Perceptual functionality of Multiple Exponence in Choguita Rarámuri (Tarahumara)

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Abstract

A recent cross-linguistic survey suggests Multiple Exponence, the redundant marking of the same meaning by multiple morphological layers, to be more widely attested than commonly believed (Caballero & Harris 2012). While this phenomenon has been examined within the context of morphological theory and diachronic research, little work has been done that investigates the processing of ME and synchronic motivations for its use. This paper reports a field speech-in-noise experiment to assess perceptual functionality of Multiple Exponence in an agglutinating language of Northern Mexico, Choguita Rarámuri (Tarahumara). This language possesses patterns of Multiple Exponence in which a meaning is redundantly cued by two consecutive suffixes, and where the second (outer) suffix is optional. We show that the effect of adding the optional suffix varies with the overall likelihood of recognizing its meaning in context: cue redundancy helps when recognition of the cued meaning is difficult but hurts when recognition of the cued meaning is easy. The results are interpreted as support for the operation of the Maxim of Clarity (Grice 1975) in spoken word recognition: the listener expects the speaker to say only as much as is necessary to transmit the message.

Keywords: multiple exponence, Gricean inference, morphological processing, Uto-Aztecan languages

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Introduction

Multiple or extended Exponence (ME) is the phenomenon where a single feature, bundle of features, or derivational category is redundantly marked by multiple morphological layers (Caballero & Harris 2012, Caballero & Inkelas to appear). Through examination of ME patterns in Choguita Rarámuri, we show that ME may bring a perceptual advantage and that, like other examples of redundancy in language, it is a fruitful testing ground for examining the interplay between production economy and clarity of expression.[1]

ME is at odds with principles of economy in morphological theory (e.g., "[a]mong equally expressive expressions, the simplest is optimal" (Kiparsky 2005:114), but consistent with a proposal regarding the role of clarity and transparency of form-meaning relationships in diachrony (hypercharacterization, where more 'clearly' or 'overtly' marked elements tend to be preferred in analogical change (Kuryłowicz's 1947; see also Hock 1991: 211)). The role of clarity has also been emphasized in the cross-linguistic sentence processing tradition arising from work on the Competition Model (Bates et al. 1982, Bates & MacWhinney 1989, MacWhinney et al. 1985).[2] However, there has been little work trying to examine how economy and clarity interact synchronically in the domain of morphological exponence.

On the other hand, in pragmatics, Grice (1975) proposed that the listener expects the speaker to say as little as possible without sacrificing communication (the Maxim of Manner calls for the speaker to both "avoid ambiguity" and "avoid unnecessary prolixity"). Importantly, Grice explicitly phrases his maxims as expectations of the listener: the listener expects the speaker to be as brief as possible without sacrificing informativeness, and deviations from this ideal are predicted to make the listener's task harder. The Gricean perspective provides the following prediction for the perceptual functionality of ME, which we test in the present paper: ME, understood as morphological redundancy, should help the listener perceive the exponed meaning when help is needed, i.e., iff the meaning is not contextually predictable. When the meaning is not contextually predictable, ME provides an additional cue to the meaning and avoids ambiguity. On the other hand, when the meaning *is* predictable from context, ME constitutes unnecessary prolixity and may actually make recognition of the meaning harder.

Previous cross-linguistic work

While only one paper (Harris & Samuel 2011) has explicitly focused on testing the perceptual functionality of ME, relevant work has also been conducted within the framework of the Competition Model (Bates et al., 1982, Bates & MacWhinney 1989, MacWhinney et al. 1985). Within the Competition Model, morphological exponents are a subtype of "cues",[3] and ME would be an example of cue coalition, a situation where multiple cues redundantly express the same meaning. Under the Competition Model, cue coalition is expected to be common; cross-linguistic work under this model has focused on exponence of agentivity ("whodunit"), exploring

[1] E.g., hyper/hypoarticulation in pronunciation and referential expression choice (see Fowler et al. 1997 for a discussion of differences and similarities)

[2] "One-to-one mappings between form and function are rare. Under the real-time pressures of language use, redundancy is welcome." (Bates & MacWhinney 1989: 22)

[3] Where 'cues' are understood as the dimensions (phonological, morphological, syntactic) within the formal (expressive) level that allow hearers to infer the functional content of utterances, plus any functional or extralinguistic content that may affect the inference process. For instance, animacy is considered a lexical semantic cue to agentivity (see Bates & MacWhinney 1989).

the relative importance of cues like case marking, verbal agreement, and word order in several, typological diverse languages (see MacWhinney 2001 for the full list of citations).

Most of the work in the Competition Model framework focused on cue competition, rather than the question of whether an additional redundant cue helps processing ("cue coalition"), which is the focus of Harris & Samuel (2011) and the present paper. However, the work of Pléh and collaborators on Hungarian (MacWhinney et al. 1985, MacWhinney & Pléh 1997, Pléh 1989, Pléh et al. 1987), Kail (1989) on French, and Mimica et al. (1994) on Serbo-Croatian is directly relevant.

The earliest version of the Competition Model (Bates et al. 1982) suggested that listeners rely on a given cue to a given meaning to the extent that the cue occurs whenever the meaning is expressed and vice versa. However, MacWhinney et al. (1985) pointed out that cues cannot be acquired unless they are detectable. The influence of cue detectability was demonstrated by MacWhinney et al. 1985, Pléh et al. 1987, Pléh 1989, and MacWhinney & Pléh 1997 in Hungarian. Hungarian has an accusative marker *–t* that lengthens a preceding [a]. Thus when *–t* is attached to a noun ending in [a], accusativity is redundantly cued by [t] and the length of the preceding vowel. On the other hand, the presence of [t] is hard to detect after another alveolar obstruent, namely [s]. Thus when *–t* is attached to a noun ending in [s], the cues to accusativity are very weak. In a series of studies, MacWhinney, Pléh and collaborators demonstrated that a noun marked with *–t* was much more easily detected not to be the agent in a sentence context when the *–t* came after the lengthened [a] compared to when it came after [s]. This was observed both in the degree to which *–t* was able to dominate the competing cue of word order and semantic plausibility. It was also observed in reaction times on trials when *–t* was dominant. While this phenomenon involves a morphologically conditioned phonological pattern rather than two separate morphological layers, these results are nonetheless relevant for the hypothesis that ME is perceptually functional. As Pléh (1989: 160) writes, "some stems are inherently more difficult with regard to perceptual identification of certain endings, and some stem alternations - most notably linking vowels - may have been preserved in the language exactly to enhance perceivability".

While cue competition data has consistently supported perceptual functionality of cue coalition, data obtained in the absence of strong competition from other cues has not (Kail 1989, Mimica et al. 1994, and Harris & Samuel 2011). Kail (1989) found that an additional cue to agentivity (a clitic pronoun or subject-verb agreement) sped up reaction times to "whodunit" questions in French and Spanish only if the other consistent cues to agentivity were weak on their own. If meaning recognition was at ceiling in the absence of the additional cue, adding the cue slowed down reaction times. Based on these data, Bates & MacWhinney (1989: 55-56) suggested that

> [L]isteners can often make up their mind more quickly on the basis of incomplete information. Having to pay attention to additional information can slow down processing unless (a) use of that cue is entirely automatic, and/or (b) the cue is expected and eagerly awaited. [...] Reaction times can be slowed down by cues the listener typically does not use (e.g., subject-verb agreement in English), and by unexpected configuration of cues (e.g., clitic pronouns and and/or contrastive stress in sentences with default word order [...])[4]

[4] cf. McDonald & MacWhinney (1989:399): "A noun will be assigned to the actor role with a higher probability and more quickly, if it is supported by two cues, than if it is supported by only one of the cues."

In other words, ME may not speed up processing if single exponence is expected in the context. From a Gricean standpoint, this is particularly likely if a single exponent is strong enough to cue the meaning on its own: the listener can expect the speaker to make as little effort as possible while still successfully getting the meaning across. When the speaker makes unexpected efforts (as in providing additional cues to a meaning that is already perfectly obvious to the listener), the listener tries to make additional inferences that eat up processing time (Engelhardt et al. 2006, Hawkins & Smith 2001).

We agree with this proposal but believe that it extends beyond processing time. We suggest that redundant cues help processing only when they are expected to occur, and that one influence on whether such cues are expected to occur is contextual predictability of the meaning expressed by the cues in question. When the meaning is expected, redundant cues are *un*expected.

Choguita Rarámuri

Choguita Rarámuri (CR; Tarahumara) ([tar]) is a Taracahitan language of the Uto-Aztecan (UA) family spoken in northern Mexico by approximately 1,000 speakers (Casaus in prep.). UA languages have complex verbal morphologies that are prototypically agglutinative (as defined in Plank 1999), with predominance of concatenative exponence, no flexivity, potentially long string of suffixes, zero exponence, large derivational paradigms, and optional marking (Langacker 1977:158). CR is an almost exclusively suffixing language that displays many of these properties, but departs from the agglutinating canon with less transparent morpheme boundaries, due to a fair amount of phonological cohesion of exponents closer to the stem (Caballero 2008).

Why Choguita Rarámuri?

CR has productive patterns of ME where words containing an inner derivational marker that is either of limited productivity or phonologically reduced add a second, redundant outer exponent. Crucially, ME in CR is optional. Therefore the speaker has a choice to use ME or not, allowing us to test whether the listener expects the speaker to be economical yet informative. Furthermore, the optional exponent follows the root and another exponent of the same meaning, allowing the listener to form expectations about whether it will occur.

CR has several applicative constructions of limited productivity: three applicative suffixes and a valence stem allomorphy system.[5] An outer, fully productive applicative suffix (–*ki*) may be added to an applicative stem built through one of these constructions. This is exemplified in (1), where the inner applicative suffixes may be reduced via post-tonic vowel reduction or deletion.[6]

1) CR applicative ME

	Single Exponence ~	*Multiple Exponence*	
a.	ˈsu**-n**-ma	ˈsu**-n-ki**-ma	‘sew-APPL(-APPL)-FUT.SG’
b.	ˈpa**-si**-ri	ˈpa**-s-ki**-ri	‘throw-APPL(-APPL)-PST’
c.	wasa ˈra-**ni**-ma	wasa ˈra-**n-ki**-ra	‘plow-APPL(-APPL)-POT’
d.	ri ˈwi-**wu**-ma	ri ˈwi-**w-ki**-ma	‘find-APPL(-APPL)-FUT.SG’

[5] Intransitive stems end in an unstressed vowel, transitive stems end in a stressed, low mid vowel, and applicative stems end in a stressed front vowel (e.g., *wi ˈri* ‘stand, INTR.’, *wi ˈra* ‘stand, TR.’, *wi ˈre* ‘stand, APPL.’).

[6] Data are transcribed using the IPA.Tone is left unmarked. Abbreviations used include: APPL- applicative; CAUS – causative; FUT – future; NOM – nominative; PASS – passive; PST – past; POT – potential; SG – singular.

Another ME process in CR involves causative doubling. The causative suffix, with two lexically conditioned allomorphs (*-ri* and *–ti*), may occur with recursive semantics, where each causative suffix is associated with the introduction of a causative argument (e.g., *biˈne-**ri**-ma* 'learn-**CAUS**-FUT.SG' 'X will teach (lit. make learn)' vs. *biˈne-**r-ti**-ki* 'learn-**CAUS-CAUS**-PST.1' 'X made Y teach Z'). In contrast, the same suffix may appear doubled in a redundant fashion:[7] causative doubling (2b) is equivalent and optional to a construction with a single causative (2a).

2) a. *ˈne=mi* *raʔiˈtʃa-**ri**-ma*
1SG.NOM=2SG.ACC speak-**CAUS**-FUT.SG
'I will make you speak'
[[speak] + Caus = make speak]

b. *ˈa* *biˈra* *taˈmi* *raʔiˈtʃa-**r-ti**-ri* *siˈriame*
AFF really 1SG.ACC speak-**CAUS-CAUS**-PST governor
'The governor made me speak'
*'I will make you make him speak'
[[speak] + Caus = make speak]

The fact that both recursive and redundant causative marking present the same allomorphy pattern is critical, since it suggests that individual exponents hold form-meaning connections at the synchronic level. That is, it is not possible to reanalyze this ME pattern as a lexicalization into a portmanteaux allomorph of the causative suffix.[8]

Methods

Given the potential importance of perceptibility for cue strength (MacWhinney et al. 1985), we decided to measure perceptibility directly by using a speech-in-noise gating task (Salasoo & Pisoni 1985). In previously collected field recordings of naturalistic speech, we found 13 minimal pairs of stems differing only in whether the causative or applicative meaning was expressed by one or two exponents. All items are morphologically complex, with tense/aspect marking and/or derivational morphology, and matched in terms of categories overtly marked in each individual pair. The pairs are shown in Table 1 below. A participant was then presented with one word from each minimal pair, 6 or 7 featuring ME and 7 or 6 single exponence. In addition, 12 multimorphemic filler items that did not feature causative or applicative suffixes were also presented to each subject. Trial number was controlled within the minimal pairs: participants who experienced the single-exponent member of the pair experienced it at the same point in the experiment at which other participants were exposed to the multiple-exponent member of the pair. Trial order was randomized once with the same random order presented to all subjects through headphones using a playlist in Praat.

Each word was embedded in speech-shaped pink noise. The signal-to-noise ratio varied from really noisy (-10 dB) to non-noisy (+20 dB) in 2 dB increments. For each word, we presented each participant with the noisiest version and then proceeded to reduce the noise level in 2 dB increments until the participant recognized the word or until we reached the lowest-noise level.

[7] Allomorphy of the causative is also phonologically conditioned: a ban on voiced/lenis consonants post-consonantally conditions the appearance of the *–ti* allomorph after post-tonic vowel deletion.
[8] For full discussion and data, see Caballero (2008, 2011).

At each step on this continuum, the participant was asked to describe what the word meant, which would generally involve the participant producing a Spanish translation.[9]

Thus the task yielded two measures for each word for each participant: 1) whether or not the participant recognized the word, and 2) if the participant did recognize the word, then what was the noise level when the word was recognized. If the additional exponent helps access the meaning in a certain context in any way, we expect participants to be better at recognizing the meanings exponed by multiple exponents. If the additional exponent helps specifically by enhancing perceptibility, we additionally expect participants to recognize words with ME at higher noise levels.

Sixteen adult native speakers of CR (aged between 18 and 60) participated. Data for two participants was eliminated due to having observed accuracy of 0.[10] Though participants' level of bilingualism in Spanish was variable, they were all fully fluent in Spanish, the language in which instructions were given. Participants recruited were all that were available that met this requirement at the time the experiment was conducted.[11]

Results

The recognition accuracy data were analyzed using logistic mixed-effects model with word stem and participant as random variables. The models included exponence (multiple vs. single) and exponed meaning (causative vs. applicative) as fixed effects. We also tested an interaction between meaning and exponence. The models were fit using the lme4 package in R (D. Bates et al. 2013).

There was no significant effect of exponed meaning. The effect of exponence was significant in a model that included random intercepts for subjects and stems and a by-subject random slope for exponence (z=2.29, p=.022 without including meaning, z=2.05, p=.04 with meaning and the interaction between exponence and meaning included). However, the effect of exponence was not significant if a by-stem random slope for exponence was also included (z=.76, p=.45). The inclusion of a random slope for stems is justified both by study design and model comparison: the by-stem random slope improves the model according to the log likelihood test ($\chi^2(2)=8.2$, p=.017). These results suggest that the effect ME should generalize to new subjects but may not generalize to new stems (e.g., Barr et al. 2013): the effect of exponence is not uniform across stems. Given this, we examined random slopes for the individual stems (Table 1). There does not seem to be a consistent advantage for ME over single exponence. However, if we correlate the observed random slopes with random intercepts for individual pairs from the model that does not include random slopes, we see that there is an almost perfect correlation (r=-.99, p<.00001), indicating that an additional cue helps to recognize meaning

[9] In cases when this could be dubious, one of the authors would ask them to elaborate a sentence or describe a context in which that form would be uttered.

[10] Since we only have 13 minimal pairs of stimuli, we are unable to detect where in the range between 1/13 and 0 these participants would fall in the long run. Running more trials would likely show that these participants have accuracies above zero but we have no confidence in how far above zero they would be. We also have no power to detect an effect of ME unless accuracy on either ME or SE trials rises above 1/7. Thus, we cannot detect an effect of ME for participants whose accuracy is below 1/13. Therefore, it is not clear where these participants would fall in the accuracy/ME-effect space we are interested in.

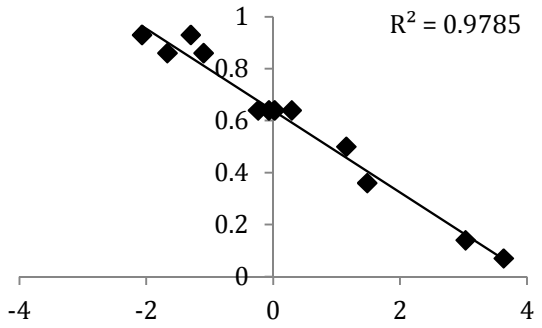
[11] Though Choguita is among the largest Rarámuri communities in the area, it also has a high degree of migration (both permanent and temporary) to larger towns in the rural area or to urban centers. These mobility patterns affected the availability of participants for this study.

when recognition rates are low and may be detrimental when they are high, as predicted by the Gricean hypothesis.[12]

Table 1. Random slopes and overall probabilities of recognition for individual items. Positive slopes indicate higher recognition rates for stimuli with multiple exponence. Negative slopes show lower recognition rates for stimuli with multiple exponence. Probability of recognition is averaged across single and multiple exponence and across participants.

Stimulus pair	Effect of multiple exponence	Probability of recognition
ki ˈp-e-ba/ki ˈp-e-ki-pa	3.63	7%
ˈpo-nu-ma/ ˈpo-n-ki-ma	3.03	14%
si ˈru-ni-ri/si ˈru-n-ki-ri	1.48	36%
ko ˈʔi-ri-ma/ko ˈʔi-r-ti-ma	1.15	50%
ˈpa-si-ri/ ˈpa-s-ki-ri	.29	64%
ˈme-ti-ma/ ˈme-r-ti-ma	.02	64%
u ˈk-e-ri/u ˈk-e-ki-ma	-.07	64%
wika ˈra-ri-ma/wika ˈra-r-ti-ri	-.24	64%
su ˈwe-ri/su ˈwe-ki-ri	-1.10	86%
wika ˈra-ni-ma/wika ˈra-ni-ki-ma	-1.30	93%
ri ˈme-ni-ma/ri ˈme-ni-ki-ma	-1.67	86%
ri ˈku-tu-ma/ri ˈku-r-ti-ma	-2.07	93%
ˈub-ti-ri/u ˈba-r-ti-pa	-2.07	93%

Figure 1. The correlation between accuracy at recognizing the meaning (vertical axis) and the effect of multiple exponence (horizontal axis).



To examine if there is an effect of exponence on noise level sufficient for identification, we took all trials on which the exponed meaning was identified (at some noise level) and used a linear mixed-effects regression to predict the step on the noise continuum at which the word was identified. Again, participants and stems were random effects. There was no effect of ME ($t<1$)

[12] By contrast, there was no significant correlation between trial number and the effect of exponence ($r = -.14$, $p = .64$). Trial number is also not significant in regression models , suggesting that the observed results are not due to using the same sequence of stems for all participants.

across random effects structures, suggesting that ME does not appreciably increase perceptibility.

General Discussion

In sum, an additional exponent helps recognition of the meaning when help is needed but may hurt recognition when the context is sufficiently predictive for recognition to occur without the extra exponent.[13] These results are exactly what one would expect if perception obeyed Grice's (1975) Maxim of Clarity: the listener expects the speaker to produce as little as possible while successfully transmitting the information. Given that ME in CR is optional, the listener expects the speaker to produce the second exponent only when the meaning would be unlikely to come across without it. We believe that the present results will not generalize to all instances of ME, but that they should generalize to situations where two conditions hold, as they do in CR:[14]

> i) ME is optional,[15] so that the speaker has a choice in production and the listener can therefore take into account the speaker's inherent tendency to be economical while transmitting their intended message; and
>
> ii) recognition of the optional exponent follows recognition of another (optional or obligatory) exponent,[16] and can therefore be anticipated by the listener as s/he is incrementally processing the speech signal from left-to-right (Allopenna et al. 1998, Marslen-Wilson & Tyler 1980).

In conclusion, we believe that ME can help recognition when the meaning is relatively difficult to recognize in context.[17] It is in these circumstances that the diachronic process of hypercharacterization (Kuryłowicz 1947) is likely to reinforce an existing exponent with an additional one. In contrast, when the exponed meaning is predictable from context, ME is unexpected and, if present in a language, diachronically unstable. ME is neither always dispreferred (as predicted by principles of economy), nor always preferred (as predicted by most versions of the Competition Model, e.g., Bates & MacWhinney 1989:22, McDonald & MacWhinney 1989). Rather, it may result from an interplay between economy and clarity of expression to the extent this interplay is expected and anticipated by the listener (Grice 1975, Bates & MacWhinney 1989:55) and permitted by the grammar of the language.

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[13] Although the additional help does not bring meaning recognition accuracy in non-predictive contexts up to the level observed in predictive contexts.

[14] Neither of these properties holds in the one previous study that examined perceptual functionality of ME in Batsbi (Harris & Samuel 2011).

[15] This may obtain more broadly for cue coalition. We expect the results to extend beyond morphological cues. For instance, phonetic cues associated with 'clear speech' might hurt recognition of a meaning that is predictable in context (instead being interpreted as a cue that some other message is intended, as in sarcasm ("He is [sːoʊː] smart") or exasperation at the listener: "I... do... not... know" vs. [ə̃ə̃ə̃], Hawkins & Smith 2001).

[16] We assume that the order of recognition usually tracks order of occurrence in the speech signal though some exponents might be harder to recognize than others or might be superimposed (fully or partially) on the other exponents, e.g., tone.

[17] Difficulty of recognition in context may be affected by many different factors, including perceptibility of that particular instance of the exponent, its confusability with other morphemes that could fit in the context, predictability given the context, etc. We do not know what all these factors are for our stimuli (which come from field recordings and are not a controlled set). But we do know that once we know accuracy in context, we can predict the effect of ME in that context with fairly high certainty.

References

Allopenna, P. D., Magnuson, J. S., & Tanenhaus, M. K. 1998. Tracking the tipe course of spoken word recognition with eye movements: Evidence for continuous mapping models. *Journal of Memory & Language*, *38*, 419-39.

Barr, D. J., R. Levy, C. Scheepers, & H. J. Tily. 2013. Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory & Language*, 68, 255-78.

Bates, D., M. Maeschler, & B. Bolker. 2013. lme4: Linear mixed-effects models using S4 classes. R package version 0.999999-2. http://CRAN.R-project.org/package=lme4

Bates, E., & B. MacWhinney. 1989. Functionalism and the Competition Model. In *The crosslinguistic study of sentence processing*, ed. by B. MacWhinney & E. Bates, 3-73. Cambridge University Press.

Bates, E., S. McNew, B. MacWhinney, A. Devescovi, & S. Smith. 1982. Functional constraints on sentence processing: A cross-linguistic study. *Cognition*, 11, 245-99.

Caballero, G. 2008. Choguita Rarámuri (Tarahumara) phonology and morphology. Berkeley: University of California dissertation.

Caballero, G. (2011). Multiple Exponence and the phonology-morphology interface. In S. Lima, K. Mullin, & B. Smith (eds.), *Proceedings of the North East Linguistics Society 39.* Amherst, MA: GLSA.

Caballero, G. and A.C. Harris. (2012) A working typology of Multiple Exponence. In Ferenc Kiefer, Mária Ladányi & Péter Siptár (eds.), *Current Issues in Morphological Theory: (Ir)Regularity, Analogy and Frequency. Selected papers from the 14th International Morphology Meeting, Budapest, 13-16 May 2010*. John Benjamins.

Caballero, G. and S. Inkelas. (to appear). Word construction: tracing an optimal path through the lexicon. In J. Trommer (ed.), *New theoretical tools in the modeling of morphological exponence*. Special Issue of *Morphology*.

Casaus, M. In prep. *Quantitative ethnobotany and acculturation among the Rarámuri of Choguita, Chihuahua, México.* Ithaca: Cornell University dissertation.

Engelhardt, P. E., K. G. D. Bailey, & F. Ferreira. 2006. Do speakers and listeners observe the Gricean Maxim of Quantity? *Journal of Memory & Language*, 54, 554-573.

Fowler, C. A., Levy, E. T., & Brown, J. M. 1997. Reductions of spoken words in certain discourse contexts. *Journal of Memory & Language*, 37, 24-40.

Grice, H. P. 1975. Logic and conversation. In *Speech acts*, ed. by P. Cole & J. L. Morgan, 41-58. New York: Academic Press.

Harris, A., & A. Samuel. 2011. Perception of exuberant exponence in Batsbi: Functional or incidental? *Language*, 87, 447-69.

Hawkins, S., & Smith, R. 2001. Polysp: A polysystemic, phonetically-rich approach to speech understanding. *Rivista di Linguistica*, 13, 99-188.

Hock, H. H. 1991. *Principles of historical linguistics*. Berlin, New York: Mouton de Gruyter.

Kail, M. 1989. Cue validity, cue cost, and processing types in sentence comprehension in French and Spanish. In *The crosslinguistic study of sentence processing*, ed. by B. MacWhinney & E. Bates, 77-117. Cambridge University Press.

Kiparsky, P. 2005. Blocking and periphrasis in inflectional paradigms. *Yearbook of Morphology 2004, 113-135.*

Kuryłowicz, J. 1947. The nature of the so-called analogical processes. (trans. Margaret Winters, 1995, *Diachronica*, 12, 113-145).

Koolen, R., A. Gatt, M. Goudbeek, & E. Kramer. 2011. Factors causing overspecification in definite descriptions. *Journal of Pragmatics*, 43, 3231-50.

Langacker, R. 1977. *Studies in Uto-Aztecan Grammar. Volume 1: An Overview of Uto-Aztecan Grammar*. The Summer Institute of Linguistics and The University of Texas at Arlington.

MacWhinney, B. 2001. The Competition Model: The input, the context, and the brain. In *Cognition and second language instruction*, ed. by P. Robinson, 69-90. Cambridge University Press.

MacWhinney, B., & Cs. Pléh. 1997. Double agreement: Role identification in Hungarian. *Language & Cognitive Processes*, 12, 67-102.

MacWhinney, B., Cs. Pléh, & E. Bates. 1985. The development of sentence interpretation in Hungarian. *Cognitive Psychology*, 17, 178-209.

Marslen-Wilson, W. D., & L. K. Tyler. 1980. The temporal structure of spoken language understanding. *Cognition*, 8, 1-71.

Matthews, P. 1974. *Morphology*. Cambridge: Cambridge University Press.

McDonald, J., & B. MacWhinney. 1989. Maximum likelihood models for sentence processing. In *The crosslinguistic study of sentence processing*, ed. by B. MacWhinney & E. Bates, 397-421. Cambridge University Press.

Mimica, I., M. Sullivan & S. Smith. 1994. An on-line study of sentence interpretation in native Croatian speakers. *Applied Psycholinguistics*, 15, 237-61.

Noyer, R. 1993. Optimal Words: towards a declarative theory of word formation. Unpublished manuscript.

Noyer, R. 1997. *Features, positions and affixes in autonomous morphological structure*. New York: Garland.

Pechmann, T. 1989. Incremental speech production and referential overspecification. *Linguistics*, 27, 89-110.

Plank, F. 1999. Split morphology: How agglutination and flexion mix. *Linguistic Typology,* 3*,* 279-340.

Pléh, Cs. 1989. The development of sentence interpretation in Hungarian. In *The crosslinguistic study of sentence processing*, ed. by B. MacWhinney & E. Bates, 158-84. Cambridge University Press.

Pléh, Cs., A. Jarovinskij, & A. Balajan. 1987. Sentence comprehension in Hungarian-Russian bilingual and monolingual preschool children. *Journal of Child Language*, 14, 587-603.

Salasoo, A., & D. B. Pisoni. 1985. Interaction of knowledge sources in spoken word identification. *Journal of Memory and Language*, 24, 210–231.