The Prosody of Niuean Pseudo Noun Incorporation: A Recursion-Based Analysis*

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1. Introduction

This paper presents an experimental investigation into the prosody of a Niuean construction known as pseudo noun incorporation (PNI), which is a VOS clause in an otherwise VSO language. The goals of this paper are to i) provide a prosodic profile of Niuean PNI in comparison to Niuean VSO based on results from a production experiment; ii) present an analysis of the prosody of PNI constructions according to the tenets of Match Theory (Selkirk 2011); and iii) assess Massam's (2001) syntactic account of Niuean PNI according to the prosodic findings.

Phonological phrases (φ-phrases) in Niuean are produced with a H*L- tune. The H* occurs on the most prominent syllable of the rightmost prosodic word (PWd) in the φ-phrase. For each of the PNI constructions discussed in this paper, the verb and the incorporated argument form a prosodic constituent. Evidence supporting this claim comes from phrase-final lengthening and pitch maxima.

Massam's (2001) syntactic analysis of Niuean PNI accounts for the construction's unique morphosyntactic properties; however, one consequence of her analysis is that θ-roles and structural positions can not be correlated. In order to address this problem, an alternative syntactic analysis is proposed, in which the instrumental argument is adjoined above the verb. Ultimately, the alternative syntactic analysis is rejected, because the prosodic data are more consistent with Massam's original syntactic analysis.

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2. Niuean PNI

Niuean is a dependent-marking ergative language that employs different case-marking paradigms for common nouns and proper nouns/pronouns. The 'basic' word order in Niuean is VSOX; however, VOSX order arises in the context of PNI clauses.

This section introduces the basic syntactic and morphosyntactic characteristics of PNI, as discussed in Seiter (1980) and Massam (2001). PNI is a productive phenomenon. The most common type of PNI involves a direct object (PNI-abs).[1] An example of a canonical VSO structure and its PNI-abs counterpart is shown in (1). In terms of word order, VSO (1a) and PNI (1b) constructions differ according to the relative order of the subject and object, as well as the position of postverbal particles relative to the verb.[2]

(1) VSO with an absolutive object and PNI-Abs

a. Ne hī *hake* e Sione **e** **lima haana** ki luga.
PST raise DIR ERG Sione ABS hand POSS LOC top
'Sione raised his hand.'

b. Ne hī **lima** *hake* a Sione ki luga.
PST raise hand DIR ABS Sione LOC top
'Sione raised his hand.'

In the standard VSO structure in (1a), the object, shown in bold, follows the subject. Particles, such as the italicized directional particle *hake*, must appear to the immediate right of the verb. In contrast, in (1b), the object precedes the subject. Furthermore, the particle in this example appears to the right of the object, rather than in its canonical position adjacent to the verb. The inability of the particle to surface in its standard postverbal position suggests that the verb and the object in PNI constructions form a surface constituent.

In the domain of morphosyntax, VSO and PNI constructions differ in terms of the functional morphology associated with the object. Objects in VSO clauses are obligatorily marked for case. In (1a), for example, the object is preceded by *e*, the absolutive marker for common nouns. In contrast, in the PNI construction in (1b), no case morphology is associated with the object. In fact, the object in a PNI construction may not be preceded by any functional material, although it may *contain* functional material, as in (2b-c) below.

2.1 Morphological and syntactic analyses

Two morphological approaches to PNI exist in the literature. The first is the lexical approach, which argues that the relationship between the verb and the incorporated argument is established in the lexicon. Lexical incorporation is advanced in di Sciullo and Williams

[1] Massam (2001) distinguishes three types of PNI: i) general PNI, which includes the incorporation of absolutive and middle objects; ii) existential PNI; and iii) instrumental PNI. For a discussion of the ways in which existential PNI differs from other PNI constructions, see Massam (2001).

[2] Unless otherwise indicated, the data in this chapter come from work with Niuean-speaking language consultants, although the specific examples are often based on those found in the literature, e.g., Seiter (1980), Sperlich (1997) and Massam (2001).

(1987). Baker (1988 et seq.) argues for a different type of morphological approach, in which noun incorporation is achieved via head movement. Under this analysis, while the verb and the incorporated argument still form a single complex word, the relevant word formation takes place in the syntax.

Both morphological analyses face a serious problem when it comes to complex incorporated arguments. A series of head movements could account for the modification of an incorporated argument by an adjective, as in (2a), but it is less clear how it could account for cases where the incorporated argument is coordinated, as in (2b), or in cases where the incorporated argument is modified by a nonfinite relative clause, as in (2c).

(2) PNI with complex objects

a. Kua onoono **fakatino mahaki toili** e tama he aoga.
pfv look.at pictures huge large ABS child LOC school
'The child is looking at extremely large pictures at school.'

b. Ne tō **talo mo e tau fiti** e magafaoa.
PST plant taro with ABS PL flower ABS family
'The family planted taro and flowers.'

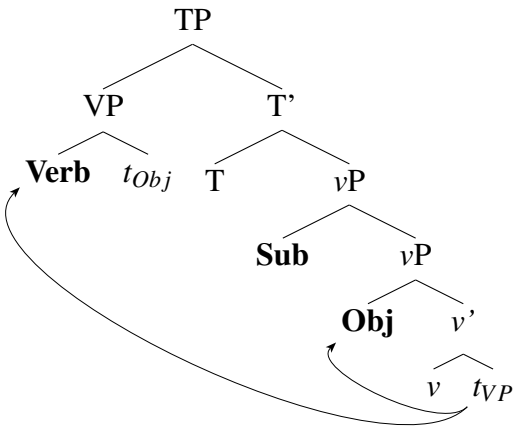
c. ...ke kumi **mena ke nonofo ai** a lautolu.
DEP.T seek thing DEP.T settle RP ABS 3.PL
'...they sought a place to settle.' (Massam 2001:160)

2.1.1 VP and VP-remnant movement

A strictly syntactic alternative to the lexical-incorporation and head movement analyses comes from Massam (2001), who posits that the derivation of PNI is tightly connected to the general derivation of verb-initial word order (V1) in Niuean. In the case of canonical VSO, Massam proposes that when a transitive verb selects a DP object, the object leaves the VP for case-checking purposes. V1 is subsequently achieved by fronting the remnant VP to the specifier of TP. Movement of the predicate to spec,TP is motivated by T^0's EPP [PRED] feature. This EPP feature differs from the one found in more familiar languages which is purported to attract subjects. The derivation of VSO word order via VP-remnant movement is shown schematically in (3).[3]

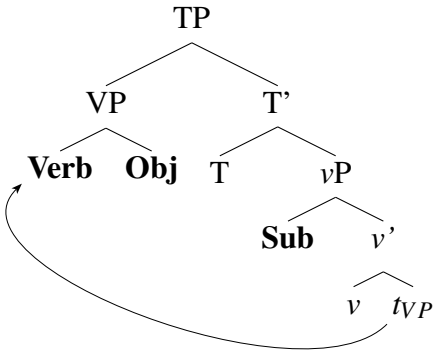
[3]In subsequent work, Massam (2010, 2013) suggests that DP objects are *always* generated in VP-external positions and only NP objects are ever generated as sister to V^0. This is her solution to the problem of object evacuation in cases where the object belongs to a complex predicate. However, the distinction between i) DP objects that are generated VP-internally, but subsequently move into VP-external positions and ii) DP objects that are generated in a VP-external position to begin with is not relevant to the present discussion. Thus, for expository reasons, I will focus on the earlier analysis.

(3)



The differences between VSO and PNI structures stem from the type of object that the verb selects. Massam proposes that transitive verbs optionally select NP objects. Unlike their DP counterparts, NP objects do not require case; hence, they can remain inside the VP. If V^0 selects an NP, both the V^0 and the NP move when the VP moves. As shown in (4), this derivation results in the VOS order of PNI clauses.

(4)



The VP/VP-remnant account of Niuean V1 captures all of the differences between canonical VSO and PNI structures highlighted in the previous section. Recall that postverbal particles surface between the verb and the subject in VSO structures but follow the incorporated argument in PNI structures (compare (1a) and (1b)). In both VSO and PNI clauses, the VP fronts to a position higher than the postverbal particle. In VSO structures, this results in the order V-part-S-O, since the object has evacuated the VP before fronting ensues. In PNI structures, the verb and the object move as a unit, so the particle is ultimately pronounced after the object. Massam proposes that objects in PNI clauses only project as high as NP, which explains the fact that objects in PNI clauses do not surface with case or any other functional morphology. Massam's assertion that incorporated arguments are of category NP - not N^0 - is supported by the fact that they can be complex, as shown in (2).

2.1.2 Middle and instrumental PNI

Massam's account applies straightforwardly to PNI-abs; and it also applies straightforwardly to the incorporation of middle objects, if an analysis is adopted in which middle objects are VP internal (Chung 1978).[4] In VSO middle constructions (5a), the object

[4]For a discussion of constructions with middle as compared to absolutive objects, see Chung (1978), Massam (2001), and Seiter (1980).

(shown in bold) bears oblique case instead of absolutive case. Despite this difference, the PNI version of the middle construction (PNI-mid) has the same surface characteristics as the PNI-abs construction (compare (1b) and (5b)): no functional morphology precedes the object (shown in bold), the object immediately follows the verb, and the subject bears absolutive case.

(5) VSO with a middle object and PNI-mid

a. Kua fakalilifu e tau momotua **ke he ekekafo.**
PFV respect ABS PL old.PL GOAL LOC doctor
'The old people respect the doctor.'

b. Kua fakalilifu **ekekafo** e tau momotua.
PFV respect doctor ABS PL old.PL
'The old people respect the doctor.'

Instrumental PNI occurs when an instrument is incorporated into the verb, as in (6b). Here, too, the incorporated argument cannot be preceded by case marking or any other functional morphology.

(6) VSOX with an instrumental argument and PNI-inst

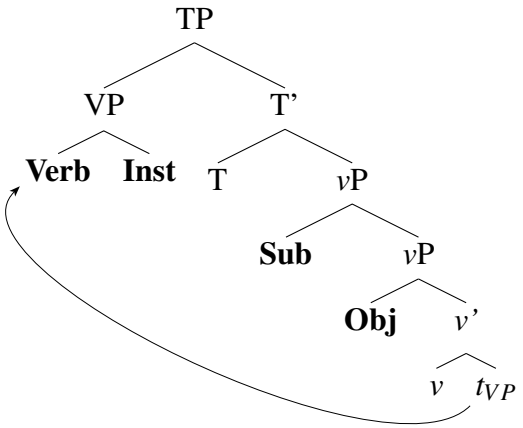
a. Kua fakahū he ekekafo e tohi **he vakalele.**
PFV send ERG doctor ABS letter LOC airplane
'The doctor sent the letter on the airplane.'

b. Kua fakahū **vakalele** he ekekafo e tohi.
PFV send airplane ERG doctor ABS letter
'The doctor sent the letter on the airplane.'

Despite the general success of Massam's syntactic account, there remain a few problematic details concerning PNI-inst. Whereas middle and direct objects are in complementary distribution, instrumental objects and direct objects can co-occur, as in (6).

According to Massam, each PNI construction consists of a verb that selects an NP, so in the PNI-inst construction, the verb selects an instrumental NP. This is shown in (7).

(7) PNI-inst with an absolutive object

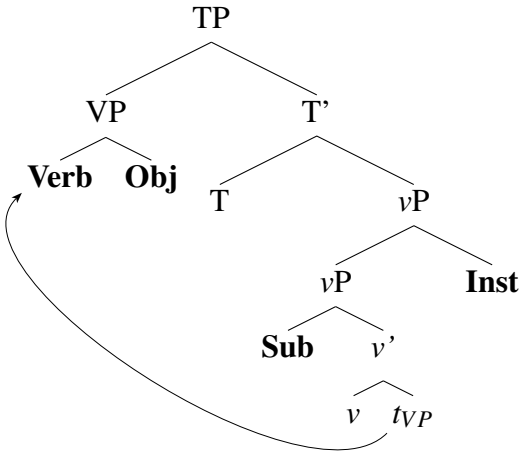


Thus, Massam (2001) must sometimes generate the absolutive argument somewhere other than sister to V^0, because i) PNI-inst constructions can contain both ergative and

absolutive arguments, and ii) for Massam, the incorporated argument is always generated as sister to V^0. Massam (2001) proposes that direct objects are optionally generated in a specifier, where they are accessible for case checking, but not implicated in VP movement.

However, it is unclear why a direct object should be generated as sister to V^0 only when the clause does not also contain an NP instrumental. Likewise, it is unclear why an instrumental argument should be generated as sister to V^0 only when it projects no higher than NP (i.e., in the PNI construction shown in (7)), but adjoined higher in the clause when it surfaces as a PP, as shown in (8).

(8) VSO with an instrumental PP



In sum, different types of PNI constructions have similar syntactic and morphosyntactic profiles. Massam accounts for these similarities by proposing that all PNI constructions contain a VP consisting of a V^0 and an NP. The cost of surface uniformity for different PNI constructions is a considerable degree of variation in the generation of arguments for each PNI/VSOX pair. Absolutive objects can be selected by V^0, as in PNI-abs and VSOX clauses, or they can be generated in the specifier of the projection associated with absolutive case, as in PNI-inst constructions. Instrumentals can be selected by V^0, as in PNI-inst constructions, or adjoined to *v*P, as when they surface in PPs.

If absolutive objects were always generated in the VP and instrumental arguments were always adjoined to a verbal projection, it would be impossible to maintain that different types of PNI constructions always contain a fronted VP consisting of only a V^0 and an NP. For example, in the case of instrumental PNI, a DP direct object might originate in VP and eventually leave to check case, as in VSOX clauses. An instrumental NP might be adjoined to VP in a position ultimately implicated in VP-raising. If this were so, the fronted VP constituent in the ensuing PNI-inst construction would look like the one shown in (9b).

(9) a. Massam's VP: $[_{VP}$ V $NP_{Inst}]$

b. Alternative VP: $[_{VP}[_{VP}$ V $t_{DO}]$ $NP_{Inst}]$

On the basis of syntax alone, it is difficult to determine whether PNI-inst clauses contain a constituent like (9a) or one like (9b), since they form a unique surface constituent in both cases. The next section illustrates how prosodic information can be used to differentiate between these two structures.

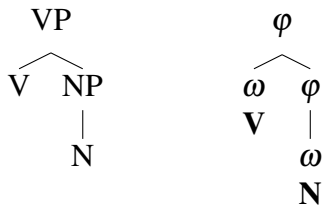
2.2 Prosodic predictions

Match Theory (Selkirk 2011) is a syntax-prosody interface theory that posits a series of violable constraints governing the correspondence between syntactic and prosodic constituents. According to Match Theory, clauses with illocutionary force correspond to intonational phrases (ι), XPs correspond to phonological phrases (φ), and X^0s correspond to phonological words (ω). The present study is presented in terms of Match Theory, but edge-based theories of the syntax-prosody interface make similar predictions (see e.g., Selkirk 1986, 1995; Truckenbrodt 1995, 1999).

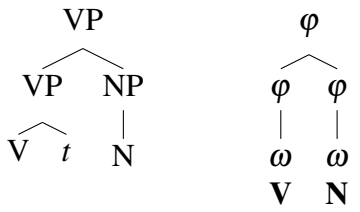
For the fronted VP, Match Theory predicts the syntax-prosody correspondence shown in (10a) in the case of Massam's account and the one shown in (10b) for the alternative VP structure introduced above.

(10) Syntax-prosody mapping

a. Massam's VP:



b. Alternative VP:



The difference between (10a) and (10b) is that the V^0 in (10b) is predicted to constitute its own φ-phrase. Because Niuean demarcates the right edges of φ-phrases, as I will soon show, it should be possible to distinguish between (10a) and (10b) on the basis of whether or not a φ-phrase boundary surfaces between the verb and the noun in PNI constructions. (Note that the use of this prosodic criterion depends on an assumption of syntax-prosody isomorphism—an assumption I adopt in the absence of evidence to the contrary.)

3. Current study

Massam (2001) demonstrates that, from a syntactic perspective, the verb and the incorporated argument form a surface constituent in Niuean PNI constructions. The present study asks whether these two elements also form a prosodic constituent. Massam maintains that the fronted VP has the structure $[_{VP}$ V NP] whether the relevant NP is a direct, middle, or instrumental argument. Here, I investigate whether the prosodic profile of different PNI constructions is consistent with this account. The results of the study suggest that PNI-inst and PNI-mid constructions are prosodically identical to PNI-abs constructions and that the verb and the incorporated argument form a prosodic constituent in PNI constructions.

3.1 Materials and methods

The experiment consisted of twelve conditions crossed with the three factors: i) structure (PNI vs. VS); ii) argument type (ABS vs. MID vs. INST); and iii) complexity (modified vs. unmodified). Complex arguments were modified by either an adjectival phrase or a conjoined phrase. The experiment included sixty test items, five for every logically-possible

combination of the factors listed above and forty fillers for a total of one hundred sentences ((2 x 3 x 2) factors x 5 items + 40 fillers = 100 sentences).

The materials were largely based on examples in the literature (Seiter 1980, Sperlich 1997, Massam 2001), but were adjusted in collaboration with a Niuean-speaking student in the University of Auckland's linguistics department in order to meet the requirements for this study. For example, all clauses were modified to contain exactly one TAM marker in clause-initial position and an extraneous adjunct in clause-final position to avoid positional effects on target material. An example of the ABS condition is shown in (11).

(11) VS vs. PNI-abs

a. Kua tō he magafaoa e tau huli talo (mo e tau fiti) he māla.
PFV plant ERG family ABS PL shoot taro with ABS PL flower LOC farm
'The family planted taro shoots (and flowers) at the farm.'

b. Kua tō huli talo (mo e tau fiti) e magafaoa he māla.
PFV plant shoot taro with ABS PL flower ABS family LOC farm
'The family planted taro shoots (and flowers) at the farm.'

Seven native speakers living in Auckland, New Zealand participated in the study. All participants self-identified as Niuean-English bilinguals literate in both languages.

A Niuean-speaking student in linguistics at the University of Auckland conducted the recording sessions. Participants were instructed to read each sentence and then produce it with neutral intonation. The research assistant and the participant discussed 'neutral intonation' until the participant reported feeling comfortable with the task. They were also instructed to repeat sentences that they felt they did not produce well or naturally. The stimuli were presented in a semi-random order.

Data from each participant were recorded over the course of two recording sessions. Each recording session included 30 test items and 20 fillers. A mixture of VS and PNI examples were recorded in each session, in order to control for the possibility that participants would approach different sessions with different strategies. However, VS/PNI minimal pairs were not included in a single session, in an attempt to deter participants from using metalinguistic awareness in the completion of the task.

Data from two speakers (one female; one male) were not analyzed due to the speakers' apparent difficulty with the task, as evidenced by hesitant, disfluent speech. Data from the remaining speakers were coded by a Harvard undergraduate trained in Praat (Boersma and Weenink 2013) and naïve to the purpose of the study. If the coder determined that an example contained excessive background noise or was otherwise unusable, the corresponding VS or PNI example was excluded as well.

3.2 Results

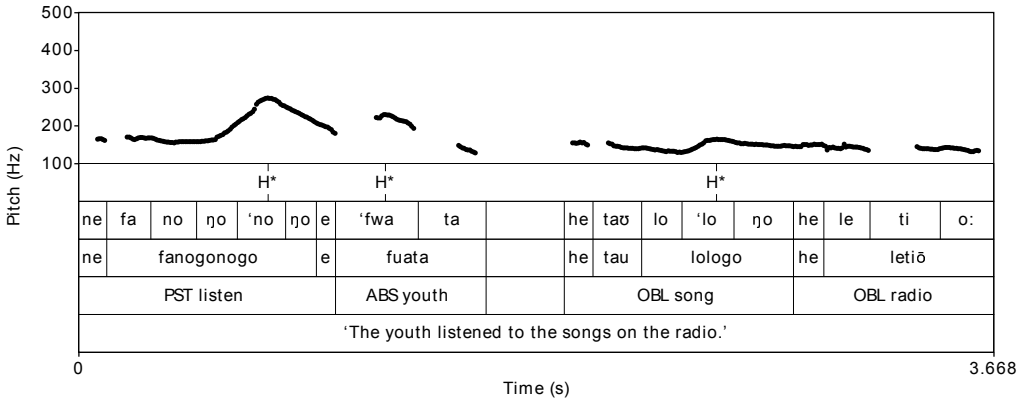
The data collected in this study suggest that Niuean utterances are produced with a series of H*L- tunes, in which the H* is associated with the most prominent syllable of the rightmost prosodic word of a prosodic constituent that corresponds to a syntactic constituent that is smaller than the clause. At the same time, not all syntactic words bear a H* tone. As such, I take each H*L- tune to correspond to a φ-phrase.

H* tones occur on the final syllable of the rightmost prosodic word in cases where the final syllable contains either a long vowel or a diphthong; otherwise, the H* occurs on the

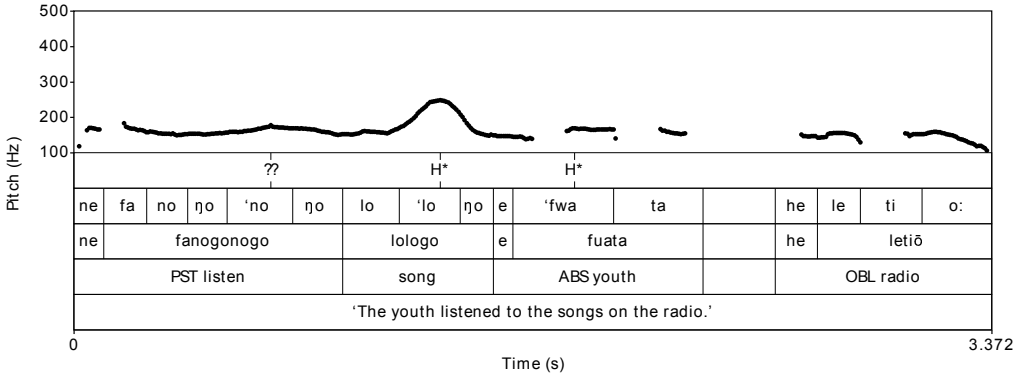
penultimate syllable of the rightmost prosodic word. The location of the H* is consistent with Rolle and Starks' (to appear) account of lexical stress in Niuean. After each H*, the pitch begins to fall immediately and continues to fall until the position of the next H* is reached (cf. Sperlich 1997:10).

Maximum pitch was measured to assist in the identification of φ-phrases. Pauses and duration, two other common indicators of φ-phrase boundaries, were also measured. Example (12) provides an illustration of the pitch contours associated with VS, and example (13) provides an illustration of the pitch contours associated with PNI.

(12) Example pitch track VS-mid



(13) Example pitch track PNI-mid



3.2.1 Pitch maxima

A chart summarizing the pitch results is given in (14). The first constituent (Const 1) corresponds to the verb in both conditions and the second constituent (Const 2) corresponds to the subject in the VS condition and the incorporated argument in the PNI condition:

(14) Maximum F0 in *Hz*

	Const 1		Const 2	
	VSOX	PNI	VSOX	PNI
Abs *n*=37	225	210	216	230
Mid *n*=35	232	203	198	215
Inst *n*=29	228	209	208	220
Mean *n*=101	228	207	207	222

On a direct comparison of the PNI condition and the VS condition, the maximum F_0 value on the verb (Const 1) is significantly higher in the case of VS than it is in the case of PNI (Paired t-Test; $p < 0.0001$). The maximum F_0 value on the constituent that follows the verb (Const 2) is significantly lower in the VS condition than it is in the PNI condition (Paired t-Test; $p < 0.0001$). These statistically significant findings represent perceptually salient differences of approximately 21 and 15 Hz, respectively (see Stevens 2000 for a discussion of just-noticeable difference in the context of F_0).

Here and elsewhere, items with modified objects and items with unmodified objects are treated as a single group, because there is no discernible difference between the two conditions with respect to the phrasing of the verb. For example, one might have expected verbs in modified PNI examples to be parsed as their own φ-phrases. Instead, there is no evidence of a φ-phrase boundary occurring on the right edge of verbs that are followed by modified incorporated objects. While the average maximum F_0 value on a verb followed by a modified object in the PNI condition is 210 Hz and the average maximum F_0 value on a verb followed by an unmodified object in the PNI condition is 204 Hz, this difference represents neither a perceptually salient nor a statistically significant difference (Paired t-Test; p = .416).

The same patterns are found for each type of PNI/VSOX pair. For each argument type, the maximum F_0 on the verb is higher in the VSOX condition than in the PNI condition (Paired T-Test; $p < 0.005$ for absolutives; $p < 0.0005$ for middles; and $p < 0.005$ for instrumentals). In contrast, the maximum F_0 on the prosodic word following the verb is significantly lower in the VSOX condition than it is in the PNI condition (Paired t-Test; $p = 0.01$ for absolutives; $p < 0.01$ for middles; and $p = 0.015$ for instrumentals).

3.2.2 Duration

The next set of results pertains to duration of the verb and is summarized in (15).

(15) Duration of verb in *ms*

	VS	PNI
Abs *n*=37	60	56
Mid *n*=35	77	75
Inst *n*=29	62	51
Mean *n*=101	66	61

The verb in the VSOX condition is significantly longer than the verb in the PNI condition (Paired t-Test; $p < 0.0005$). This general finding holds for each of the different argument conditions as well (Paired T-Test; $p = 0.016$ for absolutives; $p = 0.08$ for middles; and $p < 0.005$ for instrumentals).

The difference in duration between the verb in VS constructions and the verb in PNI constructions reaches statistical significance, but the size of the effect is below the perceptibility threshold (Stevens 2000). This finding is consistent with the idea that phrase-final lengthening is a mechanical effect of prosodic planning (Myers and Hansen 2007), as opposed to a reliable cue of prosodic constituency.

3.2.3 Pauses

Pauses were 2.5 times more likely to occur after VS verbs (*n*=10) than after PNI verbs (*n*=4). In cases where a pause occurred after a PNI verb, the pause was preceded by a modified incorporated argument. Pauses did not occur between PNI verbs and unmodified incorporated arguments in these data.

It is unlikely that phonological weight or length underlies this finding. Pauses (indicated by '||') preceded modified incorporated arguments with four syllables, but did not precede unmodified incorporated arguments with the same number of syllables. For example ...*fiafia* || *manu huifā*... '...like four-legged animals...' and ...*futi* || *ika* lahi ... '...catch big fish...' were attested, but *fakalilifu* || *ekekafo*... '...respect (the) doctor...' and ...*fakahū* || *vakalele*.... '...send (by) plane...' were not. The overall occurrence of pauses in the data is low, so a comprehensive study of the distribution of pauses would be beneficial.

4. Analysis of prosodic data

4.1 The right edge of phonological phrases

As previously noted, Niuean φ-phrases have a H*L- tune, with the H* occurring on the most prominent syllable of the rightmost prosodic word. Therefore, if the PNI verb is located at the right edge of a φ-phrase, the maximum pitch associated with the VS verb should be the same as the maximum pitch associated with the PNI verb. If the PNI verb is not located at the right edge of a φ-phrase, the maximum pitch associated with the VS verb should be greater than the maximum pitch associated with the PNI verb. In fact, the experimental data show that F_0 on the VS verb is significantly higher than on the PNI verb, indicating that verbs in PNI structures, even those with modified objects, are not produced at the right edge of φ-phrases.

The pitch data also indicate that the incorporated argument in the PNI examples is at the right edge of a φ-phrase that is anterior to the φ-phrase containing the subject in VS examples. The F_0 on the prosodic word following the VS verb (i.e. the subject) is significantly lower than the F_0 on the prosodic word following the PNI verb (i.e. the incorporated argument). The F_0 of the target H* associated with each H*L- tune decreases in fundamental frequency with each prosodic phrase. Given the structure of the experimental material (e.g. verb-initial, no clause initial adjuncts, etc.), this means that the incorporated argument in the PNI examples is located at the right edge of the first φ-phrase in the utterance.

Next, the duration of the verb is longer in VS structures than in PNI structures. Phonological phrase boundaries are known to induce lengthening (Klatt 1976, Nespor and Vogel 1986; Edwards and Beckman 1988; Beckman and Edwards 1990; Wightman et al. 1992). Thus, assuming that the difference in duration is indicative of phrase-final lengthening, the contrast in the duration of the verb in VS and PNI structures provides further evidence that the VS verb is at the right edge of a phonological phrase, but the PNI verb is not.

A preliminary analysis of the phrasing of VS and PNI examples is now possible. The verb and the subject each constitute their own φ-phrase in VS constructions (16a), while the verb and the incorporated argument in PNI constructions form a single φ-phrase (16b). The pause data are also numerically consistent with this finding, as the edges of phonological phrases are often marked by pauses (Scott 1982; Wightman et al. 1992; among others).

(16) Preliminary prosodic structure
   a. VSOX: Verb)φ Subject)φ
   b. PNI: Verb IE)φ

Thus, the right edge of a phonological phrase does not intercede between the verb and the incorporated argument in the PNI construction, regardless of whether the incorporated argument is a direct, middle, or instrumental object. This finding is consistent with Massam's syntactic analysis of Niuean PNI, as she proposes that the PNI verb and the incorporated argument form the same type of syntactic constituent, [$_{VP}$ V NP], regardless of whether the incorporated argument is a direct, middle, or instrumental object.

4.2 The left edge of phonological phrases

Recall that pauses are more likely to occur after VS verbs than after PNI verbs in these data. Furthermore, postverbal pauses are only found in PNI examples with modified incorporated arguments. In other words, speakers are able to pause between verbs and DPs, as in VS examples, and they are able to pause between verbs and modified NPs, as in half of the PNI examples, but they do not pause between verbs and unmodified NPs.

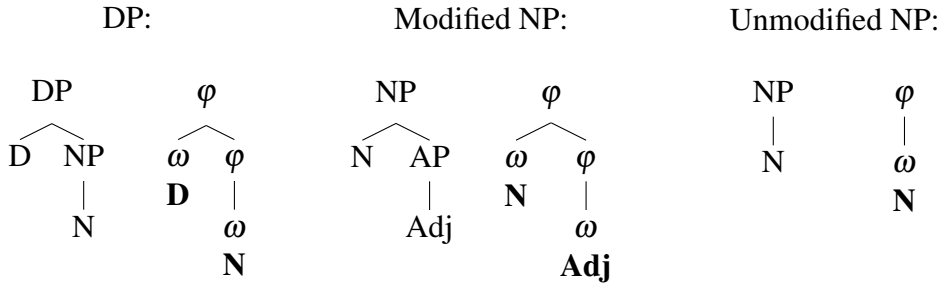
The previous section established that there is no right edge immediately following a PNI verb. Therefore, the observed pauses cannot be understood as demarcating the right edge of φ-phrases, since pauses can occur between PNI verbs and certain incorporated arguments. Instead, if pauses are understood to optionally indicate the left edge of a phonological phrase, then the distribution of pauses in these data receives a simple explanation. However, this analysis could not explain why pauses occur more frequently after VS verbs than after PNI verbs, or why it is specifically before modified incorporated arguments that pauses occur in PNI examples.

For a long time, the dominant position in prosodic theory held that all levels of prosodic structure are exhaustively parsed into constituents of the next lower level of prosodic structure (e.g. Selkirk 1984, 1986; Nespor and Vogel 1986). Therefore, prosodic structure was necessarily taken to be non-recursive. This position is part of the Strict Layering hypothesis (see Vogel 2009 for a recent take on the theory). More recently, researchers have argued that prosodic structure may, in fact, be recursive (e.g. Itô and Mester 2003 et seq.; Selkirk 2011; Wagner 2005 et seq.).

Some researchers who argue for recursive prosodic structure point to phonological processes that appear to target only prosodic constituents that dominate another constituent of the same category, or prosodic constituents that are not dominated by another constituent of the same category. For example, both Japanese downstep (Itô and Mester 2012) and Irish L-H rise pitch accent (Elfner 2012) are argued to apply exclusively to non-minimal projections—i.e., projections that dominate another constituent of the same category.

The notion of minimal and non-minimal projections can also help to account for the distribution of pauses in Niuean. Specifically, it appears that pauses optionally mark the left edge of non-minimal projections. The syntax-prosody mapping that Match Theory predicts for DPs, modified NPs, and unmodified NPs is provided in (17).

(17) Syntax-prosody mapping



This analysis captures the asymmetry in the distribution of pauses preceding modified and unmodified NPs, because modified NPs have a non-minimal φ-phrase at their left edge, but unmodified NPs do not. Because only half of the V-NP sequences contain NPs that map onto non-minimal phrases, the Match Theory account also provides a simple explanation for why pauses are approximately half as likely to interrupt V-NP sequences (PNI examples) as compared to V-DP sequences (VSO examples).

Finally, this analysis also accounts for the finding that pauses optionally precede DPs and PPs in other places in the clause as well. A further look into the distribution of PP- and modified DP-internal pauses may be relevant to a conversation about whether prosodic indicators are obligatory or variable, depending on whether all non-minimal phonological phrases are equally likely to condition the appearance of a pause.

5. Conclusion

This paper introduced new data on prosodic phrasing in Niuean, showing that: (i) Niuean clauses are produced with a series of H*L- tunes; (ii) pauses follow the verb in VSOX structures and in PNI structures containing modified incorporated arguments; and (iii) TAM markers do not bear stress. The H*L- tune was analyzed as demarcating φ-phrases. The distribution of pauses was accounted for by appealing to recursive prosodic structure. Specifically, pauses optionally mark the left edge of non-minimal φ-phrases. For each of the three types of PNI constructions discussed in this chapter, the verb and the incorporated argument form a prosodic constituent.

References

Baker, Mark. 1988. *Incorporation: A Theory of Grammatical Function Changing*. Chicago: University of Chicago Press.

Beckman, Mary and Jan Edwards. 1990. Lengthenings and shortenings and the nature of prosodic constituency. In *Papers in Laboratory Phonology I: Between the Grammar and the Physics of Speech,* ed. by John Kingston and Mary Beckman, 152-178. Cambridge, UK: Cambridge University Press.

Boersma, Paul and D. Weenik. August, 2013. Praat: doing phonetics by computer [computer program]. Version 5.3.51. http://www.praat.org/.

Di Sciullo, Anna Maria and Edwin Williams. 1987. *On the Definition of the Word.* Cambridge, MA: MIT Press.

Edwards, Jan and Mary Beckman. 1988. Articulatory timing and the prosodic interpretation of syllable duration. *Phonetica* 45: 156-174.
Elfner, Emily. 2012. Syntax-prosody interactions in Irish. Ph. D. thesis, UMass, Amherst.
Itô, Junko and Armin Mester. 2003/1992. Weak layering and word binarity. In *A New Century of Phonology and Phonological Theory. A Festschrift for Professor S. Haraguchi on the Occasion of his 60th Birthday*, 26-65. Tokyo: Kaitakusha.
Itô, Junko and Armin Mester. 2007. Prosodic adjunction in Japanese compounds. In *Formal Approaches to Japanese Linguistics* 4. Cambridge, MA: MITWPL.
Itô, Junko and Armin Mester. 2010. Recursive prosodic phrasing in Japanese. In *The Proceedings of the 18th Japanese/Korean Conference*, 147-164.
Itô, Junko and Armin Mester. 2012. Subcategories in Japanese. *Lingua* 124: 20-40.
Massam, Diane. 2001. Pseudo noun incorporation in Niuean. *NLLT* 19: 153-197.
Massam, Diane. 2010. Deriving inverse order. In *Austronesian and Theoretical Linguistics* 167: 271-296. Amsterdam: Benjamins.
Nespor, Marina and Irene. Vogel. 1986. *Prosodic Phonology*. Dordrecht: Foris.
Rolle, Nick and Donka Starks. To Apepar. Vowel length in Niuean. *Oceanic Linguistics*.
Scott, D. 1982. Duration as a cue to the perception of a phrase boundary. *Journal of the Acoustical Society of America* 71: 996-1007.
Seiter, William. 1980. *Studies in Niuean syntax*. New York: Garland.
Selkirk, Elisabeth. 1984. *Phonology and syntax: The relation between sound and structure*. Cambridge, MA: MIT Press.
Selkirk, Elisabeth. 1986. On derived domains in sentence phonology. *Phonology Yearbook* 3: 371-405.
Selkirk, Elisabeth. 1995. The prosodic structure of function words. In *UMass Occasional Papers in Linguistics 18: Papers in Optimality Theory*, ed. by J. N. Beckman, L. W. Dickey, and S. Urbancyzk, 439-469. Amherst, MA: GLSA.
Selkirk, Elisabeth. 2011. The syntax-phonology interface. In *The Handbook of Phonological Theory* (2nd ed.), ed. by J. Goldsmith, J. Riggle, and A. C. L. Yu, 435-484. West Sussex, UK: Wiley-Blackwell.
Siosikefu, M. H. & G. Haberkorn 2008. Niue population profile based on 2006 census population and housing. In *Niue Population, Planning, Development, and Statistics Unit and the SPC Statistics and Demography Programme.* Noumea, New Caledonia.
Sperlich, Wolfgang. 1997. *Niue language dictionary.* Government of Niue and Department and The University of Hawai'i, Department of Linguistics.
Truckenbrodt, Hubert. 1995. Phonological Phrases: Their Relation to Syntax, Focus, and Prominence. Ph. D. thesis, MIT.
Truckenbrodt, Hubert. 1999. On the relation between syntactic phrases and phonological phrases. *Linguistic Inquiry* 30: 219-256.
Vogel, Irene. 2009. The status of the clitic group. In *Phonological Domains: Universals and Deviations*, ed. by J. Grijzenhout and B. Kabak, 15-46. Mouton de Gruyter.
Wagner, Michael. 2005. Prosody and recursion. Ph. D. thesis, MIT.
Wagner, Michael. 2010. Prosody and recursion in coordinate structures and beyond. *NLLT* 28: 183-237.
Wightman, Colin, Stephanie Shattuck-Hufnagel, Mari Ostendorf, and Patti J. Price. 1992. Segmental durations in the vicinity of prosodic boundaries. *Journal of the Acoustical Society of America*: 1707-1717.