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Introduction to the special issue: Aspects of word learning on first exposure to a second language

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Abstract
This contribution presents an overview of first exposure studies in the context of word learning, focusing on issues that show up repeatedly in the relevant literature: computation versus storage, the nature of representations of words and how those representations are processed. I discuss aspects of research methodologies that limit our ability to generalize from experiments to normal learning situations. I conclude with a brief discussion of the articles of this issue.

Keywords
second language acquisition, first exposure learners, lexicon, grammar, rules, computation, storage

I Introduction

This special issue is about word learning in 'first exposure' populations. I discuss word learning (Section 1) and first exposure studies (Sections II and III) to help situate in a broader context the individual articles that appear here (Section IV). The emphasis is on research methods and tasks. As will become clear, first exposure studies differ in many respects: the learning problem, properties of the target language, the learning setting, the research methodology chosen, disciplinary perspectives and the research goals of the researchers. What tie them together conceptually are four properties:

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- a concern with unconscious (implicit) learning processes and learning mechanisms;
- a desire to study how those processes operate on input (speech or writing) presented in the learning context;
- a need to ensure that when tested on some task participants are not making use of representations of the target language (TL) previously stored in long-term memory; and
- a decision to control the totality of stimuli of the TL to which the participants are exposed.

Learning processes and mechanisms, constraints on learning, input, and memory are recurrent themes. What is constant is that, by definition, a first exposure study is one where learners have had no prior systematic exposure to the TL.

II Words and word learning

Words are not primitives of language but complex objects, consisting of a variety of different representations. Structuralist linguistics, since Saussure, has focused on two kinds of representations: sounds and meanings. Generative linguistics added morphosyntactic representations to the mix so that most linguists today regard words as consisting of three kinds of representations: phonological, morphosyntactic, and semantic. What exactly these representations describe is the focus of much debate. Equally contentious is whether such representations are 'psychologically real'. The question of how we process words is where we shall begin. Are words computed in real time or are they stored in a mental lexicon?

1 Computation versus storage

Words are arbitrary and conventional associations of sounds and meanings. What is conventional can only be acquired from input; what is arbitrary cannot be computed in real time via a rule but must be deployed from memory. Accordingly, some linguists have claimed that the lexicon – a language's repertoire of words and morphemes – is the realm of the 'lawless' and of 'listemes', discrete units that can appear in a list, isolated from any linguistic context (DiSciullo and Williams, 1987).[1] This makes word learning a useful point of departure for the study of associative memory (e.g. de Groot and Keijzer, 2000; Vouloumanos, 2008). It also makes words suitable for the investigation of form–reference relations (Carroll, 2012a; Gullberg et al., 2010; Vouloumanos, 2008). And while the impact of frequency can be studied using continuous text (Carroll, 2012a; Gullberg et al., 2010; Rast, 2008; Shoemaker and Rast, this issue), much of the work on frequency in word learning has involved list learning. A first issue, accordingly, are the ways in which knowledge of words is stored in memory and deployed during speech perception and planning.

A traditional view is that the language faculty is carved at the joints along linguistic-theoretic lines. By hypothesis, words are stored, sentences are not (Aitchison, 2003: Chapter one; see also the introduction to Nooteboom et al. 2002, as well as the chapters therein). However, this equation of linguistic components with psycholinguistic mechanisms cannot be correct. First, words may have complex internal structure that is predictable and results from productive processes. The creation of new words with such processes requires a ‘rule’ or algorithm. Second, the distinction between ‘word’ (say, compounds) and ‘syntax’ (say, phrases) can be drawn only with difficulty (Bauer, 1998). Third, the contrast between productive regular processes of morphology and syntax and non-productive irregular ones is a matter of degree (Bauer, 2001; Pinker and Prince, 1994). Finally, the contrast between simplex versus complex forms or productive/non-productive rules is not what determines what is stored and what is computed.

Marcus et al. (1992) provide evidence that regular inflection (a ‘rule’ attaching, e.g. [PAST TENSE] to [VERB]) is computed by native speakers of English in real time. During speech processing and word recognition, the past tense suffix will be ‘stripped’ from the word *cooked*. The [PAST TENSE] morpheme and the verb stem that it attaches to are stored independently in long-term memory. The resulting surface forms (*cooked, peeled, talked*, …) are not stored in long-term memory. It follows that *cook* can be activated from memory but *cooked* cannot. Such cases of regular past tense morphology contrast with irregularly inflected forms (*gone, seen, went*, …), which must be memorized. Testing this claim turns on behavioral differences among language users. Anglophones show sensitivity to the frequency of the irregularly inflected verbs on priming tasks but no sensitivity to the frequency of the regularly inflected verbs (Marcus et al., 1992), which is explained by assuming that priming reflects retrieval from long-term memory. The effect has been replicated in users of other languages (see, amongst others, Golato, 2006; Sonnenstuhl et al., 1999). The data clearly suggest that some but not all words/morphemes are stored in long-term memory. However, Baayen et al. (2002) have shown that some high frequency regularly inflected forms may also be stored. Thus, the contrast between regular morphology and irregular morphology is not the criterion that determines what is listed and what is computed.

In addition, the distinction between words and grammar is orthogonal to the contrast between storage and computation. Arguments for storing units of various sizes from simple morphemes to complete constructions have existed in the linguistics literature for some time (Jackendoff, 2002; Nunberg et al., 1994). Second language (L2) data adds empirical support to this claim. We know that L2 learners segment, store and make use of partially analysed strings that in the target language are phrases or constructions. These strings (called ‘formulas’) appear to function initially in the learner’s interlanguage as early sound–meaning mappings (Wray, 2002); examples include *Qu’est-ce que c’est* ‘What’s that?’, *How come x, I dunno*. The literature suggests that as learners learn more of the target language, the sound forms are analysed into smaller sound units. More importantly, they acquire morphosyntactic properties and become freely combinable in L2 sentences. There is no reason to believe, however, that the original sequences cease to be stored as sequences in the L2 learner’s memory. Finally, formulas also show that early on learners can represent some aspects of a word (e.g. a sound form or a meaning) without representing all word properties. So, formulas support claims that language learning is incremental (Ells, 2002; Ellis and Collins, 2009) since the emergence of a syntactic analysis and a morpheme-dependent semantics (a ‘sense’) takes time.

2 Words and meanings

Learning the meanings of words is a crucial part of making meaningful talk in an L2. Some researchers (VanPatten, 1996: 6–7) have argued that at early stages of second language acquisition (SLA) learners do not analyse and do not learn elements of the linguistic input that are not meaningful. (For more detail, see Han and Liu, this issue.) Such claims are hard to assess in the absence of a clear statement of what counts as 'meaningful' to the learner or of how we would assess expressions as 'more meaningful' or as 'less meaningful'. Let me illustrate. Semanticists tell us that words are meaningful in two quite distinct ways: sense and reference. Reference is a speech act that allows us to talk about our world, both experienced and imagined, in terms of individuals, properties, places, times, and other concepts (Jackendoff, 1983; Lyons, 1977: Chapter 7). It links language to things that are not language. Sense is the semantic property that permits us to combine small meaningful units into larger meaningful units. It creates propositions out of the meanings of morphemes and words. Words in lists might be referential; words in sentences have senses. Now, consider that proper names are generally assumed not to have a sense. This can be shown by the fact that they do not enter into semantic relations with other nouns (they have no antonyms, no synonyms, no contraries or other semantic opposites). Unlike predicates like *man* or *dog*, they do not license inferences from the properties of one individual that bears the name to properties of another individual with the same name. Proper names also do not have translation equivalents (Katz, 1977). They contrast in this regard to predicates (*dog, man*), and to definite and indefinite descriptions (*my dog; a friend's husband*) (Lyons, 1977: 148). Now, if lacking a sense were an impediment to learning a word, then we would predict that personal proper names should be hard to acquire. However, personal proper names are readily acquired by first exposure learners on the basis of minimal input involving pictures and sentences containing the names (Carroll, 2012a; Carroll et al., 2009). Paired associates of this sort (sound–referents) are acquired on as little as two exposures. Moreover, the mappings are retained in long-term memory over a two-week period with no additional input.

Gullberg et al. (2012) show that sound–referent paired associates emerge rapidly when the referent is expressed by a TL common noun (semantically predicates or descriptions). Gullberg et al. had adult Dutch speakers, with no prior exposure to Mandarin Chinese watch a 7-minute video-taped weather report in Chinese. (For more detail, see Han and Liu, this issue.) They showed that after only eight exposures to target words, participants were able to match Mandarin sound forms to pictures (a sun, a cloud) that had appeared on the weather charts. Note, however, that nothing in the study should lead us to conclude that participants acquired descriptions. Indeed, there is no reason to believe that the participants had semantic representations that were different in kind from those formed in the Carroll studies. Target-like language use will therefore require that learners convert their paired sound–picture associations into a target-like semantic representation. In particular, we should ask when they display the lexical concept mediation shown in advanced learners (Altarriba and Mathis, 1997; Dufour and Kroll, 1995; Kroll, 1993; Kroll and de Groot, 1997).

In laboratory studies, sound form–referent pairings are often unique. In natural languages, however, individuals or objects and sound forms do not normally appear in deterministic 1:1 pairings. An individual or object can be referred to by several words, while the same word can refer to different individuals or objects. Vouloumanos (2008) asked if the acquisition of such many-to-many pairings depends on the ability to track multiple sound–form referent relationships. She exposed English-speaking adults to 12 words from an artificial language paired with pictures of 12 novel objects. Each word and each picture were presented 10 times, but the relative frequency of a co-occurrence of word and picture varied between one and 10. Test trials were classified as either ‘ambiguous’ or ‘unambiguous’. On unambiguous trials, the word had occurred with only one of the objects while on ambiguous trials it had occurred with both. On the ambiguous trials one of the mappings was more frequent than the other in varying ratios (2:1, 6:2, 6:1, and 8:1). Results showed that while participants made fewer errors overall on test in the unambiguous trials, they performed at every probability ratio significantly better than chance. Even the low probability pairings were tracked.

These studies clearly establish that sound–picture (referent) associations are easy to make and learners are sensitive to sound–picture pairing frequencies. However, learning the senses of words is not a matter of associating a sound form and a picture. Little attention has been paid so far to learning aspects of combinatorial meanings, say, combining predicates and their arguments, based on lexical knowledge from the first language (L1) or cues from the input. Carroll and Widjaja (this issue) show that first exposure learners can map meanings to forms in one limited domain, namely number, but this study also builds directly on referential relations. The real study of learning how to construct word meanings on first exposure remains to be done.

Han and Peverly (2007), who exposed speakers of a variety of languages to a written letter in L2 Norwegian, have clearly demonstrated that first exposure learners struggle with text meaning in the absence of extra-linguistic cues. They subjected their participants to a recall task and found that learners had great difficulty in recalling the letter’s words. Learners lacked semantic knowledge that would have facilitated recall (perhaps via concept mediation). Park and Han (2008) compared learners whose L1 (English) is typologically far from the L2 (Korean) to learners whose L1 was typologically closer (Japanese). They found the English speakers attended to form-based properties whereas Japanese learners drew on lexical knowledge to focus on the meanings of words. (For more details, see Han and Liu, this issue.)

3 Words and sound forms

If sound–picture associations are easy to make, learners are readily encoding sound forms. A great deal of work has been devoted to empirically documenting this fact. Much of the relevant work has focused on statistical learning and segmentation and has made use of artificial languages. In these studies, inspired by Saffran et al. (1996), learners listen to a stream of synthesized syllables from which all prosodic cues to word boundaries, such as pause, pitch variation, or changes in syllable duration, have been removed. The sound stream is constructed to form families of three-syllable ‘words’, e.g. *beliga, befoga, puliki, talidu*, … Adults are asked subsequently to choose between two sound forms: ‘words’ and ‘part words’. The ‘part words’ are formed by adding the final syllable of one target word to the first two syllables of another target word, or by adding the initial syllable of one word to the final two syllables of another (e.g. *ligabe, gabefo, fogapu, gapuli*, …). Crucially, participants have actually heard all of the sequences so that exposure to the sequences is not decisive. What differs between the 'words' and the 'part words' is the likelihood that a given syllable will predict the occurrence of a following syllable. These transitional probabilities are higher within 'words' than across 'words' (since *be* does predict the occurrence of *li* in *beliga*) and are therefore lower within the 'part words'. Both adults and children have been shown to be sensitive to these recurrent statistical regularities; for a recent review, see Folia et al. (2010). The question is: What does this tell us about real word learning?

The most obvious response is that normal word learning always involves hearing words with prosodic cues to word boundaries (see Shoemaker and Rast, this issue), so there is no reason to assume that statistical learning is the sole or even the most important learning mechanism involved in segmentation (contra Ellis, 2003). More importantly, some psycholinguists regard segmentation as the first, pre-lexical stage, in a two-stage process of lexical activation and word recognition that draws on heuristics derived from knowledge of the abstract regularities in the sound system (Cutler, 1992, 2008). These regularities may involve tone (in lexical tone languages like Chinese, see Showalter and Hayes-Harb, this issue), stress (in languages like English, where stress is contrastive), pitch accents (in languages like Japanese), and other phonological properties that are, of course, irrelevant to the statistical learning paradigm just described. The second stage of the process – word recognition – can involve top-down processes such as semantic information or knowledge that there is a word of a given form (Mattys and Melhorn, 2007). This too is irrelevant to the paradigm. So, is statistical learning the critical factor, or L1-based properties, or do these factors interact?

Gullberg et al. (2010), using the video-taped Chinese weather report, exposed participants to sentences where the words were at most two-syllables long. Many of the words were monosyllables, since canonical word form in Chinese is monosyllabic. Participants were most accurate only on frequent two-syllable words heard eight times. Moreover, participants showed a bias to reject target one-syllable words. Neither of these results is predicted by a learning device acutely attuned to fine-grained statistical properties of the input. It is consistent with the hypothesis that Dutch participants might have a preferred template for a two-syllable prosodic word, and relied on prior L1 knowledge, possibly in combination with the input prosody, to segment the speech stream.

Additionally, no natural language consists of sequences of three-syllable words. In phrases of natural language, exponents of lexemes and grammatical words tend to differ prosodically. Lexemes tend to be much longer than grammatical words; they may be the locus of stress, pitch accents or tones, and so on. These properties create the perception of rhythmic alternations that facilitate segmentation (Cutler and Mehler, 1993). Listeners appear to actively search for rhythmic alternations. Saddy (2005) has shown that structured strings of an artificial language that lack reliable sequential transitional probabilities are nonetheless reliably perceived as rhythmic sequences (we hear a 'beat'). Saddy argues that we are able to segment strings of syllables from recursive information that could be provided by various cues. A reasonable approach to language learning is therefore to assume that learners will draw on the full range of potential cues to word segmentation.

The data bear this approach out. Adults are able to draw on ‘top-down’ cues in segmenting speech; see below. Additionally, they rely on general constraints on lexical well-formedness. Finn and Hudson Kam (2008) showed that when adults had to segment ‘words’ of an artificial language that begin with L1-impossible syllables (illicit phonotactics), they were unable to do so, even when the words exhibited high transitional probabilities. Increasing exposure to 36 minutes on two separate days of training did not change the results, showing that more exposure does not, on its own, cause learning.

First exposure studies using natural languages have found strong lexical effects. Carroll (2012a) reports on a study where English speakers were exposed to German sentences that contained target proper names. Some of the German names were cognate to English names; that is to say, they have a common historical source. Some of these cognate names sounded similar to English names, e.g. *Martina* [ma:tinə], while some did not, e.g. *Georg* [geɔ:k]. While learners were able to learn all of the names presented, regardless of length and sound shape, German names that sounded similar to English names activated those English sound forms. This was shown not only by the fact that participants responded much faster to these words, but also by the fact that, on a pronunciation task, some participants pronounced the words with a completely English pronunciation. The contrast with the pronunciation of words that had no English correspondent was quite striking (Carroll, 2010).

Rast and Dommergues (2003), in a first exposure study that involved tutoring French speakers in Polish, report a similar finding. They tested participants before exposure to Polish, after 4 hours of instruction and again after 8 hours. For details, see Rast (2008) and Shoemaker and Rast (this issue). Participants carried out a sentence repetition task, with input analysed for lexical transparency. Lexical transparency was established by having an independent group of Francophones listen to a list of Polish words and translate them into French. Words that were ‘correctly translated’ were, de facto, cognate words, and these turned out to be easier to pronounce on a sentence repetition task. Thus, there are clear lexical effects on learning the sound forms of words.

Finally, an important limitation of all of the studies mentioned here is that the sound stream to which learners have been exposed in segmentation studies lacks the variability that is typical of normal speech. This is an intended property in the statistical learning studies involving synthesized speech. In the natural language studies it is a side effect of using a single speaker to record stimuli (Carroll, 2012a; Gullberg et al., 2010) or to instruct the learners (Rast, 2008). Variability in the signal has been shown to aid L2 learners (Lively et al., 1992).

4 Words and grammar

Numerous aspects of grammar are known to be word specific and must be encoded in long-term memory: word class, gender and number specification, valence, case-marking, syntactic insertion frames. These stipulations can be seen as a set of instructions for the construction of syntactic representations (Borer, 2005: 3). Formalized as diacritics in lexical entries, they can be proceduralized as instructions on how words combine with each other in phrases and sentences. While some of these morphosyntactic stipulations might be derived from lexical semantics, others are independent of semantics (e.g. gender in French, or number in English). Accordingly, some aspects of word learning involve encoding autonomous grammatical features.

Words are known to be a locus of transfer in SLA (Odlin, 1989). If words are complex entities consisting of multiple types of representations (sound, meaning, morphosyntax), any of these representational types could be a locus of transfer. If L2 input systematically activates L1 lexical entries when the input sounds similar to an L1 word, then we might expect that learners will transfer word class, gender, subcategorization frames, etc. And they do. (See, among many others, Altenberg, 2002; Bongartz, 2002; Cammarota and Giacobbe, 1986; Harley, 1989; Inagaki, 2001.)

Still few first exposure studies concerned with grammar have focused on word-based properties and lexical transfer. See Carroll (2005), and Han and Liu (this issue). This is because relevant studies have been conducted by researchers primarily concerned with first language acquisition, with implicit or incidental learning in SLA, or with the role of phonological memory. Some studies (Braine, 1966; Valian and Coulson, 1988) have nevertheless studied how learners learn the positions of classes of words in strings based on other words serving as ‘markers’. Valian and Coulson (1988) created an artificial language in which ‘marker’ words were formally distinct from ‘content’ words, differed in position (markers preceded content words), and in frequency (targeting a high-frequency dialect and a low-frequency dialect). Results showed that learners first assumed that any marker could be paired with any content word. Learners thus had to step back from this over-generalization. Valian and Coulson (1988) found that the fine-grained dependency between marker and content word was much easier to establish in the high-frequency than in the low-frequency dialect where the proportion of pairings was reduced. These results replicate somewhat the sensitivity to statistical properties of the input that Vouloumanos (2008) found with word–picture reference. Nonetheless, there is one critical difference, namely that learners first established a generalization (a ‘rule’).

The question of whether learners are performing statistical learning or ‘rule’-learning has been a matter of some debate since the emergence of connectionist models of learning. Peña et al. (2002) showed that adults use statistical computations to recognize adjacent (e.g. A and AB in a string ‘ABC’) and non-adjacent syllables (e.g. A and C in ‘AXC’ or ‘AYC’) in a continuous stream of speech using the artificial language paradigm of Saffran et al. (1996). However, adults used other types of computations to recognize non-adjacent dependencies. In particular, when exposed to a novel form of the pattern ‘AXC’, participants showed no preference for it when the speech stream was continuous. They rapidly developed sensitivity to the pattern when the speech stream contained brief (25 ms) breaks between the words. Under these conditions, only two minutes of exposure were enough for the pattern to be acquired. Thirty minutes of exposure to speech without gaps did not lead participants to acquire the pattern. Indeed, it led them to prefer ‘part words’ that violated the structure. Gómez (2002) found a similar pattern. Amato and MacDonald (2010), in a study looking at probabilistic combinatorial properties on verb, subject and object relationships, also found that participants could rapidly acquire the patterns when words were segmented.[2] So pause changes the cognitive landscape in input processing, making it discrete. It is this discreteness that appears to create a role for statistical learning and frequency of exposure. Discreteness also makes it possible for algorithmic learning (‘rules’) to emerge.

Of course, talking about 'structure' as if it involved nothing but the learning of non-adjacent dependencies is to grossly distort the notion. While it is true that agreement relations such as those instantiated in gender and number systems are typically expressed over non-adjacent syllables, e.g. ***la*** **peti*te fille*** 'the little girl', ***two cups of flour***, an accurate description of gender or number involves much more. For more elaborate discussion, see Carroll (1989, 1995). It is difficult to see how properties of words, expressed in grammatical relations and sub-systems, could emerge solely from statistical learning mechanisms operating on strings of syllables. To learn these things, learning mechanisms must be drawing on abstract feature systems and both learned and a priori constraints on their deployment. While one can invent an artificial language to study such phenomena (e.g. Williams and Lovatt, 2003), it is not obvious that it is necessary. There are even arguments against it.

III Limitations on first exposure studies

We began by noting that first exposure studies include target languages that are artificial and even non-natural. We should ask if the use of artificial languages misrepresents the task the L2 learner faces. Robinson (2010) reports on studies carried out with Japanese speakers who were also high proficiency English L2ers. He trained them on an artificial grammar and on Samoan. His goal was to show that learning involves both algorithmic learning and exemplar learning when both artificial and natural languages are being acquired. He found that exemplar-specific knowledge of linear dependencies and abstract knowledge of grammar influenced grammaticality judgments in the case of the artificial grammar. However, high transitional probabilities within a sequence did not influence Samoan L2 learners to correctly accept new items that were grammatical. Robinson concludes that the learning of artificial grammars and natural language grammars are related but involve distinct learning processes. Of course, this conclusion might be premature. Certainly, more studies that involve first exposure to natural languages under varying conditions of exposure are warranted, as is the continued exploration of the artificial language learning paradigm. The article by Han and Liu (this issue) addresses the issue of how first exposure learners process natural input directly, see also Han and Peverly (2007).

IV The articles in this issue

Han and Liu provide a detailed review of the literature on first exposure learners done from within 'mainstream' second language acquisition research (as opposed to the artificial languages research). This includes a description of prior research on first exposure learning from the Input Processing perspective (Han and Peverly, 2007; Park and Han, 2008). Like previous work, their study focuses on processing of natural language input, which they measure with a variety of tasks, including note-taking, free recall, comprehension, elicited imitation and working memory tasks. They demonstrate that first exposure learners rely on visual cues and encyclopedic knowledge to understand L2 input at this stage, in the absence of target language knowledge of words and how to combine them to compute the meanings of sentences. The study provides empirical support for the argument above that discussion of ‘meaning’ in SLA research should carefully distinguish reference and sense, and should inspire reflection on how, in future research, we might provide extra-linguistic information about sense. The article provides detailed information about the difficulty of the various tasks employed, providing useful information for studies of other populations. Finally, the authors emphasize the importance of studying first exposure learners beyond their initial exposure using a longitudinal paradigm.

Shoemaker and Rast continue the investigation of Francophones learning Polish in a tutored context, focusing on segmenting the sound forms of words from continuous speech. In this study, participants received six-and-a-half hours of instruction, and were tested before exposure and at the end of the instruction. Previous work has relied on sentence repetition tasks which may confound segmentation with the operation of constraints on working memory that are specific to this task (Carroll, 2012b). This study expands the previous research by using a receptive task that obviates this criticism. They replicate the lexical effects found in previous work. They also replicate positional effects: words in initial or final position are more readily segmented than words in medial position, although accuracy is good in all positions. While this result may well show the effect of working memory on perception, it also invites an analysis of the acoustic and prosodic properties of sounds in these ‘positions’. Another replicated result is the absence of a frequency effect, consistent with the findings from both the artificial and the natural language studies reported above. The authors conclude that adults bring efficient processing tools to the task of learning an L2.

Showalter and Hayes-Harb shift the focus to matters of phonological learning. They are interested in how speakers of intonated languages, like English, learn lexical tone in languages like Chinese. This is difficult and perception of tone at initial stages is known to be influenced by intonational patterns of the L1 (Broselow et al., 1987). Acquiring novel representations of words in a language like Chinese thus involves associating a tone representation with the segmental information stored in memory. Graphic information in writing systems that are similar in both L1 and L2 has been shown to assist learners by supporting memory for phonological distinctions, and is reminiscent of the studies discussed above showing rapid association of sound forms to pictures. To date, however, little is known about associative memory for sounds when the writing systems of the L1 and the L2 are different. Showalter and Hayes-Harb trained English speakers on Chinese nonce forms and *pinyin*, a Romanized writing system that includes both segmental information and diacritics for tone. Two groups of first exposure learners were trained on pictures of novel objects, sound forms and written words. One group saw written words that were marked for tone while the other did not. Participants trained on the tone marked words outperformed those who were not. This study thus expands the range of studies exploring associative memory, showing that written distinctions in an unfamiliar script can support memory for phonological contrasts, even at the very initial stage of learning.

Carroll and Widjaja carried out a study examining the ability of English speakers to learn number-marking in a language with quite different properties. Indonesian can refer to single and multiple objects with bare nouns, a plural that consists of reduplication, and a numeral + classifier construction. Several theories of second language acquisition claim that morphological or syntactic structure will not be learnable at the initial stage of learning, predicting that learners will use only the bare nouns and will use them to express the singular and the plural. The authors show that learners learn all three constructions and retain all three over a two-week period. Thus, first exposure learners can learn morphosyntactic structure on limited input. Moreover, they can encode and differentiate the meanings of the different constructions. However, the study relies on sound-form–picture associative learning and, although it includes a production task, does not show that learners are freely combining morphemes to create syntactic representations. It does, however, lay the foundation for future work on this topic.

The studies in this special issue reflect the diversity of research questions, research methods and theoretical perspectives that can be found in the literature involving first exposure learners. They provide insight into how much input adult learners can actually process, and what kinds of processing are possible at this stage. They also show how dependent linguistic processing is on knowledge of how words combine and what they mean. Future research will hopefully shed light on how quickly adults can acquire the kinds of representations that make it possible to process L2 input using that linguistic knowledge.

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Notes

1. Not every morpheme is listable: bound morphemes like English *-ing* or *re-* and clitics such as French *je* or *le* are not. In some languages, both content and grammatical morphemes are bound. Inuktitut is a well-known example where, it is claimed, entire sentences are like English 'words'.
2. In this study, participants saw written words so the spaces in the text provided cues to word boundaries.

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