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 Chapter 5 and Chapter 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 Gatbonton 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.