

Robinson, P. (Ed.). (2002). *Individual differences and instructed language learning*. Amsterdam: John Benjamins.

The contributors to this edited collection focus on interactions between individual learner characteristics and learning contexts. The chapters in the first section focus on theoretical work related to aptitude, motivation, anxiety, and emotion. Each chapter in the second section describes research investigating how individual learner variables interact with a particular learning context to affect L2 learning. This includes classroom and laboratory studies examining learner variables in relation to different types of instruction and studies of natural versus instructed L2 learning.

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EXPLAINING SECOND LANGUAGE LEARNING

Preview

A general theory of second language acquisition needs to account for language acquisition by learners with a variety of characteristics in a variety of contexts. In this chapter, we examine some of the theories that have been offered to account for L2 developmental progress and final learning outcomes. We will look at how the behaviourist and innatist explanations for L1 acquisition that we saw in Chapter 1 have been extended to account for L2 acquisition. We will look at some theories drawn from cognitive psychology that have increasingly informed L2 research in recent years. These theories emphasize the way the mind perceives, retains, organizes, and retrieves information. We will look at **sociocultural theory**, a perspective that places L2 acquisition in a larger social context. We will also consider the perspective of usage-based learning, which brings together ideas from both cognitive science and sociocultural theories of L2 learning. Finally, we will review complex dynamic systems theory, an approach that draws from an even larger context that places language acquisition within a framework of self-organizing systems of all kinds.

The behaviourist perspective

As we saw in Chapter 1, behaviourist theory explained learning in terms of imitation, practice, reinforcement (or feedback on success), and habit formation. Much of the early research within behaviourist theory was done with laboratory animals, but the learning process was hypothesized to be the same for humans.

Second language applications: Mimicry and memorization

Behaviourism had a powerful influence on second and foreign language teaching, especially in North America, from the 1940s to the 1970s. Nelson Brooks (1960) and Robert Lado (1964) were two proponents of this perspective. Their influence was felt directly in the development of widely used audiolingual teaching materials and in teacher training. Classroom activities emphasized mimicry and memorization, and students learned dialogues and sentence patterns by heart. Because language development was viewed as the formation of habits, it was assumed that a person learning a second language would start off with the habits formed in the L1 and that these habits would interfere with the new ones needed for the L2. Thus, behaviourism was often linked to the contrastive analysis hypothesis. However, as we saw in Chapter 2, researchers found that many of the errors learners make are not predictable on the basis of their L1, nor do they always make the errors that would be predicted by a simple comparison of L1 and L2. This discovery led to the rejection of both the contrastive analysis hypothesis and behaviourism, leading to a period during which both the role of the L1 and the role of practice in learning a second language received limited attention in both research and pedagogy.

In Chapter 2, we saw ample evidence that L2 learners draw on what they already know—including their L1 and other previously learned languages. However, we also saw that they are sometimes reluctant to transfer certain L1 patterns, even when a translation equivalent would be correct. And we saw that L1 influence may become more apparent as more is learned about the L2, and learners become able to see L1–L2 similarities that they had not perceived at an earlier stage. All this suggests that the influence of the learner's L1 may not simply be a matter of habits, but a more subtle and complex process of identifying points of similarity, weighing the evidence in support of some particular feature, and even reflecting (though not necessarily consciously) about whether a certain feature seems to 'belong' in the target language.

By the 1970s, many researchers were convinced that behaviourism and the contrastive analysis hypothesis were inadequate explanations for L2 acquisition. We shall see, however, that as research on L2 acquisition has evolved, the explanations offered by behaviourism and the contrastive analysis hypothesis have been revisited and understood in terms of new learning theories.

The innatist perspective

As we saw in Chapter 1, the rejection of behaviourism as an explanation for L1 acquisition was partly triggered by Chomsky's critique of it. Chomsky argued that innate knowledge of the principles of universal grammar permits

all children to acquire the language of their environment during a critical period of their development. While Chomsky did not make specific claims about the implications of his theory for L2 learning, Lydia White (2020) and other linguists have argued that universal grammar offers the best perspective from which to understand L2 acquisition. Others, for example Robert Bley-Vroman (1990) and Jacquelyn Schachter (1990) have suggested that, although UG may be an appropriate framework for understanding L1 acquisition, it does not offer a good explanation for the acquisition of a second language, especially by learners who have passed the critical period. In their view, this means that L2 acquisition has to be explained by some other theory, perhaps one of the more general psychological theories described below.

The UG perspective includes the hypothesis that language learning, both L1 and L2, is 'constrained' by a set of innate principles that prevent learners from trying out every possible combination of words in every possible sequence. As children or L2 learners get more exposure to the language in their environment, they come to know which of the possible structures are represented in that language. Vivian Cook (2003) and others argue that if we reject the notion that humans have innate knowledge of some principles of language, we are left with 'the logical problem' of language acquisition. That is, we need an explanation for the fact that L2 learners, like L1 learners, eventually know more about the language than they could reasonably have learned if they had to depend entirely on the input they are exposed to. The implication is that knowledge of UG must be available to L2 learners as well as to L1 learners. Some of the theorists who hold this view claim that the nature and availability of UG are the same in L1 and L2 acquisition. Others argue that some innate language acquisition capacity is present and available to L2 learners, but that its exact nature has been altered by the acquisition of L1 and other languages (White, 2003).

Researchers working within the UG framework also differ in their hypotheses about how formal instruction or the availability of feedback will affect learners' knowledge of the L2. Bonnie Schwartz (1993), for example, concludes that instruction and feedback change only superficial aspects of language performance and do not affect the underlying systematic knowledge of the new language. She argues that language acquisition is based on the availability of natural language in the learner's environment. Interaction with speakers of that language is sufficient to trigger the acquisition of the underlying structure of the language. Lydia White (1991) agrees that acquisition of many grammatical features of the new language takes place naturally when learners are engaged in meaningful use of the language. However, she also finds evidence that the nature of UG is altered by the acquisition of the L1. The presence of the L1 grammar can lead L2 learners to mistakenly assume that certain L1 structures are also present in the L2. In that case, they may need explicit information about what is not grammatical in the L2. In Chapter 2,

we saw a good example of this in White's study of the placement of English adverbs in sentences produced by French speakers. In Chapter 6 (Studies 19 and 36), we will see some research on the effects of high frequency exposure with no explicit instruction as well as the effects of instruction and corrective feedback on the development of such language features.

Researchers who study L2 acquisition from a UG perspective are primarily interested in the language competence of advanced learners—their knowledge of complex grammar—rather than in the simple language of beginning learners. They are interested in whether the competence that underlies learner language resembles the competence underlying the language performance of native speakers. Because there are many language structures that are recognized as grammatical but only very rarely used in speech or even in writing, researchers look for other ways to investigate what the learner knows. That is, the absence of such structures in learners' speech would not be conclusive evidence that they do not know them. Thus, their investigations often involve grammaticality judgement or other methods to probe what learners know about the language rather than observations of natural language use.

Second language applications: Krashen's 'Monitor Model'

Perhaps the best-known model of second language acquisition influenced by Chomsky's theory of L1 acquisition is Stephen Krashen's (1982) Monitor Model, first described in the early 1970s, at a time when there was growing dissatisfaction with language teaching methods based on behaviourism. Krashen described his model in terms of five hypotheses.

In the *acquisition/learning* hypothesis, Krashen suggests that we 'acquire' L2 as we are exposed to samples of language that we understand in much the same way that children pick up their L1—with no conscious attention to language form. We 'learn' on the other hand through conscious attention to form and rule learning. In Krashen's view, far more language is acquired than learned.

Next, according to the *monitor* hypothesis, L2 users draw on what they have *acquired* when they engage in spontaneous communication. They may use rules and patterns that have been *learned* to 'monitor' their speech and writing, allowing them to make minor changes in language generated by acquired knowledge. Such monitoring would take place only when the speaker/writer has plenty of time, is concerned about producing correct language, and has learned the relevant rules.

The *natural order* hypothesis was based on the finding that, like L1 acquisition, L2 acquisition unfolds in predictable sequences, as we saw in Chapter 2. The language rules that are easiest to state (and thus to *learn*) are not necessarily the first to be *acquired*.

The **comprehensible input hypothesis** is that acquisition occurs when one is exposed to language that is comprehensible and contains $i + 1$. The 'i' represents the level of language already acquired, and the '+1' is a metaphor for language (words, grammatical forms, aspects of pronunciation) that is just a step beyond that level.

Krashen's *affective filter* hypothesis is proposed to account for the fact that some people who are exposed to large quantities of **comprehensible input** do not acquire language successfully. The 'affective filter' is a metaphorical barrier that prevents learners from acquiring language even when appropriate input is available. 'Affect' refers to feelings of anxiety or negative attitudes that, as we saw in Chapter 3, may be associated with poor learning outcomes. A learner who is tense, anxious, or bored may *filter out* input, making it unavailable for acquisition.



ACTIVITY 4.1 Examine the Monitor Model

A number of scholars have questioned the validity of Krashen's Monitor Model, partly on the basis that it is difficult to test the five hypotheses in empirical studies (McLaughlin, 1987), or that he has drawn the wrong conclusions from research (White, 1987). Nevertheless, Krashen's views have remained influential in L2 teaching.

- 1 Can you think of some reasons why this might be so?
- 2 Which of the hypotheses do you find intuitively convincing?
- 3 Which ones leave you sceptical? Why?

Even though the Monitor Model has been challenged by other researchers and theorists, Krashen's ideas about L2 development were influential during a period when L2 teaching was in transition from structure-based approaches that emphasized learning rules or memorizing dialogues, to approaches that emphasized using language with a focus on meaning. Since then, as we will see in Chapter 6, communicative language teaching, including immersion, content-based, and task-based language teaching, has been widely implemented.

Krashen's hypotheses, especially the comprehensible input hypothesis, have motivated many studies of L2 acquisition, and research has confirmed that a great deal of progress can be made through exposure to comprehensible input without direct instruction. Studies have also shown, however, that instruction can improve both speed and ultimate outcomes of L2 development. Contrary to Krashen's expectation that classroom 'learning' would not have an impact on the underlying acquired interlanguage, researchers have found that both explicit and implicit pedagogical interventions can influence L2 knowledge and use (see, for example, DeKeyser, 2012; R. Ellis, 2012).

The cognitive perspective

Since the 1990s, research and theories from cognitive psychology have become increasingly central to our understanding of L2 development. Some of these theories use the computer as a metaphor for the mind, comparing language acquisition to the capacities of computers for storing, integrating, and retrieving information. Some draw on neurobiology, seeking to relate observed behaviour as directly as possible to brain activity.

Cognitive and developmental psychologists argue that there is no need to hypothesize that humans have a language-specific module in the brain or that *acquisition* and *learning* are distinct mental processes. In their view, general theories of learning can account for the gradual development of complex syntax and for learners' inability to spontaneously use everything they know about a language at a given time. As noted above, some linguists have also concluded that, while the innatist perspective provides a plausible explanation for L1 acquisition, something else is required to explain L2 acquisition, since it so often falls short of full success. From the cognitive psychology perspective, however, both L1 and L2 acquisition draw on the same processes of perception, memory, categorization, and generalization. The difference lies in the circumstances of learning as well as in what the learners already know about language and how that prior knowledge shapes their perception of the new language.

Information processing

Cognitive psychologists working in an **information-processing** model of human learning and performance see L2 acquisition as the building up of knowledge that can eventually be called on automatically for speaking and understanding. Robert DeKeyser (1998), Richard Schmidt (2001), and others have suggested that learners must pay attention at first to any aspect of the language that they are trying to learn or produce. 'Paying attention' in this context is accepted to mean 'using cognitive resources to process information', but there is a limit to how much information a learner can pay attention to. Thus, learners at the earliest stages will tend to use most of their information processing resources to understand the main words in a message. In that situation, they may not notice the grammatical morphemes attached to some of the words, especially those that do not substantially affect meaning. Gradually, through experience and practice, information that was new becomes easier to process, and learners become able to access it quickly and even automatically. This frees up cognitive processing resources to notice other aspects of the language that, in turn, gradually become automatic (McLaughlin & Heredia, 1996).

For proficient speakers, choosing words, pronouncing them, and stringing them together with the appropriate grammatical markers is essentially automatic. Furthermore, much of what these speakers say is drawn from predictable patterns of language that are at least partly formulaic. That is, fluent speakers do not create new sentences by choosing one word at a time but rather by using strings of words that typically occur together. This use of patterns applies not only to idiomatic expressions, but also to much conversational language and written language in a specific genre (Ellis, Simpson-Vlach, & Maynard, 2008).

One important aspect of automaticity in language processing is the retrieval of word meanings. When proficient listeners hear a familiar word, even for a split second, they cannot help but understand it. Such automatic responses do not use up the resources needed for processing new information. Thus, proficient language users can give their full attention to the overall meaning of a text or conversation, whereas less proficient learners use more of their attention for processing the meaning of individual words and the relationships between them. The lack of automatic access to meaning helps to explain why second language readers need more time to understand a text, even if they eventually do fully comprehend it. The information-processing model suggests that there is a limit to the amount of focused mental activity we can engage in at one time (Segalowitz, 2010).

Learning theories developed within cognitive psychology have been explored by many researchers seeking to explain how languages are learned. Drawing on J. R. Anderson's (1995) work, Robert DeKeyser (1998, 2001, 2007) and

others have investigated L2 acquisition as 'skill learning'. They suggest that most learning, including language learning, starts with **declarative knowledge**, that is, knowledge that we are aware of having, for example, a grammar rule. The hypothesis is that, through practice, declarative knowledge may become **procedural knowledge**, that is, the ability to use the knowledge. With continued practice, the procedural knowledge can become automatized, which means that it can be accessed and used rapidly and without awareness. When knowledge can be retrieved in this way, the learner may no longer remember having learned it first as declarative knowledge.

According to this perspective, once skills become automatized, thinking about the declarative knowledge while trying to perform the skill actually disrupts the smooth performance of it. Think, for example, of trying to drive a car or skate while intentionally thinking about and preparing every move. With enough practice, procedural knowledge eclipses the declarative knowledge, which, in time, may be forgotten. For this reason, fluent speakers may not even realize that they once possessed the declarative knowledge that set the process in motion.

Sometimes changes in language behaviour do not seem to be explainable in terms of a gradual build-up of fluency through practice. These changes have been described in terms of **restructuring** (McLaughlin, 1990). They seem to be based on some qualitative change in the learner's knowledge. Restructuring may account for what appear to be bursts of progress, when learners suddenly seem to 'put it all together', even though they have not had any new instruction or apparently relevant exposure to the language. It may also explain apparent backsliding, when a systematic aspect of a learner's language incorporates too much or incorporates the wrong things. For example, as we saw in Chapter 2, when a learner finally masters the use of the regular *-ed* ending to show past tense, irregular verbs that had previously been used correctly may be affected. Thus, after months of saying 'I saw a film', the learner may say 'I seed' or even 'I sawed'. Such overgeneralization errors are not based on practice of those specific items but rather on their integration into a general pattern.

Another concept from the cognitive perspective offers insight into how learners store and retrieve language. According to **transfer-appropriate processing** (TAP), information is best retrieved in situations that are similar to those in which it was acquired (Lightbown, 2008b). This is because when we learn something, our memories also record aspects of the context in which it was learned and even the cognitive processes involved in the way we learned it, for example, by reading or hearing it. To date, most of the research on TAP has been done in laboratory experiments, for example, comparing the learning of word lists under different conditions. However, the hypothesis seems to offer a plausible way of explaining a widely observed phenomenon in L2

learning: knowledge that is acquired mainly in rule learning or drill activities may be easier to access on tests that resemble those learning activities than in communicative situations. On the other hand, if learners' attention is drawn to grammatical forms during communicative activities in which their focus is primarily on meaning, the retrieval of those forms during similar activities may be facilitated. In Chapter 6, a classroom investigation of L2 learning influenced by TAP is described in Study 43.

Usage-based learning

As seen in the discussion of L1 acquisition in Chapter 1, cognitive psychologists see no need to hypothesize the existence of a neurological module dedicated exclusively to language acquisition. They argue that what is innate is simply the ability to learn from experience, rather than any specific *linguistic* principles. The usage-based perspective also attributes less importance to the kind of declarative knowledge that characterizes skill learning and traditional structure-based approaches to L2 instruction. As Nick Ellis and Stefanie Wulff (2020) explain, the emphasis is on the frequency with which learners encounter specific linguistic features in the input and the frequency with which language features occur together. According to this view, learners develop a stronger and stronger network of associations or connections between these features as well as between language features and the contexts in which they occur. Eventually, the presence of one situational or linguistic feature will activate the other(s) in the learner's mind. For example, learners might get subject-verb agreement correct, not because they know a rule but because they have heard examples such as 'I say' and 'he says' so often that each subject pronoun activates the correct verb form.

Connections may be strong because the language features have occurred together frequently or they may be relatively weaker because there have been fewer opportunities to experience them together. Some of the evidence for usage-based views comes from the observation mentioned above that much of the language we use in ordinary conversation or in particular genres is predictable, and to a considerable extent based on formulaic units or chunks. As observed by Nick Ellis (2003, 2005) and others, language is at least partly learned in units larger than single words, and sentences or phrases are not usually put together one word at a time. As noted in Chapter 1, usage-based research has shown that a learning mechanism, simulated by a computer program, can not only 'learn' from input but can also generalize, even making overgeneralization errors.

The competition model

Elizabeth Bates and Brian MacWhinney (1981) described the 'competition model' as an explanation for both L1 and L2 acquisition that takes into

account not only language form but also language meaning and language use. Through exposure to thousands of examples of language associated with particular meanings, speakers of a particular language come to understand how to use the 'cues' that signal specific functions. For example, the relationship between words in a sentence may be signalled by word order, grammatical markers, and the animacy of the nouns in the sentence. Most languages make use of multiple cues, but they differ in the primacy of each. This becomes clear in a situation where the meaning of a sentence is not immediately obvious. What helps you figure out the meaning? English uses word order as the most common indicator of the relationships between sentence components. Most English sentences have the order Subject–Verb–Object (SVO). That is, the typical English sentence mentions the subject first, then the verb, then the object.

Two- and three-year-old English-speaking children can usually use cues of animacy and their knowledge of the way things work in the world to interpret odd sentences. Thus, if they hear a string of words such as 'Box push boy', they will act it out by making a boy doll push a tiny box, focusing on the fact that the 'boy' is the natural agent of action in this situation. However, the SVO pattern is so strong in English that, by the time they are four years old, children hearing this sentence will ignore the fact that boxes don't normally move on their own, and carefully demonstrate how the box pushes the boy. For English speakers, word order patterns are stronger than animacy cues at this point. At this age, children may attribute the SVO relationship to sentences in the passive voice. That is, 'The box was pushed by the boy' may be interpreted as 'The box pushed the boy.' Only later do they learn to pay attention to the grammatical markers that distinguish the active voice sentence from the passive word order.

In contrast, Spanish and Italian have more flexible word order, and speakers of these languages rely more on grammatical markers (for example, the agreement of subject and verb, the case marking of pronouns) or on the animacy of nouns to understand how sentence elements are related. When English speakers are learning these languages, they may have difficulty suppressing their tendency to rely on word order as the basis for interpretation. For example, an English-speaking learner of Italian may find it confusing to hear sentences such as *Il giocattolo sta guardando il bambino* (the toy—is looking at—the boy). An Italian speaker, accustomed to more flexible word order, focuses on the animacy of the two nouns and concludes that the most reasonable interpretation is that the boy is looking at the toy. According to the competition model, L2 acquisition requires that learners learn the relative importance of the different cues appropriate in the language they are learning (MacWhinney, 1997).

ACTIVITY 4.2 Look at how different cues lead to sentence interpretation

Consider the following sentences:

- 1 The boy eats the apple.
 - 2 The apple eats the boy.
 - 3 The dog sees the ball.
 - 4 The ball chases the dog.
 - 5 The ball is chased by the dog.
- 1 Do they all follow the patterns of English grammar?
 - 2 How can you tell which noun refers to the *agent* (the one who performs the action)?
 - 3 In each sentence, what *cue* tells you which noun is the agent?
 - 4 Is there more than one cue?
 - 5 How are sentences 4 and 5 different from each other?
 - 6 According to the *competition model*, how might these sentences be interpreted by speakers of a language with a more flexible word order than English? What would those speakers focus on?

The cognitive perspective emphasizes the role of general human abilities to process and learn information—including language—on the basis of experience. In recent years, the term 'cognitive linguistics' has emerged and highlights the view that language is but one of the complex knowledge systems that humans acquire. Peter Robinson and Nick Ellis (2008) suggest that cognitive linguistics draws from and builds on a number of different approaches that have in common the hypothesis that language is learned through our perceptual and cognitive experiences and that like all other aspects of learning, language learning involves the discovery, categorization, and determination of patterns through the use of language.

Language and the brain

Another area of work within but not limited to the cognitive perspective is concerned with language learning and the brain. Some of the questions investigated include whether L1 and L2 are acquired and represented in the same areas of the brain and whether the brain processes L2 input differently from L1 input. For a long time, the assumption was that language functions were located in the left hemisphere of the brain. Recent **brain imaging** studies show activation in different locations in both hemispheres of the brain during language processing. This is true for both L1 and L2. However, differences have been observed, depending on the learners' age and level of

proficiency. For example, when learners who acquire a second language later in life are given a grammatical task to complete, they show activation in the same neural areas that are activated for L1 processing but also activation in other areas of the brain. This is not the case with younger learners, who show activation only in the areas for L1 processing (Beretta, 2011). Other studies have measured the electrical activity in brain waves to explore differences in the processing of language input. Some of this research has shown that as an L2 learner's proficiency increases, the brain activity looks more like that which is typical of L1 processing. Kara Morgan-Short (2014), Michael Ullman (2020), and other researchers are using the technology to investigate the effect of different L2 learning environments including, for example, longitudinal studies of how electrical activity in the brain changes following explicit and implicit instruction.

A perusal of advertisements in magazines in print and online will quickly turn up claims about 'brain-based' approaches to foreign language learning, often with a promise that a language can be learned in just a few minutes a day. These claims reflect extrapolations from neurological research and also from laboratory studies of how research participants have learned word lists or artificial languages most efficiently. These studies represent valuable steps in our understanding of language acquisition and there is little doubt that in coming years, neurological research will reveal more and more about the processes of language acquisition and use. However, there are currently far more questions than answers about how language and brain research can be used to guide classroom pedagogy.

Second language applications: Interacting, noticing, processing, and practising

A number of hypotheses, theories, and models for explaining L2 acquisition have been inspired by the cognitive perspective.

The interaction hypothesis

Evelyn Hatch (1978), Michael Long (1983, 1996), Teresa Pica (1994), Susan Gass (1997), and many others have argued that conversational interaction is an essential, if not sufficient, condition for L2 acquisition. These researchers have studied the ways in which speakers modify their speech and their interaction patterns in order to help learners participate in a conversation or understand meaning in a new language. Long (1983) agreed with Krashen that comprehensible input is necessary for language acquisition. However, he focused on the question of how input could be made comprehensible. He argued that **modified interaction** is the necessary mechanism for making language comprehensible. That is, what learners need is opportunities to interact with other speakers, working together to reach mutual

comprehension through **negotiation for meaning**. Through these interactions, interlocutors figure out what they need to do to keep the conversation going and make the input comprehensible to the less proficient speaker. According to Long, there are no cases of beginner-level learners acquiring a second language from native-speaker talk that has not been modified in some way.

Modified interaction does not always involve linguistic **simplification**. It may also include elaboration, slower speech rate, gesture, or the provision of additional contextual cues. Some examples of conversational modifications are:

- 1 *Comprehension checks*—efforts by the native speaker to ensure that the learner has understood (for example, 'The bus leaves at 6:30. Do you understand?').
- 2 *Clarification requests*—efforts by the learner to get the native speaker to clarify something that has not been understood (for example, 'Could you repeat, please?'). These requests from the learner lead to further modifications by the native speaker.
- 3 *Self-repetition or paraphrase*—the more proficient speaker repeats their sentence either partially or in its entirety (for example, 'She got lost on her way home from school. She was walking home from school. She got lost.').

Long (1996) revised the **interaction hypothesis**, placing more emphasis on cognitive factors such as 'noticing' and corrective feedback during interaction. When communication is difficult, interlocutors must 'negotiate for meaning', and this negotiation is seen as the opportunity for language development. Related to this is Merrill Swain's (1985) **comprehensible output hypothesis**. She argued that when learners must produce language that their interlocutor can understand, they are most likely to see the limits of their second language ability and the need to find better ways to express their meaning. The demands of producing comprehensible output, she hypothesized, 'push' learners ahead in their development.

The noticing hypothesis

Richard Schmidt (1990, 2001) proposed the **noticing hypothesis**, suggesting that nothing is learned unless it has been 'noticed'. Noticing does not itself result in acquisition, but it is the essential starting point. From this perspective, comprehensible input leads to growth in language knowledge when the learner becomes aware of a particular language feature.

Schmidt's original proposal of the noticing hypothesis came from his own experience as a learner of Portuguese. After months of taking classes, living in Brazil, and keeping a diary, he began to realize that certain features of language that had been present in the environment for the whole time began to

enter his own L2 system only when he had noticed them. This was because they were brought to his attention in class or some other experience made them salient. Drawing on psychological learning theories, Schmidt hypothesized that L2 learners could not begin to acquire a language feature until they had become aware of it in the input. Susan Gass (1988) also described a learning process that begins when learners notice something in the L2 that is different from what they expected or that fills a gap in their knowledge of the language.

The question of whether learners must be *aware* that they are 'noticing' something in the input is the object of considerable debate. According to information-processing theories, anything that uses up our mental 'processing space', even if we are not aware of it or attending to it intentionally, can contribute to learning. From a usage-based perspective, the likelihood of acquisition is best predicted by the frequency with which something is available for processing, not by the learner's awareness of it in the input.

These questions about the importance of awareness and attention continue to be the object of research. Several researchers have found ways to track learners' attention as they engage in L2 interaction. For example, Alison Mackey, Susan Gass, and Kim McDonough (2000) had learners watch and listen to themselves in videotaped interactions and asked questions leading them to explore what they were thinking as they participated in those interactions. Ron Leow (1997) developed crossword puzzles that learners had to solve while thinking aloud, thus providing some insight into what they noticed about language as they worked. Merrill Swain and Sharon Lapkin (1998) recorded learners in pair work and kept track of the language features they mentioned. These research designs cannot tell us if learners noticed things they did not mention. However, they do make it possible to identify some things that learners were aware of and to look at how this awareness is related to measures of their language knowledge. In recent years, eye-tracking technology has been used as a more direct measure of what L2 learners notice when processing visual input. This methodology can track the eye movements of a learner reading a text and record when the eyes stop on a word, for how long, and whether the learner goes back to re-read it (Godfroid, 2020; Pellicer-Sánchez & Conklin, 2020). The extent to which learners' noticing of language features affects their L2 development will come up again in our discussion of research on L2 acquisition in the classroom in Chapters 5 and 6.

Input processing

In his research with American university students learning foreign languages, Bill VanPatten (2004) observed many cases of students misinterpreting sentences. For example, as predicted by the competition model discussed earlier in this chapter, when English speakers heard sentences in Spanish, they used word order to interpret the relationships among the nouns in the sentence.

Thus, they interpreted *La sigue el señor* as 'She (subject pronoun) follows the man'. The correct interpretation is 'Her (object pronoun) follows the man (subject of the sentence)'. In other words, the correct English translation would be 'The man follows her'. In order to understand that, students need to learn that in Spanish, a pronoun object often precedes the verb and that, rather than rely on the word order alone, it is essential to pay attention to whether the form of the pronoun indicates a subject or an object.

VanPatten argued that the problem arose in part from the fact that learners have limited processing capacity and cannot pay attention to form and meaning at the same time. Not surprisingly, they tend to give priority to meaning, overlooking some features of the language form. When the context in which they hear a sentence helps them make sense of it, that is a good strategy for understanding the general idea, but it may interfere with learners' progress in acquiring the language. In Chapter 6, we will see how VanPatten developed instructional procedures that require learners to focus on specific language features in order to interpret the meaning, thus pushing them to acquire those features.

Processability theory

Jürgen Meisel, Harald Clahsen, and Manfred Pienemann (1981) studied the acquisition of German by a group of adult migrant workers who had little or no L2 instruction. They analysed large samples of their speech and described the details of developmental sequences in their production of simple and complex sentences. They concluded that the sequence of development for features of syntax and morphology was affected by how easy these were to process. Ease of processing was found to depend to a large extent on the position of those features in a sentence. Features that typically occurred at the beginning or end of a sentence were easier to process (and learn) than those in the middle. All learners acquired the features in the same sequence, even though they progressed at different rates. The researchers also found that some language features did not seem to be affected by these constraints and could be learned and used by learners who were at different developmental stages. These were referred to as **variational features**.

Pienemann (1999, 2003) developed **processability theory** on the basis of research with learners of different languages in a variety of settings, both instructional and informal. One important aspect of his theory is the integration of developmental sequences with L1 influence. He argues that his theory explains why learners do not simply transfer features from their L1 at early stages of acquisition. Instead, they have to develop a certain level of processing capacity in the L2 before they can use their knowledge of the features that already exist in their L1. We saw examples of this in the acquisition of negatives and questions in Chapter 2. One of the predictions that arises from this theory is that learners will benefit from instruction when they reach a stage

of developmental 'readiness' that allows them to process the input or instruction that includes linguistic features they have not yet acquired. We will see examples of research testing the 'teachability hypothesis' in Chapter 6.

Continuing research has extended the investigation of processability theory to different languages being learned under different conditions—from the informal acquisition that was characteristic of the learners in the earliest studies to the L2 development of students in classroom learning contexts (Arntzen et al., 2019; Lenzing, Nicholas, & Roos, 2019).

The role of practice

One component of language learning that has seen a renewal of interest within the cognitive perspective is practice. As we saw in discussions of the behaviourist perspective, an approach to learning that is based on drill and that separates practice from meaningful language use does not usually lead to communicative competence. This does not mean, however, that practice is not an essential component of language learning. Robert DeKeyser (1998) pointed out that some classroom interpretations of behaviourism missed the point that practice is only effective if one practises the behaviour that one wishes to learn. As we will see in Chapter 6, the drills that characterized audiolingual instruction often failed to make the connection between the language patterns being drilled and the meaning(s) associated with them.

Researchers are now looking more closely at how practice converts declarative knowledge to procedural knowledge and then to automatic performance. From the perspective of cognitive psychology, the practice that promotes language development most effectively is not mechanical, and it is not limited to the production of oral and written language; listening and reading are also affected by opportunities for practice. It should also be understood that the emphasis on the centrality of meaningful interactions does mean that practice in classroom contexts should not take account of learners' need to practise particular language forms.

Lourdes Ortega (2007) has proposed three principles for practice in the foreign language classroom that she sees as compatible with the research carried out from what she calls the 'cognitive–interactionist' perspective:

- 1 Practice should be interactive.
- 2 Practice should be meaningful.
- 3 There should be a focus on task-essential forms.

Elizabeth Gatlinton and Norman Segalowitz (1988, 2005) developed an approach to language teaching called ACCESS (Automatization in Communicative Contexts of Essential Speech Segments). It draws on the cognitive perspective and is based on classroom activities which, by their

nature, require learners to use meaningful units of language repetitively in contexts where there are genuine exchanges of meaning. The goal is to provide opportunities for using these units with sufficient frequency that they will become automatic. Segalowitz (2010) has emphasized the importance of increasing the amount of language that can be used automatically, thus freeing more cognitive resources for learning new things. Paul Nation (2007) has suggested that automaticity, which he, like Segalowitz, refers to as 'fluency', may be the most neglected aspect of language teaching in contexts where instruction focuses primarily on meaning.

The sociocultural perspective

As we saw in Chapter 1, Vygotsky's sociocultural theory assumes that cognitive development, including language development, arises as a result of social interactions. Unlike the psychological theories that view thinking and speaking as related but independent processes, sociocultural theory views speaking and thinking as tightly interwoven. Speaking (and writing) mediates thinking, which means that people can gain control over their mental processes as a consequence of internalizing what others say to them and what they say to others. This internalizing is thought to occur when an individual interacts with an interlocutor within their zone of proximal development (ZPD)—that is, in a situation in which the learner can perform at a higher level because of the support (scaffolding) offered by an interlocutor.

In some ways, this approach may appear to restate some of the hypotheses encountered elsewhere in this chapter. In fact, people sometimes wonder whether the ZPD is the same as Krashen's *i + 1*. William Dunn and James Lantolf (1998) addressed this question in a review article, arguing that it is not possible to compare the two concepts because they depend on very different ideas about how development occurs. The ZPD is a metaphorical location or 'site' in which learners co-construct knowledge in collaboration with an interlocutor. In Krashen's *i + 1*, the input comes from outside the learner and the emphasis is on the comprehensibility of input that includes language structures that are just beyond the learner's current developmental level. The emphasis in ZPD is on development and how learners co-construct knowledge based on their interaction with their interlocutor or in **private speech**.

Vygotskian theory has also been compared to the interaction hypothesis because of the interlocutor's role in helping learners understand and be understood. These two perspectives differ in how cognitive processes lead to learning. In the interaction hypothesis, the emphasis is on how interaction with other speakers serves as a source of input to activate internal cognitive processes that result in learning. In Vygotsky's sociocultural theory and SLA perspectives based on it, the emphasis is on how social interaction itself

engages cognitive processes to construct knowledge that is subsequently internalized.

Second language applications: Learning by talking

Extending Vygotskian theory to L2 acquisition, Jim Lantolf (2000), Richard Donato (1994), and others are interested in showing how L2 learners acquire language when they collaborate and interact with other speakers. Traditionally, the ZPD has been understood to involve an expert and a novice. However, more recent work has broadened the term to include novice–novice or learner–learner interactions. An example of this is in Communication task B in Chapter 5 (page 147). In that excerpt, the learners are struggling with French reflexive verbs as they try to construct a storyline from pictures. The example is from the work of Merrill Swain and Sharon Lapkin (2002), who have investigated sociocultural explanations for L2 learning in Canadian French **immersion programmes**. Their work has its origins in Swain's comprehensible output hypothesis and the notion that when learners have to produce language, they must pay more attention to how meaning is expressed through language than they ordinarily do for the comprehension of language. Swain (1985) first proposed the comprehensible output hypothesis based on the observation that French immersion students were considerably weaker in their spoken and written production than in their reading and listening comprehension. She advocated more opportunities for learners to engage in verbal production (i.e. output) in French immersion classrooms. Since then, she and her colleagues have carried out extensive research to investigate the effects of output on L2 learning.

Swain's early work on the output hypothesis was influenced by cognitive theory, but more recent work has been motivated by sociocultural theory. Using the term **collaborative dialogue**, Swain and Lapkin and their colleagues have carried out a series of studies to determine how L2 learners co-construct linguistic knowledge while engaging in production tasks (i.e. speaking and writing) that simultaneously draw their attention to form and meaning. As shown in Communication task B in Chapter 5 (page 147), learners were testing hypotheses about the correct forms to use, discussing them together and deciding what forms were best to express their meaning. Swain (2000) considers collaborative dialogues such as these as the context where 'language use and language learning can co-occur. It is language use mediating language learning. It is cognitive activity and it is social activity' (p. 97).

Therefore, the difference between the sociocultural perspective and that of other researchers who also view interaction as important in L2 acquisition is that sociocultural theorists assume that the cognitive processes begin as an external socially mediated activity and eventually become internalized. Other

interactionist models assume that modified input and interaction provide learners with the raw material that is interpreted and analysed through internal cognitive processes.

Complex dynamic systems theory

Complex dynamic systems theory (CDST) refers to both complexity theory and dynamic systems theory. Diane Larsen-Freeman introduced chaos/complexity theory to applied linguistics (Larsen-Freeman, 1997); Kees De Bot and his colleagues brought dynamic systems theory into the field (De Bot, Lowie, & Verspoor, 2005). Complexity theory has its roots in the physical sciences (Lorenz, 1963) and dynamic systems theory in mathematics (Poincaré, 1899). Both are concerned with understanding complex dynamic relationships. A system is complex when it consists of many interrelated parts that interact in intricate and unpredictable ways. A system is dynamic when it is non-static and constantly changing. Some examples of complex dynamic systems are global climate, cities, beehives and the human brain. Complexity theory and dynamic systems theory share many core assumptions, which has led to their combination under the label complex dynamic systems theory (CDST) in applied linguistics. Three central characteristics of CDST are described below.

1 Complex systems and their interconnectedness

Language and language learning are viewed as complex systems. Language is multi-dimensional, consisting of several components (for example, vocabulary, pragmatics) and is embedded in our social, cultural, and psychological realities. Language learning is part of social and cultural learning and is also multi-dimensional, consisting of different learning processes (for example, analysis, inferencing) and learner characteristics (for example, aptitude, knowledge of other languages). From a CDST perspective, all these systems are interconnected so that a change in one impacts the others.

2 Non-linearity of development

Language development is not unidirectional and does not evolve in a linear manner. Learners do not move from step 1 to 2 to 3 in a neat order. Some learners jump from step 1 to 3 and then back to step 2, while other learners take a different path. This non-linear and variable nature of L2 development is the focus of examination in CDST. While there is a long tradition of investigating variability in L2 research (for example, Ellis, 1985; Huebner, 1985; Tarone, 1988), proponents of CDST argue that most of this research has focused on the external causes of variability, with less attention given to how variability provides insight into the developmental process of L2 acquisition (Verspoor, Lowie, & Van Dijk, 2008).

3 Dynamic nature of complex systems

CDST theorists prefer to use the term *L2 development* rather than L2 learning because 'there is no goal or direction in development; there is only change. In language development two forces are at work constantly: interaction with the environment and internal self-organization' (De Bot & Larsen-Freeman, 2011, p. 13). When a learner discovers something new about the grammar of English, such as how to form the regular past tense in English by adding *-ed*, this information is incorporated into the learner's language and results in a restructuring of the entire system. For example, some irregular verbs that were previously used correctly are produced with *-ed* inflections. Earlier in this chapter, the same example was considered from a cognitive perspective with reference to information-processing theories (McLaughlin, 1990).

As with usage-based learning, CDST emphasizes frequency of exposure to language in the input and the connections that are made when language forms are associated with meanings in appropriate contexts. Research has shown that L2 learners need repeated exposure to consolidate and automatize language (Ellis 2009). A CDST approach to L2 instruction is designed to include multiple exposures to language in meaningful contexts.

Some of the methodological challenges facing CDST research include the difficulty of investigating a theory where everything is connected. Given the CDST position that simple linear cause-effect relationships do not exist, there are also questions about how predictions can be made with confidence. In recent years, innovative methodologies and statistical procedures have been proposed and implemented to carry out CDST-informed research in different domains of L2 learning (De Bot & Larsen-Freeman, 2011; Hiver & Al-Hoorie, 2019; MacIntyre et al., 2017).

Second language applications: CDST

In Chapter 3, we read about a study of L2 learner motivation that was inspired by CDST. In that research it was observed that learners' motivation levels changed over short periods of time and in relation to different types of pedagogical activities. It was also observed that even learners who had expressed high levels of motivation overall became demotivated at different times (Waninge, Dörnyei, & De Bot, 2014). These findings are consistent with CDST in that motivation is complex and changes depending on context. A related study measured changes in learners' willingness to communicate from moment to moment and documented their rationale for the changes (MacIntyre & Legatto, 2011). As new methodologies for carrying out CDST research continue to be developed, more empirical studies are investigating L2 development within a CDST framework.

Audrey Rousse-Malpat and Marjolijn Verspoor (2018) describe an instructional approach that combines insights from CDST and usage-based principles. They refer to it as a dynamic usage-based approach (DUB). Based on DUB, the researchers created the 'movie approach' (Verspoor & Hong, 2013). In a study carried out in university classes in Vietnam, students had multiple exposures to a movie in the L2. The focus of the activities was on input rather than output, and the input was designed to be authentic and to be made comprehensible through scaffolding and repetition. Consistent with CDST, learners were provided with repeated exposure to language in authentic contexts to promote connections between language forms and meanings. The L2 performance of students in the movie approach was compared with that of a group who received a task-based approach including reading and listening tasks, oral interaction activities, and grammar instruction. The learners in the movie approach made significantly more progress than the learners in the task-based classes on both the receptive and productive measures. The researchers interpret these findings as support for CDST and argue that the benefits for the movie approach are 'in the dynamics of processing of meaningful input. A dynamic perspective would argue that every time we hear the same input ... the input is different' (Rousse-Malpat & Verspoor, 2018, p. 65).

Summary

In the end, what all explanations of language acquisition are intended to account for is the ability of learners to acquire language within a variety of social and instructional environments. All of the theories discussed in this chapter and in Chapter 1 use metaphors to represent something that cannot be observed directly.

Linguists working from an innatist perspective draw much of their evidence from studies of the complexity that appears to underlie proficient speakers' knowledge of language and from analysis of their own intuitions about language. Cognitive and developmental psychologists argue that it is not enough to know what the final state of knowledge is and that more attention should be paid to a more complete analysis of the language that is available in the input, as well as to the developmental steps that learners pass through on their way to the achievement of higher levels of proficiency.

Research from the cognitive perspective has sometimes involved computer simulations or controlled laboratory experiments where people learn specific sets of carefully chosen linguistic features, often in an invented language. Linguists may argue that such tightly controlled environments do not adequately represent the environments in which human language development takes place. They question whether one can infer that this is how learners acquire the knowledge of the complex language that they eventually exhibit.