
Input and Second Language Acquisition: The Roles of Frequency, Form, and Function

Introduction to the Special Issue

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The articles in this special issue explore how the acquisition of linguistic constructions as form–function mappings is affected by the distribution and saliency of forms in oral input, by their functional interpretations, and by the reliabilities of their form–function mappings. They consider the psycholinguistics of language learning following general cognitive principles of category learning, with schematic constructions emerging from usage. They analyze how learning is driven by the frequency and frequency distribution of exemplars within construction, the salience of their form, the significance of their functional interpretation, the match of their meaning to the construction prototype, and the reliability of their mappings. These investigations address a range of morphological and syntactic constructions in instructed, uninstructed, and laboratory settings. They include both experimental and corpus-based approaches (some conducted longitudinally) and consider the relationship between input and acquisition in the short term and over time, with a particular emphasis on spoken input directed to second and foreign language learners.

LEARNERS' ACQUISITION OF A SECOND language (L2) depends on their experience of this language and on what they can make of it. Accounts of successful L2 acquisition have accordingly emphasized the importance of the quality of the input available to learners (e.g., Gass, 1997; Lightbown, 1992; Swain, 1988). However, despite the long-standing recognition of the importance of input in language acquisition, our research base contains little by way of dense corpora studies describing the evidence, particularly of oral input, upon which learners base their analyses for the development of interlanguage grammars. Extensive corpus linguistic investigations of the frequencies, frequency distributions, and salience of

forms in language input and longitudinal corpora relating the properties of learner interlanguage to the available input have the potential to provide crucial insights into the input–acquisition relationship. An understanding of this relationship is also informed by experimental work, but, to date, we have a relatively limited body of research in second language acquisition in which fine-grained manipulations of learners' experience with natural language input (such as skewed vs. balanced exposure to target features) has been explored. These corpus-based and experimentally generated data are the data necessary for the investigation of how the learning of linguistic constructions (the units of the linguistic system that specify the morphological, syntactic, and lexical form of language and their associated semantic, pragmatic, and discourse functions) might follow general cognitive principles of category learning.

Key aspects of category learning include the frequency and frequency distribution of exemplars, the salience of their forms, the significance of their functional interpretations, the match of their meanings to the construction prototype, and the reliabilities of their mappings. These are the factors requiring description, across the evidence of the input and learner cognition, to investigate the acquisition of linguistic constructions as categories.

This special issue explores a range of morphological and syntactic constructions of second and foreign language acquisition in instructed, uninstructed, and laboratory settings, with particular emphasis on experimental and corpus-based investigations of spoken input directed to L2 learners. The focus on aural input provides a much needed complementary focus to the written-based corpora work, which has dominated much of the L2 research. Furthermore, it allows for comparisons with child first language (L1) acquisition and permits analyses of speech phenomena that may render some constructions more or less perceptible than others. The use of longitudinal data, where possible, also allows us to look at the development of language over time (Ortega & Ibarra-Shea, 2005).

The investigations reported broadly adopt functional, cognitive linguistic, psycholinguistic, and constructionist perspectives (e.g., Bates & MacWhinney, 1987; Ellis, 1998, 2003, 2006a; Ellis & Cadierno, in press; Goldberg, 1995, 2003, 2006; Lakoff, 1987; Langacker, 1987; Ninio, 2006; Robinson & Ellis, 2008; Tomasello, 2003) to investigate the degree to which the acquisition of linguistic constructions may be explained by the ways in which general perceptual and cognitive principles of category learning shape learners' experiences with the language input to which they are exposed.

Four determinants of learning explored in this issue are (a) input frequency (type-token frequency, Zipfian distribution, recency), (b) form (salience and perception), (c) function (prototypicality of meaning, importance of form for message comprehension, redundancy), and (d) interactions between these (contingency of form-function mapping). We now consider each in turn.

DETERMINANTS OF CONSTRUCTION LEARNING

Input Frequency

Construction Frequency. Psycholinguistic research shows how language processing is inti-

mately tuned to input frequency at all levels of grain: Input frequency affects the processing of phonology and phonotactics, reading, spelling, lexis, morphosyntax, formulaic language, language comprehension, grammaticality, sentence production, and syntax (Ellis, 2002). Sensitivity to input frequency entails that language users must have registered patterns of occurrence in processing. These frequency effects are thus compelling evidence for usage-based models of language acquisition, which emphasize the role of input.

Type and Token Frequency. Token frequency counts how often a particular form appears in the input. Type frequency, on the other hand, refers to the number of distinct lexical items that can be substituted in a given slot in a construction, whether it is a word-level construction for inflection or a syntactic construction specifying the relation among words. For example, the "regular" English past tense *-ed* has a very high type frequency because it applies to thousands of different types of verbs, whereas the vowel change found in some irregular past forms (e.g., "swim/swam"; "ring/rang") has much lower type frequency. The productivity of phonological, morphological, and syntactic patterns is a function of type rather than token frequency (Bybee & Hopper, 2001). This is so for the following reasons: (a) The more lexical items that are heard in a certain position in a construction, the less likely it is that the construction is associated with a particular lexical item and the more likely it is that a general category is formed over the items that occur in that position; (b) the more items the category must cover, the more general are its criterial features and the more likely it is to extend to new items; and (c) high type frequency ensures that a construction is used frequently, thus strengthening its representational schema and making it more accessible for further use with new items (Bybee & Thompson, 2000). In contrast, high token frequency promotes the entrenchment or conservation of irregular forms and idioms; the irregular forms only survive because they are high frequency. These findings support language's place at the center of cognitive research into human categorization, which also emphasizes the importance of type frequency in classification.

Zipfian Distribution. In the learning of categories from exemplars, acquisition is optimized by the introduction of an initial, low-variance sample centered on prototypical exemplars (Elio & Anderson, 1981, 1984). This low-variance sample allows learners to get a fix on what will account for most of the category members. The bounds of

the category are defined later by experience of the full breadth of exemplar types. Goldberg, Casenhiser, and Sethuraman (2004) demonstrated that in samples of child language acquisition, for a variety of verb–argument constructions (VACs), there is a strong tendency for one single verb to occur with very high frequency in comparison to other verbs used, a profile that closely mirrors that of the mothers' speech to these children. In natural language, Zipf's law (Zipf, 1935) describes how the highest frequency words account for the most linguistic tokens. Goldberg et al. showed that Zipf's law applies within VACs, too, and they argued that this input promotes acquisition: Tokens of one particular verb account for the lion's share of instances of each particular argument frame; this pathbreaking verb also is the one with the prototypical meaning from which the construction is derived (see also Ninio, 1999, 2006).

Recency. Cognitive psychological research shows that three key factors determine the activation of memory schemata—frequency, recency, and context (Anderson, 1989; Anderson & Schooler, 2000). Language processing also reflects recency effects. This phenomenon is known as *priming* and may be observed in our phonology, conceptual representations, lexical choice, and syntax (McDonough & Trofimovich, 2008). Syntactic priming refers to the phenomenon of using a particular syntactic structure as a result of recent prior exposure to the same structure. This behavior has been observed when speakers hear, speak, read, or write sentences (Bock, 1986; Pickering, 2006; Pickering & Garrod, 2006).

Form (Salience and Perception)

The perceived strength of stimuli is commonly referred to as *salience*. Low salience cues tend to be less readily learned. Ellis (2006b, 2006c) summarized the associative learning research, demonstrating that selective attention, salience, expectation, and surprise are key elements in the analysis of all learning, animal and human alike. As the Rescorla–Wagner model (Rescorla & Wagner, 1972) encapsulates, 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.

Many grammatical meaning–form relationships, particularly those that are notoriously difficult for L2 learners, like grammatical particles and inflections in many languages, are of low salience in the language stream. For example, adverbials such as “yesterday” and “tomorrow” are

stronger psychophysical forms in the input than the grammatical morphemes attached to verbs to indicate when a particular action occurred. Both provide cues to temporal relationships, but the lexical items are much more likely to be perceived. This can result in overshadowing and blocking of the temporal morphology, making it difficult for L2 learners to acquire (Ellis, 2006c, 2008a; Goldschneider & DeKeyser, 2001).

Function

Prototypicality of Meaning. Categories have graded structure, with some members being better exemplars than others. In the prototype theory of concepts (Rosch & Mervis, 1975; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976), the prototype as an idealized central description is the best example of the category, appropriately summarizing the most representative attributes of a category. As the typical instance of a category, it serves as the benchmark against which surrounding, less representative instances are classified. The greater the token frequency of an exemplar, the more it contributes to defining the category, and the greater the likelihood that it will be considered the prototype.

Redundancy. The Rescorla–Wagner model (Rescorla & Wagner, 1972) also summarizes how redundant cues tend not to be acquired. Not only are many grammatical meaning–form relationships low in salience, but they can also be redundant in the understanding of the meaning of an utterance. Referring to the previously mentioned example, it is often unnecessary to interpret inflections marking grammatical meanings such as tense because they are usually accompanied by adverbials that indicate the temporal reference.

Interactions Between Contingency of Form–Function Mapping

Psychological research into associative learning has long recognized that although frequency of form is important, so too is contingency of mapping (Shanks, 1995). Consider learning the category of birds. Although eyes and wings are equally frequently experienced features in the exemplars, wings are the distinctive feature in differentiating birds from other animals. Wings are important features when learning the category of birds because they are reliably associated with class membership, whereas eyes are neither. Raw frequency of occurrence is less important than the contingency between cue and interpretation. Distinctiveness or reliability of

form–function mapping is a driving force of all associative learning, to the degree that the field of its study has been known as *contingency learning*. Since Rescorla (1968) showed that, for classical conditioning, if one removed the contingency between the conditioned stimulus (CS) and the unconditioned (US), preserving the temporal pairing between CS and US but adding additional trials where the US appeared on its own, animals consequently did not develop a conditioned response to the CS. This result was a milestone in the development of learning theory because it implied that it was contingency, not temporal pairing, that generated conditioned responding. Contingency and its associated aspects of predictive value, information gain, and statistical association, have been at the core of learning theory ever since. It is central in psycholinguistic theories of second language acquisition, as well (Andersen, 1993; Ellis, 2006b, 2006c, 2008b; Gries & Wulff, 2005; MacWhinney, 1987).

THE CONTRIBUTIONS IN THIS SPECIAL ISSUE

Collins, Trofimovich, White, Cardoso, and Horst provide an integrated analysis (phonological, morphosyntactic, and lexicosemantic) of the distribution and saliency of three morphosyntactic features (simple past, progressive aspect, and the possessive determiners *his/her*) in a longitudinal corpus of instructional input directed at young francophone learners of English in Quebec. Their exploration of the interaction between the availability (defined through frequency-based criteria) and the accessibility (defined through semantic and perceptibility criteria) of the three forms identified three factors in their data that distinguished the earlier acquired progressive construction from the later acquired simple past and *his/her* forms. These factors were *type frequency*, which considered frequency in the language at large of the verbs and nouns found in the constructions; the *semantic scope* of noun and verb types associated with the target forms; and the *perceptual saliency* provided by the phonetic environment in which the forms were found.

Wulff, Ellis, Römer, Bardovi-Harlig, and LeBlanc also take a corpus approach to quantify and qualify acquisition difficulty. They compare the profiles of tense–aspect forms (present, progressive, past) from the diverse speech situations found in the spoken version of the British National Corpus and the academic discourse found in university settings compiled in the Michigan Corpus of Academic Spoken English with pro-

files of the oral use of these same forms in a longitudinal corpus of postsecondary L2 learners' speech. They look at the frequency distribution of the tense–aspect forms and the recurring verbs with which they are associated, exploring the roles that frequency, distinctiveness, and contingency play in facilitating learning of constructions. They show that the learning of temporal morphology demonstrates properties of category learning: *sensitivity to input frequency, reliability of form–function mapping, and prototypicality*.

Ellis and Ferreria-Junior examine effects of *frequency, frequency distribution, and prototypicality/generality of meaning* on the L2 acquisition of three verb–argument constructions in the European Science Foundation ESL corpus. This study presents a longitudinal sample of the speech of L2 learners who were learning their L2 mainly naturalistically from untutored contexts and the speech of native-speaker interviewers. Ellis and Ferreria-Junior show that the most frequent, most prototypical, and most generic verbs for each construction were those learned first (*go somewhere* for verb locatives; *put something somewhere* for verb object locatives; *give someone something* for ditransitives). They also found that the frequency profiles of these verbs were Zipfian (i.e., the most frequent verbs were very frequent, compared to other verbs in the paradigm). One of the contributions of this study is the demonstration of how frequency interacts with meaning to facilitate the acquisition of constructions as categories.

McDonough and Kim directly examine the relationship between input and production in an experimental study of *wh*-questions. They manipulate the *type and token frequency* of question primes in instructor speech and of prompts to elicit production of question forms in the students' speech. They find a key role for prompt type frequency in the production of accurate *wh*-questions but do not find an effect for type frequency in the priming speech. Their results point to the ways in which type frequency may affect learning of constructions at different stages of development: Low type/high token frequency may enable learners to detect patterns in the input, but high-type-frequency practice may be necessary for learners to achieve productive use of the construction.

In Year and Gordon's study, the direct link between input and production is also examined, this time in an actual foreign language classroom. The issue under investigation is *the role of skewed versus balanced input* on the acquisition of the ditransitive construction in L2 English (e.g., *give someone something*), a phenomenon that has not received much research attention in the L2 literature. Although the actual learning in the two conditions

is similar, the balanced group shows more productive use of the target construction and greater long-term retention, results that differ from previous research of the same phenomenon in L1 acquisition (Goldberg et al., 2004) in which a high-frequency prototypical verb has been found to facilitate the learning of novel constructions. In interpreting their findings, Year and Gordon consider some of the input and learning factors that distinguish L2 learning from L1 learning (including explicit vs. implicit learning modes) and that distinguish classroom and naturalistic language learning from laboratory learning (including differences in the way in which stimuli are experienced in the two learning contexts).

The issue concludes with a commentary by Boyd and Goldberg on the five studies presented herein. They describe the tenets of the constructionist framework that informed much of the research presented before focusing on the issues of type/token frequency, contingency, and learner cognition. They weigh the merits of different operationalizations of these constructs and of different accounts of their effects in acquisition, pitting the alternatives against each other to identify areas for future research. In addition, they explore further the role that skewed input may play in initial acquisition with reference to additional research of their own, thereby providing readers with alternative interpretations of some of the data presented in the volume.

Together, these articles provide perspectives on the input–acquisition relationship in a range of learning contexts, across a spectrum of learning populations: children in Quebec (Collins et al.), adolescents in Korea (Year and Gordon), migrant workers in Europe (Ellis and Ferriera-Junior), and university students in Thailand (McDonough and Kim) and the United States (Wulff et al.). The analyzed spoken corpora include teachers' speech directed at beginner-level learners in school-based programs, academic discourse directed at postsecondary students, interactive conversations among native-speaker and non-native-speaker adults, and the broadly sampled spoken situations of the British National Corpus. In addition to the impact of input on immediate learning (Boyd and Goldberg; McDonough and Kim; Year and Gordon), there are also studies that explore the role of input factors in language over time in longitudinal corpora of the development of L2 learners' speech (Ellis and Ferriera; Wulff et al.) and in teachers' classroom talk (Collins et al.).

It is our hope that this special issue will encourage researchers to broaden the linguistic base of the research approaches highlighted, focusing

on the input–acquisition relationship across different languages (see, e.g., Bernolet, Hartsuiker, & Pickering, 2007, for L2 Dutch and German; Izquierdo, 2007, for L2 French; Williams & Kuribara, 2008, for L2 Japanese; Zyzik, 2006, for L2 Spanish). Of particular interest is the instructional input (both oral and written) provided in the foreign language contexts in which many modern languages are learned. Unlike in L2 situations, where learners' most significant exposure to the target language usually takes place outside the classroom, rendering it challenging to identify and measure, in foreign language situations the significant (and sometimes near exclusive) exposure may take place in the language classroom, facilitating observations of the interaction between input factors and acquisition profiles. Additional directions for future research include studies of learners' perceptions of constructions (measured both online and offline), comparisons of input profiles of constructions in oral and written texts, and longitudinal analyses of learner production that examine the relationship between the properties of constructions in input and interlanguage development over time.

ACKNOWLEDGMENTS

All of the contributions in this collection are revised versions of papers presented at the annual meeting of the American Association for Applied Linguistics (2008) in Washington, DC. Five were part of a colloquium we organized on construction learning; the Year and Gordon study was presented as an individual paper. All papers underwent the standard double-blind review process. In addition, a member of *The Modern Language Journal* Editorial Board provided an assessment of the entire issue. We wish to thank Lourdes Ortega for undertaking such a careful reading of all of the papers and for providing insightful and constructive commentary to the guest editors.

NOTE

¹Although the authorship of this introduction is Ellis and Collins, the authorship order of the Special Issue as a whole is Collins and Ellis.

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Forthcoming in *The Modern Language Journal*, 93.4

Shigeo Kato. "Suppressing Inner Speech in ESL Reading: Implications for the Developmental Changes in Second Language Word Recognition Process."

Dongping Zheng, Michael Young, Manuela Wagner, & Robert Brewer. "Negotiation for Action: English Language Learning in Game-Based Virtual Worlds."

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