The Dynamics of Second Language Emergence: Cycles of Language Use, Language Change, and Language Acquisition

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This article outlines an emergentist account whereby the limited end-state typical of adult second language learners results from dynamic cycles of language use, language change, language perception, and language learning in the interactions of members of language communities. In summary, the major processes are:

1. *Usage leads to change*: High frequency use of grammatical functors causes their phonological erosion and homonymy.
2. *Change affects perception:* Phonologically reduced cues are hard to perceive.
3. *Perception affects learning*: Low salience cues are difficult to learn, as are homonymous/polysemous constructions because of the low contingency of their form–function association.
4. *Learning affects usage:* (i) Where language is predominantly learned naturalistically by adults without any form focus, a typical result is a Basic Variety of interlanguage, low in grammatical complexity but communicatively effective. Because *usage leads to change*, maximum contact languages learned naturalistically can thus simplify and lose grammatical intricacies. Alternatively, (ii) where there are efforts promoting formal accuracy, the attractor state of the Basic Variety can be escaped by means of dialectic forces, socially recruited, involving the dynamics of learner consciousness, form-focused attention, and explicit learning. Such influences promote language maintenance.

Form, user, and use are inextricable.

LANGUAGE IS A DYNAMIC SYSTEM. IT COMprises the ecological interactions of many players: people who want to communicate and a world to be talked about. It operates across many different agents (neurons, brains, and bodies; phonemes, morphemes, lexemes, constructions, interactions, and discourses), different human conglomerations (individuals, social groups, networks, and cultures), and different timescales (evolutionary, diachronic, epigenetic, ontogenetic, interactional, neurosynchronic). Cognition, consciousness, experience, embodiment, brain, self, communication and human interaction, society, culture, and history are all inextricably intertwined in rich, complex, and dynamic ways in language. Yet despite this complexity, despite its lack of overt government, instead of anarchy and chaos, there are patterns everywhere, patterns not preordained by God, by genes, by school curriculum, or by other human policy, but patterns that emerge—synchronic patterns of linguistic organization at numerous levels (phonology, lexis, syntax, semantics, pragmatics, discourse, genre, etc.), dynamic patterns of usage, diachronic patterns of language change

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(linguistic cycles of grammaticization, pidginization, creolization, etc.), ontogenetic developmental patterns in child language acquisition, global geopolitical patterns of language growth and decline, dominance and loss, and so forth. As a complex system, the systematicities of language are emergent and adaptive. Only by adopting an integrative, dynamic framework will we understand how they come about.

Dynamic systems theory (de Bot, Lowie, & Verspoor, 2007; Herdina & Jessner, 2002; Thelen & Smith, 1994), complex systems theory (Holland, 1998; Kauffman, 1995), connectionism (Elman, Bates, Johnson, Karmiloff-Smith, Parisi, & Plunkett, 1996), chaos-complexity theory (Cooper, 1999; Larsen-Freeman, 1997, 2002; Larsen-Freeman & Cameron, in press; Waldrop, 1992), and emergentism (Bates & MacWhinney, 1987; N. C. Ellis, 1998; N. C. Ellis & Larsen-Freeman, 2006a; MacWhinney, 1999) are general frameworks for investigating processes of emergence of systematicity and pattern from dynamic interactions. The goal of this article is to outline a program for considering second language (L2) acquisition in such light. In 8,000 words, this must necessarily be a broad-brushed, impressionistic sketch, one that is overly simplistic and lacking in detail, and where controversy and issues of current argumentation are brushed over for the sake of a general picture. At its end, there will be many specific areas requiring closer study, completion, and correction, if the outline is seen to be useful at all, that is.

Language learning and language use are dynamic processes in which regularities and systems arise from the interaction of people, brains, selves, societies, and cultures using languages in the world. Analyses of diachronic processes of grammaticization (Hopper & Traugott, 2003), complexification (Dahl, 2004), and language change (Bybee & Hopper, 2001; Croft, 2000; Mufwene, 2001), have always focused on dynamic usage. Usage-based theories have become increasingly influential in the study of language acquisition (Barlow & Kemmer, 2000; Goldberg, 2006; Tomasello, 2003), centering on how children learn constructions while engaging in communication, the "interpersonal communicative and cognitive processes that everywhere and always shape language" (Slobin, 1997, p. 267). So too are input and interaction at the core of accounts of L2 learning (Gass, 1997; Larsen-Freeman & Long, 1991; Robinson & Ellis, 2008). Yet despite their similarities, first language (L1) and L2 acquisition differ in significant ways, most obviously on the level of ultimate attainment. Even the most diligent L2 learner usually achieves a proficiency considerably below what a child L1 acquirer achieves, with some naturalistic L2 acquirers acquiring only a Basic Variety characterized by pragmatic word order and minimal morphology (Klein & Purdue, 1992).[1] Is there sense to be made of the limitations of L2 acquisition, and the structure of languages themselves, by considering the broader integrated dynamics of language change, acquisition, and use? One proposal is as follows.

An emergentist account of second language acquisition (SLA) views the limited end-state typical of many naturalistic adult L2 learners as the result of dynamic cycles of language use, language change, language perception, and language learning in the interactions of members of language communities. The major processes include the following:

1. *Usage leads to change*: High frequency use of grammatical functors causes their phonological erosion and homonymy.
2. *Change affects perception:* Phonologically reduced cues are hard to perceive.
3. *Perception affects learning*: Low salience cues are difficult to learn, as are homonymous/polysemous constructions because of the low contingency of their form–function association.
4. *Learning affects usage:* (i) Where language is predominantly learned naturalistically by adults without any form focus, a typical result is a Basic Variety of interlanguage, low in grammatical complexity but communicatively effective. Because *usage leads to change*, maximum contact languages learned naturalistically can thus simplify and lose grammatical intricacies. Alternatively, (ii) where there are efforts promoting formal accuracy, the attractor state of the Basic Variety can be escaped by means of dialectic forces, socially recruited, involving the dynamics of learner consciousness, form-focused attention, and explicit learning. Such influences promote language maintenance. And so on, always, language shifts and changes, and cycles of usage evolve dynamically onward. This article outlines each of these processes in turn.

USAGE LEADS TO CHANGE

Languages change over time. They change as a result of usage. The diachronic study of language demonstrates characteristic processes of change that occur across languages, continents, and time, universal processes so general as to be recognized as laws. For example, in sound change, Grimm's

law describes how Proto-Indo-European stop consonants developed into Proto-Germanic stops and other consonants, with voiceless stops changing into voiceless fricatives, voiced stops becoming voiceless, and voiced aspirated stops losing their aspiration and changing into plain voiced stops. Grimm's law was a turning point in the development of linguistics. The realization of such regularities in the historical replacement of one phonetic feature by another was the foundation of the rigorous scientific study of language change. There are many such regularities in processes of phonological reduction (assimilation, lenition, elision, apocope, and syncope) and elsewhere in historical sound change. But their ubiquity and law-like systematicity have never prompted any theories of diachronic change in terms of their being rule-driven—without any conceivable mechanism, any such suggestion could be little more than a distraction. Rules do not govern these universals from above, instead such regularities are emergent (Bybee, 2000, 2005, 2007; Croft, 2000; Dahl, 2004; N. C. Ellis, 1998, 2003; N. C. Ellis & Larsen Freeman, 2006a; MacWhinney, 1998, 1999), evolving, bottom-up, from language as it is used. Like other patterns in natural and social science, they emerge in ecological and social interactions. The same is likely true for ontogenetic change—for language as it is acquired by children and adults from naturalistic usage (Robinson & Ellis, 2008; Tomasello, 2003).

Usage Leads to Erosion

Frequency is the driving force of phonological change. "It's hard to keep languages from getting blurry: speakers tend to 'smudge' phonology wherever possible, to delete and contract surface forms, and so forth." (Slobin, 1992, p. 191). The basic principles of automatization that apply to all kinds of motor activities and skills (like playing a musical instrument, a sport, or cooking) are that, through repetition, sequences of units that were previously independent come to be processed as a single unit or *chunk* (N. C. Ellis, 1996). Considerable practice with a particular token results in automaticity of its production and in sound reduction, assimilation, and lenition—the loss and overlap of spoken gestures. On a variant of Hebb's (1949) learning rule later encapsulated in the paraphrase "Cells that fire together wire together," Bybee's (2003) maxim is that "Items that are used together fuse together" (p. 112). The phenomenon is entirely graded—the degree of reduction is a continuous function of the frequency of the target word and the conditional probability of the target given the preceding word and following words (Bybee & Hopper, 2001; N. C. Ellis, 2002a; Jurafsky, Bell, Gregory, & Raymond, 2001). High token frequency also leads to *autonomy* whereby creative constructions learned by rote may never be analyzed into their constituent units, for example, learners may never have considered the literal roots of a *dicey situation* or that *gimme* consists of *give* + *me*. Such changes underpin grammaticalization in language change (Bybee, 2000; Croft, 2000).

These separate processes of sound reduction themselves conspire in a more general law still, that of Zipf (1935), which describes the distributional properties of the lexicon whereby the frequency of a word decays as a (universal) power function of its rank. The more common words account for many more tokens of our language than do the less common ones (consider *the* at more than 60,000 tokens per million words, *of* at 29,000 tokens, *and* at 27,000 tokens, *a* at 22,000 tokens, etc.). The more frequent words are also the shorter ones in the language. Zipf (1949) summarized this in the *principle of least effort*—speakers want to minimize articulatory effort and hence encourage brevity and phonological reduction. They tend to choose the most frequent words, and the more they use them, the more likely it will be that automatization of production will cause their shortening. Frequently used words become shorter with use.

Erosion Leads to Homophony

The most frequent words of the language tend also to be the most ambiguous (Köhler, 1986; Polikarpov, 2006). Many of the most frequently used words are ambiguous in their homophony and polysemy (e.g., *to, too, two; there, their, they're; I, eye, aye*). Ambiguity is a result of frequent usage, too: in polysemy from the grammaticalization processes of *desemanticization* (weakening, broadening, or abstraction of semantic force by habituation) and *extension* (use in new contexts; Hopper & Traugott, 2003); in homonymy from the fact that there are an awful number of meanings to hang onto a limited number of short sounds. This pattern generalizes across languages: The greater the number of monosyllabic words in the lexicon of a language, the greater the degree of homophony (Ke, 2006). Ambiguity is a loss of communicative capacity that arises if individual sounds are linked to more than one meaning as in homophony and polysemy. If the absence of word ambiguity is a mark of its evolutionary fitness, then word formation provides an exponential

increase in fitness with length (Nowak, Komaraova, & Niyogi, 2002). Listeners also want to minimize their efforts in interpreting and determining what a word actually means. So, least effort for the speaker is in tension with least effort for the listener. As these forces play out in symbolic usage, languages evolve to have scaling properties that follow Zipf's (1935) law (Ferrer i Cancho & Solé, 2003).

Grammatical Functors Are the Most Frequently Used Forms

The most frequently used words of the language are the closed-class words, the grammatical functors. The top 20 mostly frequently used words in English are *the, of, and, a, in, to, it, is, to, was, I, for, that, you, he, be, with, on, by,* and *at* (Leech, Rayson, & Wilson, 2001). More than half of spontaneous English speech consists of functors such as these. These are the "little words" of the language because of their frequency of usage; they are ambiguous in their interpretations; they are abstract and semantically light; they are syntagmatically highly connected.

High frequency of use has caused their abbreviation over time. Indeed, eventually some grammatical markers "wear away" completely, creating a pressure for the development of others to replace them. Thus in French, negative statements were originally formed by the use of *ne* before the verb. For emphasis, *ne* often came to be reinforced by particles that once had been independent nouns (e.g., *pas* 'step,' *Je ne vais pas* 'I'm not going,' *Il ne marche pas* 'he's not walking'; *goute* 'drop,' *Je n'ai goute d'argent* 'I have no money,' etc.). These particles underwent grammaticalization, with *pas* assuming special status as the default neutral obligatory negative adverb (e.g., *Je ne pense pas* 'I don't think so'), though before the 12th century it was used with verbs of motion where its semantic connection is clear. In modern French, the *ne* is as often as not omitted entirely (e.g. *Je suis pas allée* 'I did not go'), its use dependent on sociolinguistic factors such as age, gender, style of speech, phonology, and clause type (Dewaele, 2004), again, the general pattern emergent from subpatterns of regularities of usage. A generation that grows up hearing a sound produced less distinctly than it had been pronounced for the previous generation gradually comes to take this lesser rendition as the default. In following the general tendency to pronounce unaccented sounds less distinctly, they, in turn, pronounce their default version of the sound, already less distinct than the last generation's, even less distinctly. Eventually the default is no sound at all in that position. This erosion has a particularly dramatic effect in sounds such as suffixes or prefixes that perform important grammatical functions. In this way, whereas Latin had different forms for all six combinations of person and number in the present tense, French has just three different forms for the present tense of *–er* verbs (four for *–ir*, *–re*, and *–oir* type verbs), and modern English has just two different forms (McWhorter, 2002).

The ambiguity of the most frequent grammatical functors of a language and their lack of clear semantic reference is readily evident from the number of pages devoted to their explanation in dictionaries and grammars. Because of their range and frequency of use, these functors also have the highest connectivity or *degree*. When the sequential co-occurrence of words in discourse is described in terms of graphs of word connections, mapping the interactions like social networks, the World Wide Web, or other complex systems, these graphs show so-called small-world properties of being highly clustered and richly interconnected (Ferrer i Cancho & Solé, 2001; Ferrer i Cancho, Solé, & Köhler, 2004). Despite having many thousands of nodes (the >450,000 words populating a language), the average number of jumps in the path needed to get from any word to any other in this graph is remarkably small at less than three. A small number of highly connected words allows these properties. And it is the function words, the prepositions, pronouns, determiners, and so forth, that connect like this, having both high token frequency and a high degree of connectivity. The 10 most connected words of English are *and, the, of, in, a, to, 's, with, by,* and *is* (Ferrer i Cancho & Solé, 2001).

The grammatical functors of a language, the closed-class words and morphological inflections, are the milestones; they mark the structure of language. In language usage, they cue the combinatorial interpretation of words in phrases and sentences. In growth, they are the high degree nodes of the kernel lexicon of the language network to which new subunit constructions are preferentially attached, allowing scale-free growth distribution according to the so-called Barbarási-Albert model (Barbarási & Albert, 1999; Ferrer i Cancho & Solé, 2001).

Gathering the strands of this section together, we see too that grammatical functors are the most frequent tokens of the language. As a result of this high frequency of usage, they are the shortest, most phonologically reduced, least salient aspects of linguistic form. And, as a result of their

high frequency of usage and shortness, they are also the most ambiguous forms of the language—they have many functions, they are abstract and semantically light, and they are often homonymous, too.

CHANGE AFFECTS PERCEPTION

In informal and rapid speech, the tendency to give short shrift to function words and bound morphemes, exploiting their frequency and predictability, deforms their phonetic structure and blurs the boundaries between these morphemes and the words that surround them. Clitics, accentless words, or particles that depend accentually on an adjacent accented word and form a prosodic unit together with it, are the extreme examples of this blurring: the /s/ of *he's*, /l/ of *I'll*, and /v/ of *I've* can never be pronounced in isolation. Thus, grammatical function words and bound inflections tend to be short and low in stress, even in speech that is produced slowly and deliberately (Bates & Goodman, 1997) and in speech directed at children (Goodman, Nusbaum, Lee, & Broihier, 1990), with the result that these cues are difficult to perceive. When grammatical function words (*by, for, no, you,* etc.) are clipped out of connected speech and presented in isolation at levels where their open-class equivalents (*buy, four, know, ewe*, etc.) are perceived 95% correctly, adult native speakers can recognize them only 50% of the time (Herron & Bates, 1997). Grammatical forms are of low salience.

PERCEPTION AFFECTS LEARNING

Low Salience Cues Are Poorly Learned

The Rescorla-Wagner (1972) model, a formula summarizing the results of thousands of psychological investigations of animal and human associative learning, states that the amount of learning induced from an experience of a cue-outcome association depends crucially on the salience of the cue and the importance of the outcome. Low-salience cues are poorly learned. They are also readily affected by *overshadowing* and *blocking*. Overshadowing describes how, when two cues are presented together and they jointly predict an outcome, the strength of conditioning to each cue depends on their salience, with the most salient cue becoming associated with the outcome and the less salient one being overshadowed so that on its own it evinces little or no reaction (Kamin, 1969). Blocking is a "learned attention" effect (N. C. Ellis, 2006c, p. 164) whereby a cue that is experienced in a compound along with a known strong predictor is blocked from being seen as predictive of the outcome; once a cue has been blocked, further subsequent learning about that cue is attenuated/inhibited (Kamin, 1968; Kruschke & Blair, 2000; Mackintosh, 1975).

In earlier work (N. C. Ellis, 2006b, 2006c), I discussed how these selective attention effects and the low salience of grammatical functors conspire in making their acquisition more difficult for adult L2 learners. The salience of these forms correlates 0.63 with their difficulty of acquisition in the morpheme order studies (Goldschneider & DeKeyser, 2001).

What of the other factor in the Rescorla-Wagner model, the importance of the outcome? Grammatical morphemes are often redundant and overshadowed by more salient lexical cues to tense or number (e.g., *Tomorrow*, I *'ll* do the shopping; *Yesterday* I walk*ed*; *Seven* boy*s*; Pica, 1983; Terrell, 1991). If a learner knows these lexical cues and has processed them, then subsequent processing of the morphological cues in these contexts affords no further information. Blocking affects L2 tense much more than L1 tense. Infants learn meanings at the same times as words, and children learning their L1 only acquire the meanings of temporal adverbs quite late in development. But adults, with their experience of the world and of their L1, know a variety of pragmatic and lexical means for expressing temporal reference (serialization: presenting events in their order of occurrence; adverbials, e.g., *soon*, *now*; prepositional phrases, e.g., *in the morning*; calendric reference, e.g., *May 12, Monday,* etc.; Schumann, 1987). Thus, adult language learners' expression of temporality exhibits a sequence from pragmatic to lexical to grammatical devices, and the earlier other means block the acquisition of the later morphosyntactic ones: "Whereas all learners apparently achieve the pragmatic and lexical stages of development, fewer learners achieve the morphological stage of development" (Bardovi-Harlig, 2000, p. 415). Lexical and serialization strategies for expressing temporal reference are salient, constant, and simple to apply. Morphological cues to tense are nonsalient, they often vary by person and number, and typically there are additional irregularities. If, in expression, adult learners can get their message across by using these simpler strategies, they have achieved their goal. In the words of Simon (1962, p. 167), they have "satisficed" rather than "optimized," using the minimum necessary level of formal accuracy to achieve their communicative intention, whereas optimizing on native-like accuracy would be beyond their current cognitive bounds. Good enough (for the

naturalistic world), but not perfect enough (for the more formal criteria of schooling).

Homophonous (Low Form-Function Contingency) Forms Are Poorly Learned

Learning the associations between cues and outcomes is a function of their contingency (Rescorla, 1968). The more reliably a cue predicts an outcome, the better the association is learned. The contingency as measured using, for example, ΔP, the one-way dependency measure of the directional association between a cue and an outcome, predicts difficulty of learning (Shanks, 1995) in a wide variety of human and animal learning. This relationship is at the core of connectionist (Chater & Manning, 2006; Christiansen & Chater, 2001) and competition (MacWhinney, 1987) models of language learning.

Consider an English as a second language (ESL) learner trying to learn from the naturalistic input the interpretation of *–s* at the ends of words. Plural *–s*, third-person singular present *–s*, and possessive *-s*, are all homophonous with each other as well as with the contracted allomorphs of copula and auxiliary *be*. Therefore, if we evaluate *–s* as a cue for one particular of these functional interpretations, it is clear that there are many instances of the cue being there but that outcome not pertaining and thus ΔP is accordingly low. Consider the mappings from the other direction as well: plural *–s*, third-person singular present *–s*, and possessive *–s* all have variant expression as the allomorphs [/s/, /z/, /ez/]. Therefore, if we evaluate just one of these, say /ez/, as a cue for one particular outcome, say, plurality, it is clear that there are many instances of that outcome in the absence of the cue; ΔP is concomitantly reduced. Thus, a contingency analysis of these cue-interpretation associations suggests that they will not be readily learnable (N. C. Ellis, 2006b, 2006c; Goldschneider & DeKeyser, 2001).

This is just one particular illustration of the general case. The ambiguity of grammatical functors, their homophony and polysemy that result from high frequency of usage, erosion, desemanticization and extension, entail that they are low-contingency constructions that are difficult to learn.

Compounded Prejudices: Low Salience and Low Contingency

These simple analyses have profound consequences. If, as Herron and Bates (1997) demonstrated, fluent native speakers can only perceive grammatical functors from the bottom-up evidence of input 50% of the time compared to open-class words, how can language learners hear them thence to learn their function? Fluent language users perceive these elements in continuous speech because their language knowledge provides top-down support. Knowledge of the constructional patterns of the language also helps them to disambiguate some interpretations from context. Although homophony abounds in language, homophonous forms rarely exist within the same grammatical class. Fluent speakers do not seem to have any difficulty in disambiguating homophones from different syntactic categories; and as languages evolve, fitness for usage entails that they do so to allow the possible interpretations of homophonic form to be limited usually to one by syntactic constraints (Lyon, Nehaniv, Bailey, & Warren, May 2004).

But these top-down constraints are exactly the knowledge that learners lack. It is not surprising, therefore, that in L1 acquisition young children are unable to acquire grammatical forms until they have a critical mass of content words, providing enough top-down structure to permit perception and learning of those closed-class items that occur to the right or left of "real words" (Bates & Goodman, 1997, pp. 51–52). Nor is it surprising that it is these elements that are difficult for L2 learners, with the order of acquisition of these morphemes being much the same among L2 as among L1 learners (Bailey, Madden, & Krashen, 1974; Brown, 1973; Dulay & Burt, 1973; Larsen-Freeman, 1976).

Grammatical L2 Acquisition Is Harder Still

Fluent L1 users produce grammatical functors (because of their high frequency) that are smoothly automatized, eroded, and non-salient. They also perceive these grammatical functors fluently by expectation-driven means, supplementing the weak data-driven source and its low contingency with outcome by means of top-down support.

Children find grammatical functors difficult to perceive (low salience) and hard to learn (low salience plus low contingency). They have little language knowledge to provide top-down support in their perception because it is this language knowledge that they are trying to acquire. But they slowly accrete the strings, formulas, and more memorized forms (Bates & Goodman, 1997; N. C. Ellis, 1996; Peters, 1983; Peters & Menn, 1993) that provide the top-down support to allow the construction of language (Croft, 2001; Goldberg,

2006; Tomasello, 2003). They do so from plastic neural foundations that provide an optimal rational analysis of the problem space (N. C. Ellis, 2006b). The very things that make language use easy for a fluent speaker (automaticity and top-down knowledge) make language acquisition hard (nonsalient cues, no top-down support).

Adult L2 learners also find grammatical functors difficult to acquire for all these reasons. But they are hampered, in addition, by learned attention to language. The language foundation of an adult learner is not a tabula rasa, but a *tabula repleta* (N. C. Ellis, 2006a, 2006c). Adult learners have various cognitive biases, as a result of their L1 experiences, which tune their attention away from these cues.

LEARNING AFFECTS USAGE

The consequences of the low salience and low learnability of grammatical functors by adult acquirers depends on their learning contexts, their motivations for learning, and the social and educational reactions to their language usage. Communicative bias in naturalistic contexts where language learning is predominantly implicit results in outcomes that differ from more explicit, form-focused interactions either in the classroom or in the feedback from accuracy-minded discourse partners. The extremes are so different that I will characterize them here as two possible parallel futures.[2] This is a bifurcation point (Holland, 1998; Scott Kelso & Engstrøm, 2006) in the dynamical system, and as such it is a point of leverage (Holland, 2006), where biasing one way or the other has the potential to switch or shift the future phase.

Naturalistic L2 Acquisition

Consider the following snippet of ESL, a classic piece from Lightbown and Spada (1999) that has introduced many students to the study of SLA. It is writing by an ESL French speaking secondary school pupil describing the cartoon film "The Great Toy Robbery": "During a sunny day, a cowboy go in the desert with his horse. he has a big hat. His horse eat a flour. In the same time, Santa Clause go in a city to give some surprises" (pp. 74–75). It illustrates a classic ESL difficulty—the omission of the third-person singular present tense *–s*, that same *–s* which was used previously for illustration of the low salience and low ΔP of grammatical functors. Third-person present *–s* and possessive *–s* are the last acquired functors in the morpheme order studies (Bailey, Madden, & Krashen, 1974; Goldschneider & DeKeyser, 2001).

This is a particular example of the more general phenomenon that, although naturalistic L2 learners are surrounded by language, not all of it "goes in," and L2 acquisition is typically much less successful than L1 acquisition. This is Corder's (1967) distinction between *input*, the available target language, and *intake*, that subset of input that actually gets in and that the learner utilizes in some way. Schmidt (1984) described a naturalistic language learner, Wes, as very fluent, with high levels of strategic competence, but low levels of grammatical accuracy: "using 90% correct in obligatory contexts as the criterion for acquisition, none of the grammatical morphemes counted has changed from unacquired to acquired status over a five year period" (Schmidt, 1984, p. 5). The European Science Foundation crosslinguistic and longitudinal research project (Perdue, 1993) examined how 40 adult learners picked up the language of their social environment (Dutch, English, French, German, and Swedish) by means of everyday communication. Analysis of the interlanguage of these L2 learners resulted in its being described as the Basic Variety. All learners, independent of source language and target language, developed and used it, with about one third of them fossilizing at this level in that although they learned more words, they did not further complexify their utterances in respects of morphology or syntax. In this Basic Variety, most lexical items stem from the target language, but they are uninflected.

> There is no functional morphology. By far most lexical items correspond to nouns, verbs and adverbs; closed-class items, in particular determiners, subordinating elements, and prepositions, are rare, if present at all .... Note that there is no functional inflection whatsoever: no tense, no aspect, no mood, no agreement, no casemarking, no gender assignment. (Klein, 1998, pp. 544–545)

These grammatical functors abound in the input, but, as a result of their low salience, the low contingency of their form-function mappings, and adult acquirers' learned attentional biases and L1-tuned automatized processing of language, they are simply not implicitly learned by many naturalistic learners whose attentional focus is on communication.

Naturalisic L2 Use Causes Language Simplification. Linguistic evolution proceeds by natural selection from among the competing alternatives made available from the idiolects of individual speakers that vary among them (Croft, 2000;

Mufwene, 2001). Given that adults are typically less successful than children at language learning, language use by a high proportion of adult language learners typically means simplification, most obviously manifested in a loss of redundancy and irregularity and an increase in transparency (Trudgill, 2002a, 2002b). The Basic Variety of interlanguage shows similarities with pidgins (Schumann, 1978) because pidgins are the languages that result from maximal contact and adult language learning (McWhorter, 2001). Veronique (1999, 2001) and Becker and Veenstra (2003) detailed many parallels between the grammatical structures of French-based creoles and the Basic Variety of interlanguage of learners of French as an L2, particularly in the 1:1 iconicity of their mapping of function and form (Andersen, 1984), their controller-first, focus-last constituent ordering principles, their lack of verbal morphology, and the order of development of their means of temporal reference. Some creoles evolve as the complexification of pidgins resulting from the habitual use by children learning it as their L1. Other creoles, such as the Atlantic and Indian Ocean French-related creoles, developed from the interactions of adult speakers of nonstandard varieties of the target language and nonnatives (Mufwene, 2001). Creoles have systematic grammar, but not as many syntactic features as languages like West African Fula, which has 16 grammatical genders, or as many morphophonological features as the complex system of consonant mutations of Welsh, or as many phonological features as the tonal languages of South East Asia. All these are languages that have had much longer than the creoles to evolve their grammatical elaborations and diachronically motivated but synchronically obscure irregularities. Creoles typically have little or no inflection, they have little or no tone to distinguish words or express grammar, and their prefix/suffix + root combinations are semantically predictable (McWhorter, 2001, 2002).

The older and more isolated a language, the more complexity it has, that is, the more it overtly signals distinctions beyond strict communicative necessity. The most elaborate languages in these respects are those older, more isolated languages that are spoken by groups of people whose interactions are primarily with other speakers of the language and that thus are learned as L1s by children whose plastic brains are ready to represent them optimally. But their linguistic complexities pose great difficulties to L2 learners, who are prejudiced by L1 transfer and entrenchment. So some languages are easier for adults to learn, in an absolute sense, than others: "If one were given a month to learn a language of one's choice, I think one would select Norwegian rather than Faroese, Spanish rather than Latin, and Sranan rather than English" (Trudgill, 1983, p. 106). It is no accident that Faroese, as a low-contact language not subject to adult language learning, has maintained a degree of inflectional complexity that Norwegian has lost. Stasis allows a language, left to its own devices, to develop historical baggage—linguistic overgrowths that, however interesting, are strictly incidental to the needs of human exchange and expression (McWhorter, 2001, 2002, 2004). In the same way that in nature, niche-stability during the flat periods of punctuated evolution allows the continuation of elaborate vestigial forms while competition selects them out, so in language, isolation allows the slow accretion of complexity and its maintenance, while large amounts of external contact and adult language learning select out the less functional linguistic overdevelopments.

Consider again the case in point of the English third-person present tense *–s*. It weaves through this stream like a yellow rubber duck, illuminating the flow of the English language and L2 acquisition wherever it bobs. English is no longer a language spoken primarily as an L1. The 375 million L1 speakers are in a very definite minority compared to the 750 million English as a foreign language (EFL) and 375 million ESL speakers (Graddol, 2000). This preponderance of adult language learning of English is changing the nature of the language. Seidlhofer (2004) described these changes as English is used across the world as a lingua franca. First and foremost on her list of observables is "'dropping' the third person present tense *-s* (as in 'She look very sad')" (p. 236).

"Languages are 'streamlined' when history leads them to be learned more as second languages than as first ones, which abbreviates some of the more difficult parts of their grammars" (McWhorter, 2004, p. 51). As complex, adaptive systems, languages emerge, evolve, and change over time (N. C. Ellis & Larsen Freeman, 2006a, 2006b; Larsen-Freeman, 1997; Lee & Schumann, 2003, 2005; Schumann et al., 2006). Just as they are socially constructed, so too are they honed by social discourse. They adapt to their speakers. Because children are better language learners than adults, languages that adults can learn are simpler than languages that only children can learn. Thus the circle is unbroken. L2 acquisition by adults changes the very nature of language itself.

Form-Focused L2 Acquisition

Social–interactional or pedagogical reactions to nonnative-like utterances can serve as dialectic forces to pull L2 acquisition out of the attractor state of the Basic Variety. When an interaction partner or instructor intentionally brings additional evidence to the attention of the learner by some means of *focus on form* (Doughty & Williams, 1998), form-focused instruction, or consciousness raising, this focusing of attention can help the learner notice aspects of linguistic form or form–function mapping (Schmidt, 2001). Terrell (1991) characterized explicit grammar instruction as the use of instructional strategies to draw the students' attention to, or focus on, form or structure, or both, with instruction targeted at increasing the salience of inflections and other commonly ignored features, first by pointing them out and explaining their structure, and second, by providing meaningful input that contains many instances of the same grammatical meaning–form relationship. *Processing instruction* (VanPatten, 1996) similarly aims to alter learners' default processing strategies, to change the ways in which they attend to input data, thus to maximize the amount of intake of data to occur in L2 acquisition. L2 acquisition can thus be freed from the bounds of L1-induced selective attention by some means of focus on form that is socially provided (Lantolf & Thorne, 2006) and that recruits the learner's explicit conscious processing. In this way, L2 acquisition involves learners in a conscious dialectic tension (Kramsch, 2002; Lantolf & Pavlenko, 1995; Lantolf & Thorne, 2006; Larsen-Freeman, 2002; Swain, 2000) between the conflicting forces of their current interlanguage productions and the evidence of feedback, either linguistic, pragmatic, or metalinguistic, that allows socially scaffolded development.

Form-focused instruction of this type results in more accurate L2 acquisition than does instruction without focus on form. Reviews of the experimental and quasi-experimental investigations into the effectiveness of explicit learning and L2 instruction (N. C. Ellis & Laporte, 1997; Spada, 1997), particularly the comprehensive meta-analysis of Norris and Ortega (2000) that summarized the findings from 49 unique sample experimental and quasi-experimental investigations into the effectiveness of L2 instruction, demonstrated that form-focused L2 instruction results in large, target-oriented gains, that explicit types of instruction are more effective than implicit types, and that the effectiveness of L2 instruction is durable.

Consciousness and Learning. Form-focused instruction pulls learners out of their implicit habits, their automatized routines, by recruiting consciousness. Habits are implicitly controlled attractor states. We never think of walking, until it breaks down; as we start to stumble, then the feeling of falling is the negative evidence that recruits conscious control. We rarely think about driving, until it breaks down; as the clutch grinds, or the child runs into the road, these are the times when we become aware of the need to escape automatized routines. "The more novelty we encounter, the more conscious involvement is needed for successful learning and problem-solving" (Baars, 1997a, p. 303). So too for language: At each point in our history of language usage, the sample of language to which we have been exposed serves as the database from which we have induced our current model of how language operates—our modus operandi is based on estimates of the workings of the whole that we have determined from analysis of our sample of usage (N. C. Ellis, in press a). We operate according to these hypotheses until we receive negative evidence that we have erred in our analysis. Our consciousness is raised, and the tension between our implicitly controlled system and the evidence of overgeneralization to which we have been made aware serves as the interface allowing system change (N. C. Ellis, 2005).

The last 10 years have seen significant advances in our understanding of consciousness, its dynamics, and its roles in learning and memory. There have been three main developments to the scientific study of consciousness (Baars, Banks, & Newman, 2003): (a) cognitive neuroscientific investigation of the neural correlates of consciousness (see Koch, 2004, for review), (b) cognitive analysis of consciousness (particularly global workspace theory; see Baars, 1988, 1997b), and (c) computational modeling of the events underlying the emergence of self-amplifying resonances across a global network of neuronal coalitions, the dynamic competition among the massively parallel constituency of the unconscious mind that elects (Koch, 2004) the current oneness of the fleeting stream of conscious experience (Dehaene & Changeux, 2004; Dehaene, Sergent, & Changeaux, 2003).

The neural correlates of consciousness involve a coalition of forebrain neurons implicated in working memory and planning, interconnected via widespread cortico–cortico and cortico–thalamic feedback loops with sets of neurons in sensory and motor regions that code for particular features. Any one percept—real or imagined—corresponds to a winning coalition of the essential

features coded by these different but related regions. Thus, for example, even though different areas of the brain code the heat, the liquidity, the aroma, the sweetness, and the color of a mouthful of coffee, activation in these nodes is simultaneously synchronized into a winning coalition that reinforces the firing activity of its member neurons—probably by synchronizing their spiking discharge—and suppresses competing ones in a winner-takes-all fashion. Consciousness gives *clout*: When processes compete for ongoing control of the body, the one with the greatest clout dominates the scene until a process with even greater clout displaces it (Dennett, 2001). At any one moment, the winning coalition, expressed in the content of consciousness, is briefly sustained for a discrete epoch of somewhere between 20 and 200 ms before it is replaced by another coalition in the ongoing stream of snapshots of consciousness. Stabilization of the coalition seems to be achieved by massive feedback known as *reentrant signaling*, perhaps involving thalamo–cortical loops, which is synchronized in rhythmic action potential discharge in the 30–60 Hz gamma band of electroencephalography frequency. There is considerable ongoing research into this gamma band activity, both as an index of attentive awareness and as a mechanism for solving the binding problem (Crick & Koch, 2003; Dehaene & Changeux, 2004; Edelman, 1989; Edelman & Tononi, 2000; Koch, 2004; Singer, 1999).

The dynamics of election to consciousness have profound implications for the nature of the lexicon and of grammatical categories as well. Lexical meaning is not static and compartmentalized as in a dictionary. Lexicography demonstrates that any instantiation of a word's use represents an activation of only selected components of a word's fuzzy meaning, largely indicated by the context (Hanks, 2000). Words do not have meaning; instead, they provide cues to meaning. They are stimuli that affect mental states. Their phonological, syntactic, and semantic properties are revealed by the effects they have on those states (Elman, 2004). The same is true for grammar. There are numerous places in grammar where it is necessary to recognize categories with a clear prototypical core but a somewhat fuzzily delimited periphery (Huddleston, 1984). A distributional analysis of nouns demonstrates that different nouns vary as to their morphosyntactic behavior, and that some nouns display more behavior characteristic of nouns than others (N. C. Ellis, 2002b). "Knowledge of language is knowledge" (Goldberg, 1995, p. 5), hence "linguistic categories should be of the same type as other categories in our linguistic system" (Lakoff, 1987, p. 58). Elman's (1990) Serial Recurrent Network connectionist models of grammatical category activation shows how network state does not correspond to a word per se, but rather to the outcome of processing a word within a particular context. The contextual nature of interpretation suggests that it is better to look to the phrase or to the construction than to words as the basic level of language representation where form and meaning come together with greatest reliability (Chafe, 1994; Croft, 2001; N. C. Ellis, 1996, 2007b; Goldberg, 1995, 2003; Peters, 1983; Sinclair, 1991, 2004). Language, like the rest of cognition, is dynamical, situated, and embodied (Beer, 2000).

What is elected to consciousness affects learning. Consciousness is the publicity organ of the brain. It is a facility for accessing, disseminating, and exchanging information and for exercising global coordination and control. Consciousness is the interface (N. C. Ellis, 2005). "Paying attention—becoming conscious of some material—seems to be the sovereign remedy for learning anything, applicable to many very different kinds of information. It is the universal solvent of the mind" (Baars, 1997b, p. 301).

So learning is dynamic; it takes place during processing, as Hebb (1949), Craik and Lockhart (1972), Pienemann (1998), and O'Grady (2003) have all reminded us from their neural, cognitive, and linguistic perspectives. There are different forms of language learning. Broadly, these forms are (a) the implicit tallying and chunking that take place during usage (N. C. Ellis, 2002a, 2002b), and (b) the explicit learning in the classroom and that follows communication breakdown (N. C. Ellis, 2005). Implicit learning from usage occurs largely within modality and involves the priming, or chunking, of representations or routines within a module, with abstract schema and constructions emerging from the conspiracy of memorized instances. It is the means of tuning our "zombie" agents, the menagerie of specialized sensory-motor processors that carry out routine operations in the absence of direct conscious sensation or control. It is largely automatized. It operates in parallel. In contrast, conscious processing is spread wide over the brain and unifies otherwise disparate areas in a synchronized focus of activity. Conscious activity affords much more scope for focused long-range association and influence than does implicit learning. It brings about a whole new level of potential associations. It operates serially.

Consciousness too is dynamic. It is perhaps the prototype example of an emergent phenomenon:

The stream of consciousness is one of ever-changing states, each cued by prior state and perceptual context, the units of consciousness being identifiable as patterns of brain synchrony in time (Spivey, 2006). The dynamics of language learning are inextricably linked to the dynamics of consciousness, in neural activity and in the social world as well.

Social Interaction and Dialectics. Language use and consciousness are both socially emergent, too. Language use, social roles, language learning, and conscious experience are all socially situated, negotiated, scaffolded, and guided. They emerge in the dynamic play of social intercourse. Our expectations, systematized and automatized by prior experience, provide the thesis, our model of language, and we speak accordingly. If we speak intelligibly and appropriately, we get one type of social reaction, and conversation focuses further on the intended message, meaning, and communication. If not, we may get another type of social reaction that helpfully focuses our attention on what we do not yet know how to do. Through the provision of negative feedback, be it a clarification request or possibly a recast, some dialectic (an antithesis that contradicts or negates our thesis, our model of language, and the tension between the two, which is resolved by means of synthesis) promotes the development of our language resources (Kramsch, 2002; Lantolf, 2006; Lantolf & Thorne, 2006).

The usual social–interactional or pedagogical reactions to non-native-like utterances involve an interaction partner (Gass & Varonis, 1994) or instructor (Doughty & Williams, 1998) intentionally bringing additional evidence to the attention of the learner by some clarification request, or negative feedback, or correction, or focus-on-form, or explicit instruction, recruiting consciousness to overcome the implicit routines that are nonoptimal for the L2. Analyses of classroom, mother–child, and native speaker–nonnative speaker interactions demonstrate how conversation partners can scaffold the acquisition of novel vocabulary and other constructions by focusing attention on perceptual referents or shades of meaning and their corresponding linguistic forms (R. Ellis, 2000; Gass, 1997; Long, 1983; Mackey & Gass, 2006; Oliver, 1995; Tomasello, 1999; Tomasello & Akhtar, 2000). An interlocutor has various means of making the input more comprehensible: (a) by modifying speech, (b) by providing linguistic and extralinguistic context, (c) by orienting the communication to the "here and now" and, (d) by modifying the interactional structure of the conversation (Long, 1982). Of course, learners are not passive recipients of modified input, but rather are agents of their own learning, playing an active role in negotiating meaning and selective attending (Larsen-Freeman, 1985). Interaction in which the participant's attention is focused on resolving a communication problem, and the consequent negotiation of form and meaning "connects input, internal learner capacities, particularly selective attention, and output in productive ways" (Long, 1996, p. 452).

Learning is ever thus. It takes place in a social context, involving action, reaction, collaborative interaction, intersubjectivity, and mutually assisted performance (Donato, 1994; Lantolf, 2006; Lantolf & Appel, 1994; Lantolf & Pavlenko, 1995; Lantolf & Thorne, 2006; Ricento, 1995; van Geert, 1994). Speech, speakers, and social relationships are inseparable (Norton, 1997). Activity theory emphasizes how individual learning is an emergent, holistic property of a dynamic system comprising many influences, both social, individual, and contextual (Lantolf & Appel, 1994). Action provides a context within which the individual and society, mental functioning and sociocultural context can be understood as interrelated moments (Wertsch, 1998; Wertsch, Del Rio, & Alvarez, 1995). Uttering invokes feedback that is socially provided (Tarone, 1997) and that recruits the learner's consciousness. Indeed consciousness itself is an emergent end product of socialization (Vygotsky, 1980; Wertsch, 1985). Just as L1 acquisition is "socially gated" (Kuhl, 2004), so too is SLA (N. C. Ellis, in press b).

Cultural Forces: Written Language, Instruction, and Language Maintenance. Social reactions conspire in cultural dynamics. Setting a language into written form affects both language change and language learning. Language change occurs much faster in languages that are spoken but not written (only approximately 5% of the roughly 6,000 languages of the world are written; McWhorter, 2002). Written language affects L2 acquisition (Tarone & Bigelow, 2005). Educational policies and national curricula can focus on grammar to greater or lesser degrees. Language use is directly and indirectly forged with politics, government, nationhood, and identity. Language change can be challenged with prescriptive grammars; language loss can be reversed through language maintenance, revitalization, and reversal policies (Baker & Prys Jones, 1998; Fishman, 1991; Skutnabb-Kangas, Phillipson, & Rannut, 1994), and so on. In these ways, the dynamics of language

learning are inextricably linked with the dynamics of the sociopolitical world as well.

Language usage involves consciousness and learning and dialogue and dialectics, and it is motivated by cultural forces whether it occurs in naturalistic or formal contexts. Socially guided consciousness is the motivator for growth and change in all contexts and all cognitive domains. So why do I put these sections here in Parallel Future 2 where language structure is preserved or complexified, rather than in Parallel Future 1 where things tend toward simplification? Simply because in naturalistic environments these forces tend more toward meaning, whereas in formal environments, their bias is more toward form.

EMERGENCE AND PANCHRONY

There are many notable and interesting regularities of language structure, of L1 and L2 acquisition, of language production and language comprehension, and of language change. Despite considerable individual variation, where we are unable to predict precisely what a particular learner will say next, how he or she will phrase it, or what he or she will pick up from the social or pedagogical reactions to the utterance (de Bot, Lowie, & Verspoor, 2007; N. C. Ellis & Larsen Freeman, 2006b; R. Ellis, 1985, 1999; Larsen-Freeman, 2006; Tarone, 1988; Verspoor, Lowie, & van Dijk, this issue), or, in advance, how French, Spanish, Italian, Portuguese, and Romanian were to diverge from Latin, there are general patterns of interlanguage developmental sequences, of psycholinguistic processing, of native norms, of L1 transfer effects, of native-like selection, of different types of instruction, of language change, and of the rest across the wide range of phenomena of language. There is a lot of patterning to be explained (N. C. Ellis, 2007a; Long, 1990). Yet these regularities are not rule-driven; there are no mechanisms for such top-down governance. Instead, they emerge from the dynamics of language usage (Bybee, 2005, in press; N. C. Ellis, 2003; N. C. Ellis & Larsen-Freeman, 2006a; Elman et al., 1996; MacWhinney, 1998, 1999).

Much comes from usage frequency (Bod, Hay, & Jannedy, 2003; Bybee & Hopper, 2001; N. C. Ellis, 2002a). This article has outlined effects of frequent production on phonological erosion, both ontogenetically and diachronically, and also on the language changes involved in grammaticalization (Hopper & Traugott, 2003). Words found together with a high frequency come to be cognitively processed as single chunks, which then evolve as individual words. As they are frequently used, so four processes of change typically occur: *desemanticization*, the broadening or abstraction of meaning or content; *extension*, or use in new contexts; *decategorialization*, the loss of morphosyntactic properties; and *erosion*, the loss of phonetic substance. The result is a very predictable linguistic cycle (Givón, 1971; Hodge, 1970) whereby a notion that is first expressed in discourse > syntax > morphology > morphophonemics > zero (> discourse.>.>, and round again). "The mechanisms and principles involved in grammaticalization conform to a complex process of coding and organization of language which is universally applicable to describe the evolution of grammatical forms" (Wischer & Diewald, 2002, p. 425). These universal processes emerge from dynamic processes of cognition and diachrony: "For a theory of grammaticalization, it is both unjustified and impractical to maintain a distinction between synchrony and diachrony" (Heine, Claudi, & Hünnemeyer, 1991, p. 248), and of usage, discourse, and social interaction:

> Grammar is not absolutely formulated and abstractly represented, but always anchored in the specific form of an utterance . . . . Its forms are not fixed templates, but are negotiable in face-to-face interaction in ways that reflect individual speakers' past experience of these forms, and their assessment of the present context. (Hopper, 1998, p. 142)

"Grammar is always emergent and never present" (Hopper, 1998, p. 148). So too are the regularities of language production and language reception, so too are the regularities of L2 acquisition. We cannot separate language from discourse, language from usage, language from cognition, language from society, or language from brain. Human thinking, like nature, appears to partition things, events, and ideas into pairs. But these pairs too are emergent, and they are complementary, more mutually dependent than mutually exclusive. They drive change, with the "action" taking place in between in complex coordination dynamics (Scott Kelso & Engstrøm, 2006). From dynamic processes over all diachronic timescales and all synchronic states, there emerge what Saussure (1916) termed "Panchronic principles" (p. 135), generalizations of language that exist independently of time, of a given language, or of any concrete linguistic facts. There are indeed laws of L1 and L2 acquisition, comparable to the laws of the natural sciences. They are emergent too.

NOTES

[1] This is not invariably the case, there are documented cases of adults acquiring nativelike skills (Ioup, Boustagoui, Tigi, & Moselle, 1994). Nevertheless, it is an

outcome typical enough to be regarded as an accepted fact of L2 acquisition (Long, 1990).

[2] Of course, this characterization of two black-and-white extremes (naturalistic acquisition as implicit leading to some kind of pidgin or basic variety vs. formal acquisition as conscious leading to a grammatical variety) is a gross simplification. Consciousness and social support play roles in naturalistic contexts because there is always learning in formal contexts that is implicit and data-driven. There are numerous gradations between these two extremes. Thanks to Kathleen Bardovi-Harlig for encouraging me to make this point explicit, and therefore, for encouraging the realization that every interaction is a point of possible bifurcation. Some causal factors combine additively, some are nonlinear in their combinations, and some are more catastrophic in their interactions causing marked qualitative or topological changes in the system's long-term dynamical behavior. The problem is knowing which, when, and why.

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