Learning Morphology with Inductive Bias: Evidence from Infixation

Colin Wilson

1. Introduction

When acquiring morphology, language learners face the challenge of identifying both the **form** of each affix and its **location** within words. Descriptive research on language typology has identified a limited set of attested locations for affixes (e.g., Ultan, 1975; Moravcsik, 1977), and research in prosodic morphology has developed restrictive theories of the locations themselves as well as strong dependencies between affix location and form (e.g., Anderson, 1972; McCarthy & Prince, 1986, 1993; Prince & Smolensky, 1993; Yu, 2007; Zuraw, 2007; Samuels, 2010). It is plausible that language learners have inductive biases, similar to the principles of linguistic theories, that guide their acquisition of these aspects of morpheme realization. This paper reports on artificial grammar experiments that probe for such biases in rapid adult learning of novel affixes from sparse and ambiguous input.

Many previous artificial grammar studies have investigated learning of morphology (e.g., Braine et al., 1990; Brooks et al., 1993; Frigo & McDonald, 1998; Finley & Newport, 2010; Finley, 2018; Schumacher & Pierrehumbert, 2021; Saldana et al., 2018, 2021) or proto-morphology (i.e., recurring patterns of form and location in the absence of meaning). Most studies have focused on strictly concatenative affixes — prefixes and suffixes — with only a few examining **reduplication** (e.g., Marcus et al., 1999), **templatic** patterns (e.g., Newport & Aslin, 2004; Finley & Newport, 2018), or **subtractive** morphology (e.g., Kapatsinski, 2017). This mirrors research on natural language acquisition of morphology, which has also focused mainly on concatenative patterns (but cf. Berman 1987; Ravid & Avidor 1998; Saiegh-Haddad et al. 2012; Albirini 2015 on Semitic root-and-pattern/templatic systems). Similarly, most computational models of morphological learning are limited in principle to identifying edge-based affixes (e.g., Goldsmith, 2001; Johnson & Goldwater, 2009; Sirts & Goldwater, 2013), or have not been evaluated on their ability to learn other patterns (e.g., Albright & Hayes, 2002, 2003; Malouf, 2017; Engelmann et al., 2019) (but cf. Botha & Blunsom 2013; Xu et al. 2020; Haley & Wilson 2021).

The present experiments investigate learning of **infixation**, using patterns modeled loosely on the UM affix found in Chamorro and other Austronesian

* Colin Wilson, Johns Hopkins University, colin.wilson@jhu.edu.

 Proceedings of the 46th annual Boston University Conference on Language Development, ed. Ying Gong and Felix Kpogo, 851-861. Somerville, MA: Cascadilla Press.

languages (e.g., Topping & Dungca, 1973; Crowhurst, 2001; Zuraw, 2007; Zuraw & Lu, 2009; Chung, 2020). In Chamorro, UM has several meanings and is generally realized as the **infix** /um/ located immediately before the first vowel of its base: for example, /f-um-ahan/ 'buy (infin.agreement)' and /tr-um-isti/ 'becomes sad'. However, UM is realized as the metathesized **prefix** /mu-/ when the base begins with a sonorant consonant: for example, /mu-naʔi/ 'give (infin.agreement)'.[1] How do learners identify and generalize patterns of infixation like this one? How do they further learn that both the form and location of a given affix is conditioned by the phonology of the base?

Despite the descriptive richness of infixation patterns, and the central role that they play in the theory of prosodic morphology, only a handful of previous studies have addressed such questions (e.g., Treiman, 1983; Pierrehumbert & Nair, 1995; Staroverov & Finley, 2021). The present experiments are most similar in their logic to those of Pierrehumbert & Nair (1995), though they used real English words as bases and did not feature a conditioned alternation between infixation and prefixation. Section 2 describes the experiments and their results. Section 3 presents compares the pattern of performance shown by the human learners with that predicted by the Minimal Generalization Learner (MGL; Albright & Hayes, 2002, 2003), demonstrating that the MGL cannot account for the experimental results. Section 4 summarizes the paper and discusses future directions.

2. Artificial infixation experiments

Two experiments were conducted, each replicated twice, as referred to below by Experiment 1A/1B and Experiment 2A/2B. Because the experiments were highly similar in design, they are presented together.

2.1. Participants

Participants were English-speaking adults (N = 20 per replication) recruited through Amazon's Mechanical Turk crowdsourcing service. Participants were told that they would be learning "how to form the plural in a new language" by listening to words, accompanied by pictures and spelled forms, and producing spoken responses. They were asked to listen to the stimuli over headphones if possible, and to participate in a quiet place so that their responses would be recorded clearly.

[1] Not all Chamorro speakers use the prefix variant of UM, and for many that do it is in free variation with the infix (Chung, 2020); for example, /n-um-aʔi/ could also express 'give (infin.agreement)' . The experiments reported here do not involve optionality or unconditioned/nonsystematic variation.

2.2. Design

Each experiment began with brief verifications that participants' headphones and microphones were functioning, followed by presentation of the instructions. There were two main experimental phases, familiarization and testing.

During the **familiarization** phase, participants were exposed to singular and plural forms of novel nouns. The spoken stimuli were produced by a high-quality neural speech synthesizer given phonetic transciptions that included stress. The meaning of each noun was indicated by a color image (one instance for singular, two instances for plural), but memory for meaning was not tested in the experiment. The spoken stimuli were also accompanied by spellings, in a simplified English orthography that was explained with examples in the instructions, but again knowledge of spelling was not tested. None of the spoken or written forms were real words of English. In each familiarization trial, participants listened to the singular form of a noun, then the plural form, and repeated the plural form for recording.

In Experiment 1A/1B, every singular form presenting during familiarization had the following shape (see Table 1): it begin with a single labial consonant (LAB) from the set /p b f m/, followed by a vowel (V1) from /i eɪ a oʊ u/, then a single coronal consonant (COR) from /t d ʃ n/, and finally a vowel (V2) from the same set as V1 but always distinct from that vowel. Stress was always on the first syllable (marked on V1 in Table 1). The positional frequencies of consonants and vowels, and their cooccurrences, were statistically balanced across the stimuli (both familiarization and testing). The singulars in Experiment 2A/2B had the same shape except that the positions of labial and coronal consonants were swapped.

For each singular, the corresponding plural was formed by infixation or prefixation. In Experiment 1A/1B, the infix /-ɪl-/ was placed immediately before the first vowel except when the singular base began with /m/, in which case the plural was realized by the metathesized prefix /lɪ-/. The formation was the same in Experiment 2A/2B except that an initial /n/ in the base conditioned prefixation.

Table 1. Singular and plural forms in the familiarization phase.

Exper.	Singular	Plural	Example
1A/1B	LAB 'V1 COR V2	LAB -**ɪl**- 'V1 COR V2	
		if LAB is /p b f/	*b'etu* ∼ *b*-**ɪl**-*'etu*
		lɪ- LAB 'V1 COR V2	
		if LAB is /m/	*m'ido* ∼ **lɪ**-*'mido*
2A/2B	COR 'V1 LAB V2	COR -**ɪl**- 'V1 LAB V2	
		if COR is /t d ʃ/	*d'ipe* ∼ *d*-**ɪl**-*'ipe*
		lɪ- COR 'V1 LAB V2	
		if COR is /n/	*n'ebo* ∼ **lɪ**-*n'ebo*

Crucially, however, the singular/plural pairs encountered during familiarization were ambiguous — equally consistent with many possible morphological generalizations. Participants in Experiment 1A/1B could in principle have induced that the infix is placed (i) before the first vowel of the base, as just described, or (ii) after the first segment, (iii) after the first consonant, (iv) after the first labial consonant, (v) after the first labial obstruent, (vi) before the stressed vowel, etc. Participants in Experiment 2A/2B faced the same range of possibilities, with coronal replacing labial. The familiarization examples were also indeterminate about the conditioning of the prefix. Should the prefix be used (i) when the base begins with /m/ (resp. /n/), as described above, or (ii) when it begins with any consonant other than /p b f/ (resp. /t d ʃ/), (iii) for an arbitrary set of singular bases, or (iv) in free variation with the infix? The restricted shape of singulars, enforced by design, leaves many analytic options open to the learner.

The amount of familiarization was also highly limited. There were 4 trials for each of the possible initial consonants; that is, 12 trials exemplifying infixation and 4 trials for prefixation. This provides a test of rapid morphological induction on the part of humans, and the same stimuli may confound computational models that are typically trained on data sets several orders of magnitude larger.

The **testing** phase probed for inductive biases by requiring participants to generate plurals for singulars that had the same shape as those in familiarization or differed from them by one of several manipulations. None of the items were real words of English or repeated from the first phase. In each test trial, participants listened to the singular form of a noun (accompanied by an image and spelling), and then produced a spoken plural form for recording.

Table 2. Singular forms in the testing phase.

Exper.	Singular	Manipulation	Example
1A/1B	LAB 'V1 COR V2	none	*b'iʃo* ∼ ?
	LAB V1 COR 'V2	iambic	*pin'u* ∼ ?
	COR 'V1 LAB V2	coronal-labial	*d'ebu* ∼ ?
	CLUST 'V1 COR V2	initial cluster	*fɹ'uni* ∼ ?
	'V1 LAB V2	initial vowel	*'ebo* ∼ ?
2A/2B	COR 'V1 LAB V2	none	*t'efo* ∼ ?
	COR V1 LAB 'V2	iambic	*ʃop'i* ∼ ?
	LAB 'V1 COR V2	labial-coronal	*f'uʃo* ∼ ?
	CLUST 'V1 LAB V2	initial cluster	*st'ome* ∼ ?
	'V1 COR V2	initial vowel	*'ide* ∼ ?

Test singulars were evenly distributed over the categories shown in Table 2; there were 8 items of each type, for a total of 40 test trials per participant. Items labeled *none* had the same shape as familiarization singulars (but, again, were novel). Those labeled *iambic* had stress on the second syllable, departing from the consistent trochaic (first syllable) stress of the familiarization singulars. The remaining three types swapped the order of labial and coronal consonants relative to familiarization, began with a consonant cluster instead of a singleton, or had no initial consonant (i.e., begin with a vowel). The consonant clusters were /bɹ fɹ sp sm/ for Experiment 1A/1B and /dɹ ʃɹ st sn/ for Experiment 2A/2B.

Heterogeneity at test can reveal distinctions among rules that are indistinguishable from homogeneous familiarization. For example, a hypothetical participant who learned to place the infix after the first segment of the base would give different responses for *initial cluster* and *initial vowel* test items than a participant who learned to place the infix before the first vowel. Another participant who learned that the infix is located after the first labial obstruent would give responses different from the other two (e.g., infixing after the first consonant in *fɹ'uni* ∼ *f*-**ɪl**-*ɹ'uni*, but infixing before the first vowel in *spo'ne* ∼ *sp*-**ɪl**-*o'ne*, and hyperinfixing in *d'ebu* ∼ *d'eb*-**ɪl**-*u*), and may be perplexed by items that do not contain any consonant in that natural class (e.g., *'ide* ∼ ?).

2.3. Results

Spoken responses, despite being recorded remotely, were overwhelmingly clear and straightforward to transcribe. They were coded for affix form, affix location, and any changes to the base. Accuracy of repetition in the familiarization phase was high (Experiment 1A: 0.96, Experiment 1B: 0.96, Experiment 2A: 0.98, Experiment 2B: 0.90).[2]

The proportion of responses during testing for each of several possible affix locations, averaged across participants, are shown in Figure 1 (for Experiment 1A) and Figure 2 (for Experiment 2A). The locations as coded in these figures are anchored to the first vowel of the base: an affix was coded as before/after the first vowel if it appeared before/after that segment, as after the first consonant if it was located between the members of a base-initial cluster, as a prefix if it appeared before a base-initial consonant (or cluster), etc. Of course, participant responses have the same ambiguities of interpretation that were noted above for the familiariation trials. The statistical analysis below takes into account these ambiguities, which are not reflected in the figures. Response proportions for affix location were highly correlated across replications (Experiment 1A/1B: $r = .83$; Experiment 2A/2B: $r = .88$), suggesting that a sample of 20 participants suffices to obtain reliable results in this kind of experiment.

The main finding is that participants preferred to locate the infix before the first vowel, independently of all but one manipulation. This most preferred location is common in Austronesian languages and others that have infixes. The

---

[2] Approximately 15% of the original participants were excluded according to a lax criterion: namely, systematic use of any affix containing the consonant /l/ during testing. These participants were replaced until there were 20 in each replication. The response patterns of excluded participants are of broader interest — for example, several of them spontaneously innovated reduplication patterns that were not supported by familiarization trials — but do not bear directly on learning infixation and will be reported elsewhere.

exception was for vowel-initial bases, which elicited a higher rate of affixation after the first vowel. For such bases, placing the infix after V1 satisfies 'edge-anchoring' constraints that have been proposed in prosodic morphology. Importantly, no participant consistently located the infix after the first labial (obstruent) in Experiment 1A/1B, or after the first coronal (obstruent) in Experiment 2A/2B. These response patterns, which would be predicted by statistical learning or n-gram models that simply track segment cooccurrence frequencies, are consistent with the familiarization evidence but apparently dispreferred by human learners.

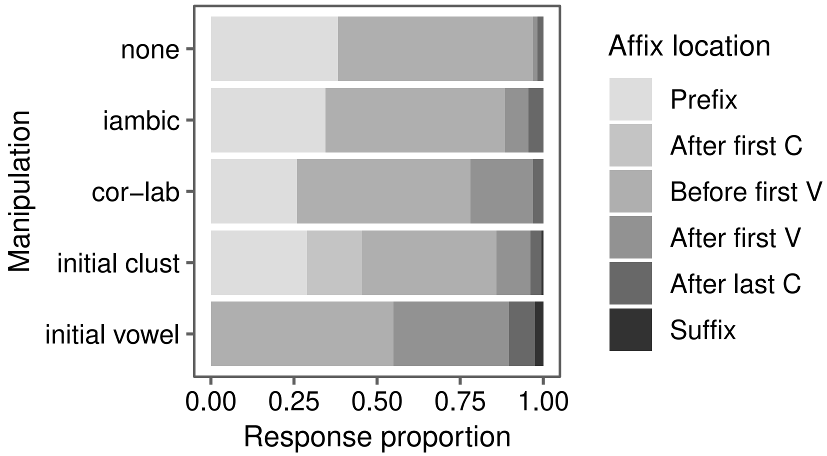

Figure 1. Affix location in the testing phase of Experiment 1A.

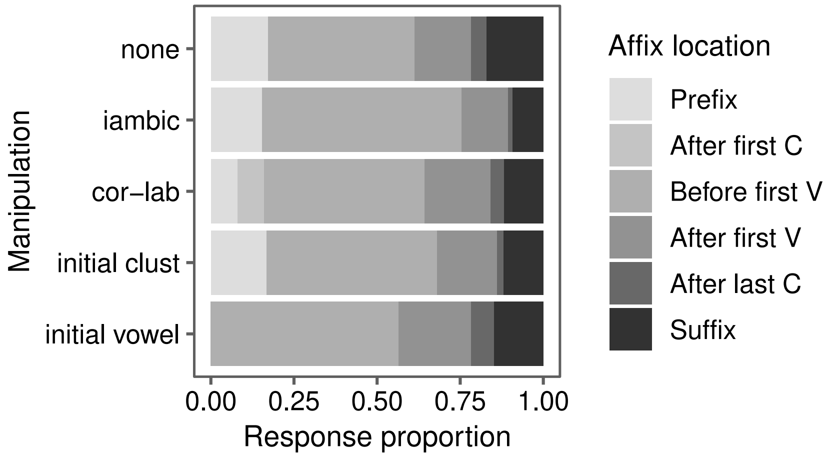

Figure 2. Affix location in the testing phase of Experiment 2A.

Mixed-effects multinomial regressions of affix location were performed with custom Stan models (Carpenter et al., 2017). Response probabilities in the models were calculated in a way that reflects the ambiguity of individual responses. For example, the probability of the response *b*-**ɪl**-*'iʃo* for the base *b'iʃo* was the sum of the probability of placing the affix before the first vowel, before the stressed vowel, after the first consonant, and after the first segment. The estimated probability of placing the infix before the first vowel was significantly greater than that of any location other than prefixation (all p-values $< .01$). The result that prefixation was numerically but not significantly dispreferred relative to infixation is unsurprising, given that prefixes did occured during familiarization and are found in the participants' native language.

3. MGL simulations

The Minimal Generalization Learner (MGL; Albright & Hayes, 2002, 2003) has proven effective at modeling morphological learning and generalization for a number of natural languages (e.g., Hijazi Arabic, English, Japanese, Korean, Navajo, Portuguese, Russian, Tgdaya Seediq, Spanish, Swedish), and has recently been found to outperform several other computational models of morphology in predicting adult *wug*-test ratings Wilson & Li (2021).

The MGL forms the 'tightest fit' rules that are consistent with its training data by generalizing (initially lexeme-specific rules) in a way that retains shared segments and features. The process of merging specific rules into those that are more general is illustrated by the folling example:

- From example *b'etu* $\sim$ *b*-**ɪl**-*'etu* learn rule
  (R1) $\emptyset \rightarrow$ -ɪl- / # b _ 'etu
- From example *f'uʃo* $\sim$ *f*-**ɪl**-*'uʃo* learn rule
  (R2) $\emptyset \rightarrow$ -ɪl- / # f _ 'uʃo
- Generalize R1 and R2 to rule
  (R3) $\emptyset \rightarrow$ -ɪl- / # $[-$sonorant, $+$labial, $\ldots]$ _ $[+$syllabic, $+$stress, $\ldots]$ X

When applied to the familiarization examples of the present experiments, the MGL 'overfits' its training data — learning rules that are too specific, none of which apply to most of the test items. This is a direct consequence of the homegeneity of the items. All of the familiarization singulars that take the infix **-ɪl-** begin with labial obstruents /p b f/ (Experiment 1A/1B) or coronal obstruents /t d ʃ/ (Experiment 2A/2B), therefore no infixation rule learned by the MGL can apply to bases beginning with consonants of any other place of articulation or to vowel-initial bases. All of the familiarization singulars that take the prefix **lɪ-** begin with /m/ (Experiment 1A/1B) or /n/ (Experiment 2A/2B), therefore no prefixation rule learned by the MGL can apply to bases that begin with any other segments.

A preference for narrow generalizations that hew close to the training data is shared by many other computational models (e.g., statistical learning, n-gram, and 'ideal observer' models; see Frank & Tenenbaum 2011). Unlike the MGL and other computational systems, humans apparently have an inductive bias in this empirical domain that favors coarse-grained, prosodic rules such as infixation before the first vowel. This bias is borne out in the results of the present artificial grammar experiments and in the properties of naturally-occurring infixation patterns in many diverse languages.

4. Summary & future directions

When presented with sparse and ambiguous examples of a novel infixation patterns, humans rapidly form coarse-grained prosodic generalizations and extend them to base forms about which they were provided no direct evidence. Thise finding converges with previous experimental results of Pierrehumbert & Nair (1995) and is consistent with the restricted typology of infix locations observed in natural languages (Ultan, 1975; Moravcsik, 1977; Yu, 2007:e.g.,). Many computational learning models for morphology, like the MGL, instead have a bias for segment- and feature- specific generalizations unlike those found experimentally and typologically. Future research should experimentally investigate a wider range of infixation patterns, including those that show some sensitivity to distinctive features (e.g., Zuraw, 2007; Staroverov & Finley, 2021), and develop models that learn and generalize morphology in a way that is more consistent with the biases shaping human experimental performance and natural languages.

References

Albirini, Abdulkafi (2015). Factors affecting the acquisition of plural morphology in Jordanian Arabic. *Journal of Child Language* 42:4, 734–762.

Albright, Adam & Bruce Hayes (2002). Modeling English past tense intuitions with minimal generalization. *Proceedings of the ACL-02 Workshop on Morphological and Phonological Learning*, Association for Computational Linguistics, 58–69, URL `https://aclanthology.org/W02-0607`.

Albright, Adam & Bruce Hayes (2003). Rules vs. analogy in English past tenses: A computational/experimental study. *Cognition* 90:2, 119–161.

Anderson, Stephen R. (1972). On nasalization in Sundanese. *Linguistic Inquiry* 3, 253–268.

Berman, Ruth A. (1987). A developmental route: Learning about the form and use of complex nominals in Hebrew 25:6, 1057–1086.

Botha, Jan A. & Phil Blunsom (2013). Adaptor Grammars for learning non-concatenative morphology. *Proceedings of the 2013 Conference on Empirical Methods in Natural Language Processing*, Association for Computational Linguistics, Seattle, Washington, USA, 345–356, URL `https://aclanthology.org/D13-1034`.

Braine, Martin D. S., Ruth E. Brody, Patricia J. Brooks, Vicki Sudhalter, Julie A. Ross, Lisa Catalano & Shalom M. Fisch (1990). Exploring language acquisition in children with a miniature artificial language: Effects of item and pattern frequency, arbitrary subclasses, and correction. *Journal of Memory and Language* 29:5, 591–610.

Brooks, Patricia J., Martin D. S. Braine, Lisa Catalano, Ruth E. Brody & Vicki Sudhalter (1993). Acquisition of Gender-like Noun Subclasses in an Artificial Language: The Contribution of Phonological Markers to Learning. *Journal of Memory and Language* 32:1, 76–95.

Carpenter, Bob, Andrew Gelman, Matthew D. Hoffman, Daniel Lee, Ben Goodrich, Michael Betancourt, Marcus Brubaker, Jiqiang Guo, Peter Li & Allen Riddell (2017). Stan: A probabilistic programming language. *Journal of Statistical Software* 76:1, 1–32.

Chung, Sandra (2020). *Chamorro Grammar*. Sandra Chung.

Crowhurst, Megan (2001). Coda conditions and um infixation in Toba Batak. *Lingua* 111:8, 561–590.

Engelmann, Felix, Sonia Granlund, Joanna Kolak, Marta Szreder, Ben Ambridge, Julian Pine, Anna Theakston & Elena Lieven (2019). How the input shapes the acquisition of verb morphology: Elicited production and computational modelling in two highly inflected languages. *Cognitive Psychology* 110, 30–69.

Finley, Sara (2018). Cognitive and linguistic biases in morphology learning. *Wiley Interdisciplinary Reviews: Cognitive Science* p. e1467.

Finley, Sara & Elissa Newport (2018). Segmentation of non-concatenative morphology: Child and adult learning.

Finley, Sara & Elissa L Newport (2010). Morpheme segmentation from distributional information. Franish, Katie, Kate Mesh Iserman & Lauren Keil (eds.), *Boston University Conference on Language Development (BUCLD 34) Online Proceedings Supplement*, BUCLD, Boston.

Frank, Michael C. & Joshua B. Tenenbaum (2011). Three ideal observer models for rule learning in simple languages. *Cognition* 120:3, 360–371.

Frigo, Lenore & Janet L. McDonald (1998). Properties of phonological markers that affect the acquisition of gender-like subclasses. *Journal of Memory and Language* 39:2, 218–245.

Goldsmith, John (2001). Unsupervised learning of the morphology of a natural language. *Computational Linguistics* 27:2, 153–198, URL `https://aclanthology.org/J01-2001`.

Haley, Coleman & Colin Wilson (2021). Deep neural networks easily learn unnatural infixation and reduplication patterns. *Proceedings of the Society for Computation in Linguistics 2021*, Association for Computational Linguistics, Online, 427–433, URL `https://aclanthology.org/2021.scil-1.51`.

Johnson, Mark & Sharon Goldwater (2009). Improving nonparameteric Bayesian inference: experiments on unsupervised word segmentation with adaptor grammars. *Proceedings of Human Language Technologies: The 2009 Annual Conference of the North American Chapter of the Association for Computational Linguistics*, Association for Computational Linguistics, Boulder, Colorado, 317–325, URL `https://aclanthology.org/N09-1036`.

Kapatsinski, Vsevolod (2017). Learning a subtractive morphological system: Statistics and representations. LaMendola, Maria & Jennifer Scott (eds.), *Proceedings of the 41st Annual Boston University Conference on Language Development (BUCLD 41)*, vol. 41, 357–372.

Malouf, Robert (2017). Abstractive morphological learning with a recurrent neural network. *Morphology* 27:4, 431–458.

Marcus, Gary F., Sugumaran Vijayan, S. Bandi Rao & Peter M. Vishton (1999). Rule learning by seven-month-old infants. *Science* 283:5398, 77–80.

McCarthy, John & Alan Prince (1993). Prosodic Morphology I: Constraint Interaction and Satisfaction. RuCCS 3, University of Massachusetts, Amherst, and Rutgers University.

McCarthy, John J. & Alan Prince (1986). *Prosodic Morphology*. New Brunswick, NJ.

Moravcsik, Edith (1977). *On Rules of Infixing*. IULC Publications, Bloomington.

Newport, Elissa L. & Richard N. Aslin (2004). Learning at a distance I. Statistical learning of non-adjacent dependencies. *Cognitive Psychology* 48:2, 127–162.

Pierrehumbert, Janet & Rami Nair (1995). Word games and syllable structure. *Language and Speech* 38, 78–114.

Prince, Alan & Paul Smolensky (1993). *Optimality Theory: Constraint Interaction in Generative Grammar*. Blackwell, Malden, MA.

Ravid, Dorit & Avraham Avidor (1998). Acquisition of derived nominals in Hebrew: Developmental and linguistic principles. *Journal of Child Language* 25:2, 229–266.

Saiegh-Haddad, Elinor, Areen Hadieh & Dorit Ravid (2012). Acquiring Noun Plurals in Palestinian Arabic: Morphology, Familiarity, and Pattern Frequency. *Language Learning* 62:4, 1079–1109.

Saldana, Carmen, Kenny Smith, Simon Kirby & Jennifer Culbertson (2018). Is regularisation uniform across linguistic levels? Comparing learning and production of unconditioned probabilistic variation in morphology and word order. Preprint, PsyArXiv.

Saldana, Carmen, Yohei Oseki & Jennifer Culbertson (2021). Cross-linguistic patterns of morpheme order reflect cognitive biases: An experimental study of case and number morphology. *Journal of Memory and Language* 118, p. 104204.

Samuels, Bridget (2010). The topology of infixation and reduplication. *The Linguistic Review* 27:2, 131–176.

Schumacher, R. Alexander & Janet B. Pierrehumbert (2021). Familiarity, consistency, and systematizing in morphology. *Cognition* 212.

Sirts, Kairit & Sharon Goldwater (2013). Minimally-supervised morphological segmentation using Adaptor Grammars. *Transactions of the Association for Computational Linguistics* 1, 255–266, URL `https://aclanthology.org/Q13-1021`.

Staroverov, Peter & Sara Finley (2021). Learning Syllable-Based vs. Segment-Based Infixation Patterns. Soo, Rachel, Una Y. Chow & Sander Nederveen (eds.), *Proceedings of the 38th West Coast Conference on Formal Linguistics*, Cascadilla Proceedings Project, Somerville, MA, 397–405.

Topping, Donald M. & Bernadita C. Dungca (1973). *Chamorro Reference Grammar*. University Press of Hawaii, Honolulu.

Treiman, R. (1983). The structure of spoken syllables: Evidence from novel word games. *Cognition* 15, 49–74.

Ultan, Russell (1975). Infixes and their origins. Seider, H. (ed.), *Linguistic Workshop III*, Wilhelm Fink, Munich, 156–205.

Wilson, Colin & Jane S.Y. Li (2021). Were We There Already? Applying Minimal Generalization to the SIGMORPHON-UniMorph Shared Task on Cognitively Plausible Morphological Inflection. *Proceedings of the 18th SIGMORPHON Workshop on Computational Research in Phonetics, Phonology, and Morphology*, Association for Computational Linguistics, Online, 283–291.

Xu, Hongzhi, Jordan Kodner, Mitchell Marcus & Charles Yang (2020). Modeling morphological typology for unsupervised learning of language morphology. *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*, Association for Computational Linguistics, Online, 6672–6681, URL https://aclanthology.org/2020.acl-main.596.

Yu, Alan C. L. (2007). *A Natural History of Infixation*. Oxford University Press, Oxford.

Zuraw, Kie (2007). The role of phonetic knowledge in phonological patterning: Corpus and survey evidence from Tagalog infixation. *Language* 83:2, 277–316.

Zuraw, Kie & Yu-An Lu (2009). Diverse repairs for multiple labial consonants. *Natural Language & Linguistic Theory* 27:1, 197–224.

Proceedings of the 46th annual Boston University Conference on Language Development

edited by Ying Gong
and Felix Kpogo

Cascadilla Press Somerville, MA 2022

Copyright information

ISSN 1080-692X
ISBN 978-1-57473-077-7 (2 volume set, paperback)

Ordering information

To order a copy of the proceedings or to place a standing order, contact:

Cascadilla Press, P.O. Box 440355, Somerville, MA 02144, USA
phone: 1-617-776-2370, sales@cascadilla.com, www.cascadilla.com