Granularity and the acquisition of grammatical gender: How order-of-acquisition affects what gets learned

Inbal Arnon & Michael Ramscar
Stanford University,
CA 94305.

Abstract

Why do adult language learners typically never achieve the same level of language mastery as native speakers? We examine how prior knowledge and experience might influence the size of the linguistic units employed in learning, and as a consequence, what gets learned. We hypothesize that adult learners tend to learn from more segmented representations, and that these can hinder learning about the relations *between* segments (e.g. between articles and nouns). In particular, we focus on the acquisition of grammatical gender, an aspect of language later learners show difficulty with compared to native speakers. In a study of adults, we show that participants are better at learning grammatical gender in an artificial language when they are exposed first to article-noun sequences and then to noun-labels as compared to learners that start out with noun-labels and then hear article-noun sequences. This striking finding can be explained by a simple blocking effect. We discuss how the units children and adults learn from impact language learning.

Introduction

Why is acquiring a language to native proficiency in adulthood so difficult? Numerous studies have revealed that the expertise levels of native and non-native speakers diverge across many aspects of language, including pronunciation (Moyer, 1999), morphological processing (Johnson & Newport, 1989), and the use of formulaic speech and idioms (Vanlancker–Sidits, 2003). Given the many differences between children and adults, both in terms of cognitive and neural development and in terms of the social contexts in which they learn languages, it is perhaps not surprising that children and adults differ in their ability to learn. What is surprising, given adults' proficiency when it comes to learning in other domains, is that children appear to learn languages far more successfully than adults.

Various approaches have been taken in seeking to understand this pattern: Lennenberg (1967) argues that adults no longer have access to a biological window of opportunity for learning language. Newport (1990) and Elman (1993) emphasize differences in cognitive capacity, suggesting that adult's increased memory hinders correct generalization by preventing them from ignoring some of the variability and complexity in their input. Other researchers (Kuhl, 2000; Neville & Bavelier, 2001) highlight the changes in neural plasticity and the way early neural commitment shapes consequent learning (e.g. learning the phonetic distinctions that are relevant to your language changes the sensitivity to non-phonemic distinctions, Werker & Tees, 1984).

Here, we propose another difference: the linguistic units that adults learn from often differ from the ones children use. We suggest that the different background knowledge that children and adults bring to language learning shapes the linguistic units they employ in early language learning, and this in turn shapes subsequent learning. Adults come to the task of language learning with a great deal of prior knowledge about language; they know about words and grammar, and know the words and grammatical elements of their first language. Children, on the other hand, have none of this knowledge, and as a result are far more likely to be learning segmentation, meaning, and structure, interdependently, at the same time.

We explore the hypothesis that these differences in background knowledge influence the linguistic units learners employ: adults learn from more segmented representations – with word boundaries more clearly marked – while children begin with larger, less segmented representations (that cross word boundaries). We suggest that the more segmented representations adults' employ actually make it harder for them to learn about the relations between units.

To examine this idea, we focus on the task of learning the agreement patterns between articles and nouns in languages with grammatical gender, an aspect of language that non-native speakers have considerable difficulty with (see e.g., Harley, 1979; Scherag, Demuch, Roesler, Neville & Roeder, 2004). If some of this difficulty is indeed related to the units that adult learners employ, manipulating these units should result in changes in learning. Having adults learn from larger units of language should enhance learning. Specifically, starting with sequences of language in which the article and the noun are less differentiated should facilitate learning of the relation between them.

Learning grammatical gender: A case study

Grammatical gender is a system found in many languages. It assigns all nouns (including inanimate ones) to noun classes, and marks neighbouring words for agreement (Corbett, 1991). In Hebrew, for example,

verbs and adjectives are marked for gender. In Spanish and French, articles have to agree in gender with the nouns they precede. Knowing a nouns' gender in gender-marking languages is essential for correct sentence construction.

Grammatical gender provides a good test case for studying differences between L1 and L2 learning. Native and non-native speakers show different patterns of learning grammatical gender. Children master grammatical gender relatively early (see Slobin, 1985 for cross-linguistic reports), and make few mistakes in spontaneous speech. In contrast, L2 learners have persistent difficulty with grammatical gender even after extensive exposure (Scherag et al., 2004). Native and non-native speakers also differ in their ability to use the gender information conveyed by the article in real time processing. Native speakers (adults and children) can use this information to guide lexical access; they anticipate a feminine noun following a feminine article (Lew-Williams & Fernald, 2007) and slow down if there is a gender mismatch between the article and the noun (Grosjean et al., 1994; Dahan et al., 2000). Non-native speakers do not show these effects (Guillelemon & Grosjean, 2001; Scherag et al., 2004). These findings suggest that native speakers treat the article and the noun as a more cohesive unit than do non-native speakers; this allows them to select the correct article in production, and use it to facilitate recognition in comprehension.

Several suggestions have been advanced to explain these different patterns of grammatical gender learning, including: that grammar cannot be fully mastered in adulthood (Clahsen & Muyksen, 1986), or at least not aspects of it that are not found in the learner's native tongue (Hawkins & Chan, 1997); and that L2 learners form more shallow grammatical representations that are hard to access in real time (Clahsen & Felser, 2006). These accounts describe the difficulty L2 learners have with grammatical gender, but they do not fully explain *why* this difficulty arises.

Could the units that learners start out with play a role in creating these different learning patterns? Researchers from various theoretical backgrounds have suggested that children initially treat the article and the noun as a single unit, rather than two separable ones, as an adult might (J. Carroll, 1939; S. Carroll, 1989; Chevrot et al., 2008; MacWhinney, 1978). This would be a natural consequence of the way children encounter nouns, which most often is in the company of articles (especially in gender-marking languages, Mariscal, 2008).

Numerous findings support this observation: Children's early knowledge of articles appears to be lexically-specific. Instead of productively using articles with many nouns, children often initially only use a given article with a given noun. (e.g., produce only the definite article with one noun and only the indefinite with another, Mariscal, 2008; Pine & Lieven 1997). Patterns of liaison acquisition in French (variation in pronunciation of the final consonant of certain articles depending on the beginning of the following word) also support the idea that articles and nouns are initially stored as a single unit; children make mis-segmentation errors where the liaison consonant is incorrectly treated as part of the noun (Chevrot et al., 2008).

Adults, on the other hand, may be less likely to treat the article and the noun as a single unit. Adult L2 learners may know that nouns and articles are separate entities from their experience with their first language, and the way they encounter nouns and articles, especially in a classroom setting, may emphasize their independence (Doughty & Williams, 1998). While none of children's early language input is written, adults are likely to learn from written input in which the distinction between the article and the noun is explicit and visually salient. Finally, there is evidence that while adults can use cognitive control to selectively attend to particular aspects of the input, children may largely lack this facility (Ramscar & Gitcho, 2007). In other words, adults not only know that articles and nouns are separate, but they can also 'choose' to focus their attention on one or the other.

Training experiment

Does adults' difficulty with grammatical gender stem from the fact that they begin with more segmented linguistic units, in which the article and noun are not initially treated as a single unit? If so, adult learning should improve if the linguistic environment emphasizes larger linguistic units. To examine this, we created an auditorily presented novel language and contrasted the effect on learning of initially exposing adult learners to article-noun sequences—in which the boundaries between articles and nouns were less prominent—with that of initially presenting them with the noun-labels as identifiable units (we use the term noun-label to refer to a noun appearing without an article).

Learners were divided into two groups. In the sequence-first group, learners were first exposed to article + noun sequences in whole sentences and then to noun-labels. In the noun-label-first group, learners were first exposed to noun-labels and then to full sentences. By the end of the experiment, both groups had received exactly the same input, but in different orders. By manipulating the initial units that learners were exposed to while keeping the frequency of exposure constant, we could examine the way that initial learning with different sized units affected subsequent learning. We then assessed how well participants learned the article-noun pairings. We predicted that participants in the sequence-first group would be more likely to

produce the correct article for a given noun, and more able to detect a mismatch between the article and the noun.

Participants

Thirty-two native English-speaking undergraduate students at Stanford University participated.

Materials

The artificial language had 14 novel labels for familiar concrete objects (e.g., piano-'slindot'), two articles ('sem' and 'bol') and a carrier phrase ('os ferpal en'). The nouns were divided into two "noun classes"; each noun could only appear with one article. There were no semantic or phonological cues to class membership. Articles always followed the carrier phrase and preceded nouns. An example of a full sentence in the language is given in (1).

(1)	*Os-ferpal-en*	*bol*	*slindot*
	Carrier phrase	article 1	"piano"

All noun labels were two syllables long. The objects were matched for familiarity, and for frequency and Age-of-Acquisition of the English word. Participants were exposed to auditory stimuli of two kinds: noun-labels, and full sentences consisting of the carrier-phrase and an article + noun sequence. A male speaker recorded the carrier phrase, the articles, and the nouns separately. These were concatenated using Praat to create the full sentences. One recorded token of each noun, each article and the carrier phrase was used throughout the experiment to ensure that the nouns had the same prosody in full sentences and in isolation and that the articles had the same acoustic features with all nouns. The duration of the two articles was kept identical ensuring that neither had any acoustic prominence.

Another block of phrases in the artificial language was constructed in addition to the experimental items. This "distracter block" comprised the same carrier phrase, seven different nouns and two additional articles ('tid' and 'gob). In contrast to the experimental items, the mapping between the articles and the nouns was not consistent (nouns could appear with either article).

Procedure

The experiment was divided into two phases: learning trials, and test trials. Participants were told that they would be tested on the novel language and were asked to repeat the sounds they heard to enhance learning. The experiment lasted 25 minutes (20 minutes of training and around 5 minutes of testing). Training and testing sessions took place in a quiet room. All sessions were video-taped. Forced-choice responses and reaction times were collected using a response box.

Learning Trials. Pictures of objects were presented on screen with an accompanying "description" in the artificial language. Participants were exposed to two kinds of stimuli: noun-labels and full sentences (carrier-phrase + article + noun) that were presented in separate blocks of trials. In noun-label trials, a picture of the named object was presented on screen alone; in full-sentence trials a picture of the named object was presented on screen along with a picture of a male gesturing to the object. Stimuli presentation was timed; objects appearing with full-sentences stayed on the screen for 3500 ms and objects appearing with noun labels stayed on the screen for 2000 ms. Participants in both learning conditions were exposed to the same number of noun-labels (each noun-label was repeated five times, with a total of 70 labels) and full sentences (each noun in a sentence five times, with a total of 70 sentences).

Participants in the sequence-first condition heard a block of full sentences followed by a block of noun-labels while participants in the label-first condition heard a block of noun-labels followed by a block of sentences. The only difference between the two conditions was the order of the blocks. Following the two learning blocks, participants in both learning conditions were exposed to a distracter block of 35 sentences (accompanied by pictures of the objects). The distracter block was introduced to eliminate recency effects during testing, and ensured that the last block before testing was identical in the two learning conditions.

Test Trials. Test trials were identical in the two learning conditions. Participants completed a forced-choice task and then a production task. In the forced-choice task, participants saw a picture, heard two sentences and had to indicate which sentence was the correct one in the language. They were told that only one sentence was correct.

Half of the forced-choice trials tested knowledge of the article + noun pairing. On these trials, the incorrect sentence had the right noun label but the wrong article (e.g. participants saw a piano and heard: *Os-ferpal-en sem slindot versus Os-ferpal-en bol slindot). The other half of the trials tested knowledge of the noun-labels. On these trials, the incorrect sentence had the right article but the wrong noun-label (see piano and hear: **Os-ferpal-en bol* ***viltord*** versus *Os-ferpal-en bol* ***slindot***). Because participants heard a full sentence, they could also use the mismatch between the article and noun as a cue. Each object was presented once in an article trial and once in a noun trial yielding 28 forced-choice trials (half testing article + noun pairing and half testing noun knowledge). Order of presentation was randomized for each participant.

In the production task, participants saw a picture and had to produce a full sentence to describe it. They were encouraged to produce full sentences even if they were unsure about all the parts. There were 14 production trials (one for each object). Order of presentation was randomized for each participant. Responses were coded for accuracy by a research assistant blind to the study goals (reliability with coding by the first author was high, $\kappa = .95$). Nouns and articles were coded as correct if they didn't differ from the target in more than one sound (*slipdot* for *slindot*, and *vol* for *bol* were coded as correct). An article+noun sequence was coded as correct only if both the article and the noun were correctly produced. The carrier-phrase was coded for accuracy on a scale from 1-3 (1-fully accurate, 2-partically accurate, 3-not accurate).

Results

As predicted, participants in the sequence-first condition showed better learning of the article + noun pairing. They were significantly above chance (61%) in choosing the correct article $t(15) = 3.55$, $p = .003$, while participants in the label-first condition were at chance $t(15) = .81$, $p > .4$. A mixed-effect regression model with trial type and learning condition as fixed effects, and subject and item as random effects, revealed a main effect of learning condition that was not qualified by a significant interaction: participants in the sequence-first condition were more accurate overall (80% vs. 71% correct, $B = .44$ ($SE = .21$), $p < .05$). They were better at selecting both the correct article (61% vs. 54%) and the correct noun-label (98% vs. 92%, $B = 1$, $p > .1$). Not surprisingly, given the difficulty of grammatical gender, participants selected the correct noun-label more often than they selected the correct article (95% vs. 57.5% correct, $B = 2.72$ ($SE = .26$) $p < .001$).

The production results showed a similar pattern. Participants in the sequence-first condition were more likely to produce a correct article + noun sequence (40% of the time) than were participants in the label-first condition (29% of the time), $B = .76$ ($SE = .32$), $p < .05$. Overall accuracy rates were not high, which is not surprising given the short exposure time (20 minutes) and the number of noun-labels taught (14). Importantly, there was no difference between the groups in the production of the carrier-phrase, $t(30) = -1.08$, $p > .2$. That is, participants in the sequence-first condition showed better learning precisely of the association between the articles and the nouns.

In summary, both measures (forced-choice and production) produced the same pattern of performance: Participants in the sequence-first condition showed better learning on all measures: recognition of the correct article, recognition of the correct noun, and production of the article + noun sequence.

Discussion

Our artificial grammatical gender system was learned better when participants started with "less segmented" input, where the boundaries between individual segments (in this case articles and noun) were less prominent. Participants in the sequence-first condition were more likely to choose the sentence with the correct article in a forced-choice task and more likely to produce the appropriate article for a given noun in a production task. This was despite the fact that by the end of training, all participants had seen exactly the same training items exactly the same number of times.

As we noted above, there is reason to believe that adults are more likely to focus on noun-labels in learning. Thus these results offer one explanation why they struggle to learn grammatical gender, and why the representations they learn are shallow and hard to access in real time (Clahsen & Felser, 2006): starting from noun-labels may hinder learning about the relation *between* articles and nouns.

Why is it harder to learn about the relations between nouns and articles when you start with noun-labels? What kind of mechanism underlies these effects? One answer lies in the effect of blocking on learning (Kamin, 1969). Blocking occurs when a new cue is introduced into a situation where a set of previously learned cues fully predict a response. In the absence of any discrepancy between what was encountered and what was anticipated, the new cue will not be associated with the event (Rescorla & Wagner, 1972; Rescorla, 1988). This principle of learning can be extended to grammatical gender in a relatively straightforward manner. Learners starting with noun-labels will initially associate an object and a noun-label: their knowledge about the object will center on the noun. This will make it harder to later learn about the relation between the article and the noun: because the noun will fully predict the object, the article will add no information. Because the largest gains in associativity come in the earliest stages of learning (Rescorla & Wagner, 1972), the more adults treat articles and nouns as separate in these stages, and the more they associate the noun alone with an object, the less they will come to associate the article with the noun. In effect, initially focusing on the noun may cause learners to 'listen through' the article, because it doesn't add any information.

In contrast, if learning starts with larger article-noun sequences, the initial association will be between the object and the article + noun sequence. Generally, an article can appear with many nouns, but a noun will appear with a more limited set of objects. Because of this, over time, cue competition will cause objects to become more strongly associated with nouns. The presence of a noun with an object (but without the

article) will strengthen the association between the noun and object; similarly, the presence of an article without the given object or noun will weaken its association with them. Speakers will thus come to largely dissociate articles and nouns over time. Crucially, however, the article will still remain associated with the object and the noun as a result of initial learning (Rescorla & Wagner, 1972; see also Ramscar, Yarlett, Dye, Denny & Thorpe, submitted).

This insight from learning theory suggests that our results may reflect a broader pattern: learning segments individually may have the potential cost of blocking later learning about the relations between segments. Furthermore, what is learned about the relationships between units may in turn be affected by the information they convey. This may offer a way of reconciling our results with the extensive research demonstrating speakers' ability to detect and use co-occurrence information in language learning. Both children and adults learn transitional probabilities for sound sequences in a robust and reliable fashion (Saffran, Aslin & Newport, 1996). However, participants in our experiments did not learn the relations between articles and nouns equally well in both conditions, even though they had access to the same co-occurrence information. They learned them better when they were segmenting speech and learning semantics at the same time. That is, when the articles initially carried more semantic information - because they were more closely tied to the object.

The results underline the effect that prior knowledge has on what gets learned: if you already know noun-labels, you may learn about articles differently. There are many other examples of this: the initial sound patterns children learn influence the acquisition of later forms (Kuhl et al., 1992); the stress pattern of children's first words in English affects the segmentation of later words (Swingley, 2005); and children are more likely to pick up new words that conform to their existing production templates (Velleman & Vihman, 2002). All these findings demonstrate the way prior knowledge shapes subsequent learning in non-obvious ways.

The present study offers a novel perspective on adults' difficulty with mastering certain aspects of language in adulthood and suggests testable predictions as to how that difficulty may arise. Specifically, starting from more segmented units may be especially problematic when the relation between the segments is more semantically opaque. This problem may extend to other linguistic domains like verb-preposition pairing (e.g., that you say *hit him* in English but *hit to-him* in Hebrew), and idioms (where semantic meaning is non-compositional); indeed, this does seem to be the case (DeKeyser, 2007). Learning in such domains may be improved by a 'starting big' process where smaller units are initially part of a larger chunk.

While the current study did not test children's language learning (we have not shown that children start from larger units), we found that starting with units of different sizes influenced learning in adults (Elman, 1993; Newport, 1990), and that starting with larger units, and slowly increasing segmentation with learning, may prove advantageous.

How might these factors play out in a model of first language-learning? Infants enter the world without knowledge of word boundaries. Much like a second language learner, they cannot immediately detect word boundaries. But unlike that learner, they do not even know those boundaries exist. As a result, their initial units may correspond to major prosodic boundaries, yielding units that cross word boundaries. This in turn may allow children to learn about grammatical relations (like those between articles and nouns) from the "analysis" and segmentation of such larger sequences.

This fits nicely with usage-based models of language (Bybee, 1998; Tomasello, 2003), which posit that grammatical relations emerge from a gradual process of abstraction over stored utterances. It also fits well with evidence about what children can and do attend to in learning. Infants appear to be sensitive to larger prosodic units before smaller ones (Jusczyk et al,. 1992): 9-month-old infants are sensitive to both clausal and phrasal boundaries, whereas 6-month-old ones can only detect the larger clausal boundaries. Young children produce under-segmented utterances like 'give-it the ball' where give-it is treated as a single unit (Peters, 1983). They also produce multi-word utterances like 'how-are-you' at a stage where their other utterances are mostly single words (see Tomasello, 2003). Older children also attend to sequences (Bannard & Matthews, 2008)—they are better at repeating frequent four-word *sequences*, even when the frequency of individual words is matched (e.g., at 'a drink of milk' compared to 'a drink of tea'). Finally, production of irregular plurals is facilitated in familiar sequences (e.g., 'teeth' in 'brush your teeth'; (Arnon & Clark, 2009).

We have shown in this study that adults were better at learning grammatical gender in an artificial language when they were first exposed to article-noun sequences and only then to noun-labels, demonstrating an effect of size and order-of-acquisition on adult learning. There are multiple differences between children learning a first language and adults learning a second. In the current study we have tried to highlight one of these: how adult's prior knowledge of language and their ability to 'break it down' may adversely affect how well they learn a novel one.

Acknowledgments

This material is based upon work supported by NSF Grant Nos. 0547775 and 0624345 to Michael Ramscar

References

Arnon, I. & Clark, E.V. (2009). Children's word production is facilitated by familiar phrases. Talk presented at the LSA Annual Meeting, SF.

Bannard, C., & Matthews, D.E. (2008) Stored Word Sequences in Language Learning: The Effect of Familiarity on Children's Repetition of Four-Word Combinations, *Psychological Science , 19*, 241-248.

Bybee, J. (1998). The emergent lexicon. In: *Chicago Linguistic Society*, 34, 421-435.

Carroll, J. B. (1939). Determining and numerating adjectives in children's speech. *Child Development, 10*, 215-229.

Carroll, S. (1989). Second-language acquisition and the computational paradigm. *Language Learning, 39*, 535-594.

Chevrot, J. P., Dugua, C., & Fayol, M. (2008). Liaison acquisition, word segmentation and construction in French: a usage-based account. *Journal of Child Language,* 1-40.

Clahsen, H., & Felser, C. (2006). Grammatical processing in language learners. *Applied Psycholinguistics*, *27*, 3-42.

Corbett, G.G. (1991). *Gender*. Cambridge, England: Cambridge University Press.

DeKeyser, R. M. (2007). What makes learning second language grammar difficult? A review of issues. *Language Learning*, *55*, 1-25.

Doughty, C. and Williams, J (eds.) (1998). *Focus on Form in Classroom Second Language Acquisition.* Cambridge: Cambridge University Press.

Elman, J.L., (1993) Learning and development in neural networks: The importance of starting small. *Cognition, 48*, 71-99.

Grosjean, F., Dommergues, J. Y., Cornu, E., Guillelmon, D., & Besson, C. (1994). The gender marking effect in spoken word recognition. *Perception & Psychophysics, 56*, 590-598.

Guillelmon, D., & Grosjean, F. (2001). The gender marking effect in spoken word recognition: The case of bilinguals. *Memory and Cognition, 29*, 503-511.

Harley, B. (1979). French gender 'rules' in the speech of English-dominant, French-dominant and monolingual French-speaking children. *Working Papers in Bilingualism, 19*, 129–156.

Hawkins, R., & Chan, C. Y.-H. (1997). The partial availability of UG in second language acquisition. *Second Language Research, 13*, 187-226.

Johnson, J.S., & Newport, E.L. (1989). Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology, 21*, 60-99.

Jusczyk, P. W., Hirsh-Pasek, K., Kemler Nelson, D.G., Kennedy, L.J., Woodward, A. & Piwoz, J. (1992). Perception of acoustic correlated of major phrasal units by young infants. *Cognitive Psychology*, *24*, 252-293.

Kamin L.J. (1969). Predictability, surprise, attention, and conditioning. In: Campbell B, Church R (eds). *Punishment and Aversive Behaviour*. Appleton-Century-Crofts: New York.

Kuhl, P.K. (2000). A new view of language acquisition. *Proceedings of the National Academy of Science. 97(22),* 11850-11857.

Lenneberg, E. H. (1967). *Biological Foundations of Language*. Wiley.

Lew-Williams, C., & Fernald, A. (2007). Young children learning Spanish make rapid use of grammatical gender in spoken word recognition. *Psychological Science, 18*, 193-198.

Mariscal, S. (2008). Early acquisition of gender agreement in the Spanish noun phrase: starting small. *Journal of Child Language*, 1-29.

Moyer, A. (1999). Ultimate attainment in L2 phonology: the critical factors of age, motivation, and instruction. *Studies in Second Language Acquisition, 21*, 81-108.

Neville, H.J. and Bavelier, D. (2001). Variability of developmental plasticity. In J. McClelland and R. Siegler (Eds), *Mechanisms of cognitive development: Behavioural and neural perspectives*.

Newport, E.L. (1990). Maturational constraints on language learning. *Cognitive Science, 14*, 11-28.

Pine, J. M., & Lieven, E. (1997). Slot and frame patterns and the development of the determiner category. *Applied Psycholinguistics, 18*, 123-138.

Ramscar, M., & Gitcho, N. (2007). Developmental change and the nature of learning in childhood. *Trends In Cognitive Science, 11(7)*, 274-279.

Ramscar, M., Yarlett, D., Dye, M., Denny. K., & Thorpe, K. (in submission) The Feature-Label-Order Effect In Symbolic Learning.

Rescorla R.A. (1988). Pavlovian Conditioning: It's Not What You Think It Is, *American Psychologist, 43(3),* 151-160.

Rescorla R.A. and Wagner A.R. (1972). A Theory of Pavlovian Conditioning: Variations in the Effectiveness of Reinforcement and Nonreinforcement. In A.H. Black & W.F. Prokasy (Eds.), *Classical Conditioning II: Current Research and Theory* (pp. 64-99). New York: Appleton-Century-Crofts.

Saffran, J.R., Aslin, R.N., & Newport, E.L. (1996). Statistical learning by 8-month-old infants. *Science, 274,* 1926–1928.

Scherag, A., Demuth, L. Roesler, F., Neville, H.J. and Roeder, B. (2004). The effects of late acquisition of L2 and the consequences of immigration on L1 for semantic and morpho-syntactic language aspects. *Cognition, 93*, B97-B108.

Tomasello, M. (2003). *Constructing a Language: A Usage-Based Theory of Language Acquisition*. Harvard University Press.