The Prosodic Realization of Negation in Saisiyat and English

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This study investigates the prosodic realization of negation in Saisiyat, an endangered aboriginal Austronesian language of Taiwan, and compares the prosodic properties of its affirmative and negative sentences with those of British English. In order to test Yaeger-Dror's "Cognitive Prominence Principle," according to which cognitively prominent items (such as negators) should be prosodically marked, we measure the F_0 peak, the intensity peak, and duration of lexical items appearing in affirmative and negative sentences. Our results indicate that sentential subjects are the most acoustically prominent items with respect to F_0 height and intensity in Saisiyat negative sentences, whereas the negator itself is the most acoustically prominent item with respect to F_0 in an English sentence. In addition, the presence of a negator does not significantly change the prosodic parameters of contiguous words in Saisiyat. English, in contrast, exhibits relatively large-scale prosodic differences in both F_0 and intensity between affirmative and negative sentences. This paper suggests that the following typological features can account for the differences observed between Saisiyat and English: (1) the relationship between prosodic prominence and syntactic subjects in Saisiyat, (2) transparency of the negation system in Saisiyat, and (3) the relationship between prosodic prominence and semantically defined focus in English.

1. INTRODUCTION.[1] Cross-linguistically, negation can be realized by means of syntactic marking, prosodic marking, or a combination of the two, depending on the prosodic characteristics of the language in question. Syntactically, a language can use a single negator to express negation, such as *not* in English, or it can use various negators for different syntactic structures, such as those found in the Austronesian languages of Taiwan. Negation can also be marked prosodically. For example, Yaeger-Dror (2002) found that the F_0 (fundamental frequency) of English "*not*" and French "*pas*" are higher than the F_0 of surrounding words. The current literature suggests that the combination of prosodic and syntactic marking of negation is relatively common; the use of

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only prosodic marking to realize negation, in contrast, is relatively rare (for a detailed discussion, see Remijsen 2003).

The question of whether a negator is invariably more prominent acoustically than its surrounding words, however, remains unresolved. Semantically, negators generally contribute focused or new information to a sentence; for this reason, they assume "focal prominence" (Yaeger-Dror 2002:1496). Both theoretical (Horn 2001, Kadman 2001) and empirical studies (Hirschberg 1990, 1993)[2] support the claim that negators contribute salient information to the discourse; it is thus likely that the information they convey is also cognitively prominent. According to the "Cognitive Prominence Principle" (Yaeger-Dror 2002), acoustic prominence enhances discourse participants' attention to focused items, which maximizes the effectiveness of communication. Based on Bolinger's (1978) claim that prosodic marking of focused information is a linguistic universal, cognitively prominent items should therefore also be prosodically salient. Cutler, Dahan, and Donselaar (1997) proposed a "Cognitive Prominence Corollary," according to which "a prosodically nonprominent token of a highly significant word is quite unlikely" (as cited in Yaeger-Dror 2002:1497).

Despite the wide range of cross-linguistic variation in the prosodic realization of negators (see Yaeger-Dror 2002 for a comprehensive review), acoustic evidence has been found to support the "Cognitive Prominence Principle." In O'Shaughnessy and Allen (1983), measurement of the F_0 values produced by speakers within negative sentences determined that the F_0 of negators was usually higher than that of contiguous lexical items. However, they found the F_0 of negators to be raised only in isolated utterances. When negators were uttered within larger units of discourse such as paragraphs, F_0 raising was found only rarely.[3] Other studies, such as that of English *not* (Hirschberg 1990) and that of French *pas* (Morel 1995) found negators to be consistently prominent with respect to F_0 in read speech.

Bolinger (1978) provided an alternative analysis of the prosodic characteristics of negators. Although he agreed that new information is usually prosodically marked, he claimed that cross-linguistic prosodic realization of negative sentences tends to favor lower, rather than higher F_0. Yaeger-Dror (1985) interpreted this observation to mean that the F_0 on negative particles is made prominent by being produced lower in the speaker's F_0 range. In the same study, however, Yaeger-Dror claimed that F_0 lowering of negators has never been found in research on English prosody. Instead, the F_0 level of English negators was found to be either higher than or even with the other constituents.

In addition to the controversy over whether negators are actually prosodically prominent, it also has yet to be determined whether the prosodic prominence that has

2. We cited these works from Yaeger-Dror (2002).

3. According to Yaeger-Dror (1985, 2002), the unstable behavior of negators stems from the conflict between the "Cognitive Prominence Principle" and the "Social Agreement Principle." On the one hand, a negator, due to its sentential prominence, must be prosodically marked in order to comply with the Cognitive Prominence Principle. On the other hand, the Social Agreement Principle discourages emphasis on any objection to a conversation partner's previous assertion, which would effectively eliminate any prosodic prominence assigned to negators. Yaeger-Dror's research suggests that the choice to assign prosodic prominence to negators may be sensitive to the dynamics of culture and discourse. Because our experimental materials contain only short sentences, we do not test the "Social Agreement Principle" in this study.

been attributed to English negative sentences can be found across a range of language types. The current study focuses on the prosodic realization of negators in Saisiyat,[4] an endangered aboriginal Austronesian language of Taiwan, and compares its prosodic realization of negation with that of English.[5] Although this research focuses on acoustic measurement of the negators themselves, it also measures the F_0 and intensity of the lexical items surrounding the negator. The prosodic characteristics of negative Saisiyat sentences are compared with those of affirmative sentences. In addition, differences between negative and affirmative sentences are compared between Saisiyat and English. Acoustic parameters to be measured include F_0 peak, intensity peak, and duration. These results provide data for typological comparison of the prosodic realization of negation, as well as information on the intonational structure of Saisiyat.

The significance of choosing Saisiyat for comparison with English lies in its morphosyntactic structure; agreement between the verb and its arguments depends on whether a sentence is agent-focused (AF) or nonagent focused (NAF). Focus markers are obligatory in Saisiyat; this requirement is common among the Austronesian languages of Taiwan.[6] Focus markers are morphologically affixed to the verb, and Saisiyat licenses only one focus marker per verb. Verbal affixation can be used to mark agreement between the verb and any constituent, including agents, patients, locations, and other arguments. Yeh (2000) divided focus markers into two groups and identified four different kinds of focus markers within those groups; these were classified according to the relationship between the verb and the semantic roles of its arguments. This is illustrated in table 1:[7]

TABLE 1. FOCUS MARKERS IN SAISIYAT (YEH 2000)

FOCUS MARKERS	GROUP I	GROUP II
AGENT FOCUS (AF)	m-, -om-, ma-, Ø	Ø
PATIENT FOCUS (PF)	-ən	-i
LOCATIVE FOCUS (LF)	-an	
REFERENTIAL FOCUS (RF)	si-	-ani

4. Saisiyat is an endangered language in Taiwan with about 7,000 speakers. It belongs to the Austronesian language family and has two major dialects—Northern Saisiyat (the Taai dialect) and Southern Saisiyat (the Tungho dialect). The speaker population of these two dialects of Saisiyat lives in central Taiwan. Northern Saisiyat is spoken in Hsinchu County and Southern Saisiyat is spoken in Miaoli County.
5. The English-speaking informant in this study is a male speaker of UK English.
6. The traditional view of "focus" in Austronesian languages is that "the focused NP in Austronesian languages not only functions as syntactic pivot for relativization and verb serialization, but also has the pragmatic effect of highlighting it as the center of attention in a clause"(Huang 2002:666). This position has been challenged in recent literature (e.g., see Huang 2000 for a detailed discussion). Moreover, some researchers refer to this kind of focus system as a voice system or a trigger system (e.g., Shibatani 1988, Rau 1992, Wouk 1996). According to Rau's (1992:36) analysis, verbs in the Austronesian languages of Taiwan "usually contain a root or base and one or more affixes. The base provides the meaning of the verb, whereas the primary affixes show the perspective of the sentence and designate the role relationship of the participant to the event in question."
7. The symbol Ø represents the zero morpheme in all tables and examples.

Choice of negator is subject to cooccurrence restrictions for focus markers in Groups I and II, the details of which will be explained in section 2.3. Examples (1) through (4)[8] illustrate the use of different types of focus markers in affirmative sentences.

EXAMPLE OF AF (data from our field work)

(1) Ø ʔojaʔ s-om-βət ka korkoriŋ.
NOM mother beat-AF-beat ACC child
'Mother beats the child.'

EXAMPLE OF PF (data from our field work)

(2) Korkoriŋ niʔ ʔojaʔ səβət-ən.
child GEN mother beat-PF
'The child is beaten by mother.'

EXAMPLE OF LF (data from Yeh 2000)

(3) Ka-patol-an hiniʔ.[9]
NMLZ-sing-LF this
'This is the place for singing.'

EXAMPLE OF RF (data from Yeh 2000)

(4) Kahœj si-səβət ni βakiʔ ka korkoriŋ.
stick RF-beat GEN grandfather ACC child
'The stick was used by grandfather to beat the child.'

In (1), adding the AF infix *-om-* to the verb *səβət*[10] 'beat' places focus on the agent *ʔojaʔ* 'mother,' marking "mother" as the agent in the sentence 'Mother beats the child.' When a verb takes the PF suffix *–ən*, as in (2), the patient becomes the focus of the sentence, which marks "child" as the patient subject in 'The child is beaten by mother.' In (3), the LF suffix *-an* and nominalization marker *ka-* are both added to the verb *patol* 'sing', creating the word *kapatolan* 'the place for singing'; this construction places sentential focus on the location of singing. In (4), the use of the RF (referential) suffix places the focus on the instrument *kahœj* 'stick'.

Syntactic position can also be used to focus salient information (see Yaeger-Dror 2002, Cutler et al. 1997, Fowler and Housum 1987, Kadmon 2001, Koopmans-van Beinum 1992). In Saisiyat, utterance-initial position, which might be a prosodically focused syntactic position, often cooccurs with a morphosyntactically marked focused NP. Because Saisiyat typically exhibits SVO word order,[11] the focused argument (as a sentential subject) occurs at or near the beginning of a sentence. Thus, it is possible that a syntactically or positionally defined item such as a focused agent[12] may realize prosodic prominence.

The results of this study indicate that sentential subjects are the most acoustically prominent items in the Saisiyat negative experimental sentences. This contrasts sharply with our English experimental sentences, in which the negators themselves are the most acoustically prominent items. In addition, the presence of negators does not

8. The phonemic inventory of Saisiyat is introduced in 2.1.
9. Yeh (2000) pointed out that this construction is usually used in equational sentences. Please note that *hiniʔ* 'this' in Yeh (2000) is pronounced as *hini* by our informant.
10. Based on our data drawn from fieldwork, we find that *səβət* 'beat' can have *ʃəβət* as a variant.
11. Verb-initial word order has also often been observed in natural discourse of Saisiyat.
12. This study's test materials include only agent-focused subjects.

significantly change the prosodic parameters of contiguous words in Saisiyat. English, in contrast, exhibits relatively large-scale prosodic differences between affirmative and negative sentences. We propose that the following factors can account for the cross-linguistic variation observed in our data: (1) the relationship between prosodic prominence and syntactic subjects in Saisiyat, (2) transparency of the Saisiyat negation system, and (3) the relationship between prosodic prominence and semantically defined focus in English.

The remainder of this paper is organized in the following way: First, we provide a brief introduction to the phonological, morphological, and syntactic structures of Saisiyat. Then, we describe the method and results of Experiments 1 and 2, in which we measured the relative prosodic prominence of lexical items in both affirmative and negative sentences in both Saisiyat and English. Then, to investigate the question of whether the presence of a negator would result in global prosodic changes in either language, we compare our acoustic measurement of the items surrounding negators in affirmative and negative sentences between Saisiyat and English. Finally, we provide possible interpretations for our results and suggest directions for future research.

2. THE STRUCTURE OF SAISIYAT.

This section provides a brief introduction to the phonology, morphology, and syntax of Saisiyat. This information has three sources: Yeh (2000), our own fieldwork, and a database of Saisiyat discourse collected at the Graduate Institute of Linguistics of National Taiwan University.

2.1 THE PHONEMIC INVENTORY OF SAISIYAT.

The phonemic inventory of Saisiyat consists of seventeen consonants[13] and six vowels; they appear in tables 2 and 3.[14]

The accent within words usually falls on the last syllable, except for function words and place names.[15] The most prevalent syllable structures are CV, CVC, and CVV. According to Chiang and Chiang (2005), Saisiyat can be classified as a pitch accent language at the lexical level, because lexical accent is realized by means of specific F_0 patterns, rather than by duration and intensity.

2.2 SAISIYAT CASE MARKING.

In contrast with other Austronesian languages of Taiwan, which exhibit VOS word order, Saisiyat exhibits primarily SVO word

13. Note that /s/ and /z/ are phonemes of Northern Saisiyat that correspond to /θ/ and /ð/ in Southern Saisiyat. For consistency, these two variants are both represented as /s/ and /z/ throughout the paper. Moreover, the lateral flap was reported to be extinct in some dialects and retained by only a few speakers (Yeh 2000). For this reason, this sound is not included in table 2. With respect to the Saisiyat vowel inventory, the presence of /u/ is controversial, so we do not include it in our inventory.

14. The letters in parentheses represent the ASCII equivalents of IPA characters, following the transcription system that appears in Yeh (2000). For consistency, all Saisiyat words will be transcribed in standard IPA.

15. Yeh (2000) indicated that the ultimate stress rule does not apply to function words or place names. We observed that the prosody of function words in Saisiyat was much less regular than that of content words. Many function words are either monosyllabic or disyllabic and bear neither stress nor accent, unless they are emphasized for pragmatic reasons. As for place names, too few tokens occurred in our data to discern any patterns.

order. Case markers usually occur before nouns to mark their syntactic function. According to Yeh (2000), there are six case markers in Saisiyat, each of which is divided into two categories: persons (not including pronouns) and common nouns, as shown in table 4. In example (5), the subject *jaβaʔ* 'father' is assigned nominative case, which is marked with the zero morpheme, and *ka* marks *korkoriŋ* 'child' as accusative case.

(5) Ø Jaβaʔ ʃ-om-βət ka korkoriŋ.
NOM father beat-AF-beat ACC child
'Father beats the child.' (data from Yeh 2000)

2.3 NEGATORS IN SAISIYAT. Yeh et al. (1998) and Yeh (2000) claim that Saisiyat has an inventory of eight negators: *ʔokik, ʔokaj, ʔamkik, ʔamkaj, kajnʉ̆ʔ, ʔokaʔ, ʔizʉ̆ʔ,* and *ʔinʔinʉ̆ʔ*.[16] Negators are chosen from this inventory according to the syntactic constructions in which they appear, and they are followed by verbs with focus markers chosen according to sentential focus. Examples (6) to (13) describe the distribution and cooccurrence restrictions of the eight negators in Saisiyat, based on the descriptions given in Yeh (2000). All data are from Yeh (2000).

TABLE 2. CONSONANTS IN SAISIYAT

		BILABIAL	ALVEOLAR	ALVEOPALATAL	PALATAL	VELAR	GLOTTAL
STOP		p	t			k	ʔ (')
NASAL		m	n			ŋ (ng)	
FRICATIVE	VL.		s	ʃ (S)			h
FRICATIVE	VD.	β(b)	z				
LATERAL			l				
TRILL				r			
GLIDE		w			j (y)		

TABLE 3. VOWELS IN SAISIYAT

	FRONT	CENTRAL	BACK
HIGH	i		
MID	œ (oe)	ə (e)	o
LOW	æ (ae)	a	

TABLE 4. THE CASE SYSTEM OF SAISIYAT (YEH 2000)

	NOMINATIVE	ACCUSATIVE	GENITIVE	POSSESSIVE	DATIVE	LOCATIVE
PERSONAL NAME	Ø hi	hi	ni	ʔan-a	ʔini	kan kala
COMMON NOUNS	Ø ka	ka	noka no	ʔan noka-a	no	raj

16. See Zeitoun (2001) for a different analysis of some negators.

(6) *ʔokaj* is followed by dynamic verbs, which must be affixed with Group II focus markers; these cannot occur with aspectual markers.

ʔojaʔ ʔokaj ʃəβət ka korkoriŋ.
mother NEG beat-Ø ACC child
'Mother does not beat the child.'

(7) *ʔokik* is followed by nominal predicates, stative verbs or dynamic verbs affixed with aspectual markers.

Sia ʔokik sararaʔ jakin.
he NEG like-Ø me
'He dislikes me.'

(8) *ʔamkaj* cooccurs with future events or possible events. It is a blended form derived from '*ʔam*' (a modal verb similar to the English 'will') and '*ʔokaj*.' Like *ʔokaj*, it is followed by dynamic verbs with Group II focus markers, and it cannot cooccur with aspectual markers.

βakiʔ ʔamkaj wa:iʔ.
grandfather NEG come-Ø
'Grandfather will not come.'

(9) *ʔamkik* cooccurs with future events or possible events. It is a blended form derived from '*ʔam*' and '*ʔokik*.' Like *ʔokik*, it is followed by nominal predicates, stative verbs, or dynamic verbs affixed with aspectual markers.

Sia rimʔan ʔamkik raj tawʔan.
he tomorrow NEG LOC home
'He will not be at home tomorrow.'

(10) *kajniʔ* is used in volitional constructions. It can be followed by nouns or verbs with Group I focus markers.

Jako kajniʔ m-aʔrəm.
I NEG AF-sleep
'I don't want to sleep.'

(11) *ʔokaʔ* occurs in existential constructions; it can only be followed by nouns.

Jako ʔokaʔ ka rajhil.
I NEG ACC money
'I have no money.'

(12) *ʔiziʔ* is an imperative negator, similar to English 'don't.' The verb following it is affixed with Group II focus markers.

ʔiziʔ ʃəβət ka korkoriŋ.
NEG beat-Ø ACC child
'Don't beat the child.'

(13) *ʔinʔiniʔ* 'not yet' precedes adverbs or verbs with Group II focus markers.

Jako ʔinʔiniʔ o:næhne: m-wa:iʔ.
I NEG for-a-long-time AF-come
'I have not come for a long time.'

The above descriptions and examples show that negators in Saisiyat have many different forms and functions, and that they must cooccur with specific syntactic or semantic structures. Sentence (14) contains an example of an additional negator found in our data, which appears to be a modal with a meaning similar to the English 'cannot.'

(14) ʔœβaj haʃaʔ m-atol.
'Œbaj cannot AF-sing
''Œbaj cannot sing.'

3. EXPERIMENTS FOR TESTING YAEGER-DROR'S "COGNITIVE PROMINENCE PRINCIPLE"

3.1 EXPERIMENT 1. Experiment 1 compared the prosodic prominence of items in both Saisiyat and English sentences, including sentential subjects, negators and words directly following negators (hereafter referred to as 'X'). For the purpose of comparison with negative sentences, the prosodic prominence of subjects and X-constituents was also compared in affirmative sentences.

3.1.1 Methodology[17]

3.1.1.1 Informants. Three informants participated in the experiment: two native Saisiyat speakers and one native UK-English speaker. One of the Saisiyat informants speaks Northern Saisiyat and the other speaks Southern Saisiyat.[18] Both are male, and between 50 and 60 years of age. They also speak Japanese and Hakka, a Chinese dialect spoken in Taiwan. The British English–speaking informant is a 24-year-old male from London. By self-report, none of the informants had a problem related to either hearing or articulation. Recordings were made in the speech lab at the Graduate Institute of Linguistics at National Taiwan University using a Kay Elemetrics CSL 4400. A condenser microphone was placed approximately 10 centimeters away from the informants' mouths for the duration of the recording. Total recording time for each participant was approximately one hour.

3.1.1.2 Materials and procedure. Saisiyat is a language without a writing system, so it was not possible to elicit the sentences using written materials. Instead, informants were asked questions by the researcher, and they were instructed to answer each of the questions in the affirmative or in the negative. Examples are given in (15a–b). The experimental materials included 15 pairs of elicited affirmative and negative sentences in both English and Saisiyat.

17. Aside from the content of the experimental materials, the methodology given for Experiment 1 applies to Experiment 2. Therefore information on informants, procedure, and measurement will be given for Experiment 1 only and will not be repeated in the description of Experiment 2.

18. Because Saisiyat is an endangered language, informants who are both proficient enough to participate in the experiment and fluent enough in Mandarin Chinese to comprehend the instructions were very difficult to find.

ELICITATION OF AFFIRMATIVE SENTENCES

(15) a. Researcher: ʔœβaj minatiniʔ aj?[19]
'Œbaj brother PARTICLE
'Is 'Œbaj (someone's) brother?'

Informant: ʔœβaj minatiniʔ.
'Œbaj brother
''Œbaj is (someone's) brother.'

ELICITATION OF NEGATIVE SENTENCES

b. Researcher: ʔœβaj minatiniʔ aj?
'Œbaj brother PARTICLE
'Is 'Œbaj (someone's) brother?'

Informant: ʔœβaj ʔokik minatiniʔ.
'Œbaj NEG brother
''Œbaj is not (someone's) brother.'

English sentences were elicited using the same procedure, as exemplified in (16a–b):

ELICITATION OF AFFIRMATIVE SENTENCES

(16) a. Researcher: Is Bob your brother?
Informant: Bob is my brother.

ELICITATION OF NEGATIVE SENTENCES

b. Researcher: Is Bob your brother?
Informant: Bob is not my brother.

Each Saisiyat negative sentence contained a single subject, a negator, and a predicate. The predicate consisted of either a noun or a stative/dynamic verb, depending on the negator chosen. The grammatical subject of each sentence was *ʔœβaj*, a common name for men. Saisiyat experimental materials included the following bisyllabic negators: *ʔokik, haʃaʔ, ʔokaj, ʔokaʔ,* and *kajniʔ*.[20] Words appearing after negators were controlled for segmental content; these were limited to words composed exclusively of sonorants and vowels, so that an uninterrupted F_0 track could be extracted from that area. Our Northern Saisiyat informant confirmed that all experimental sentences were grammatical and acceptable.

To avoid the possible confound of semantic discrepancy between the two sets of materials, the English experimental sentences were designed to be translations of the Saisiyat sentences. In the English materials, however, the subject's name was changed from "'Œbaj" to "Bob," as given in (17).

ENGLISH SENTENCES

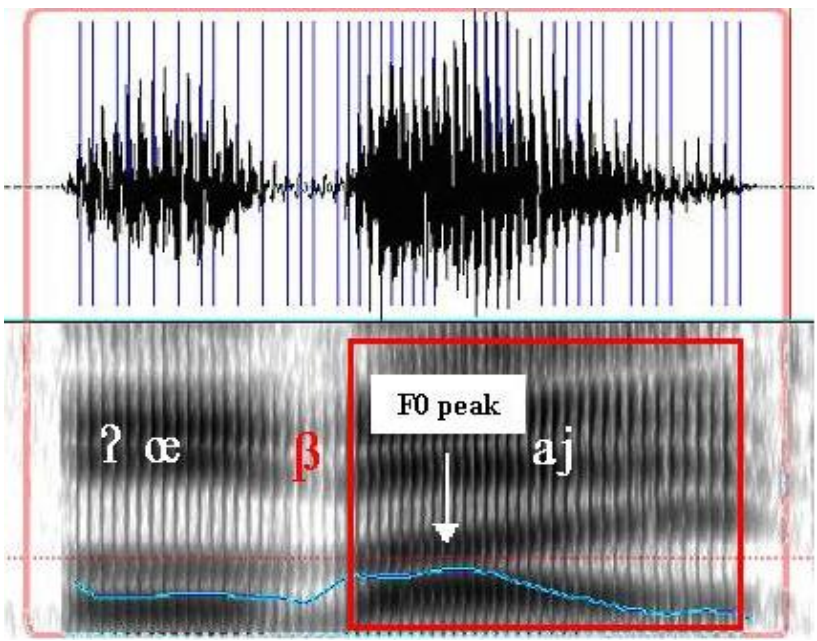
(17) a. Bob is my brother. (affirmative)
b. Bob is not my brother. (negative)

19. In (15a–b), the presence of the interrogative particle *aj* marks these sentences as interrogative.
20. We chose bisyllabic negators to better match bisyllabic subjects in experimental materials. Among bisyllabic negators, we did not include *ʔamkik* and *ʔamkay*, which have been classified as negators blended with the future tense marker *ʔam* (Yeh 2000). We did not include *ʔiziʔ,* because it is an imperative negator, which would have disrupted SVO word order. Also excluded was the trisyllabic negator *ʔinʔiniʔ* 'not yet,' because its relatively complex syntactic structure would have made the sentence in which it appeared differ substantially from the other experimental items.

Note that negation in both the Saisiyat and English materials was designed not to elicit a narrow-focus contrastive reading (e.g., 'Œbaj is not *X's* brother, but he could be someone else's), but to have a broad-focused reading over the predicate. The subjects were instructed to answer the negative sentences with a broad-focused reading in both languages. After the informants had answered one question, both the researcher and the informant listened to the recorded response to determine whether it had been fluently and naturally pronounced. If not, or if the informant had hesitated, he was asked to read it again, until the utterance had been produced to the informant's satisfaction. Then, the informant was instructed to proceed to the next item.

3.1.1.3 Measurement of prosodic prominence. Three prosodic parameters are generally used to realize prominence on a focused or an accented word: fundamental frequency (F_0), higher intensity, and increased duration (see Fox 2000 for a detailed discussion). For our data, the F_0 peak, intensity peak, and duration of the syllable rime (the vowel and coda consonant) appearing in accented syllables were measured using Praat 4.1.19 signal processing software. In the Saisiyat materials, accented syllables of content words were invariably final syllables. For example, in the sentence *ʔœβaj ʔokik minatiniʔ* ''Œbaj is not (someone's) brother,' we measured the F_0 peak and intensity peak in the rime of the last syllable of each word (namely *-aj*, *-ik*, *-iʔ*), because accent in Saisiyat falls on the final syllable. Figure 1 shows the measured area for the word

FIGURE 1. AN EXAMPLE OF F0 PEAK MEASUREMENT FOR THE SAISIYAT WORD 'ŒBAJ (A PROPER NAME)†



† The marked area indicates the measured portion.

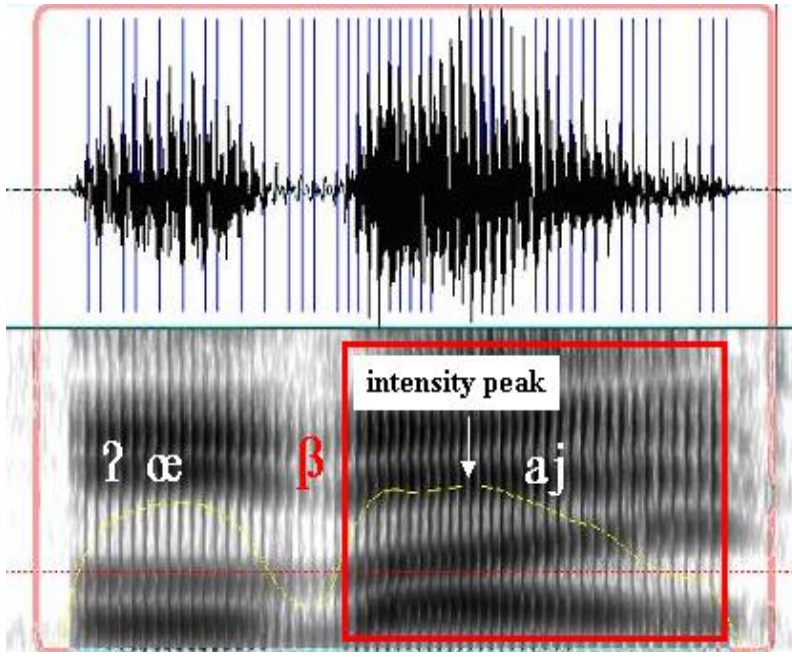
ʔœβaj, with the arrow indicating peak location. The arrow in figure 2 marks the intensity peak for the measured portion of the word *ʔœβaj*.

Syllable onsets were excluded from these measurements to avoid the possible confound of microprosodic variation that would have been introduced by intrinsic F_0 differences in initial consonants. Furthermore, the accusative marker *ka,* which occurs in existential sentences, was also excluded from measurement, because it is unaccented when it appears in isolation. Instead, the accented word following it was measured.

In English, we measured the same three parameters in syllable rimes for the following items in negative sentences: the subject "Bob," the negator "not," and the first syllable of the word (X) that followed the negator. We also measured the same parameters for the subject "Bob" and the X-constituent in affirmative sentences, for the purpose of comparison across utterance types.

3.1.2 Results. Table 5 summarizes comparison among the Northern Saisiyat, Southern Saisiyat, and English informants with respect to their production of both F_0 and intensity peaks. It shows general patterns in affirmative and negative sentences for the Northern Saisiyat informant. In affirmative sentences, the subject *ʔœβaj* is realized with a significantly higher F_0 peak and intensity peak than X is ($t[14]=6.708$, $p<.01$ for F_0 peak, and $t[14]=5.123$, $p<.01$ for intensity peak). In negative sentences, F_0 peak and intensity peak are also realized on the sentential subject. The mean difference between item cate-

FIGURE 2. AN EXAMPLE OF INTENSITY PEAK MEASUREMENT FOR THE SAISIYAT WORD 'ŒBAJ†



† The marked area indicates the measured portion.

gories was found to be significant in a one-way ANOVA ($F[2,42]=7.27$, $p<.01$ for F_0 peak, and $F[2,42]=9.986$, $p<.01$ for intensity peak). A posthoc test indicated that the difference between *ʔæβaj* and X contributes to the contrast in F_0 peak mean ($t[42]=2.17$, $p<.01$), while the contrast in intensity peak mean is created by *ʔæβaj* being significantly higher than both negator and X ($t[42]=3.72$, $p<.01$, $t[42]=4.002$, $p< .01$).[21]

TABLE 5. COMPARISON OF THE F_0 AND INTENSITY PEAKS IN SUBJECT, NEGATOR, AND X-CONSTITUENTS BETWEEN AFFIRMATIVE AND NEGATIVE SENTENCES

AFFIRMATIVE SENTENCES			SUBJECT	X	T-TEST
Northern Saisiyat	F_0 PEAK (HZ)	MEAN	133.22	121.68	t(14)=6.708,
		SD	7.08	6.88	$p<.01$
	INTENSITY PEAK (DB)	MEAN	78.55	75.08	t(14)=5.123,
		SD	1.35	2.91	$p<.01$
Southern Saisiyat	F_0 PEAK (HZ)	MEAN	115.64	99.61	t(14)=6.480,
		SD	5.41	9.93	$p<.01$
	INTENSITY PEAK (DB)	MEAN	76.75	71.97	t(14)=9.957,
		SD	3.10	2.67	$p<.01$
English	F_0 PEAK (HZ)	MEAN	132.76	134.42	t(14)=-.317,
		SD	8.25	14.82	$p=.756$
	INTENSITY PEAK (DB)	MEAN	77.61	70.75	t(14)=7.061,
		SD	1.83	3.91	$p<.01$

NEGATIVE SENTENCES			SUBJECT	NEGATOR	X	ANOVA
Northern Saisiyat	F_0 PEAK (HZ)	MEAN	134.89	127.1	121.29	F(2, 42)=7.27,
		SD	8.17	12.29	8.39	$p<.01$
	INTENSITY PEAK (DB)	MEAN	78.43	75.35	75.12	F(2, 42)=9.986,
		SD	2.69	2.34	1.64	$p<.01$
Southern Saisiyat	F_0 PEAK (HZ)	MEAN	115.73	107.21	100.43	F(2, 42)=12.772,
		SD	7.08	7.23	10.23	$p<.01$
	INTENSITY PEAK (DB)	MEAN	76.4	72.35	70.83	F(2, 42)=7.551,
		SD	3.61	4.44	4.09	$p<.01$
English	F_0 PEAK (HZ)	MEAN	130.77	142.73	110.69	F(2, 42)=122.816,
		SD	4.67	5.17	6.89	$p<.01$
	INTENSITY PEAK (DB)	MEAN	77.24	72.63	68.5	F(2,42)=46.147,
		SD	2.24	1.63	3.31	$p<.01$

21. Duration data have been temporarily excluded from this section, because our Saisiyat and English sentences contain words that have different nuclear vowels, syllable structures, and syllabicities. The variations in duration caused by these factors would have been likely to distort our overall analysis. Yaeger-Dror (2002:1497) found that "many factors influence duration" and "while duration was coded, it has not been a useful measure." Duration measurements have been included in section 4, where tokens of the same item were compared between affirmative and negative sentences within the same language. The results of Experiment 2 (see 3.2) also include Saisiyat duration data for Saisiyat experimental items whose rimes were designed to be uniform in duration.

The Southern Saisiyat informant's data display patterns similar to those of the Northern Saisiyat informant. Both F_0 and intensity peaks are realized on the sentential subject in affirmative sentences (for F_0 peak: $t[14]=6.480$, $p<.01$; for intensity peak: $t[14]=9.957$, $p<.01$). Similarly, the three items in negative sentences are significantly different with respect to both parameters (for F_0 peak: $F[2,42]=12.772$, $p<.01$; for intensity peak: $F[2,42]=7.551$, $p<.01$). A posthoc test revealed that the significant difference emerges as the result of differences between the subject and X (F_0 peak: $t(42)=5.04$, $p<.01$; intensity peak: $t(42)=3.758$, $p<.01$).

The English informant's data with respect to intensity peak are similar to the Saisiyat informants' data; the highest intensity peak is located in the sentential subject for both affirmative and negative sentences (affirmative: $t[14]=7.061$, $p<.01$; negative: $F[2,42]=46.147$, $p<.01$). However, the English informant's data differ with respect to F_0 peak. In affirmative sentences, the sentential subject and X have F_0 peaks at similar values, which show no significant difference. In negative sentences, the highest F_0 peaks are realized on negators (142.73 Hz) and the values among three items are significantly different ($F[2,42]=122.816$, $p<.01$). A posthoc test showed that the mean differences in F_0 and intensity peak among the three item types are all significant (F_0 peak: subject vs. negator: $t[42]=5.79$, $p<.01$; subject vs. X: $t[42]=9.72$, $p<.01$; negator vs. X: $t[42]=15.51$, $p<.01$; intensity peak: subject vs. negator: $t[42]=5.06$, $p<.01$; subject vs. X: $t[42]=9.60$, $p<.01$; negator vs. X: $t[42]=4.54$, $p<.01$).

To investigate the possibility of individual variation among sentences, we calculated the occurrence frequency of highest F_0 peak and intensity peak on each item in a sentence separately for all experimental sentences; these calculations appear in table 6. As displayed in the table, Saisiyat and English differ from each other with respect to F_0 peak realization in negative and affirmative sentences. For the two Saisiyat speakers, the highest F_0 and intensity peaks in sentences are mostly realized on sentential subjects (F_0 peak:

TABLE 6. F_0 AND INTENSITY PEAK LOCATION FOR THREE ITEM TYPES IN AFFIRMATIVE AND NEGATIVE SENTENCES

AFFIRMATIVE SENTENCES

SPEAKER	PROSODIC PARAMETERS	SUBJECT	X
Northern Saisiyat	HIGHEST F0 PEAK (HZ)	100%	0%
	HIGHEST INTENSITY PEAK (DB)	100%	0%
Southern Saisiyat	HIGHEST F0 PEAK (HZ)	100%	0%
	HIGHEST INTENSITY PEAK (DB)	100%	0%
English	HIGHEST F0 PEAK (HZ)	78.6%	21.4%
	HIGHEST INTENSITY PEAK (DB)	100%	0%

NEGATIVE SENTENCES

SPEAKER	PROSODIC PARAMETERS	SUBJECT	NEGATOR	X
Northern Saisiyat	HIGHEST F0 PEAK (HZ)	80%	20%	0%
	HIGHEST INTENSITY PEAK (DB)	100%	0%	0%
Southern Saisiyat	HIGHEST F0 PEAK (HZ)	100%	0%	0%
	HIGHEST INTENSITY PEAK (DB)	93.3%	6.7%	0%
English	HIGHEST F0 PEAK (HZ)	0%	100%	0%
	HIGHEST INTENSITY PEAK (DB)	100%	0%	0%

from 80–100 percent; intensity peak: from 93.3–100 percent). Exceptions are found in the Northern Saisiyat speaker's negative sentences 4, 5, and 6, in which the negator *haʃɑ̀ʔ* received the highest F_0 peak. An exception in intensity peak location occurs in the Southern Saisiyat speaker's negative sentence 12, with his highest intensity peak falling on the negator *ʔokɑ̀ʔ*.[22]

The English speaker, in contrast, realizes 78.6 percent of the highest F_0 peaks on sentential subjects in affirmative sentences, and 100 percent of his highest F_0 peaks on the negator in negative sentences. Intensity peaks are realized on sentential subjects in all experimental sentences (100 percent).

3.2 EXPERIMENT 2: *-aj* SENTENCES. The English data analyzed in Experiment 1 provide evidence to support the Cognitive Prominence Principle, because the English informant invariably realized F_0 peaks on negators.

In Experiment 2, to investigate the possibility that microprosodic effects of the *-aj* rime in the subject *ʔœβaj* skewed the results of Experiment 1, another 15 sentences were constructed for Saisiyat, each word of which has an *-aj* rime, an example of which appears in (18).[23]

(18) Researcher: ʔœβaj βəːaj aj?
'Œbaj give PARTICLE
'Does 'Œbaj give (something)?'

Informant: ʔœβaj ʔokaj βəːaj.
'Œbaj NEG give
''Œbaj does not give (something).'

If we obtain similar results holding vowel quality constant across item types, it diminishes the likelihood that *aj* is simply intrinsically higher in F_0 and/or intensity than other vowels. Furthermore, because each of the tested items in Experiment 2 contains the same rime, duration comparisons can be made across items.

3.2.1 Results. As can be seen in table 7, the subject *ʔœβaj* remains the most prominent item for all parameters measured except duration, even when the last three items were controlled for vowel quality. In Experiment 2, F_0 peak and intensity peak location measurement results are similar to those of Experiment 1; peaks fall mostly on sentential subjects (86.6–100 percent) in both affirmative and negative sentences. F_0 peak is invariably realized on the subject for both Saisiyat speakers. Intensity peaks are also most often realized on sentential subjects, with three exceptions: the negator in the ninth sentence and the X-*aj* in the fifteenth sentence for the Northern Saisiyat speaker, and the X-*aj* in the sixth sentence for the Southern Saisiyat speaker.[24]

A posthoc test showed that the significance of both F_0 and intensity peak results stems from the mean difference between *ʔœβaj* and *ʔokaj*, *ʔœβaj* and X-*aj*. That is to say, the F_0 and intensity peaks of *ʔœβaj* are significantly higher than *ʔokaj* (F_0 peak: $t[42]=4.91$, $p<.01$; intensity peak: $t[42]=4.03$, $p<.01$) and X-*aj* (F_0 peak: $t[42]=6.94$, $p<.01$; intensity peak: $t[42]=4.48$, $p<.01$).

22. Because the percentage of exceptions is low, we can find no systematic explanation to account for them. We regard the F_0 prominence of *haʃɑ̀ʔ* for Northern Saisiyat speakers as an idiosyncratic variation.
23. A complete list of sentences is given in appendix B.
24. As in Experiment 1, the percentage of exceptions is too small to offer any systematic explanation.

The Southern Saisiyat informant's data are similar to those of the Northern Saisiyat informant. The subject *ʔæβaj* is still the most prominent in terms of both F_0 and intensity peaks. In addition, a posthoc test revealed that the subject *ʔæβaj* is significantly higher than both *ʔokaj* (F_0 peak: $t[42]=6.07$, $p<.01$; intensity peak: $t[42]=5.57$, $p<.01$) and X-*aj* (F_0 peak: $t[42]=5.68$, $p<.01$; intensity peak: $t[42]=3.45$, $p<.01$).

In terms of rime duration, however, the rimes of sentential subjects are not found to be longer than those of other constituents. The mean rime duration for sentential subjects is in between that of the negator and the X-*aj* constituent for the two Saisiyat speakers. In the Northern Saisiyat informant's case, the negator has the longest rime duration (0.403 seconds). A posthoc test demonstrated that the overall difference ($F[2, 42]=10.255$, $p<.01$) is the result of the significant contrast between the negator and the X-*aj* constituent. In the Southern Saisiyat informant's case, X-*aj* has the longest duration (0.274 seconds); in this case, it is the contrast between X-*aj* and the negator that produces the overall difference ($F[2, 42]=5.993$, $p<.01$).

4. COMPARISON OF AFFIRMATIVE AND NEGATIVE SENTENCES IN SAISIYAT AND ENGLISH.

In this section, we investigate the prosodic differences between affirmative and negative sentences, comparing the F_0 peak, intensity peak, and duration of sentential subjects and X constituents. In addition, we compare affirmative and negative sentences in terms of subject-X pair differences, to determine whether the

TABLE 7. LOCATION OF F_0 AND INTENSITY PEAK FOR SUBJECT, NEGATOR, AND X IN NEGATIVE SENTENCES (THREE ITEM RIMES CONTROLLED AS *–aj*)

NORTHERN SAISIYAT		SUBJECT	NEGATOR	X	ANOVA
pitch peak (Hz)	MEAN	134.99	118.16	111.2	$F(2, 42)=25.496$, $p<.01$
	SD	9.57	11.95	5.45	
highest F_0 †		100%	0%	0%	
intensity peak (dB)	MEAN	65.94	63.34	63.05	$F(2, 42)=12.185$, $p<.01$
	SD	1.27	1.39	2.41	
highest intensity ‡		86.6%	6.7%	6.7%	
duration (sec)	MEAN	0.364	0.403	0.335	$F(2, 42)=10.255$, $p<.01$
	SD	0.042	0.038	0.042	
SOUTHERN SAISIYAT		**SUBJECT**	**NEGATOR**	**X**	**ANOVA**
pitch peak (Hz)	MEAN	136.93	121.49	122.49	$F(2, 42)=23.084$, $p<.01$
	SD	4.71	7.2	8.45	
highest F_0 †		100%	0%	0%	
intensity peak (dB)	MEAN	71.69	67.95	69.37	$F(2, 42)=15.812$, $p<.01$
	SD	1.51	1.46	2.40	
highest intensity ‡		93.3%	0%	6.7%	
duration (sec)	MEAN	0.267	0.226	0.274	$F(2, 42)=5.993$, $p<.01$
	SD	0.041	0.038	0.044	

† Frequencies of cases that carry the highest Fo in the negative sentence.
‡ Frequencies of cases that carry the highest intensity in the negative sentence.

appearance of a negator in a sentence will affect the F_o drop-off (declination) of its intonational contour. Second, we compare the difference between the F_o height changes in subject-negator pairs with those in negator-X pairs for both English and Saisiyat negative sentences. If differences exist, it is possible that the presence of a negator causes different kinds of global intonational modification in different languages.

4.1 METHODOLOGY. The original 15 pairs of Saisiyat and English negative and affirmative sentences used in Experiment 1 were reanalyzed to compare the F_o peak, intensity peak, and syllable rime duration of sentential subjects and Xs between affirmative and negative sentences. Example sentences appear below in (19) and (20).

SAISIYAT SENTENCES

(19) a. Affirmative: ʔœβaj minatiniʔ.
'Œbaj brother
''Œbaj is (someone's) brother.'

b. Negative: ʔœβaj ʔokik minatiniʔ.
'Œbaj NEG brother
''Œbaj is not (someone's) brother.'

ENGLISH SENTENCES

(20) a. Affirmative: Bob is my brother.
b. Negative: Bob is not my brother.

In addition, pair differences between the same item appearing in an affirmative and a negative sentence were calculated as:

a. F_o peak difference: | F_o $peak_A$ – F_o $peak_B$ | (in Hz)
b. intensity peak difference: | intensity $peak_A$ – intensity $peak_B$ | (in dB)

The following pair differences were calculated for both languages: (1) subject-X pairs in affirmative sentences, (2) subject-negator pairs, and (3) negator-X pairs in negative sentences.

4.2 RESULTS

4.2.1 Sentential subjects in affirmative and negative sentences. Analysis of sentential subjects in the three informants' affirmative and negative sentences is given in table 8. The Northern Saisiyat informant's data show that, although there are small differences between the prosodic parameter values of sentential subjects in affirmative and negative sentences, none of those differences is statistically significant. The results of the Southern Saisiyat informants' data do not deviate from those of the Northern Saisiyat informant. Small differences in these prosodic parameters do exist, but none of them is statistically significant. Furthermore, there is no statistically significant difference in the F_o and intensity of sentential subjects between affirmative and negative sentences in English.

4.2.2 Xs in affirmative and negative sentences. Results of the X item analysis for the three informants' data are given in table 9. Both the Northern and Southern Saisiyat informants' data show no statistically significant differences in X items

between utterance types. The English informant's data, in contrast, exhibit statistically significant differences in X items between utterance types for all parameters measured, with the exception of duration. F_0 and intensity in X items are significantly higher in English affirmative sentences than they are in negative sentences.

TABLE 8. COMPARISON OF THE F_0 PEAK, INTENSITY PEAK, AND DURATION OF SENTENTIAL SUBJECTS BETWEEN AFFIRMATIVE AND NEGATIVE SENTENCES

NORTHERN SAISIYAT	AFFIRMATIVE		NEGATIVE		MEAN DIFFERENCE	PAIRED SAMPLE T-TEST
	MEAN	SD	MEAN	SD		
Fo peak (Hz)	133.22	7.08	134.89	8.17	1.66	$t(14)=-.852$, $p=.409$
intensity peak (dB)	70.99	29.68	78.43	2.69	7.44	$t(14)=-.954$, $p=.356$
duration (sec)	0.33	0.05	0.37	0.04	0.45	$t(14)=-2.837$, $p=.013$
SOUTHERN SAISIYAT	**AFFIRMATIVE**		**NEGATIVE**		**MEAN DIFFERENCE**	**PAIRED SAMPLE T-TEST**
	MEAN	**SD**	**MEAN**	**SD**		
Fo peak (Hz)	115.64	5.41	115.73	7.08	0.935	$t(14)=-.053$, $p=.958$
intensity peak (dB)	76.75	3.10	76.40	3.61	0.35	$t(14)=.524$, $p=.608$
duration (sec)	0.27	0.04	0.28	0.04	0.007	$t(14)=-0.559$, $p=.585$
ENGLISH	**AFFIRMATIVE**		**NEGATIVE**		**MEAN DIFFERENCE**	**PAIRED SAMPLE T-TEST**
	MEAN	**SD**	**MEAN**	**SD**		
Fo peak (Hz)	132.76	8.25	130.77	4.67	1.989	$t(14)=.733$, $p=.476$
intensity peak (dB)	77.61	1.83	77.24	2.24	0.37	$t(14)=.613$, $p=.550$
duration (sec)	0.14	0.03	0.15	0.02	0.0015	$t(14)=-0.191$, $p=.851$

TABLE 9. COMPARISON OF F_0 PEAK, INTENSITY PEAK, AND DURATION OF ITEM X BETWEEN AFFIRMATIVE AND NEGATIVE SENTENCES

	AFFIRMATIVE		NEGATIVE		MEAN DIFFERENCE	PAIRED SAMPLE T-TEST
	MEAN	SD	MEAN	SD		
NORTHERN SAISIYAT						
Fo peak (Hz)	121.68	6.88	121.29	8.39	0.388	$t(14)=0.203$, $p=.842$
intensity peak (dB)	75.08	2.91	75.12	1.64	0.04	$t(14)=0.953$, $p=.357$
duration (sec)	0.29	0.12	0.29	0.1	0.0007	$t(14)=-0.043$, $p=.966$
SOUTHERN SAISIYAT						
Fo peak (Hz)	99.61	9.93	100.43	10.23	0.818	$t(14)=-0.313$, $p=.759$
intensity peak (dB)	71.97	2.67	70.83	4.09	1.14	$t(14)=1.477$, $p=.162$
duration (sec)	0.24	0.08	0.24	0.08	0.002	$t(14)=0.219$, $p=.830$
ENGLISH						
Fo peak (Hz)	134.42	14.82	110.69	6.89	23.729	$t(14)=7.236$, $p<.01$
intensity peak (dB)	70.75	3.91	68.50	3.31	2.25	$t(14)=4.983$, $p<.01$
duration (sec)	0.29	0.13	0.28	0.11	0.124	$t(14)=0.449$, $p=.660$

4.2.3 Global intonational change across utterance types. To investigate the possibility that global intonational change is triggered by the presence of a negator, we provide a direct comparison of F_0 and intensity values of subject and X between negative and affirmative sentences in table 10. A direct comparison of subject and X shows no significant difference between their parameter values in affirmative and negative sentences. This result is consistent with the comparisons presented in 4.2.1 and 4.2.2 for the two Saisiyat informants; their subject and X did not differ significantly across sentence types. As for the English informant, the subject and X difference is relatively large (20.09 Hz in F_0 peak and 8.74 dB in intensity peak), but this difference is not significant across sentence types. The other two pair differences (subject-negator vs. negator-X) are compared within negative sentences; the results appear in table 11.

The results reveal distinctive differences in F_0 peak between Saisiyat and English negative sentences. For the Saisiyat informants, the level of F_0 height change between subject-negator and negator-X is quite similar (13.45 Hz and 13.07 Hz for Northern Saisiyat, 10.68 Hz and 9.20 Hz for Southern Saisiyat). For the English speaker, however, the degree of F_0 height change differs significantly between subject-negator and negator-X. The difference between negator and X (32.04 Hz) is larger than that between subject and negator (11.95 Hz) ($t[14]=11.296$, $p<.01$). As for intensity peak values, only the Northern Saisiyat informant shows a significant difference between subject-negator and negator-X.

TABLE 10. SUBJECT-X PAIR DIFFERENCES IN F_0 PEAK, AND INTENSITY PEAK BETWEEN AFFIRMATIVE AND NEGATIVE SENTENCES

	AFFIRMATIVE		NEGATIVE		MEAN DIFFERENCE	PAIRED SAMPLE T-TEST
	MEAN	SD	MEAN	SD		
NORTHERN SAISIYAT						
Fo PEAK (Hz)	11.54	6.66	13.60	8.07	2.05	$t(28)=-0.760$, $p=.453$
INTENSITY PEAK (dB)	3.67	2.33	3.94	1.81	0.27	$t(28)=-0.356$, $p=.725$
SOUTHERN SAISIYAT						
Fo PEAK (Hz)	16.69	8.28	16.00	8.45	0.69	$t(28)=0.226$, $p=.823$
INTENSITY PEAK (dB)	4.78	1.86	5.57	2.02	0.79	$t(28)=-1.118$, $p=.273$
ENGLISH						
Fo PEAK (Hz)	12.94	15.26	20.09	6.89	7.14	$t(28)=-1.652$, $p=.110$
INTENSITY PEAK (dB)	6.86	3.76	8.74	4.19	1.88	$t(28)=-1.293$, $p=.206$

TABLE 11. COMPARISON OF F_0 PEAK AND INTENSITY PEAK BETWEEN SUBJECT–NEGATOR AND NEGATOR–X PAIRS IN NEGATIVE SENTENCES

	SUBJECT-NEGATOR		NEGATOR-X		MEAN DIFFERENCE	PAIRED SAMPLE T-TEST
	MEAN	SD	MEAN	SD		
NORTHERN SAISIYAT						
Fo PEAK (Hz)	13.45	8.42	13.07	7.88	0.38	$t(14)= 0.117$, $p=.909$
INTENSITY PEAK (dB)	4.53	2.30	1.81	1.25	2.72	$t(14)=4.433$, $p<.01$
SOUTHERN SAISIYAT						
Fo PEAK (Hz)	10.68	5.81	9.20	4.10	1.48	$t(14)=0.778$, $p=.450$
INTENSITY PEAK (dB)	4.25	2.47	2.54	1.88	1.71	$t(14)=2.069$, $p=.058$
ENGLISH						
Fo PEAK (Hz)	11.95	6.83	32.04	8.82	20.09	$t(14)=11.296$, $p<.01$
INTENSITY PEAK (dB)	4.61	2.48	4.53	3.28	0.07	$t(14)=0.071$, $p=.945$

5. DISCUSSION AND CONCLUSION. The major findings of this paper are summarized in this section, and possible explanations are offered to account for the prosodic differences observed between Saisiyat and English.

5.1 CORRESPONDENCE BETWEEN PROSODIC PROMINENCE AND SYNTACTIC SUBJECT IN SAISIYAT. Although negators have been shown to be prosodically prominent with respect to F_0 in our English data, they are not the most acoustically prominent items in Saisiyat negative sentences. Thus, our results show that the "Cognitive Prominence Principle" holds for English negators but not for those in Saisiyat. Saisiyat informants realize more acoustic prominence on sentential subjects in negative sentences than they do on any other items. Because the posthoc test in Experiment 1 showed that there are significant differences among all three item types in English negative sentences, we suggest that there is a principled difference in prominence-ranking orders between English and Saisiyat negative sentences. The ranking order for English would be negator > subject > X, and for Saisiyat, subject > negator or X.

In addition, a disjunction between mean F_0 peak and intensity peak can be observed in the English data. In Experiment 1, the highest mean F_0 peak falls on English negators, but the highest mean intensity peak falls on sentential subjects. The English informant's reliance on F_0 to realize prominence on the negator confirms previous findings demonstrating F_0 to be the primary prosodic parameter used to express focal prominence in English (Bolinger 1958, and see Yaeger-Dror 2002:1497 for literature review).[25]

We propose, on the basis of our Saisiyat results, that syntactic position determines prosodic prominence in Saisiyat; prosodic prominence will tend to fall on the noun that appears as the sentential subject. Because SVO is the predominant word order in Saisiyat, the focused argument (the sentential subject) occurs at or near the beginning of a sentence. Although this study's materials include only agent-focused sentences, Chiang's (2005) data show that both the agent in agent-focused sentences and the patient in patient-focused sentences receive prosodic prominence.[26] The high cooccurrence of prosodic prominence and sentential subjects in Chiang (2005) provides further evidence for syntactically determined prominence in Saisiyat.[27] It remains to be seen whether the Austronesian languages of Taiwan with VOS word order would exhibit patterns similar to those found in our Saisiyat data.

5.2 TRANSPARENCY OF THE NEGATION SYSTEM IN SAISIYAT. It is possible that division of negation functions into several separate morphemes in Saisiyat may increase the transparency of the negation system. Thus, there is no need

25. Yaeger-Dror (2002:1497) claimed that speakers of Standard American English have different patterns in production of fundamental frequency and intensity: "Amplitude generally appears to covary with fundamental frequency."

26. Chiang's thesis (2005) was under the supervision of the first author of this paper.

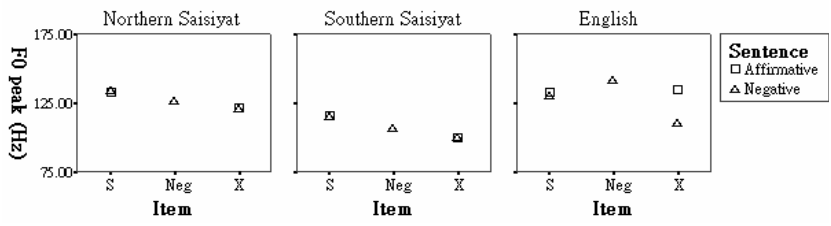
27. Because focused nouns usually occur early in Saisiyat sentences, one might argue that the "global utterance intonation contour" quite often exhibits declination effects, which could contribute to onsets having a higher pitch than offsets. Previous studies have demonstrated that the declination shown in declarative sentences does not necessarily make the first stressed word more perceptually prominent than subsequent words, nor the last word less prominent than those preceding it. Because our study investigated production rather than perception, it remains to be seen whether acoustically prominent items are also perceptually prominent.

to increase articulatory effort by raising F_0 to highlight negators. Recently, there has been a growing trend to incorporate functional considerations into phonological theory (e.g., Boersma 1998, Flemming 2004). For example, Flemming (2004) proposes that phonological contrast is achieved through competing interaction of the following three constraints: (1) maximizing the distinctiveness of contrasts, (2) minimizing articulatory effort, and (3) maximizing the number of contrasts in a language's inventory. These three functional goals may come into conflict. Applying Flemming's constraints to the phenomena observed in Saisiyat, we propose that the number of contrasts in the Saisiyat negation system has already been maximized by its large inventory of negative morphemes, and that the distinctiveness of those contrasts has already been maximized by the cooccurrence restrictions on those morphemes, so no extra articulatory efforts need be made to prosodically highlight negators.

5.3 CORRESPONDENCE BETWEEN PROSODIC PROMINENCE AND SEMANTICALLY DEFINED FOCUS IN ENGLISH. To investigate whether the presence of a negator may trigger global intonational modification, we made additional comparisons (described in detail in 4.2.3) whose three major findings are summarized here: (1) The English negator becomes prominent in F_0 and intensity through its contrast with the X item, while in Saisiyat, there is no significant difference in the F_0 values of negators and X items.[28] (2) F_0 drop-off from the sentential subject to X does not differ significantly between affirmative and negative sentences for Saisiyat informants. (3) There is a greater F_0 height change from negator to X than from subject to negator in English, while in Saisiyat there is no significant difference in the level of the two drop-offs. Figure 3 illustrates this point, providing the F_0 mean for each item in Saisiyat and English affirmative and negative sentences.

Figure 3 shows that the English negator *does* affect global intonational contours; its presence suppresses the F_0 and intensity of the item(s) following it. Saisiyat, in contrast, demonstrates general declination throughout sentences, which is not interrupted by the presence of a negator. We propose that a semantically defined focus item, such as the English negator, requires more articulatory effort than a syntactically defined one does, because the former cannot rely on *linguistic form* to enhance its prominence. Thus,

FIGURE 3. F_0 MEAN FOR EACH ITEM TYPE IN SAISIYAT AND ENGLISH AFFIRMATIVE AND NEGATIVE SENTENCES



28. Note that the intensity of the English negator is significantly higher than that of X, although the subject is the most prominent item in the whole sentence.

English speakers must not only raise F_0 at the negator to increase its prominence, but also lower F_0 at the item(s) following the negator in order to maximize acoustic contrast.

In sum, this paper offers typological explanations for the differences observed between Saisiyat and English. Saisiyat assigns prosodic prominence to focused sentential subjects, while English assigns prosodic prominence to semantically-defined focus items. Moreover, the morphosyntactic transparency of the Saisiyat negation system may allow for minimization of articulatory effort in production of negators. This study contributes to our overall knowledge and understanding of the range of possible strategies for realizing negation across languages; it also provides potential topics for future research, to test whether our proposal can be extended to describe the prosody of VOS-dominant Austronesian languages of Taiwan, or the prosody of other language types.

APPENDIX 1. SAISIYAT SENTENCES AND THEIR CORRESPONDING ENGLISH SENTENCES USED IN EXPERIMENT 1

	SAISIYAT SENTENCES	ENGLISH SENTENCES
1	ʔœβaj minatiniʔ.	'Bob is my brother.'
	ʔœβaj ʔokik minatiniʔ.	'Bob is not my brother.'
2	ʔœβaj lalaor.	'Bob dozes.'
	ʔœβaj ʔokik lalaor.	'Bob does not doze.'
3	ʔœβaj lijaβoʔ.	'Bob is rich.'
	ʔœβaj ʔokik lijaβoʔ.	'Bob is not rich.'
4	ʔœβaj m-atol.	'Bob sings.'
	ʔœβaj haʃaʔ m-atol.	'Bob cannot sing.'
5	ʔœβaj miltamakoʔ.	'Bob smokes.'
	ʔœβaj haʃaʔ miltamakoʔ.	'Bob cannot smoke.'
6	ʔœβaj lalœhaj.	'Bob has fun.'
	ʔœβaj haʃaʔ lalœhaj.	'Bob does not have fun.'
7	ʔœβaj majna:aʔ.	'Bob waits.'
	ʔœβaj ʔokaj ajna:aʔ.	'Bob does not wait.'
8	ʔœβaj mwa:iʔ.	'Bob comes to my place.'
	ʔœβaj ʔokaj wa:iʔ.	'Bob has not come to my place.'
9	ʔœβaj miltamakoʔ.	'Bob smokes.'
	ʔœβaj ʔokaj miltamakoʔ.	'Bob does not smoke.'
10	ʔœβaj hajzaʔ ka lapowar.	'Bob has a guava.'
	ʔœβaj ʔokaʔ ka lapowar.	'Bob does not have a guava.'
11	ʔœβaj hajzaʔ ka laroʔ.	'Bob has a persimmon.'
	ʔœβaj ʔokaʔ ka laroʔ.	'Bob does not have a persimmon.'
12	ʔœβaj hajzaʔ ka mona:.	'Bob has a snail.'
	ʔœβaj ʔokaʔ ka mona:.	'Bob does not have a snail.'
13	ʔœβaj ʔam lapowar.	'Bob wants a guava.'
	ʔœβaj kajniʔ lapowar.	'Bob does not want a guava.'
14	ʔœβaj ʔam laroʔ.	'Bob wants a persimmon.'
	ʔœβaj kajniʔ laroʔ.	'Bob does not want a persimmon.'
15	ʔœβaj ʔam mona:.	'Bob wants a snail.'
	ʔœβaj kajniʔ mona:.	'Bob does not want a snail.'

APPENDIX 2. DESIGNED NEGATIVE SAISIYAT SENTENCES USED IN EXPERIMENT 2

NO.	SAISIYAT SENTENCES	ENGLISH TRANSLATIONS
1	ʔœβaj ʔokaj βəːaj.	''Œbaj does not give (something).'
2	ʔœβaj ʔokaj sanraj.	''Œbaj does not marry.'
3	ʔœβaj ʔokaj ramramaj.	''Œbaj does not comfort (someone).'
4	ʔœβaj ʔokaj sowaj.	''Œbaj does not grip (something).'
5	ʔœβaj ʔokaj kipazaj.	''Œbaj does not cut the paddy.'
6	ʔœβaj ʔokaj kiβowaj.	''Œbaj does not pick the fruit.'
7	ʔœβaj ʔokaj ʔælipowaj.	''Œbaj is not covered by a blanket.'
8	ʔœβaj ʔokaj inkonkonaj.	''Œbaj does not roll down.'
9	ʔœβaj ʔokaj rasiwazaj.	''Œbaj does not divorce.'
10	ʔœβaj ʔokaj tisko-æwhaj.	''Œbaj does not say anything wrong.'
11	ʔœβaj ʔokaj pasaj.	''Œbaj did not die.'
12	ʔœβaj ʔokaj ʔasʔasaj.	''Œbaj does not waste (food or money).'
13	ʔœβaj ʔokaj ʔiʃtalaj.	''Œbaj has not stopped (walking).'
14	ʔœβaj ʔokaj βalβalaj.	''Œbaj was not excited.'
15	ʔœβaj ʔokaj kakowaj.	''Œbaj does not move.'

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