

CHAPTER

4 The Psychology of Second Language Acquisition

CHAPTER PREVIEW

KEY TERMS

Lateralization
Critical Period Hypothesis
Information Processing (IP)
Controlled processing
Automatic processing
Restructuring
Input
Output
U-shaped development

In this chapter we survey several approaches to SLA that have been heavily influenced by the field of psychology. They are ordered according to their primary focus of attention: first those that focus on *languages and the brain*, then those that focus on the *learning processes* that are involved in SLA, and finally those that focus on *differences among learners*.

Study of languages and the brain is based largely on the framework provided by **neurolinguistics**, which seeks to answer questions about how the location and organization of language might differ in the heads of monolingual versus multilingual speakers, and of multilinguals who acquire second languages at different ages or under differing circumstances. It primarily addresses *what* is being acquired in a physical sense: what is added or changed in the neurological “wiring” of people’s brains when they add another language?

Connectionism

Complexity
Theory

Aptitude

Motivation

Cognitive style

Learning
strategies

The study of learning processes draws especially on the frameworks of **Information Processing (IP)** and **Connectionism**, and includes questions about stages and sequences of acquisition. This focus primarily addresses *how* acquisition takes place. Is there a specialized **language faculty** in the brain (as we read in the last chapter), or does all learning involve the same mechanisms? More recently, **Complexity Theory** addresses these questions from an integrated perspective, combining linguistic, social, and traditional psychological considerations.

Approaches to the study of learner differences derive largely from **humanistic** traditions that take affective factors into account, but some consider factors associated with age and sex, and some consider possible individual differences in aptitude for language learning. This third focus primarily addresses the question of *why* some second language learners are more successful than others. Does it make a difference if learners are ten or twenty years old when they begin a new language, or whether they are male or female, or whether they are gregarious or introverted?

Finally, we will explore how being multilingual might affect the ways people think, and how multilinguals perform on tests of intelligence.

Languages and the Brain

Notions that particular locations in the brain may be specialized for language functions date back at least into the nineteenth century. Paul Pierre Broca (1861, 1865) observed that an area in the left frontal lobe (**Broca's area**) appeared to be responsible for the ability to speak and noted that an injury to the left side of the brain was much more likely to result in language loss than was an injury to the right side. Wernicke (1874) further identified a nearby area which is adjacent to the part of the cortex that processes audio input (**Wernicke's area**) as also being central to language processing. Some exceptions have been found, but for the vast majority of individuals, language is represented primarily in the left half (or **hemisphere**) of the brain within an area (including both Broca's area and Wernicke's area) around the **Sylvian fissure** (a cleavage that separates lobes in the brain). Subsequent research has shown that many more areas

of the brain are involved in language activity than was thought earlier: language activity is not localized, but core linguistic processes are typically housed in the left hemisphere.

Such specialization of the two halves of the brain is known as **lateralization**, and is present to some extent even in infancy (e.g. Mills, Coffey-Corina, and Neville 1993). There is increased specialization as the brain matures and has less **plasticity**: i.e. one area of the brain becomes less able to assume the functions of another in the event it is damaged. Lenneberg (1967) proposed that children had only a limited number of years during which they could acquire their L1 flawlessly if they suffered brain damage to the language areas; brain plasticity in childhood would allow other areas of the brain to take over the language functions of the damaged areas, but beyond a certain age, normal language would not be possible. This is the **Critical Period Hypothesis**, mentioned in Chapter 2 and to be discussed below in relation to the influence of age on SLA.

Paul Pierre Broca (b. Sainte-Foy-la-Grande, France), 1824–1880

Neuroscience

After becoming a professor and researcher at the University of Paris, Paul Pierre Broca made a most important discovery about the anatomy of the brain: he found its speech center, now called *Broca's Area*. Broca arrived at his discovery by studying the brains of patients with aphasia (the inability to talk).

Interesting note: Broca was considered a child prodigy and earned baccalaureates in literature, mathematics, and physics. He began medical school at age seventeen, and finished at age twenty, when most medical students were just beginning their studies.



Communicative functions for which each hemisphere of the brain is primarily specialized are listed in Table 4.1, as suggested by L1 research reviewed in Obler and Gjerlow (1999).

Table 4.1 Principal communicative specializations of L and R hemispheres

Principal hemispheric specializations	
Left hemisphere	Right hemisphere
Phonology	Nonverbal (as babies' cries)
Morphology	Visuospatial information
Syntax	Intonation
Function words and inflections	Nonliteral meaning and ambiguity
Tone systems	Many pragmatic abilities
Much lexical knowledge	Some lexical knowledge

In discussing hemispheric specialization, Obler and Gjerlow emphasize that, “while localizing language phenomena in the brain is the eventual goal of neurolinguistics, we no longer expect that there are language areas that are entirely ‘responsible’ for language, or even ‘dominant’ for language, to be contrasted with areas that have nothing to do with it” (1999:11–12).

Hemispheric specialization for language is the same regardless of whether the language is spoken or not; core linguistic functions for sign languages used in deaf communities are also located in the left hemisphere. The visuospatial information listed for the right hemisphere in [Table 4.1](#) refers to movement which may be meaningful but is nonlinguistic in nature. When movement incorporates linguistic units of phonology, morphology, and syntax (as in sign language), it is left-hemisphere based (Emmorey 2002). The typical distribution of primary functions is probably due to the left hemisphere’s being computationally more powerful than the right and therefore better suited for processing the highly complex elements of language.

Interest in how the brain might be organized for multiple languages also dates back to the nineteenth century (e.g. Freud 1891). The initial questions arose from observing differing patterns for the interruption and recovery of languages following brain damage in multilinguals. Most individuals lose or recover multiple languages equally (Paradis 1987), but some recover one before the other, and some never recover use of one (either L1 or L2). These findings suggest that two or more languages may be represented in somewhat different locations in the brain and/or have different networks of activation. This possibility has stimulated observation and research on the topic for the past century, although research procedures have changed radically with changing technology. Methods for gathering data have included the following:

- Correlations of location of brain damage with patterns of loss/recovery in cases where languages are affected differentially.
- Presentation of stimuli from different languages to the right versus the left visual or auditory fields to investigate which side of the brain is most involved in processing each language. What is presented to the right fields will be processed faster and more accurately by the left hemisphere and vice versa.
- Mapping the brain surface during surgery by using electrical stimulation at precise points and recording which areas are involved in which aspects of speech, and in which language. (This mapping procedure is often used prior to or even during removal of brain tissue because of a tumor or other abnormality, allowing the neurosurgeon to avoid disrupting language functions as much as possible.)
- Positron Emission Tomography (PET-scans), functional Magnetic Resonance Imaging (fMRI), and other non-invasive imaging techniques that allow direct observation of areas of the brain that are activated by different language stimuli and tasks.

In spite of many years of research, some questions remain unanswered or answers remain controversial. In part this is because study has generally involved limited numbers of subjects and there is considerable individual variation in how the brain is “wired”; in part it is because research efforts have not used the same procedures for data collection and analysis and therefore do not yield entirely comparable results. Still, there are a number of findings which shed increasing light on the representation and organization of multiple languages in the brain. Specific questions which have been explored are listed below, along with a brief summary of results from some of the research conducted on them.

1. How independent are the languages of multilingual speakers?

There is no single answer to this question, both because there appears to be considerable individual variation among speakers, and because there are very complex factors which must be taken into account. It seems reasonable to conclude, however, that multiple language systems are neither completely separate nor completely fused.

Ervin and Osgood (1954; following Weinreich 1953) suggested a three-way possibility for how languages relate in an individual's mind, which are called **coordinate**, **compound**, and **subordinate bilingualism**. **Coordinate** refers to parallel linguistic systems, independent of one another; **compound** to a fused or unified system; and **subordinate** to one linguistic system accessed through another. Ervin and Osgood claim that these different relationships result in part because of different contexts for language learning. An extreme case of coordinate bilingualism would be the rare individual who has learned two or more languages in different contexts and is not able (even with conscious effort) to translate between them. More common would be compound bilingualism, believed by many to characterize simultaneous bilingualism in early childhood (before the age of three years), and subordinate bilingualism, believed to result from learning L2 through the medium of L1 (as in grammar-translation approaches to foreign language instruction). There is evidence that suggests the relationship may depend on L2 proficiency, changing from compound or subordinate to coordinate at higher knowledge and skill levels (Kroll and Stewart 1994).

There is also evidence for two distinct memory systems, which may involve different representations of L1 and L2 grammars (see e.g. review in Green 2008). Research on this question from a linguistics perspective has most often focused on the relationships of syntactic systems, but there is also pervasive interest in the question from primarily psychological and social points of view. These perspectives often focus on the level of cognitive relations of L1 and L2 as they are revealed in the differential vocabulary organization of semantic elements (e.g. Xia 2014).

Other researchers stress the interdependence of languages, although separation can be maintained for many purposes. Obler and Gjerlow conclude that multiple linguistic systems “are only as independent as necessary, and reliance on a single system is the rule whenever possible (1999:140).

2. How are multiple language structures organized in relation to one another in the brain? Are both languages stored in the same areas?

Again, there is considerable variation among speakers. For at least some multilinguals, it appears that L1 and L2 are stored in somewhat different areas of the brain, but both are predominantly in (probably overlapping) areas of the left hemisphere. However, the right hemisphere might be more involved in L2 than in L1.

Researchers have stimulated certain segments of the brain during surgery (Ojemann and Whitaker 1978) and found that disturbing some points in the brain blocks people from being able to name things in both languages, while disturbing other points does not have this effect. The area common to both L1 and L2 storage is near the Sylvian fissure in the left hemisphere (already established as the primary language area for monolinguals, including Broca's and Wernike's areas), but only L1 or L2 (more likely L2) is disrupted by stimulation of points further away from the Sylvian fissure. Using PET-scan imaging on one Spanish-English subject in repetition tasks, Fedio et al. (1992) also found more diffuse brain activation for L2 than for L1, and different areas involved, which the authors interpreted as indicating that greater memorization of words and phrases is involved in L2 (as opposed to direct processing of words for meaning in L1).

3. Does the organization of the brain for L2 in relation to L1 differ with age of acquisition, how it is learned, or level of proficiency?

The answer is probably "yes" to all three, with the strongest body of evidence showing that age of acquisition influences brain organization for many second language learners (see Watterndorf and Festman 2008 for a comprehensive review).

After reviewing research on lateralization in bilinguals, Vaid (1983) concludes that individuals who acquire L2 later in life show more right-hemisphere involvement. Supporting this conclusion, Wuillemin and Richards (1994) report more right-hemisphere involvement for individuals who acquire L2 between ages nine and twelve than for those who acquire L2 before age four. Cook suggests that how people learn languages might be a factor: "The variation in right hemisphere involvement may be due to the lack of a single route to L2 knowledge: second languages may be learnt by many means rather than the single means found in L1 acquisition and, consequently, may have a greater apparent hemispheric spread" (1992:572), and differences in achievement are ascribed to explicit and implicit L2 learning by Morgan-Short and others (2012). Hull and Vaid (2007) also report on the significance of amount and duration of L1 and L2 exposure. Because they have more experience with interpreting and producing two languages, perhaps "early bilinguals intensify or accelerate the automatization of language processes" (Watterndorf and Festman 2008:16).

4. Do two or more languages show the same sort of loss or disruption after brain damage? When there is differential impairment or recovery, which language recovers first?

As noted in the first part of this section, brain damage results in the same or very similar patterns of loss and recovery for both/all of most multilingual persons' languages, but many exceptions have been reported. One early hypothesis was that in cases of such brain damage, the last-learned language would be the first lost, the next-to-the-last learned the second to be lost, and so forth, with L1 the last to remain; recovery was speculated to be L1 first. This in fact does not appear to occur at a level greater than chance, at least with respect to order of recovery. Obler and Gjerlow (1999) conclude rather that a significant factor in initial recovery is which language was most used in the years prior to the incident which caused the damage, whether this is L1 or L2.

Research on this question also shows that not only can different languages be affected differentially by brain damage, but different abilities in the same language may be differentially impaired: e.g. syntax versus vocabulary, production versus comprehension, or oral versus written modality. These observations have possible implications for claims that different elements of language are located in separate parts of the brain.

We may conclude that *what* is being added in the brain when a second language is acquired is not very different from, nor usually entirely separate from, what is already there for the first. But there are intriguing differences: some differences may be due to level of L2 proficiency, some to circumstances of L2 learning, and some to the fact that our brains are not "wired" in exactly the same way. Research on this focus is expanding rapidly with the help of brain-imaging technology, and it promises also to contribute more neurological answers to questions of *how* second languages are learned and *why* some people are more successful than others.

Learning Processes

Psychology provides us with three major frameworks for the focus on learning processes: **Information Processing (IP)**, **Connectionism**, and **Complexity Theory**. IP has had more influence on the study of SLA than any other psychological perspective, following an approach developed by John Anderson (e.g. 1976, 1983). All three make the claim that learning language is essentially like learning other domains of knowledge: that whether people are learning mathematics, or learning to drive a car, or learning Japanese, they are not engaging in any essentially different kind of mental activity. *Learning is learning*. We take a general look at the information-processing framework and then discuss three approaches based on it, the **Multidimensional Model**, **Processability**, and the **Competition Model**, respectively. The Connectionism framework also claims that "learning is learning," but considers learning processes as a matter of increasing strength of associations rather than as the abstraction of rules

or principles. **Complexity Theory** focuses on processes and states of change in a wide variety of domains. As it has been applied to language development, it differs from other psychological approaches in the importance it gives to (1) social and contextual as well as cognitive factors and (2) the role of variability.

Information Processing (IP)

Approaches based on IP are concerned with the mental processes involved in language learning and use. These include perception and the input of new information; the formation, organization, and regulation of internal (mental) representations; and retrieval and output strategies.

The information processing approach makes a number of assumptions (McLaughlin 1987):

- (1) Second language learning is the acquisition of a complex cognitive skill. In this respect language learning is like the acquisition of other complex skills.
- (2) Complex skills can be reduced to sets of simpler component skills, which are hierarchically organized. Lower-order component skills are prerequisite to learning of higher-order skills.
- (3) Learning of a skill initially demands learners' attention, and thus involves **controlled processing**.
- (4) Controlled processing requires considerable mental "space," or attentional effort.
- (5) Humans are limited-capacity processors. They can attend to a limited number of controlled processing demands at one time.
- (6) Learners go from controlled to **automatic processing** with practice. Automatic processing requires less mental "space" and attentional effort.
- (7) Learning essentially involves development from controlled to automatic processing of component skills, freeing learners' controlled processing capacity for new information and higher-order skills.
- (8) Along with development from controlled to automatic processing, learning also essentially involves **restructuring** or reorganization of mental representations.
- (9) Reorganizing mental representations as part of learning makes structures more coordinated, integrated, and efficient, including a faster response time when they are activated.
- (10) In SLA, restructuring of internal L2 representations, along with larger stores in memory, accounts for increasing levels of L2 proficiency.

Our mental capacity requirements for controlled processing are obvious when we are beginning to learn a second language, as we need to concentrate our attention to comprehend or produce basic vocabulary and syntactic structures. It is only after these have been automatized that we can attend to more complex, higher-order features and content. We encounter similar capacity limitations (we easily experience "information overload") in learning a new "language" for computerized word processing: we must

Table 4.2 Stages of Information Processing

Input	Central processing	Output
Perception	Controlled–automatic processing	Production
	Declarative–procedural knowledge	
	Restructuring	

initially use controlled processing to select appropriate symbols and apply the right rules, and it is difficult or impossible to simultaneously pay attention to higher-order content or creative processing. It is only after we have automatized the lower-level skills that our processing capacity is freed for higher-order thought. Writers usually cannot compose “online” effectively until lower-level word-processing skills such as typing, saving documents, and changing fonts have become automatized. Further examples can readily be drawn from learning other complex nonverbal skills, such as driving or skiing, where tasks that initially require attentional control become automatized with practice; they then generally remain out of conscious awareness unless some unusual occurrence returns them to controlled processing. Behaviors under attentional control are permeable, i.e. they are changeable; but once automatized, they are both more efficient and more difficult to change. In fact, one explanation for L2 **fossilization** (or apparent cessation of learning) from an IP perspective is that aspects of L2 may become automatized before they have developed to target levels, and positive input no longer suffices to lead to their improvement.

Information Processing has three stages, as shown in Table 4.2 (adapted from Skehan 1998).

Input for SLA is whatever sample of L2 that learners are exposed to, but it is not available for processing unless learners actually notice it: i.e. pay attention to it. Then it can become **intake**. It is at this point of perception of input where priorities are largely determined, and where attentional resources are channeled. Richard Schmidt (1990) lists the following features as likely contributors to the degree of noticing or awareness which will occur:

- Frequency of encounter with items
- Perceptual saliency of items
- Instructional strategies that can structure learner attention
- Individuals' processing ability (a component of **aptitude**)
- Readiness to notice particular items (related to hierarchies of complexity)
- Task demands, or the nature of activity the learner is engaged in

In line with this IP approach to learning, developing, and testing strategies to heighten learner awareness of input and to structure attention has been a major thrust in foreign language instructional design and pedagogy, so that successful intake can occur.

Output for SLA is the language that learners produce, in speech/sign or in writing. The importance of output for successful L2 learning has been

most fully expounded by Merrill Swain (e.g. Swain and Lapkin 1995). Meaningful production practice helps learners by:

- Enhancing fluency by furthering development of automaticity through practice
- Noticing gaps in their own knowledge as they are forced to move from semantic to syntactic processing, which may lead learners to give more attention to relevant information
- Testing hypotheses based on developing interlanguage, allowing for monitoring and revision
- Talking about language, including eliciting relevant input and (collaboratively) solving problems

Fluency is achieved in production both through use of automatized rule-based systems and through memory-based chunks which serve as exemplars or templates and are “retrieved and used as wholes” (Skehan 1998:60).

Central processing is the heart of this model, where learning occurs. It is here that learners go from controlled to automatic processing, and where restructuring of knowledge takes place. It is possible to test for degree of automatization because controlled processing requires more time. Research that measures the amount of time it takes multilinguals to recall words and grammatical structures shows that the L2 of even fluent speakers of both languages is generally less automatized than their L1, and less proficient L2 is less automatized than more fluent L2.

In the model of learning that was proposed by Anderson (1976), development from **declarative** to **procedural** stages of knowledge is parallel to development from controlled to automatic processing in many respects. The declarative stage involves acquisition of isolated facts and rules; processing is relatively slow and often under attentional control. Development to the procedural stage involves processing of longer associated units and increasing automatization, which frees attentional resources for higher-level skills. Proceduralization requires practice.

As noted in the assumptions about IP listed above, the restructuring that takes place during central processing makes mental representations more coordinated, integrated, and efficient. It involves qualitative changes, meaning that L2 development cannot be characterized as a seamless continuum along which new forms are added to old, but as a partially discontinuous plane along which there is regular systemic reorganization and reformulation. Two types of evidence from learners’ speech and writing are often cited. One is the sequence of acquisition which learners exhibit when they produce unanalyzed chunks of L2 correctly and then make errors as they restructure the elements they have processed in accord with newly formulated patterns and rules: i.e. an onset or increase of ungrammaticality in utterances is often an indicator of “progress” in SLA. A related type of evidence is found in **U-shaped development**: i.e. learners’ use of an initially correct form such as plural *feet* in English, followed by incorrect *foots*, eventually again appearing as *feet*. In this case, *feet* is first learned as an unanalyzed word, without recognition that it is a

combination of *foot* plus plural. The later production of *foots* is evidence of systemic restructuring that takes place when the regular plural -s is added to the learner's grammar. *Feet* reappears when the learner begins to acquire exceptions to the plural inflection rule.

Theories Regarding Order of Acquisition

Psychological approaches to SLA have made significant contributions to understanding why certain elements are acquired in a fixed sequence. One of the best known of these approaches is the **Multidimensional Model**, developed by researchers who initially studied the German L2 learning of adult L1 speakers of Italian, Spanish, and Portuguese in the ZISA project (see Clahsen, Meisel, and Pienemann 1983). This model includes the following claims:

- Learners acquire certain grammatical structures in a developmental sequence.
- Developmental sequences reflect how learners overcome processing limitations.
- Language instruction which targets developmental features will be successful only if learners have already mastered the processing operations which are associated with the previous stage of acquisition.

The processing strategies which account for developmental sequences in perception and production are explained by Clahsen (1984) in relation to the IP constraint of limited capacity: "linguistic structures which require a high degree of processing capacity will be acquired late" (p. 221). Which syntactic structures require more processing capacity (i.e. are more complex) is determined by the extent to which their underlying relations are preserved in output, and by the perceptual salience of any reordering that does occur. Clahsen (1984:23) infers the following hierarchy:

- (1) *Canonical Order Strategy*: There is no reordering from "basic" word order. Structures which can be processed with this strategy will be acquired first.
- (2) *Initialization/Finalization Strategy*: Reordering which moves underlying elements into the first or last position in a grammatical string are perceptually more salient, and thus easier to process than permutations to internal positions.
- (3) *Subordinate Clause Strategy*: Reordering in subordinate clauses is not allowed. This accounts for why "learners initially use certain reorderings only in main clauses and ... thus the order of the elements in subordinate clauses is less varied."

A reorientation of the Multidimensional Model is known as **Processability Theory** (Pienemann 1998; Pienemann and Kessler 2011); it also has the aim of determining and explaining the sequences in which processing skills develop in relation to language learning. (See also Lenzing 2013, especially for more consideration of L1-L2 transfer phenomena.) The following acquisitional hierarchy of processing skills is proposed (from Pienemann and Håkansson 1999):

- (1) *Lemma/word access*: Words (or **lemmas**) are processed, but they do not yet carry any grammatical information, nor are they yet associated with any ordering rules.
- (2) *Category procedure*: Lexical items are categorized, and grammatical information may be added (e.g. number and gender to nouns, tense to verbs).
- (3) *Phrasal procedure*: Operations within the phrase level occur, such as agreement for number or gender between adjective and noun within the noun phrase.
- (4) *S-procedure*: Grammatical information may be exchanged across phrase boundaries, such as number agreement between subject and verb.
- (5) *Clause boundary*: Main and subordinate clause structures may be handled differently.

This is an implicational hierarchy in the sense that processing skill at level 1 is a prerequisite for processing skill at level 2, level 2 is prerequisite for level 3, and so forth. The sequence of strategies describes the developing learner grammar in terms of processing prerequisites needed to acquire grammatical (syntactic and morphological) rules at successive stages.

The universality of this sequence in SLA is being tested by researchers, with generally supportive results. In addition to Pienemann's analysis of German L2 (1998) and reanalysis of data from prior research on Swedish L2 (Pienemann and Håkansson 1999), extensive studies thus far have included Danish, Norwegian, and Swedish (Glahn et al. 2001).

Claims that language instruction will be effective only if it targets the next stage in an L2 learner's developmental sequence (rather than more advanced levels) have been tested on many languages since the 1970s (reviewed in Spada and Lightbown 1999). Results are mixed concerning the interaction of developmental order and instructional level, with indication that at least for some structures, and for some learners, instruction at a more advanced level can be more efficient. Complexities include the type of instruction (e.g. whether explicit contrastive L1–L2 information on the structure is presented), and the degree to which L1 knowledge may be applicable. However, these complexities do not appear to invalidate claims about order of acquisition; even when learners profit from more advanced levels of instruction, they progress through the same developmental sequence.

Competition Model

Another psychological approach that has addressed the general question of how languages are learned is the **Competition Model** (Bates and MacWhinney 1981; MacWhinney 2001). This is a functional approach which assumes that all linguistic performance involves "mapping" between external form and internal function. The form of a lexical item is represented by its auditory properties, and its function by its semantic properties; the forms of strings of lexical items are word-order patterns and morphological inflections, and their functions are grammatical. For

example, for the word *horse* the form is represented by the sounds [hors]; the function is the meaning of a four-legged, hay-eating animal. In the sentence *Horses eat hay*, the word orders of *horses* before and *hay* after the verb are forms; the functions are to convey that *horses* is the subject and *hay* is the object. The inflection -s on *horses* is also a form; its function is to convey that more than one horse is being referred to.

This approach considers that learning the system of **form-function mapping** is basic for L1 acquisition. SLA involves adjusting the internalized system of mapping that exists in the learner's L1 to one that is appropriate for the target language. This is accomplished by detecting **cues** in language input which are associated with a particular function, and by recognizing what weight to assign each possible cue (the **cue strength**). The cue in English that *horses* is the subject in the sentence *Horses eat hay* is word order – *horses* comes in front of the verb. If the sentence were in Japanese, the cue would be a **case marker**, the inflection -ga that is attached to the end of a word which means it is the subject (i.e. that it has nominative case).

Brian MacWhinney (b. New York), 1945–present

Psychology

MacWhinney's studies of language processing across languages led to the co-development of the Competition Model with Elizabeth Bates (MacWhinney and Bates 1989). In this research, many areas of processing were studied: normal adult sentence processing, the development of child sentence processing, and language processing of people with aphasia. MacWhinney has also developed a set of computer programs and a database called CHILDES (Child Language Data Exchange System), which has been used by more than 800 researchers in forty-six different countries.



Multiple cues are available simultaneously in input; language processing essentially involves “competition” among the various cues. For example, for the grammatical function of subject, possible cues are *word order*, *agreement*, *case marking*, and *animacy* (i.e. capacity for volitional action). All of these possible cues are illustrated in the following sentences (some are not grammatical or grammatically felicitous):

- a. *The cow kicks the horse.*
- b. *The cow kick the horses.*
- c. *Him kicks the horse.*
- d. *The fence kicks the horse.*

The relative strength of word order as a cue in English over the other possibilities can be tested by presenting native speakers with sentences such as these and asking them to identify the subject or agent in each (i.e. who/what does the “kicking”).

In spite of the ungrammaticality of (b–c), or in the case of (d) its anomalous character, native English speakers are most likely to identify the first noun phrase in each of these sentences as subject, even though in (b) the verb agrees with the second noun phrase rather than the first, in (c) *him* is case-marked as object (the receiver of the action) rather than subject, and in (d) *fence* is inanimate and cannot be interpreted literally as a “doer” of the verb *kick*. If these sentences were translated into other languages, different identifications of subject would likely be made depending on whether agreement, case marking, or animacy carried more weight. In Japanese, for instance, the case marker *-ga* attached to a noun phrase (if no other *-ga* occurred) would generally carry more weight in identifying that NP as the subject, no matter where in the word order it occurred. An English L1 speaker learning Japanese as L2 might inappropriately transfer the strong word-order cue to initial form–function mapping (and identify the wrong noun phrase as subject if it occurred first), whereas native speakers of Japanese might transfer their L1 cue weights to English L2 and also provide non-native interpretations.

Acquisition of appropriate form–function mappings is driven primarily by the probability that a particular functional interpretation should be chosen in the presence of a particular cue. If the probability is high, the cue is reliable. The following determinants of cue strength are also discussed by MacWhinney (2001:74–75; see Ellis 2008:473–79):

- *Task frequency*: how often the form–function mapping occurs. The vast majority of English sentences have a subject before the verb, so the mapping of word-order form to subject function is very frequent.
- *Contrastive availability*: when the cue is present, whether or not it has any contrastive effect. In example (a) above, for instance (*The cow kicks the horse*), the third-person singular *-s* on the verb agrees with both noun phrases and so the agreement cue tells nothing about which is the subject. An available cue must occur contrastively if it is to be useful.
- *Conflict reliability*: how often the cue leads to a correct interpretation when it is used in comparison to other potential cues.

Transfer of L1 cue strengths to L2 is the most likely outcome in early stages of SLA when the systems differ, but research has shown that some learners ultimately abandon L1 cue strengths in favor of L2, while some compromise and merge the two systems, and some differentiate between the languages in this aspect of processing.

Connectionist Approaches

Connectionist approaches to learning have much in common with IP perspectives, but they focus on the increasing strength of associations between stimuli and responses rather than on the inferred abstraction of “rules” or on restructuring. Indeed, from a connectionist perspective learning essentially is change in the strength of these connections. Some version of this idea has been present in psychology at least since the 1940s and 1950s (see McClelland, Rumelhart, and Hinton 1986 for an overview

of historical developments), but **Connectionism** has received widespread attention as a model for first and second language acquisition only since the 1980s.

The best-known connectionist approach within SLA is **Parallel Distributed Processing**, or **PDP**. According to this viewpoint, processing takes place in a network of nodes (or “units”) in the brain that are connected by pathways. As learners are exposed to repeated patterns of units in input, they extract regularities in the patterns; probabilistic associations are formed and strengthened. These associations between nodes are called **connection strengths** or **patterns of activation**. The strength of the associations changes with the frequency of input and nature of feedback. The claim that such learning is not dependent on either a store of innate knowledge (such as Universal Grammar) or rule-formation is supported by computer simulations. For example, Rumelhart and McClelland (1986) demonstrated that a computer that is programmed with a “pattern associator network” can learn to associate English verb bases with their appropriate past tense forms without any a priori “rules,” and that it does so with much the same learning curve as that exhibited by children learning English L1. The model provides an account for both regular and irregular tense inflections, including transfer to unfamiliar verbs, and for the “U-shaped” developmental curve (discussed in the [previous section](#) on order of acquisition), which is often cited in linguistic models and in other cognitive approaches as evidence for rule-based learning.

Assumptions about processing from a connectionist/PDP viewpoint differ from traditional IP accounts in other important ways. For example (McClelland, Rumelhart, and Hinton 1986; Robinson 1995):

- (1) Attention is not viewed as a central mechanism that directs information between separate memory stores, which IP claims are available for controlled processing versus automatic processing. Rather, attention is a mechanism that is distributed throughout the processing system in local patterns.
- (2) Information processing is not serial in nature: i.e. it is not a “pipeline... in which information is conveyed in a fixed serial order from one storage structure to the next” (Robinson 1995:288). Instead, processing is parallel: many connections are activated at the same time.
- (3) Knowledge is not stored in memory or retrieved as patterns, but as “connection strengths” between units which account for the patterns being recreated.

It is obvious that parallel processing is being applied when tasks simultaneously tap entirely different resources such as talking on a cell phone while riding a bicycle, but it also less obviously occurs within integrated tasks such as simply talking or reading, when encoding/decoding of phonology, syntactic structure, meaning, and pragmatic intent occur simultaneously. Many connections in the brain must be activated all at once to account for successful production and interpretation of language, and not processed in sequence (i.e. one after the other).

Relatively little research based on this approach has been conducted in SLA, but the assumption is that transfer from L1 to L2 occurs because strong associations already established in L1 interfere with establishment of the L2 network. Because frequency is the primary determinant of connection strength, it might be predicted that the most common patterns in L1 would be the most likely to cause interference in L2, but research on transfer from linguistic perspectives does not support this conclusion in any strong sense; L1–L2 relationships are not that simple. Proponents of connectionist approaches to language acquisition note that while frequency is “an all-pervasive causal factor” (Ellis 2002:179), it interacts with other determinants, including how noticeable the language patterns are in the input learners receive, and whether the patterns are regular or occur with many variations and exceptions (Ellis 2013).

Many linguists and psychologists would argue against a strong deterministic role for frequency of input in language learning. One counterargument is that some of the most frequent words in English (including the most frequent, *the*) are relatively late to appear, and among the last (if ever) to be mastered. Still, whatever one's theoretical perspective, the effects of frequency on SLA clearly merit more attention than they have typically received since repetition drills went out of fashion in language teaching. Researchers from several approaches to SLA which focus on learning processes are taking a renewed look at how frequency influences learning.

Complexity Theory

What we choose to call **Complexity Theory (CT)**, following Larsen-Freeman (2011, 2013), is closely related to what others in SLA call Dynamic Systems Theory (e.g. van Geert 2008), Complex Systems Theory, and Chaos Theory. The approach traces its roots to theoretical developments in the natural sciences, where its general goal has been to describe and explain change in complex systems (including language). Its first application to second language acquisition is usually credited to Larsen-Freeman (1997).

The key question in SLA which CT and related theories address has been viewed from a linguistic perspective for more than fifty years, as discussed in Chapter 3: what accounts for the nature and order of language development? As we have already seen, this has also been a key question as viewed from a psychological perspective. CT differs fundamentally from most linguistic approaches in denying that any innate mental faculty for language is required in an account of either first or second language acquisition. In this important respect it agrees with common views in psychology that learning is essentially the same process in any domain (not just language). CT also differs from many psychological perspectives, however, in integrating considerations of social and contextual factors along with cognitive ones in attempting to describe and explain the processes of SLA.

A basic concept in Complexity Theory as it applies to SLA is that all languages, and varieties of language, are complex systems with interconnected components and stages of learner language. Saying that a complex system has interconnected components means that levels of language like

phonology, vocabulary, and discourse are interdependent in their development. In the process of development, the different components become more orderly, more structured or organized, over time. “Only by adopting an integrative dynamic framework will we understand how they come about” (Ellis 2008:233).

The dynamic process thus accounts for the formation of patterns in the development of both first and second language acquisition, as well as all other complex systems in nature. This is an important departure from the claims of UG and even many functional views of grammar that basic rules and constraints of grammar are uniquely hard-wired in the brain. According to Complexity Theory, “these regularities are not rule-driven; there are no mechanisms for such top-down governance. Instead, they emerge from the dynamics of language usage” (ibid.).

In a further departure from most linguistic as well as prior psychological perspectives, descriptions and explanations of the dynamic processes of language change and development need to take into account the variable effects of communicative functions and opportunities, the structural relationships of L1 and L2, the intentions and acts of learners and others, and a host of other internal and external factors. (For a comprehensive and in-depth overview of dynamic aspects of SLA, see de Bot, Lowie, and Verspoor 2005.)

While this holistic view of SLA is appealing to many of us, it presents some problems for researchers who need to control variables in order to predict outcomes in different learning circumstances. The results of research from this perspective so far are yielding some interesting insights into language development processes and experiences, however, and have considerable promise for enlightening some of our teaching practices.

Differences in Learners

In [Chapter 3](#), we considered the basic question of why some L2 learners are more successful than others from a linguistic perspective, and in [Chapter 5](#) we will again consider this question from the perspective of the social contexts of learning. Here we address this question from a psychological perspective, focusing on differences among learners themselves. The differences we explore here are age, sex, aptitude, motivation, cognitive style, personality, and learning strategies. Some of the relevant research looks at neurological representation and organization (such as the research reported above in the section on languages and the brain), some is of an experimental nature (which manipulates variables and makes direct claims about cause and effect), and some relies on “good language learner” studies (which deal with correlations between specific traits and successful SLA). Some of this research remains quite speculative.

Age

It is a common belief that children are more successful L2 learners than adults, but the evidence for this is actually surprisingly equivocal. One reason for the apparent inconsistency in research findings is that some studies define relative “success” as [initial rate](#) of learning (where,

Table 4.3 Age differences in SLA

Younger advantage	Older advantage
• Brain plasticity	• Learning capacity
• Not analytical	• Analytic ability
• Fewer inhibitions (usually)	• Pragmatic skills
• Weaker group identity	• Greater knowledge of L1
• Simplified input more likely	• Real-world knowledge

contrary to popular belief, older learners have an advantage) while other studies define it as **ultimate achievement** (where learners who are introduced to the L2 in childhood indeed do appear to have an edge). Also, some studies define “success” in terms of how close the learner’s pronunciation is to a native speaker’s, others in terms of how closely a learner approximates native grammaticality judgments, and still others in terms of fluency or functional competence. It is very important to keep evaluative criteria clearly in mind while judging conflicting claims.

The question of whether, and how, age affects L2 outcomes has been a major issue in SLA for several decades, and a number of recent publications provide reviews from different points of view (e.g. Birdsong 1999; Scovel 2000; Singleton 2001). Some of the advantages which have been reported for both younger and older learners are listed in Table 4.3.

We noted in the earlier section of this chapter on languages and the brain that many linguists and psychologists believe there is a **critical period** for first language acquisition: children have only a limited number of years during which normal acquisition is possible. Beyond that, physiological changes cause the brain to lose its **plasticity**, or capacity to assume the new functions that learning language demands. Individuals who for some reason are deprived of the linguistic input which is needed to trigger first language acquisition during the critical period will never learn any language normally. One famous documented case which provides rare evidence for this point is that of Genie, an abused girl who was kept isolated from all language input and interaction until she was thirteen years old. In spite of years of intensive efforts at remediation, Genie never developed linguistic knowledge and skills for her L1 (English) that were comparable to those of speakers who began acquisition in early childhood (Curtiss 1977).

Genie

Evidence for the Critical Period Hypothesis

The tragic case of “Genie” bears directly on the Critical Period Hypothesis. Genie was discovered in 1970, at the age of thirteen, having been brought up in conditions of inhuman neglect and extreme isolation. She was severely disturbed and underdeveloped,

and had been unable to learn language. In the course of her treatment and rehabilitation, great efforts were made to teach her to speak. She had received next to no linguistic stimulation between the ages of two and puberty, so the evidence of her language-learning ability would bear directly on the Lenneberg hypothesis.

Analysis of the way Genie developed her linguistic skills showed several abnormalities, such as a marked gap between production and comprehension, variability in using rules, stereotyped speech, gaps in the acquisition of syntactic skills, and a generally retarded rate of development. After various psycholinguistic tests, it was concluded that Genie was using her right hemisphere for language (as well as for several other activities), and that this might have been the result of her beginning the task of language learning after the critical period of left-hemisphere development. The case was thus thought to support Lenneberg's hypothesis, but only in a weak form. Genie was evidently able to acquire some language from exposure after puberty (she made great progress in vocabulary, for example, and continued to make gains in morphology and syntax), but she did not do so in a normal way. (After S. Curtiss 1977, in Crystal 1997b.)

Lenneberg (1967) speculated that the critical period applies to SLA as well as to first language acquisition, and that this accounts for why almost all L2 speakers have a "foreign accent" if they do not begin learning the language before the cut-off age. Seliger (1978) and Long (1990) argue instead that there are multiple periods which place constraints on different aspects of language: e.g. different periods relate to the acquisition of phonology versus the acquisition of syntax. They also suggest that these periods do not impose absolute cut-off points; it is just that L2 acquisition will more *likely* be complete if begun in childhood than if it does not start until a later age. This weaker claim seems warranted since some older learners can achieve native-like proficiency, although they definitely constitute a minority of second language learners.

While most would agree that younger learners achieve ultimately higher levels of L2 proficiency, evidence is just as convincing that adolescents and adults learn faster in initial stages. While "brain plasticity" is listed as a younger learner advantage in Table 4.3, older learners are advantaged by greater learning capacity, including better memory for vocabulary. Greater analytic ability might also be an advantage for older learners, at least in the short run, since they are able to understand and apply explicit grammatical rules. On the other hand, Newport (1990) suggests that "less is more" in this respect: one reason younger learners develop more native-like grammatical intuitions is that they are in a non-analytic processing mode. This calls for another qualification: younger learners are probably more successful in informal and naturalistic L2 learning contexts, and older learners in formal instructional settings.

Other advantages that younger learners may have are being less inhibited than older learners, and having weaker feelings of identity with people (other than close family or caregivers) who speak the same native language. Children are also more likely to receive simplified language input from others, which might facilitate their learning (a factor that will be discussed in [Chapter 5](#)). Other advantages that older learners may have include higher levels of pragmatic skills and knowledge of L1, which may transfer positively to L2 use; more real-world knowledge enables older learners to perform tasks of much greater complexity, even when their linguistic resources are still limited.

A comprehensive explanation of age effects on SLA must ultimately take into account not only the multiple evaluative criteria for “success” that we mentioned above, but the system of language being learned, the stage of L2 development under consideration, the roles of both innate and environmental predispositions, and the complexities of input and of individual differences. (For a well-researched and carefully reasoned discussion of the full range of influencing factors, see Herschensohn 2007; Cook and Singleton 2014.)

Sex

Most research on the relation of learner sex and SLA has been concerned with cognitive style or learning strategies, or to issues of what variety of L2 is being acquired or opportunities for input and interaction (social factors to be discussed in [Chapter 5](#)). There is widespread belief in many western cultures that females tend to be better L2 learners than males, but this belief is probably primarily a social construct, based on outcomes which reflect cultural and sociopsychological constraints and influences.

There do appear to be some sex differences in language acquisition and processing, but the research evidence is mixed. For example, women outperform men in some tests of verbal fluency (such as finding words that begin with a certain letter), and women’s brains may be less asymmetrically organized than men’s for speech (Kimura 1992). Of particular potential relevance to SLA are findings in relation to mental representations in the lexicon versus the grammar: females seem to be better at memorizing complex forms, while males appear to be better at computing compositional rules (e.g. Halpern 2000). Other differences may be related to hormonal variables: higher androgen levels correlate with better automatized skills, and high estrogen with better semantic/interpretive skills (Mack 1992). Kimura (1992) reports that higher levels of articulatory and motor ability have been associated in women with higher levels of estrogen during the menstrual cycle.

Aptitude

The assumption that there is a talent which is specific to language learning has been widely held for many years. The following four components were proposed by Carroll (1965) as underlying this talent, and they constitute the bases for most aptitude tests:

- Phonemic coding ability
- Inductive language learning ability
- Grammatical sensitivity
- Associative memory capacity

Phonemic coding ability is the capacity to process auditory input into segments which can be stored and retrieved. It is particularly important at very early stages of learning when this ability “is concerned with the extent to which the input which impinges on the learner can become input that is worth processing, as opposed to input which may simply be an auditory blur or alternatively only partially processed” (Skehan 1998:203). In other words, if the hearer cannot analyze the incoming stream of speech into phonemes in order to recognize morphemes, input may not result in intake.

Inductive language-learning ability and **grammatical sensitivity** are both concerned with central processing. They account for further processing of the segmented auditory input by the brain to infer structure, identify patterns, make generalizations, recognize the grammatical function of elements, and formulate rules. It is in central processing that restructuring occurs.

Associative memory capacity is importantly concerned with how linguistic items are stored, and with how they are recalled and used in output. Associative memory capacity determines appropriate selection from among the L2 elements that are stored, and ultimately determines speaker fluency.

The concept of language-learning aptitude is essentially a hypothesis that possessing various degrees of these abilities predicts correlated degrees of success in L2 acquisition. Skehan (1998) reviews research in this area which largely supports this assumption, although he concludes that individual ability may vary by factor: e.g. a learner who has a high level of grammatical sensitivity may have a poor associative memory or vice versa. Talent in all factors is not a requirement for success in L2 learning. Some good learners achieve success because of their linguistic-analytic abilities, and some because of their memory aptitude. Skehan further concludes that language-learning aptitude “is not completely distinct from general cognitive abilities, as represented by intelligence tests, but it is far from the same thing” (1998:209).

The findings that aptitude is an important predictor of differential success in L2 learning holds both for naturalistic contexts and for formal classroom instruction. It is not completely deterministic, however, and is but one of several factors which may influence ultimate L2 proficiency.

Motivation

Another factor which is frequently cited to explain why some L2 learners are more successful than others is individual motivation. Motivation largely determines the level of effort which learners expend at various stages in their L2 development, often a key to ultimate level of proficiency.

Motivation is variously defined, but it is usually conceived as a construct which includes at least the following components (see Oxford and Ehrman 1993; Dörnyei 2001):

- Significant goal or need
- Desire to attain the goal
- Perception that learning L2 is relevant to fulfilling the goal or meeting the need
- Belief in the likely success or failure of learning L2
- Value of potential outcomes/rewards

The most widely recognized types of motivation are **integrative** and **instrumental**. **Integrative motivation** is based on interest in learning L2 because of a desire to learn about or associate with the people who use it (e.g. for romantic reasons), or because of an intention to participate or integrate in the L2-using speech community; in any case, emotional or affective factors are dominant. **Instrumental motivation** involves perception of purely practical value in learning the L2, such as increasing occupational or business opportunities, enhancing prestige and power, accessing scientific and technical information, or just passing a course in school. Neither of these orientations has an inherent advantage over the other in terms of L2 achievement. The relative effect of one or the other is dependent on complex personal and social factors: e.g. L2 learning by a member of the dominant group in a society may benefit more from integrative motivation, and L2 learning by a subordinate group member may be more influenced by instrumental motivation. Although the concept of **speech community** (Chapter 5) has expanded globally to include the virtual community of internet users, usually in L2 English, the same general distinction between integrative and instrumental motivation can be applied. Other reported motivations include altruistic reasons, general communicative needs, desire to travel, and intellectual curiosity (Skehan 1989; Oxford and Ehrman 1993).

Most of the research on this topic has been conducted using data collected with questionnaires that ask individuals to report on their reasons for learning another language. The reliability of such information has been questioned, but the consistently high correlation between reported strength of motivation and level of L2 achievement make it seem quite likely that the connection is indeed significant. Whether any cause-effect relationship is a “chicken-and-egg” matter is more uncertain. Does high motivation cause high L2 achievement, or is the satisfaction which results from successful L2 learning responsible for increasing motivation? In the process of language learning (which usually requires several years), there is probably a reciprocal effect.

A different perspective (Schumann 1997, 2001) suggests that motivation for second language learning, along with L2 representation and processing, is controlled by neurological mechanisms. Specific areas within our brain conduct a “stimulus appraisal,” which assesses the motivational relevance of events and other stimuli and determines how we respond, including what our attitudes and ultimately degree of effort will be.

Table 4.4 Cognitive styles

Field-dependent	–	Field-independent
Global	–	Particular
Holistic	–	Analytic
Deductive	–	Inductive
Focus on meaning	–	Focus on form

Research on motivation in SLA has given increasing consideration to factors such as the self-concept and identity of learners, as well as those teachers and others who are part of their context for learning, and with how they interact (see Ushioda 2013; Csizér and Magid 2014). Some of these will be addressed in Chapter 5.

Cognitive Style

Cognitive style refers to individuals' preferred way of processing: i.e. of perceiving, conceptualizing, organizing, and recalling information. Unlike factors of age, aptitude, and motivation, its role in explaining why some L2 learners are more successful than others has not been well established, but extravagant claims have sometimes been made which need to be viewed with skepticism and caution. We do know that, whatever the relation of cognitive style to success, it involves a complex (and as yet poorly understood) interaction with specific L2 social and learning contexts. Cognitive style is also closely related to and interacts with personality factors and learning strategies, which will be discussed below.

Categories of cognitive style are commonly identified as pairs of traits on opposite ends of a continuum; individual learners are rarely thought to be at one extreme or the other, but are located somewhere along the continuum between the poles. Researchers typically correlate individuals' ratings on different dimensions of cognitive style with various measures of L2 proficiency. Some of the traits which have been explored are listed in Table 4.4.

The **field-dependent/field-independent (FD/FI)** dimension is the one most frequently referred to in SLA-related research (reviewed in Chapelle and Green 1992). This distinction was originally introduced by Witkin et al. (1954) in a study of how individual perceptual differences relate to general cognitive processes, and was only later applied to language learning. A commonly used criterion for FD/FI is performance on an embedded figures test, which requires subjects to find a simple shape within a more complex design. Individuals who have difficulty discerning a figure apart from the ground (or field) within which it is embedded are judged to be relatively FD; individuals who have no difficulty with this test are judged relatively FI. The cognitive tasks are to disassemble or restructure visual stimuli and to rely on internal versus external referents. As this dimension has been applied to learning, individuals who are FD are also

considered more global and holistic in processing new information; individuals who are FI are considered more particularistic and analytic. FD learners are thought to achieve more success in L2 acquisition via highly contextualized interactive communicative experiences because that fits better with their holistic “cognitive style,” and FI learners to profit more from decontextualized analytic approaches and formal instruction. In terms of an Information Processing model of learning, FI learners may have better attentional capacities (Skehan 1998). This distinction has been metaphorically extended by some investigators to cultural differences between whole national or ethnic populations, with highly questionable results.

Another partially related dimension is preference for **deductive** or **inductive processing**. **Deductive** (or “top-down”) **processing** begins with a prediction or rule and then applies it to interpret particular instances of input. **Inductive** (or “bottom-up”) **processing** begins with examining input to discover some pattern and then formulates a generalization or rule that accounts for it, and that may then in turn be applied deductively. An inductive cognitive style is related to the linguistic-analytic ability discussed above as one component of language aptitude, which does appear to contribute to success in L2 learning in either naturalistic or instructed circumstances.

Some evidence can also be found for differential success in relation to relative focus on meaning versus focus on form. In a study of exceptionally talented L2 learners, for instance, Novoa, Fein, and Obler (1988) found that they possess “a cognitive style whereby subjects are able to focus on form perhaps better than meaning (but certainly in conjunction with meaning)” (Obler and Hannigan 1996:512–13).

Another difference in cognitive style may be related to age. Ellen Bialystok (1997) suggests that L2 learners have two options when adapting their existing categories of linguistic structure to adequately represent the structure of the new language. One option is extending the existing categories to include new instances from L2: in phonological structure, an L2 sound which is actually slightly different from a similar sound in L1 may be identified as the same as the L1 sound and pronounced with that value, resulting in a foreign accent. The second option is creating new categories: in phonological structure, this would mean recognizing the slightly different L2 sound as phonetically different, and learning to keep it distinct from the similar (and often functionally equivalent) L1 sound. For example, both English and Spanish have a sound that we can broadly represent as [t], but the English [t] is usually pronounced with the tongue touching the bony ridge that is behind the teeth (the alveolar ridge), while the Spanish [t] is usually pronounced with the tongue further forward, touching the back of the teeth. If English L1 learners of Spanish L2 fail to perceive the difference and produce these sounds as “the same,” this will contribute to an English accent in their Spanish. If they recognize the difference and learn to develop motor control of the tongue to produce the Spanish [t] differently, they will sound more like a native speaker of that language. (The reverse, of course, contributes to a Spanish accent in L2 learners’ English.)

Bialystok claims that adults tend to extend existing categories (i.e. not notice small differences), while children notice differences and tend to create new categories accordingly. She suggests that this difference in cognitive style, rather than a critical or sensitive period, may account for why many people consider children to be superior in L2 learning. Since the age-style relationship is a tendency rather than absolute, children might pronounce L2 with a foreign accent (but be less likely to) and adults might achieve native-like pronunciation (but are less likely to do so). However, as we will see in the [next chapter](#), children might intentionally choose to adopt non-native pronunciation in their L2 because of social factors.

Another dimension sometimes considered as a matter of cognitive style is sensory preference for processing input: visual, auditory, kinesthetic (movement-oriented), or tactile (touch-oriented). Apparently no one means of processing has an inherent advantage over others, but L2 learners reportedly feel more comfortable when teachers' instructional strategies are congruent with their sensory preference. This dimension may also be age-related, with younger learners showing more preference for kinesthetic and tactile modalities (cited in Reid 1987).

Criticisms of research on cognitive style and the implications which are drawn for L2 instruction have been primarily directed at the FD/FI distinction and related continua. One criticism is that the embedded figure test used to assess traits is not applicable to language acquisition and therefore is not relevant. Another concerns analytic procedures which often correlate a single cognitive trait and a single language proficiency measure without taking other influencing factors and complexities of performance into account. Still other criticisms concern lack of consideration given to differences in cultural background, prior educational experiences, possibilities of change over time, and stages of language learning. While cognitive style is interesting, and is ultimately likely to prove significant in some way in explaining differential L2 learning outcomes, we must be cautious in drawing conclusions.

Personality

Personality factors are sometimes added to cognitive style in characterizing more general [learning style](#). Speculation and research in SLA has included the following factors, also often characterized as endpoints on continua, as shown in [Table 4.5](#). As with cognitive styles, most of us are somewhere in between the extremes. Boldface print in this table indicates positive correlation with success in L2 learning.

Research in this area is almost always correlational: individuals are assessed for some personality trait (usually using questionnaires and scales), and the strength of the relationship between that score and the result of an L2 language proficiency measure is calculated. Evidence in some cases is very limited or contradictory.

Anxiety has received the most attention in SLA research, along with lack of anxiety as an important component of self-confidence (see Horwitz 2001 for a review). Anxiety correlates negatively with measures of L2 proficiency including grades awarded in foreign language classes,

Table 4.5 Personality traits

Anxious	–	Self-confident
Risk-avoiding	–	Risk-taking
Shy	–	Adventuresome
Introverted	–	Extroverted
Inner-directed	–	Other-directed
Reflective	–	Impulsive
Imaginative	–	Uninquisitive
Creative	–	Uncreative
Empathetic	–	Insensitive to others
Tolerant of ambiguity	–	Closure-oriented

meaning that higher anxiety tends to go with lower levels of success in L2 learning. In addition to self-confidence, lower anxiety may be manifested by more risk-taking or more adventuresome behaviors.

We need to keep some complex issues in mind when we read about or interpret research on anxiety:

- (1) The direction of cause and effect is uncertain. Lower anxiety levels might very well facilitate language learning; conversely, however, more successful language learners might feel less anxious in situations of L2 learning and use, and thus be more self-confident.
- (2) Instructional context or task influences anxiety level and reporting. For example, foreign language classes or tests which require oral performance normally generate more anxiety than do those in which production is in writing. Small-group performance generates less anxiety than whole-class activity.
- (3) Although personality factors are defined as individual traits, systematic cultural differences are found between groups of learners. For example, oral performance in English classes generates relatively more anxiety for Korean students (Truitt 1995) than for Turkish students (Kunt 1997). This may be because of cultural differences in concepts of “face” (i.e. projecting a positive self-image; see Liu 2001), or because of cultural differences in classroom practices and experiences.
- (4) Low anxiety and high self-confidence increase student motivation to learn, and make it more likely that they will use the L2 outside of the classroom setting. It is therefore not clear whether more successful learning is directly due to lower anxiety, or to a higher level of motivation and more social interaction.

On a partially related personality dimension, introverts generally do better in school and extroverts talk more. Some SLA researchers have hypothesized that extroverts would be more successful language learners, but

there is no clear support for the advantage of either trait. Nearly synonymous pairs of terms found in the research literature are “inner-directed/other-directed” and “reflective/impulsive.” Most personality studies have involved adult subjects, but when Saville-Troike (1984) explored this dimension with children from several countries, she found no significant correlation between either trait and academic achievement measures of English. She did find that among the Japanese L1 girls in her study, higher achievers on the academic language measures tended to be less passive, less compliant, and less dependent in coping with the challenges of learning English. However, these trends did not hold true for other L1 groups (Arabic, Hebrew, Icelandic, Korean, Polish, and Spanish), nor for Japanese boys.

Little study has been carried out on other personality factors in relation to differences in L2 outcomes, but there is some evidence that being imaginative or creative, empathetic, and tolerant of ambiguity is advantageous.

Learning Strategies

Differential L2 outcomes may also be affected by individuals' **learning strategies**: i.e. the behaviors and techniques they adopt in their efforts to learn a second language. Selection from among possible strategies is often a conscious choice on the part of learners, but it is strongly influenced by the nature of their motivation, cognitive style, and personality, as well as by specific contexts of use and opportunities for learning. The other variables we considered earlier in this section – age, sex, and aptitude – also play a role in strategy selection. Many learning strategies are culturally based: individuals learn how to learn as part of their socialization experiences, and strategies they acquire in relation to other domains are commonly transferred to language learning, which may take place under very different circumstances, sometimes within a foreign educational system.

Not all strategies are equal: some are inherently more effective than others, and some more appropriate in particular contexts of learning or for individuals with differing aptitudes and learning styles. One goal in SLA research has been to identify which strategies are used by relatively good language learners, with the hope that such strategies can be taught or otherwise applied to enhance learning.

A typology of language-learning strategies which has been widely used in SLA was formulated by O'Malley and Chamot (Chamot 1987):

- **Metacognitive**: e.g. previewing a concept or principle in anticipation of a learning activity; deciding in advance to attend to specific aspects of input; rehearsing linguistic components which will be required for an upcoming language task; self-monitoring of progress and knowledge states.
- **Cognitive**: e.g. repeating after a language model; translating from L1; remembering a new word in L2 by relating it to one that sounds the same in L1, or by creating vivid images; guessing meanings of new material through inferencing.

- **Social/affective:** e.g. seeking opportunities to interact with native speakers; working cooperatively with peers to obtain feedback or pool information; asking questions to obtain clarification; requesting repetition, explanation, or examples.

Metacognitive strategies are those which attempt to regulate language learning by planning and monitoring; **cognitive strategies** make use of direct analysis or synthesis of linguistic material; **social/affective strategies** involve interaction with others.

Self-reporting is a common means for collecting information on what strategies learners select, usually with interviews and questionnaires about what they have done or usually do (retrospective reports), or with think-aloud activities which have learners talk about what they are doing while engaged in an L2 learning task (concurrent reports). Self-reports are also collected by asking learners to keep journals or diaries and to record what they are conscious of doing in their effort to learn. Because the strategies used by adults are usually not visible, observation has limited value, but it is often used to collect information on children. Some researchers (e.g. Kleifgen 1986) have also used play-back techniques with children, where they videotape learners working at L2 tasks and then interview them in their L1 about what strategies they were using along with replaying the videotape for them. Recording private speech with unobtrusive wireless microphones is also a profitable data-collection procedure with children who naturally talk to themselves while working at cognitively demanding tasks (e.g. Saville-Troike 1988). Some of these subjects as young as three years of age softly repeated the new language forms after others, drilled themselves with self-created pattern practices, translated L2 forms to L1, rehearsed what they were going to say before speaking, and played games that were based on sounds of the new language. (Examples from this research are included in the [next chapter](#).)

Age can have an influence on learning strategies; for example, children tend to use more repetition whereas adults use more synthesis. Similarly the sex of learners can be significant, as females tend to use relatively more social/affective strategies than males, as well as more metacognitive strategies in listening tasks. A range of findings show “good learners” to have the following major traits (Ellis 2008:708):

- Concern for language form (but also attention to meaning)
- Concern for communication
- Active task approach
- Awareness of the learning process
- Capacity to use strategies flexibly in accordance with task requirements

As with other correlational research, it is difficult to establish causality, or even directionality; for example, “good learners” may approach language tasks more actively because they are more proficient (not more proficient because they are more active), or because they are more self-confident.

In spite of the extensive research documenting “good learner” traits, the extent to which strategic behavior can be initiated or changed with training is still not known. One problem in determining this, as noted above, is whether strategies are the cause or the result of L2 learning success. Another problem is the complex of other variables which must be taken into account. This “problem” is at the heart of “context” for **Complexity Theory**, a relatively recent theoretical focus in SLA which is discussed in this chapter. Inclusion of strategy training for SLA is generally viewed positively in any case, with the reasonable expectation that heightened awareness of strategic possibilities will beneficially inform L2 learners and may empower them to take control of their own learning (e.g. Oxford 1992; Jones 1998). A danger is that a researcher or instructor may have preconceived ideas as to “what works” and disrupt a student’s successful strategy by imposing or encouraging a different one. (For comprehensive overviews of research on aptitude, motivation, cognitive style, personality, and learning strategies, see Dörnyei 2005, 2006; Dörnyei and Ryan 2015; and Granena and Long 2013).

The Effects of Multilingualism

The possible gains/costs of multilingualism in relation to other cognitive faculties or processes have been a matter of speculation and study for many years. The strength of positive versus negative perceptions of the relationship has shifted over time, and this shift has been attributable as much to philosophical and political factors as to scientific findings.

Philosophically, the notion that multilingualism has positive effects on cognitive development was traditionally related to the belief that foreign language study (especially Greek and Latin) is good for “training the mind”; there is still an assumption in many parts of the world that multilingualism is an essential characteristic of “educated” and “cultured” members of society.

The opposite notion, that multilingualism has a negative impact on general intelligence, perhaps reached its zenith in US-based research on immigrants during the 1930s, motivated by increasingly xenophobic isolationist political sentiments at that time, and based on the low scores of immigrants who spoke languages other than English natively on the standardized tests of intelligence which then were coming into widespread use. (The point was not made until some years later that these tests were being administered in a language which the subjects did not speak fluently or understand well, and that the individuals were not being tested in their native languages.)

Research since the 1960s has largely supported claims that multilingualism has positive effects on intellectual functions, based on “measures of conceptual development, creativity, metalinguistic awareness, semantic development, and analytic skills” (Diaz 1985:18). The following list is a summary of positive findings (Diaz and Klingler 1991:184):

- Bilingual children show consistent advantages in tasks of both verbal and nonverbal abilities.

- Bilingual children show advanced metalinguistic abilities, especially manifested in their control of language processing.
- Cognitive and metalinguistic advantages appear in bilingual situations that involve systematic uses of the two languages, such as simultaneous acquisition settings or bilingual education.
- The cognitive effects of bilingualism appear relatively early in the process of becoming bilingual and do not require high levels of bilingual proficiency nor the achievement of balanced bilingualism.
- Bilingual children have advantages in the use of language for verbal mediation, as shown by their higher frequency of private-speech utterances and their larger number of private-speech functions.

Recent attention has focused in part on the positive effects that bilingualism appears to have on memory. This holds true both for children and for aging adults (e.g. Kormi-Nouri, Moniri, and Nilsson 2003; Bialystok, Craik, Klein, and Viswanathan 2004).

Relatively recent negative claims regarding multilingualism have primarily addressed capacity limitations for language acquisition and maintenance, with evidence that simultaneous bilingualism in childhood may result in a narrower range of lexical development in either language, and that intensive and continued use of L2 may reduce accessibility of L1. Common and stable multilingualism among populations in many parts of the world, however, suggests that whatever limitations there may be are not biological in nature. Some of the social factors influencing interaction between multilingualism and other aspects of cognitive development and academic performance are discussed in [Chapter 5](#).

Most interesting here is that, whether evidence is positive or negative (and it is generally positive), there are *differences* in the way multilinguals perform cognitive tasks. A person who knows more than one language can perceive and experience the world through more than one lens: “Both negative and positive effects are signs that L2 users think differently from monolinguals... Multicompetence is a different state of mind” (Cook 1992:565). Accounting for the differences remains one of the most intriguing challenges for psychological approaches to SLA.

Chapter Summary

Psychological perspectives on *what* is acquired in SLA concentrate on additions or changes that occur in neurological makeup, and on how the multilingual brain is organized. We have seen that the physical representation of the second language in the brain is not very different from the first, but there are differences in brain organization which relate to how proficient people are in L2, and to how they learned it. In contrast to Chomsky's proposal that there is a species-specific Language Acquisition Device (LAD), the psychologists surveyed in this chapter generally view *how* second languages are learned as

involving the same processes as the acquisition of other areas of complex knowledge and skills: i.e. “learning is learning.” Some consider the processes to be largely a matter of abstracting rules or principles, and some consider them to be more a physical neurological development of associative networks and connections. The question of why some learners are more successful than others leads to the examination of differences in the learners themselves. We find that language-learning outcomes are influenced by age, aptitude, and motivation. Other factors in individuals’ learning styles and strategies correlate with degree of success in SLA, but we can be much less sure of claims for cause–effect relationships.

Humans are inherently social creatures, and it is difficult to assess individual cognitive factors in language learning apart from the influence of the learner’s total social context, to which we turn next.

Activities

Questions for Self-Study

1. Match the following areas of SLA theory and research to their descriptions:

- | | |
|------------------------|--|
| 1. learning processes | a. considers aptitude in learning, how learning is linked to age and sex, and addresses why some second language learners are more successful than others |
| 2. neurolinguistics | b. studies the stages and sequences of language acquisition, addressing how acquisition happens |
| 3. learner differences | c. studies how the location and organization of language might differ in the heads of monolingual versus multilingual speakers, addressing what is added and changed in people’s brains when they learn another language |

2. Broca’s area is responsible for the ability to _____, whereas Wernicke’s area is responsible for processing _____.

3. Match the following terms to the situation that illustrates each:

- | | |
|-----------------------------|--|
| 1. coordinate bilingualism | a. Maria speaks French and English fluently, and often speaks “Frenglish,” a mixture of French and English, with her other bilingual friends. She produces and understands this mixture of languages easily. |
| 2. subordinate bilingualism | b. Ursula speaks French and German fluently, but cannot switch readily between the two. She must speak all German with you, or all French, even if you both know both languages. |

3. compound bilingualism
 - c. Shane speaks English natively and German as an L2. Each time he learns something new in German, he translates it into English to memorize the literal translation and compare it to the English meaning and structure.
4. Input is considered whatever sample of L2 that learners are exposed to. However, according to the Information Processing framework, what must learners do to make this input available for processing? What is the term for this kind of input?
5. Swain contends that _____ is necessary for successful L2 learning because it helps develop automaticity through practice and because it helps learners notice gaps in their own knowledge.
6. The _____ approach to learning focuses on the increasing strength of associations between stimuli and response, considering learning a change in the strength of these associations.
7. Considering second language acquisition a system of interconnected language components and stages of learner language, _____ combines linguistic, social, and psychological considerations of language acquisition.
8. _____ motivation involves emotional or affective reasons for learning an L2, such as an intention to participate or integrate in the L2 speech community. _____ motivation involves a purely practical reason for learning, such as better job opportunities or passing required courses in school.

Active Learning

1. If you have learned any second languages, at what age did you begin learning them? Are you more successful now in languages that you were exposed to earlier? Based on your personal experience, what do you think of the Critical Period Hypothesis? Do you know others whose experiences would support or refute it?
2. Which models relating to L2 learning processes do you feel you can use to explain your own learning process in your L2(s)? Does one seem more plausible than the others? Explain why or why not.
3. Integrative and instrumental motivation can both play a role in the desire to learn an L2. How have these two kinds of motivation influenced your L2 learning? If you have learned more than one L2, is it different depending on the L2 in question? If you know other L2 learners, ask them about what kinds of factors motivated them to learn, and compare them to your own.
4. Some studies define "success" in L2 acquisition per the initial rate of learning, some define it per the ultimate achievement, whereas others define it based upon how closely a learner comes to native-like pronunciation, or grammaticality judgments similar to a native speaker's. How do you define "success" in L2 acquisition in general as compared to how you define it for yourself? Is your definition of success in L2 learning the same as the standards by which you are judged, or do the members of your L2 speech community (teachers, classmates, colleagues, friends, etc.) have different definitions of success in L2 learning than you do?

5. It is postulated that younger learners are probably more successful in informal and naturalistic learning contexts, and older learners are more successful in formal instructional settings. Do you agree or disagree? Use your own experience combined with theoretical support from this chapter to make your argument.

Discuss and Debate

There is disagreement about whether someone who acquires an L2 after the age of about twelve could be considered a native speaker of it. What is your opinion, and what evidence or experience is that based on?

Further Reading

Bialystok, E. & Hakuta, K. (1994). *In Other Words: The Science and Psychology of Second-Language Acquisition*. New York: Basic Books.

Bialystok and Hakuta treat the Critical Period Hypothesis and different models of how language is processed by the brain in [chapters 3 and 4](#).

Birdsong, D. (ed.) (1999). *Second Language Acquisition and the Critical Period Hypothesis*. Mahwah, NJ: Lawrence Erlbaum.

A compilation of articles from various scholars, this book offers competing views on the Critical Period Hypothesis, allowing readers to hear many sides of the argument before judging for themselves.

Oblor, L. K. & Gjerlow, K. (1999). *Language and the Brain*. Cambridge: Cambridge University Press.

As foundational knowledge, [chapter 1](#) offers a useful overview of the history and present-day state of neurolinguistics and [chapter 2](#) is an introduction to the brain and its language-specific areas. More related to SLA, chapter 10 focuses on bilingualism, whereas chapter 11 explores the relationship between linguistic theory and neurolinguistics.

Pinker, S. (2007). *The Language Instinct: How the Mind Creates Language (P.S.)*. New York: Harper Perennial Modern Classics.

For clear discussion of various aspects of language acquisition, learning, and processing, see [chapters 1–3, 7, 10, and 13](#).

Larsen-Freeman, D. & Cameron, L. (2008). *Complex Systems and Applied Linguistics*. Oxford: Oxford University Press.

The first introductory book on Complexity Theory and applied linguistics, this work helps the reader define complex versus simple systems, explains the history of the study of complex systems, and then shows the application of Complexity Theory to different areas of applied linguistics (e.g. first and second language acquisition, second language teaching).

Ecke, P. (2015). Parasitic vocabulary acquisition, cross-linguistic influence, and lexical retrieval in multilinguals. *Bilingualism: Language and Cognition*, 18: 145–62.

This recent article, most suitable for readers with previous background in psycholinguistics, treats cross-linguistic influence in multilingual lexical retrieval. First, it discusses the influence of language typology of the languages involved, and then presents a model for vocabulary acquisition.

Sanz, C. (ed.) (2005). *Mind and Context in Adult Second Language Acquisition*. Washington, DC: Georgetown University Press.

As a compilation of articles by a variety of authors from an information processing perspective, this book includes updated looks at the cognitive neuroscience of language ([chapter 5](#)), learning processes ([chapter 6](#)), and individual differences in learners ([chapter 4](#)).

Skehan, P. (1998). *A Cognitive Approach to Language Learning*. Oxford: Oxford University Press.

This volume contains discussion of psycholinguistics and learner differences with respect to language learning, with emphasis on cognition rather than on linguistics or sociolinguistics.

Rebuschat, P. (ed.) (2015). *Implicit and Explicit Learning of Languages*. Amsterdam: John Benjamins.

This edited volume focuses on implicit and explicit language learning as viewed by researchers from multiple disciplines (cognitive psychology, linguistics, education, cognitive neuroscience, developmental psychology). It contains sections on theory, methodology, and practical applications.