

ON THE RELATIONSHIP BETWEEN SYNTACTIC AND PROSODIC BOUNDARIES: FREE RELATIVE CLAUSES IN APPALACHIAN ENGLISH

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ABSTRACT

Using the case of variation in free relative (FR) clauses in Appalachian English (AppE) spoken in the United States, this study provides evidence for syntax-prosody interaction devoid of semantic influence. In AppE, the meaning of sentences like (1) *I gave what-ever you left to charity* and (2) *I gave ever-what you left to charity* is identical. The raising of *ever* to the determiner phrase head position in (2) was hypothesized to increase the prosodic continuity between the matrix verb and *ever*, and decrease the continuity between *ever* and *what*. To test these hypotheses, acoustic correlates of prosodic phrase boundaries were examined in matrix verbs and relative pronouns of sentences produced by four speakers of AppE. The results showed significant differences between the two sentence types, although the continuity interpretation was not supported. Duration differences in the acoustic analysis were consistent with perceptual judgments of prosodic grouping.

Keywords: syntax-prosody interaction, free relative clauses, prosodic boundaries, Appalachian English.

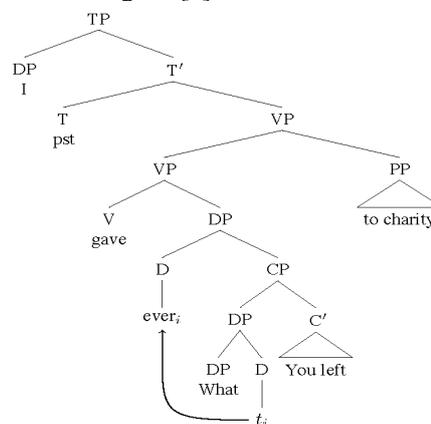
1. INTRODUCTION

Whether prosodic constituent structure is viewed as distinct from the syntactic constituent structure or not [see an overview of theoretical approaches in 7], models of syntax-prosody interface assume that at least the edges of major syntactic and prosodic constituents tend to align [8-9, 12, 18]. Prosodic boundaries at constituent edges vary in their strength, depending on the size and type of a constituent [1-2, 11]. In this study, one particular instance of syntactic variation is used to show that a morpho-syntactic ordering alternation is reflected in changes in prosodic boundaries, thus, providing support for theories proposing matching between syntax and prosody [2, 12].

Syntactic variation in the reverse ordering of *wh-ever* forms of pronouns (e.g., *ever-what*, *ever-who*, *ever-where*, *ever-which*) occurs in free relative (FR) clauses in Appalachian English (AppE) [9, 15]. This variation is arguably due to a head movement shown in Figure 1 [9], which is infelicitous in General

American English. In AppE, both *John cooked what-ever was left in the fridge* and *John cooked ever-what was left in the fridge* are grammatical, although the former occurs more frequently than the latter, 147 to 5 occurrences, respectively, in the AAPCAppe corpus [15].

Figure 1: Syntactic head movement of *ever* (D) across the free relative clause boundary (CP) in Appalachian English [9].



The question addressed in the current study is whether the *ever* movement shown in Figure 1 is reflected in a parallel change in the prosodic re-grouping as in (1) to (2a) or as in (1) to (2b).

1. ([I]_ω [gave]_φ)_ι ([what ever]_φ ...
- 2a. ([I]_ω [gave]_φ [ever]_φ)_ι ([what]_φ ...
- 2b. ([I]_ω [gave]_φ)_ι ([ever]_ω what]_φ ...

These hypotheses follow Match Theory [7, 13] in that syntactic heads are mapped onto phonological words (ω), syntactic phrases onto phonological phrases (φ), and clauses onto intonational phrases (ι), excluding all phonologically null elements and traces. CP in Figure 1 is mapped onto ι (as a clause) rather than φ (as a maximal projection) following [2]. Prosodization of function words *I*, *what*, and *ever* follows Selkirk [12] wherein 'weak-form' function words are clitics (e.g., stressless, non-phrase-final *what* in (1)), and 'strong-form' function words are phonological words (e.g., stressed, phrase-final *ever* in both (1-2)). A previous report on stress patterns in *what-ever* and *ever-what* supports such prosodization in the current analysis [14].

To test the hypotheses of prosodic re-grouping from (1) to (2), acoustic correlates associated with

prosodic phrase boundaries were examined in the region of the matrix verb and relative pronouns. Because ι -phrases are higher-level constituents than their internal constituent φ -phrases, ι -boundaries are expected to be more prominent than φ -boundaries. One acoustic correlate of higher-level prosodic constituents in fluent English speech is phrase-final lengthening [1, 16]. This lengthening is larger at the end of subordinate clauses than at the end of the other phrase types or phrase-medially [4]. This lengthening occurs in phrase-final syllable rhymes and in main-stress syllable rhymes, when the latter are not phrase-final [16]. Another acoustic correlate is amplitude which increases phrase-initially [5]. The duration and amplitude correlates have to be interpreted with caution because they are both boundary-related and prominence-related. A similar confound makes it difficult to interpret a change in fundamental frequency that can signal a phrase-final boundary or a pitch accent [1, 16] or phrase-initial vowel glottalization that is influenced by pitch-accents [6].

In the current study, vowel duration and amplitude were examined to determine whether *ever* is prosodified differently in What-ever FR clauses and Ever-what FR clauses. Specifically, the prosodic boundary between the matrix verb and *ever* was predicted to weaken because they are not separated by the clause boundary in (2a). The prosodic boundary between *ever* and *what* was predicted to strengthen because they become separated by the ι -boundary. In addition, a probabilistic measure of the locations of prosodic boundaries was obtained in a perceptual task where English listeners marked boundary locations separating chunks of speech [4].

2. METHODS

2.1. Participants

Four native speakers of AppE were recruited by the second author, also a native AppE speaker, from his hometown in eastern Kentucky, U.S. At the time of the recording, the female speakers were 38 and 68 years old (F38, F68); the male speakers were 42 and 69 years old (M42, M69). Per assessment of the second author, all participants use AppE in their daily and professional lives, as well as during the time of recording for the current study.

Thirty-seven college-aged participants were also recruited to provide perceptual judgments of prosodic grouping. These participants were native English listeners, naïve to prosodic analysis and to AppE.

2.2. Materials

Stimulus sentences were of three types:

- (a) six bi-clausal sentences with What-ever FRs, e.g., *Mary served what-ever we brought to the party;*
- (b) six bi-clausal sentences with Ever-what FRs, e.g., *Mary served ever-what we brought to the party;*
- (c) six mono-clausal sentences with quantifier determiner phrases (Quant-DP), e.g., *Mary served every-one drinks from the cooler,* which did not have an internal ι -boundary, and thus provided baseline comparisons for (a) and (b).

In each sentence type, matrix verbs were the same monosyllabic *gave, served, chased, picked, ate,* and *cooked*. The length of the phrases following the matrix verbs was comparable across sentence types.

2.3. Procedure

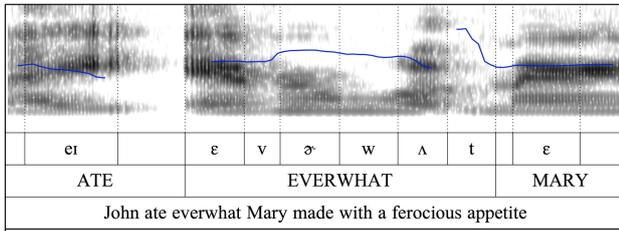
The participants were recorded in their places of residence, in a thirty-minute session. First, participants familiarized themselves with the printed list of eighteen randomized sentences. Then, they read each sentence as a response to the oral question “What happened?” repeated by the second author to avoid a narrow focus interpretation. Using this elicitation technique, each sentence was repeated five times in a row. The reading list was cycled through three times, resulting in fifteen productions of each sentence. The total number of recorded sentences was 720 -- 3 sentence types x 6 sentences x 15 repetitions x 4 speakers.

Three sentences of each type were selected for a perceptual task. The total number of sentence recordings in this task was 72 -- 3 sentence types x 3 sentences x 2 repetitions x 4 speakers. Eight distractor sentences were added as well; then, all recordings were randomized. All stimuli were fluent productions of the sentences, with no clearly audible pauses. For each recording they heard, listeners were asked to mark the locations of prosodic boundaries separating chunks of speech by highlighting '/'s in a sentence transcription on a computer screen, e.g., *I / gave / what / ever / you / left / to charity*. Similar methodology has been validated in previous research on prosodic boundary perception [4]. In this study, the task was administered via an online survey, which took about forty minutes to complete.

2.4. Analysis

Disfluent sentence productions were eliminated from analyses. The vowels in matrix verbs, *what* and *ever* morphemes were segmented in Praat [3]. Rhoticized vowels in *ever* were treated as one segment because vowels could not be reliably separated from corresponding rhotics. For each vowel segment, duration and amplitude at vowel midpoint were extracted in Praat [3].

Figure 2: Segmentation of matrix verbs (e.g., *ate*) and following function words (e.g., *ever-what*).



3. RESULTS

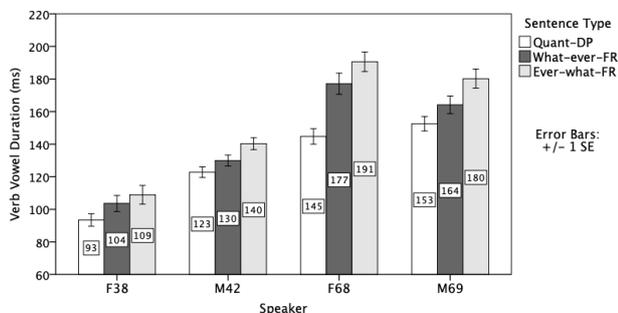
3.1. Duration as a correlate of phrase-final lengthening

Variation in duration was examined in matrix verbs and in the following function words. Mixed-effects linear regression analyses on vowel duration were conducted with sentence type as a fixed effect (Quant-DP, What-ever-FR, Ever-what-FR), speaker and verb as random effects. These analyses were followed by pairwise comparisons with Bonferroni corrections for multiple comparisons.

3.1.1. Duration in matrix verbs

A regression on vowel durations in matrix verbs yielded a significant effect of sentence type [$F(2,1059) = 68.02, p < .001$]. Figure 3 illustrates that in all speakers the duration of vowels in the matrix verbs was larger in What-ever-FRs than in Quant-DPs [$t(1058) = 6.95, p < .001$], and in Ever-what-FRs than in Quant-DPs [$t(1058) = 11.58, p < .001$]. This pattern suggests a lengthening effect in the matrix verbs of bi-clausal sentences as compared to monoclausal sentences. In bi-clausal sentences, however, the verb lengthening was larger in Ever-what-FRs than in What-ever-FRs, [$t(1058) = 4.71, p < .001$].

Figure 3: Vowel duration in matrix verbs.



3.1.2. Duration in the *ever* / *every* morphemes

An analysis of the [ε] durations in the *ever* and *every* morphemes yielded a significant effect of sentence type, [$F(2,1003) = 18.39, p < .001$]. Stressed

[ε] was longer in *ever-what* than in *what-ever* [$t(1003) = 4.05, p < .001$], and in *every-one* than in *ever-what* [$t(1003) = 2.00, p = .045$]. Similarly, an analysis of the [ø] durations in the *ever* morpheme showed that this unstressed vowel was longer in *ever-what* than in *what-ever* [$F(1,705) = 24.46, p < .001$]. These results are shown in Figures 4 and 5, respectively. They are consistent in three speakers, but the F68's data show a different pattern where the vowels in *ever-what* are shorter than or similar to vowels in *what-ever*.

Figure 4: Vowel [ε] duration in *ever* and *every*.

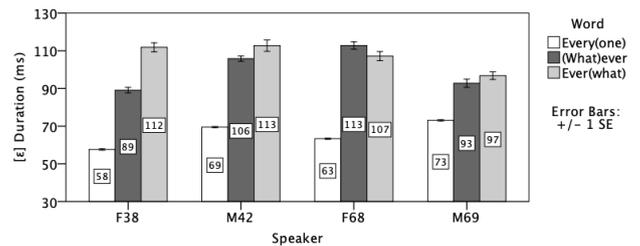
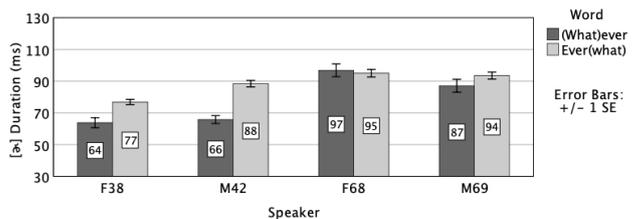


Figure 5: Vowel [ø] duration in *ever*.



3.2. Amplitude as a correlate of phrase-initial strengthening

Vowel amplitude in the *ever* morpheme was examined in a regression analysis with sentence type as a fixed effect (What-ever-FR, Ever-what-FR), speaker and verb as random effects. Amplitude was higher in *what-ever* than in *ever-what*, 67.3 dB versus 65.1 dB, respectively, [$F(1,705) = 90.47, p < .001$]. This pattern was consistent across all four speakers.

3.3. Perceptual judgments of phrase boundaries

Perceptual judgments of prosodic grouping are summarized in Table 1. Mann-Whitney pairwise-comparison tests on proportion of responses with the Dunn-Bonferroni corrections for multiple comparisons showed that a boundary was more frequently perceived after the matrix verb when it was followed by What-ever-FRs than by Quant-DPs, [$U = 129, p < 0.001$], and when the verb was followed by Ever-what-FRs than by Quant-DPs, [$U = 87, p < 0.001$]. However, there was no difference between the two bi-clausal sentence types.

The boundary after the first function-word morpheme following the matrix verb was more

frequently perceived after *ever* in Ever-what-FRs than after *every* in Quant-DP sentences, [$U = 75, p = 0.003$], and after *ever* in Ever-what-FRs than after *what* in What-ever-FRs, [$U = 102, p < 0.001$]. Lastly, all pairwise differences in boundary perception after the second function-word morpheme following the matrix verb were significant at (at least) $p = .002$.

Table 1: Boundary perception after matrix verbs (e.g., *ate*), the first morpheme of the following function words (e.g., *what, ever, every*), and the second morpheme of the function words (e.g., *ever, what, one*). Significant differences in each row are marked with a '*'.

Boundary Perceived After	Quant-DP	What-ever-FR	Ever-what-FR
Matrix Verb	79.2%*	88.9%	85.7%
Morpheme 1	13.7%	11.8%	19.4%*
Morpheme 2	68.2%*	48.1%*	56.2%*

4. DISCUSSION

This small-scale study investigated whether a head-movement of *ever* across the clause boundary in sentences like *Mary served ever-what we brought to the party* (Fig. 1) correlates with prosodic re-grouping in the region of the clause boundary such that the higher-level syntactic boundaries align with high-level intonational phrase boundaries (i.e., MATCH-PHRASE constraint in [13]). An examination of acoustic correlates associated with edges of prosodic phrases [1, 4, 5, 16] showed differences in prosodification of sentences with *what-ever* and *ever-what* relative clauses.

Assuming that lengthening indicates a higher-level prosodic boundary at the right edge of a phrase, a comparison of the matrix-verb vowel durations in sentences with FRs and sentences with Quant-DPs suggests that the vowel lengthening in bi-clausal sentences is due to the presence of the ι -boundary. Unexpectedly, vowels in matrix verbs had longer duration when followed by *ever-what* FRs than by *what-ever*-FRs. This suggests that the location of the ι -boundary does not change in the direction of (1) to (2a), unless this result is explained by multiple domains of phrase-final lengthening in English [16]. Namely, the ι -boundary in *ever-what*-FRs as shown in (2a) may induce lengthening not only in the phrase-final *ever*, but also in the matrix verb containing the main-stress syllable which is not phrase-final.

1. ([I] [gave] _{ϕ}) _{ι} ([what ever] _{ϕ}) ...
- 2a. ([I] [gave] _{ϕ} [ever] _{ϕ}) _{ι} ([what] _{ϕ}) ...
- 2b. ([I] [gave] _{ϕ}) _{ι} ([ever] _{ϕ} [what] _{ϕ}) ...

The lengthening of both vowels in *ever* of *ever-what* as compared to *what-ever* does favor, however, (2a) over (2b), with an exception of one speaker's data. The examination of [ϵ] amplitude, which was lower in *ever-what* than in *what-ever*, also suggests the phrase-final position of *ever* in *ever-what*, and thus favors (2a) over (2b). Another interpretation of this amplitude difference may be attributed to the secondary-stress status of this vowel in / $\epsilon v \partial$ 'wat/ and its primary-stress status in /wət 'ev ∂ / ([14]).

In summary, the acoustic measures of prosodic phrasing in matrix verbs favored (2b), but the acoustic measures in the *what* and *ever* morphemes favored (2a). Perceptual judgments of boundary locations are more consistent with (2b) than with (2a), because the frequency of boundary perception after the matrix verb did not differ in bi-clausal sentences, and because the listeners perceived a boundary more frequently after each morpheme in *ever-what* than in *what-ever*. A comparison of boundary perception after the matrix verb (85.7%) and after the *ever* morpheme in *ever-what* (19.4%) suggests that the former boundary location is perceptually stronger (more consistent) than the latter.

Taken together, the findings in production and perception of prosodic grouping in this study did not provide reliable evidence for re-allocation of the prosodic ι -boundary which would parallel the syntactic movement of *ever* shown in Figure 1. Syntactic head-movements may not influence speech prosodification, although syntactic and prosodic boundaries tend to co-align [8, 10, 13, 17]. Overall, the "displacement" of *ever-* in AppE may be explained by the STRONG START constraint that penalizes prosodically weak element at the left edge of ϕ and outranks MATCH-PHRASE [8, 13]. In other words, the 'weak', cliticized form of *what* in *what-ever* relatives may encourage *ever-wh* reordering in AppE.

In this study, the use of acoustic correlates for prosodic grouping analyses did not lead to results that would offer their straightforward interpretation. This is because duration and amplitude serve not only as markers of prosodic boundaries but also as markers of prosodic prominence [1, 4, 16]. This limitation would have also persisted if other acoustic correlates of prosodic grouping, such as fundamental frequency patterns and phrase-initial vowel glottalization, were chosen [1, 6]. Other limitations include the small number of speakers and experimentally designed stimuli. Naturalistic recordings of free relatives produced by AppE speakers are difficult to obtain, but future studies should strive to do so in larger numbers.

5. REFERENCES

- [1] Beckman, M. E., Pierrehumbert, J. B. 1986. Intonational structure in Japanese and English. In: *Phonology Yearbook*. Cambridge UP, 255-309.
- [2] Bennett, R., Elfner, E., McCloskey, J. 2016. Lightest to the right: An apparently anomalous displacement in Irish. *Linguistic Inquiry* 47, 169-234.
- [3] Boersma, P., Weenink, D. 2018. *Praat: doing phonetics by computer* <http://www.praat.org/>
- [4] Cole, J., Mo, Y., Baek, S. 2010. The role of syntactic structure in guiding prosody perception with ordinary listeners and everyday speech. *Language and Cognitive Processes*, 25, 1141-1177.
- [5] Cho, T., Keating, P. 2009. Effects of initial position versus prominence in English. *J. of Phon.* 37, 466-485.
- [6] Dilley, L., Shattuck-Hufnagel, S., & Ostendorf, M. 1996. Glottalization of word-initial vowels as a function of prosodic structure. *J. of Phon.* 24, 423 – 444.
- [7] Elfner, E. 2018. The syntax-prosody interface: current theoretical approaches and outstanding questions. *Linguistics vanguard: A multimodal journal for the language sciences* 4, 1-14.
- [8] Gee, J. P., Grosjean, F. 1983. Performance structures: A psycholinguistic and linguistic appraisal. *Cognitive Psychology* 15, 411-458.
- [9] Johnson, G. The structure of Ever-WH free relatives in Appalachian English. Submitted.
- [10] Nespor, M., Vogel, I. 1986. *Prosodic phonology*. Dordrecht: Foris.
- [11] Price, P. J., Ostendorf, M., Shattuck-Hufnagel, S., Fong, C. 1991. The use of prosody in syntactic disambiguation. *J. Acoust. Soc. Am.* 90, 2956-2970.
- [12] Selkirk, E. 1995. The prosodic structure of function words. In: Beckman, J., Dickey, L. W., Urbanczyk, S. (eds.), *Papers in Optimality Theory* Amherst: GLSA, 439–470.
- [13] Selkirk, E. 2011. The syntax-phonology interface. In: Goldsmith, J. A., Riggle, J., Yu, A. C. L. (eds.), *The handbook of phonological theory* (vol. 2). Oxford: Blackwell, 435-483.
- [14] Shport, I.A., Johnson, G., Herd, W. 2018. Flapping before a stressed vowel – whatever! *Proc. of Meetings on Acoustics* New Orleans.
- [15] Tortora, C., Santorini, B., Blanchette, F., Diertani, C.E.A. 2017. *The audio-aligned and parsed corpus of Appalachian Engl.* <http://csivc.csi.cuny.edu/aapcappe/>
- [16] Turk, A. E., Shattuck-Hufnagel, S. 2007. Multiple targets of phrase-final lengthening in American English words. *J. of Phon.* 35, 445-472.