicit learning in 1976. Much like his early work on implicit learning, he did not define explicit learning but instead operationalized it by including an "explicit group" of participants who were given instructions to actively search for rules that underlay the array of letters generated by a finite-state grammar. The explicit group in this study was

[1] Reber (1976) still does not define implicit learning directly but does say that "Implicit learning has been characterized as a process whereby a subject becomes sensitive to the structure inherent in a complex array by developing (implicitly) a conceptual model which reflects the structure to some degree" (p. 88). For additional discussion, see the various papers in Underwood (1996).

given the following directions as part of the experimental treatment: "[I]t will be to your advantage if you can figure out what the rules are, which letters may follow other letters and which ones may not. Such knowledge will certainly help you in learning and memorizing the items" (Reber, 1976, p. 89). Thus, explicit learning under this scenario seems to mean a conscious intent to discern patterns or rules in some kind of input.[2] Implicit learning, then, would be learning something without the intent to do so.

In L2 research, definitions of explicit and implicit learning vary somewhat but essentially capture Reber's ideas. We offer examples from three exemplary essays on the nature of L2 learning:[3]

> Implicit learning is acquisition of knowledge about the underlying structure of a complex stimulus environment by a process which takes place naturally, simply and without conscious operations. Explicit learning is a more conscious operation where the individual makes and tests hypotheses in a search for structure. (Ellis, 1994a, p. 1)

> Explicit learning is input processing with the conscious intention to find out whether the input information contains regularities and, if so, to work out the concepts and rules with which these regularities can be captured. Implicit learning is input processing without such an intention, taking place unconsciously. (Hulstijn, 2005, p. 131)

> Implicit learning, essentially the process of acquiring unconscious (implicit) knowledge, is a fundamental feature of human cognition . . . explicit learning refers to a process during which participants acquire conscious (explicit) knowledge; this is generally associated with intentional learning conditions . . . (Rebuschat, 2015, p. xiii)

It seems, then, that, irrespective of one's theoretical orientation (e.g., VanPatten, Keating, & Wulff, 2020), the difference between explicit and implicit learning hinges largely on intent. That is, explicit learning involves some kind of intent to purposefully learn something, whereas, with implicit learning, there is no such intent (see also Williams, 2009). *Intent* can be one's own intent or be externally induced through what Reber calls an "instructional set." For our purposes, it's important to note that, with the possible exceptions of skill-theoretical and sociocultural approaches to Second Language Acquisition (SLA), all current discussions on adult L2 learning posit input as a necessary condition; that is,

[2] The use of "some kind of input" is purposeful here as few would claim that the kind of input used in Reber's research could be considered the kind of linguistic input as normally conceived in first and second language acquisition. Finite-state grammars are not "grammars" and letter strings are not "sentences" as commonly defined by linguists that encode not just formal properties but also meaning. For discussion, see VanPatten (1994).

[3] For additional definitions and commentary on these constructs, see DeKeyser (2003).

they all agree that language acquisition does not happen in the absence of input. Thus, the definitions of explicit and implicit learning ought to be tied directly to how learners engage input as they encounter it within communicative or meaningful events (see the above-cited quote from Hulstijn, 2005).

As we will see in Section 5.3, in applied L2 research on explicit and implicit learning, Reber's original idea is sometimes distorted. In Reber's research, explicit and implicit groups only differed in that the explicit group was told to search for patterns but, crucially, they were never told what the patterns were ahead of time. As such, they were left to their own devices to try to come up with them. In L2 research, we sometimes see this operationalization of explicit/implicit, but we also see others, making the research messy and often a problem of comparing apples to oranges. In such research, the construct of "explicit" is operationalized as an explanation or description of a "rule" or "form" and can be followed by exposure to stimuli or some kind of actual practice (in the traditional sense of practice). In other words, explicit teaching and practice are conflated with explicit learning (i.e., there was no explicit teaching or practice in Reber's foundational work). In this Element, we are focused on what learners do with input as they are exposed to it, not on what learners do in response to explicit teaching and practice. In this sense, explicit learning might be conceived of as explicit processing of input. In other words, explicit learning is input processing with the intention to search for rules or regularities in the input.

Although such definitions are clearly important for matters such as operationalization during empirical research, they are equally important for the constructs embedded within them – especially those that are not defined. In the particular case of explicit and implicit learning in L2 research (as well as the field of cognitive psychology), we note that definitions of explicit and implicit learning almost always contain constructs such as "rules," "knowledge," and "structure." Such constructs clearly are meant to refer to language, but, interestingly, no characterization of language is offered in any research on the explicit and implicit learning of languages (that is, that we can find). Just what do researchers mean by "rules," "knowledge," "structure," or any other term used in discussions about explicit and implicit learning? Is there some common definition of language that underlies the research in this area? What is it, exactly, that researchers believe learners are constructing as linguistic systems? In anticipation of the ideas we will develop in this Element, we see the nature of language as fundamental to the discussion of explicit and implicit learning, for without a characterization of the "implicit knowledge" that learners are supposed to acquire, researchers may at best be talking past each other or, at worst, arguing over something that turns out not to be grounded in the nature of language. We turn our attention now to a characterization of language we will

use in this Element. In Section 5.1, we will briefly review some alternatives to this characterization.

2.2 Language

Language is distinct from communication. Language is an abstract, complex, and implicit system of mental representations. It is generative and creative in nature, meaning that whatever exists within this system generates all utterances and can create utterances a speaker has not heard, read, said, or written before. In contrast, communication is the expression and interpretation of meaning in a given (social) context for a particular purpose. For most humans, language is a principal tool – albeit not the only one – used in communication. Thus, the learner may draw upon language to communicate – read a newspaper or novel, watch a TV show or movie, or participate in a conversation, for example – but such activities are not the linguistic system itself. Thus, when we talk about language acquisition, we don't have communication in mind, important though it is. Rather, what we have in mind is the underlying mental representation that may be tapped during communication.

The linguistic system is modular and it includes a number of subsystems – the most researched include the lexicon, the morphological system, the syntactic component, and the phonological system. What gets acquired, then, are elements of these modules as well as the ways in which they interact with each other.

2.2.1 The Lexicon

Although this is an imperfect analogy, the lexicon is essentially a mental dictionary in that it contains information about words and morphemes. Morphemes are the smallest units of meaning in any given language, so all words consist of at least one morpheme, but not all morphemes are words. The lexicon stores individual morphemes, not words, so this is one way in which the analogy of a dictionary breaks down. Another way in which the analogy breaks down is that the lexicon is organized by both frequency and similarity, with connections between morphemes based on phonological and/or semantic similarity, and more frequently used morphemes are more easily accessed than less frequently used morphemes. Words and morphemes are stored with the following information: phonological form, semantic representation, features, and co-occurrence information. Let's consider the lexical entry in (1):[4]

[4] This notational structure for lexical entries comes from Carnie (2011). There are other approaches to the lexicon, but they all share these same basic elements. Nothing we discuss in what follows hinges on this particular analysis.

(1) *Dog*

$$\begin{bmatrix} \text{PF} & [\text{dɑg}] \\ \text{CATEGORY} & \begin{bmatrix} \text{N} \\ [+\ \text{count}] \end{bmatrix} \\ \text{ARG} - \varphi & \begin{bmatrix} \text{PERS} & 3 \\ [\text{NUM} & 1] \end{bmatrix} \\ \text{SEM} & [\text{dog}] \end{bmatrix}$$

This lexical entry contains the following information: phonological form (PF), that is, the information about how the word is pronounced; information about which syntactic category the word belongs to; agreement features (listed here as AGR-φ features); and the word's meaning. So, this lexical entry is pronounced [dɑg], is a count noun (which has consequences for which determiners it can co-occur with), and is a third-person, singular noun. All of this is information that the syntax will make use of.

The lexical entry in (1) is for *dog*, which is a noun. This entry therefore includes information relevant to nouns, including agreement features for person and number and whether the noun is a mass noun or a count noun. Lexical entries for verbs include information relevant to verbs, namely the argument or arguments that the verb takes and whether those arguments are optional. Much like the lexical entries for nouns and verbs, functional categories, such as determiners and tense, also have lexical entries. The lexical entry for tense, for example, includes features that ensure that the verb gets marked for tense and the appropriate auxiliary verb is selected and that the subject of the sentence gets marked for nominative case.

In short, all of the information the syntax needs to combine one lexical entry with another to form a multi-word phrase is stored with each lexical entry. Some of this information is fairly straightforward, such as the word's syntactic category and its pronunciation. Some of this is far more abstract, such as a word's agreement features and what it co-occurs with (for instance, its internal and external arguments or its theta grid). And, in some cases, we have lexical entries that are purely abstract, such as those for Tense. These abstract entries play a vitally important role. Including a lexical entry for Tense, for instance, ensures that every sentence has Tense, and because Tense is the mechanism by which nominative case is checked, it also ensures that every sentence has a subject. In other words, these abstract categories are, in many ways, the "glue" that binds sentences together and makes sure they are all grammatical for a particular language.

2.2.2 Syntax

Syntax is the linguistic module or subsystem that combines words into phrases and phrases into sentences. It is a computational system and uses just a few

operations to combine lexical entries into phrases and sentences. These basic operations are universal in that they operate in all of the world's languages. In addition to these basic operations, syntax also includes linguistic universals and language-specific constraints that (1) are learned or derived from the input and (2) interact with universal operations to construct phrases and sentences. Today, the set of linguistic universals and language-specific constraints is thought to be significantly smaller than it was in the early years of linguistic theory. These universals include the inventory of syntactic categories, the stipulation that these categories must be organized with respect to each other in some way (i.e., phrase structure rules), and the requirement that every sentence has a subject and a set of features (e.g., Case, Tense, person/number/gender agreement, and so forth). Several of these universals have options associated with them, such that, for instance, every language must order key elements with respect to each other, but each language is free to choose how it orders them. This universal paired with this option gives us SOV languages like Japanese, Korean, Latin, and Turkish; SVO languages like English, French, Spanish, and Mandarin; and VSO languages like Irish, Welsh, and Hawaiian. Similarly, although every sentence is required to have a subject, this subject can be obligatorily overt, such as in English and French, or optionally (and sometimes obligatorily) null, such as in Korean and Italian. These language-specific constraints on how universals are realized are, coupled with phonological and lexical differences, a primary source of linguistic diversity.

In addition to these language-level constraints, the syntax also contains a set of operations that allows words to be combined into phrases and sentences. These operations are Merge, Move, and Agree. Merge combines two lexical entries into a phrase. Merge can only combine lexical entries whose feature structures match – this is why the lexicon stores this information – which means, for instance, that Merge cannot combine the verb *chase* with a complementizer phrase (CP) because *chase* cannot select a CP as its internal or external argument. Move allows phrases to move from one position in the sentence to another. For example, the *wh-* question *What did you eat?* involves moving *what*, which is the object of the verb *eat*, to the beginning of the sentence to form a question. As an operation, however, Move is somewhat constrained. It can only operate to satisfy features, such as Case features or question features. Agree is another feature-checking operation, but it functions at more local levels and ensures that feature structures are compatible once Merge has taken place.

Syntax is an abstract system, and this abstraction sometimes strikes people as implausible because it seems like the abstract nature of the system makes it difficult, or impossible, to acquire. However, most of this system is "hardwired" as part of the human capacity for language. Of the elements discussed in this

section, the only parts of the syntax that must be acquired on the basis of input are language-specific constraints such as word order and whether the language permits null subjects and the specific features that a language instantiates (e.g., not all languages instantiate Case or do so the same way). These features are mapped to lexical entries, so the acquisition of syntax is a by-product of lexical learning. The basics of the computational system are built into the human capacity for language, and language-specific instances of movement and agreement are acquired as a result of acquiring individual features. We will return to this issue in Sections 2.3 and 4.

2.2.3 Phonology

A third linguistic module that must be acquired is phonology. Phonology includes the set of sounds a given language makes use of, the rules for combining these sounds, and suprasegmental information such as stress, intonation contours, and the ability to identify word boundaries. Because the set of possible sounds in human language is finite, it is likely that a second language learner will already be able to produce and perceive some of the sounds in the target language because they are instantiated in the learner's first language. The nature of the phonological learning task, however, depends to a large extent on what the phonological inventories of the learner's L1 and L2 look like. For example, the phonological inventory of Standard American English consists of the following consonants: [p] [b] [m] [f] [v] [θ] [ð] [t] [d] [n] [s] [z] [l] [ɹ] [ʃ] [ʒ] [tʃ] [dʒ] [j] [k] [g] [ŋ] [h] [w]. This means that a native American English speaker will perceive each of these sounds as distinct from each other and will also perceive them in other languages. English has a relatively large array of consonants, including several (e.g., [f] [v] [θ] [ð]) that are relatively rare cross-linguistically. A native speaker of Japanese has a language whose phonological inventory includes the consonants [p] [b] [ɸ] [s] [ss] [z] [t] [tt] [d] [ɾ] [n] [m] [j] [w] [k] [kk] [g]. The L1 Japanese speaker learning English, then, has to learn to perceive several new sounds, some of which, such as [ʃ] and [tʃ], are allophones of the phonemes [s] and [t] in Japanese. Because English has a larger phonological inventory than Japanese does, Japanese learners of English must learn to perceive more sounds than English learners of Japanese do. That said, Japanese also has sounds, such as geminate consonants, that English lacks and English learners of Japanese must learn to perceive these sounds. These are examples of phonological learning at the segmental level; learners must also acquire suprasegmental features such as stress, pitch, and intonation contours. The phonological learning task may seem monumental, but, as we will see in Section 2.3, the main driver of

acquisition is communicatively embedded input, and phonemes make a meaningful difference in a given language.

2.3 Acquisition

Holding social context constant,[5] we build upon mainstream approaches in that there are three principal ingredients that interact to shape language in the learner's mind/brain: (1) input, (2) internal mechanisms that constrain and contribute to the shape of language, and (3) processors that mediate between input and the internal mechanisms.[6] The nature of input is relatively uncontroversial, so we will dispense with it quickly. Input (also called "primary linguistic data") consists of language that learners hear (or see) that is embedded in a communicative event. That is, the role of learners is to interpret the meaning encoded in the language they are exposed to. Thus, input is language intended for learner comprehension of some kind of message.

We take the internal mechanisms to be of two types. The first are mechanisms that are language-specific. The second are those that are learning-general. The major language-specific mechanism we have in mind is Universal Grammar (UG), whose principal function is to restrict the nature of language as it grows in the mind/brain. Under current accounts of linguistic theory (i.e., Minimalism; see, e.g., Hornstein, Nunes, & Grohmann, 2005, as well as the collection in Boeckx, 2011), the content of UG is both agreed on and debated. Important for the present discussion is what is agreed on. Common to all current conceptualizations, UG consists of an inventory of features (e.g., Case, Aspect, Tense, Question), some principles (e.g., phrase structure), and basic operations (e.g., Merge/Move, Agree). Thus, as we saw in Sections 2.2.1 and 2.2.2, sentence structure is the result of a complex interaction of phrase structure, computations involving movement, and agreement based on features encoded in the syntax and the lexicon.

The second set of internal mechanisms includes those that are responsible for general learning and data processing, including those that tabulate frequency. So, while UG restricts the basic properties or nature of language, the general learning mechanisms are partly responsible for which features make it into the developing system more quickly than others and how robustly they are

[5] By holding social context constant, we acknowledge that it plays a role in both the quantity and the quality of interactions that learners receive in the L2 (e.g., VanPatten, Smith, & Benati, 2020). This role affects progress, ultimate attainment, attitudes, and other matters that form the complex quilt that is adult SLA. However, for the present discussion on input and internal mechanisms, social context plays no discernible role.

[6] Readers familiar with the Modular Online Growth and Use of Language (MOGUL) might see some similarity in our discussion here with that framework (see, e.g., Sharwood Smith & Truscott, 2014).

represented in the lexicon (for a more extended discussion, see Sharwood Smith & Truscott, 2014, as well as Yang, 2004). As a simple illustration, if a language selects for the abstract feature Tense (i.e., finiteness), then that feature must be represented in the morpho-syntax somehow. In Spanish, for example, it is represented in verbal morphology and in word order that is the result of movement to check Tense or Question features. The general learning mechanisms are not responsible for learning about movement and feature checking, but they are implicated in the acquisition of, for instance, verbal morphology that includes Tense features. As discussed in Section 2.2.2, syntactic movement happens in order to check features, so acquiring these features will result in acquiring movement operations as well.

Generally left out of the discussion in L2 research but worth mentioning here is that language acquisition also makes use of those mechanisms that aid in discerning meaning – possibly related to general learning mechanisms. By this we mean that, as learners process language, they are also engaged in figuring out what an input string means or what a particular word or phrase means. Such mechanisms are unspecified in the literature on SLA, but the field may wish to consider these mechanisms more closely as they may be an important aspect of explicit learning related to nonformal elements of language.

Between the input "out there" and the mechanisms "somewhere inside" is another mechanism or set of mechanisms that bridges the two. These are called "input processors." In other words, UG does not directly make use of input but instead makes use of processed input data (e.g., VanPatten, 1996; VanPatten & Rothman, 2014). These data are, essentially (but not exclusively), what we call form-meaning connections and consist largely of morphophonological units, that is, words and their inflections as well as chunks of language used in formulaic utterances (e.g., "Howzitgoin?" "Whatsup?"). An example of variation among form-meaning connections would be the Spanish verb *escribo* "I write/I'm writing" versus *escribe* "he wrote." Each would, if tagged for encoded information, look like this:

(2) *escribo* ["write" + thematic grid] [−N] [+V] [+PRESENT] [−PAST] [+1st] [−PL] [−PERFECTIVE], and so on

(3) *escribe* ["write" + thematic grid] [−N] [+V] [−PRESENT] [+PAST] [−PL] [+PERFECTIVE], and so on

For a variety of reasons beyond the scope of the present discussion (but see, e.g., VanPatten, 1996, 2015), learners do not necessarily tag each and every morphophonological unit in the input with meaning, nor do they tag each morphophonological unit with its full meaning. What is more, the strength of the encoded information for the morphophonological unit is partially determined