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Duration Correlates of Nasal Consonants in Akan

Lawrence Bosiwah

Abstract - *The study examines the duration of Akan nasal consonants at different word positions. In all, 70 speakers were recorded, ten from each of the seven Akan communities, made up of five males and five females. The subjects were asked to repeat the words presented in a carrier frame “Ɔse {key word} anaa?” [ɔsɪ...anaa] three times, which were recorded and analyzed using Kay Elemetrics Computerized Speech Laboratory (CSL) model 4500 software. The study reveals that the bilabial nasal [m] has the longest duration, followed by the alveolar nasal [n], the velar nasal [ŋ] and the palatal nasal [ɲ] respectively. At different word-positions, the duration at word-initial is longer than word-medial and word-final, as that of word-medial is also longer than word-final¹.*

Key Words - Akan, acoustics, duration, nasals, spectrographic analysis

I. INTRODUCTION

Akan, which belongs to the Kwa language family spoken in Ghana and some parts of Côte d'Ivoire in West Africa, is a tonal language. The language has several dialects such as Akuapem, Asante, Akyem, Fante, Wassa, Bono, Kwahu, Akwamu, Assin, Twifo, Denkyira, Agona, Bremang, and Adanse. The speakers occupy the middle and the southern parts of Ghana. This comprises Western, Central, Eastern, Brong-Ahafo, Ashanti Regions of Ghana and some parts of Volta Region and Côte d'Ivoire. From the linguistic point of view, Akan falls into two main divisions, the Fante (also known as Fantse or Mfantse) and Twi, (see Ward, 1967). The term “Twi” is now used as a label for the varieties of Akan spoken in such areas as Akuapem, Akwamu, Akyem, Assin, Twifo, Asante, Denkyira, Kwahu, and Bono, while “Fante” is spoken along the coast between Sekondi-Takoradi in the Western Region and Accra in the Greater Accra Region of Ghana (see Boadi, 1997). Slightly more than 45 percent of Ghanaians speak Akan as their first language (see Akpanglo-Nartey 2006:2). The Ahanta, Nzema, Sefwi, Aowin, Effutu, Awutu, Senya, Anum, Larteh, and Kyerepong, speak Akan as their second language. “It is also widely spoken as a second language especially in the state capital, Accra, and all the regional capitals, for trade and commerce”, (Boadi, 1997:3).

1. This paper was extracted from the author's M.Phil thesis submitted to the Department of Applied Linguistics, University of Education, Winneba, Ghana.

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The major issue is that, due to its tonality, it is sometimes very difficult to determine a sound change whether it is as a result of tone or duration, especially when it comes to the use of nasals at word-medial position. For instance, in Akan, the word *ama* /àmà/ meaning ‘so that’ is negated by lengthening the nasal sound to become, *amma* /ám:à/ ‘so that not’. Now the question is, is it the tone effect or duration that brings about the changes? This is a preliminary study to establish the duration of Akan singleton nasals acoustically. The areas selected for the study include Fante, Agona, Akuapem, Asante, Akyem and Bremang.

II. PROCEDURE FOR THE STUDY

A. Subjects

Ten adult indigenous speakers were selected between ages 30 and 64 – comprising five males and five females from each of the seven selected communities. The researcher chose adults who had stayed in the various communities almost all their life time and could speak the indigenous dialects without any influence of other dialects.

B. Data Collection

The target syllables are NV, VNV, and CVN, with C =/b/, V=/a/ or [o]/ and N=/m, n, ɲ, ŋ/. The subjects were asked to repeat the words prepared on a carrier frame “Ɔse {key word} anaa?” [ɔsɪ.....anaa] (S/he says...?), three times, which were recorded and analyzed. Sentences containing the target nasal on a two-inch by three cards were written in Fante, Asante Twi and Akuapem Twi, and presented to the speakers to read. Iguae, Gomua, Agona, and Bremang read Fante; Asante and Akyem Twi read Asante Twi, while Akuapem speakers read Akuapem Twi. Four additional stimuli were added to the beginning and the end of the list in order to eliminate ‘beginning’ and ‘end’ effects, (See Rebecca Akpanglo-Nartey 2006: 24. The speakers repeated each sentence three times in the corpus, which constitute eight tokens per target nasal per sub-dialect area, (see Table 1). In all, 24 tokens of each nasal phoneme per dialect per seven dialects per 10 speakers constituting 1680 tokens were analyzed. The speakers were asked to read the carrier sentences as natural as possible. The gloss was given in English for easy

identification and pronunciation and to avoid ambiguity. The sounds were recorded and analyzed. The recording of the speakers were done using a Sony DPC V.O. R. IC digital recorder ICD – MS525. The recording was done in a relaxed and informal atmosphere. The digital recorder was placed about 45⁰, 4 centimeters away from their mouth. This was to reduce noise.

Table 1 Akan word list

WORD	IPA TRANSCRIPTION	ENGLISH GLOSS
ɔman	[ɔman]	country
nkwan	[ŋk ^w an/ŋk ^w aŋ/ŋk ^w ai]	soup
ma	[ma]	give
na	[na]	mother
nya	[ɲa]	get
ama	[ama]	so that
ana	[ana]	did it?
onya	[oɲa]	he/she gets
bam	[bam]	embrace
ban	[ban / baŋ / baĩ /]	fence
nam	[nam]	fish
ampa	[ampa]	true

C. Measurements

The nasal consonants were digitized using Kay Elemetrics Computerized Speech Laboratory (CSL) model 4500 software at a sampling rate of 11025 Hz, filter order 12, pre emphasis 0.900, <500 bandwidth, frame count -360 msec, using Blackman window with a frequency range between 0 Hz and 5,900 Hz for all the nasal sounds at various distributions. CSL is an instrument which analyzes speech sounds into sound waves. It produces a graphic display of a speech sample, which is conventionally referred to as spectrograms. Time is shown along the horizontal axis and the frequency (Hz) along the vertical axis. The amplitude of the frequency at any point is indicated by the intensity of the darkness at that particular point and it is indicated in Hertz (Hz) on the vertical axis. (Also, see Rebecca Akpanglo-Nartey, 2006 and Gbegble, 2006).

Measuring the duration of nasals, the green cursor was put at the onset and the red at the end of the sound. Before the figures were recorded, the sound was played back and listened to. This was to make sure the right sound was measured. Figure 1 and 2 show how the duration measurements were done.

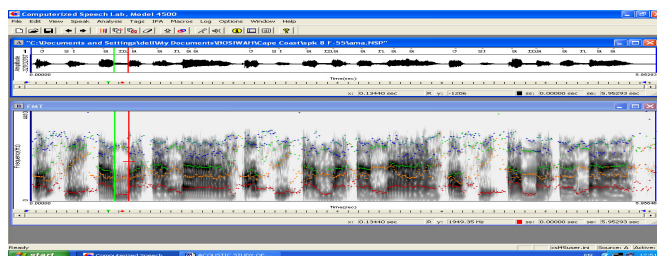


Fig. 1 a waveform (top box) and spectrogram (bottom box) of Iguae Fantse female speaker showing the duration of [m] in [ɔsi ama ana] in three repetitions

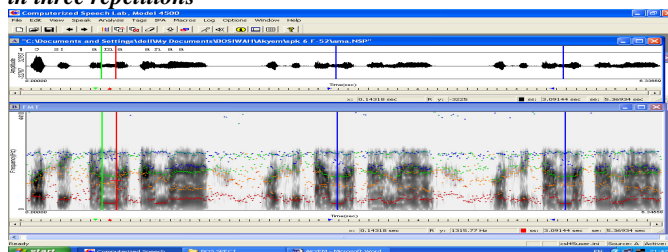


Fig. 2 a waveform (top box) and spectrogram (bottom box) of Akyem Twi male speaker showing the duration of [m] in [ɔsi ama ana] in three repetitions

II. RESULTS

Iguae Fantse

Table 2 below shows the result of nasal duration of Iguae Fantse at word positions measured in milliseconds (ms). It was found out that at word initial [m] is 138 ms , [n], 134 ms and [ɲ] 129 ms. At word medial, [m] is 114 ms, [n] 113 ms, and [ɲ] 112 ms. At word final [m] is 91 ms, and [n] 93 ms. It was also found out in Iguae Fantse that at word-initial and word-medial, [m] is higher than [n] as [n] is also higher than [ɲ]. At the word-final [n] is higher than [m]. It is also realized that [m] at word-initial is 138 ms word-medial 114 ms and word-final 91 ms. The word-initial, medial, and final of [n] are 134 ms, 113 ms and 93 ms respectively. The word initial and word-final of [ɲ] are 129 ms, and 112 ms respectively. All the results in Iguae Fantse show that the initial sounds are higher than medial, as the medial is also higher than word-final. See also Fig. 3 below.

Table 2 showing nasal durations in milliseconds at different word positions for Iguae Fantse speakers

Iguae Fantse	Word Position	m	n	ɲ
	Initial	138	134	129
	Medial	114	113	112
	Final	91	93	

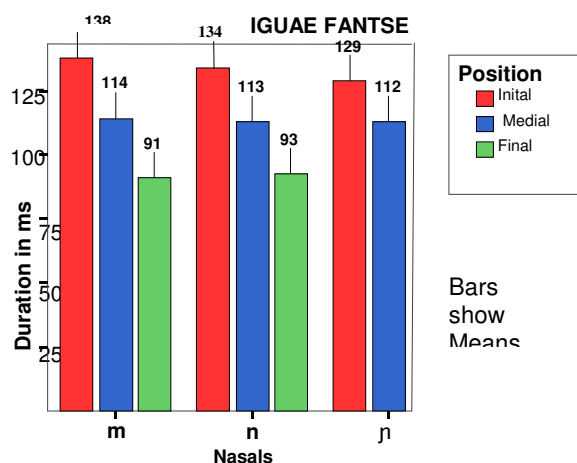


Fig. 3 bar charts showing nasal duration at different word positions for Iguae Fantse speakers

Gomua Fantse

Table 3 below shows the result of nasal duration of Gomua Fantse at word positions measured in milliseconds (ms). It was found out that at word initial [m] is 114 ms, [n], 108 ms and [ɲ] 104 ms. At word medial, [m] is 103 ms, [n] 97 ms, and [ɲ] 98 ms. At word final [m] is 77 ms. Nothing was recorded at [n] at word-final position because there is no occlusion. It was also found out in Gomua Fantse that at word-initial, [m] is higher than [n] as [n] is also higher than [ɲ]. At word-medial [n] has the lowest duration as [m] has the highest. All the nasals have the duration at word-initial being the highest, followed by the word-medial. All the results show that the initial sounds are higher than medial, as the medial is also higher than word-final. See also Fig. 4 below.

Table 3 showing nasal durations in milliseconds at different word positions for Gomua Fantse speakers

Gomua Fantse	Nasal Duration in milliseconds			
	Position	m	n	ɲ
	Initial	114	108	104
Medial	103	97	98	
Final	77			

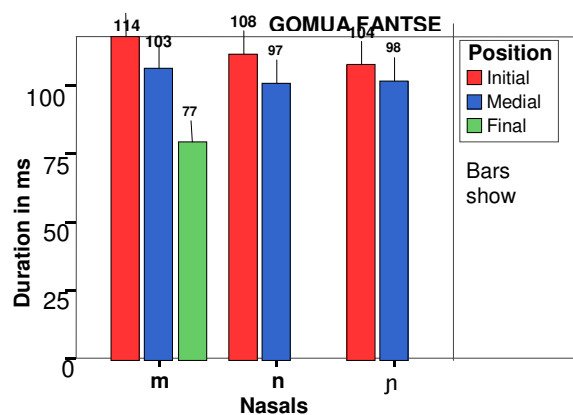


Fig. 4 bar charts showing nasal duration at different word positions for Gomua Fantse speakers

Akuapem Twi

Table 4 shows the result of nasal duration of Akuapem Twi at word positions measured in milliseconds (ms). It was found out that at word initial [m] is 120 ms, [n], 115 ms and [ɲ] 117 ms. At word medial, [m] is 104 ms, [n] 102 ms, and [ɲ] 102 ms. At word final [m] is 90 ms, and [ɲ] 98 ms. In Akuapem, [n] changes to [ɲ] at word-final position. It was also found out in Akuapem Twi that at word-initial position, [n] has the lowest duration as [m] has the highest. At word-medial, [m] is higher than [n], which has equal duration with [ɲ]. At the word-final [ɲ] is higher than [m]. It was also realized that at word positions the duration at word-initial is higher than the medial and final respectively. See also Fig. 5 below.

Table 4 showing nasal durations in milliseconds at different word positions for Akuapem Twi speakers

Akuapem Twi	Nasal Duration in milliseconds			
	Word Position	m	n	ɲ
Initial	120	115		117
Medial	104	102		102
Final	90		98	

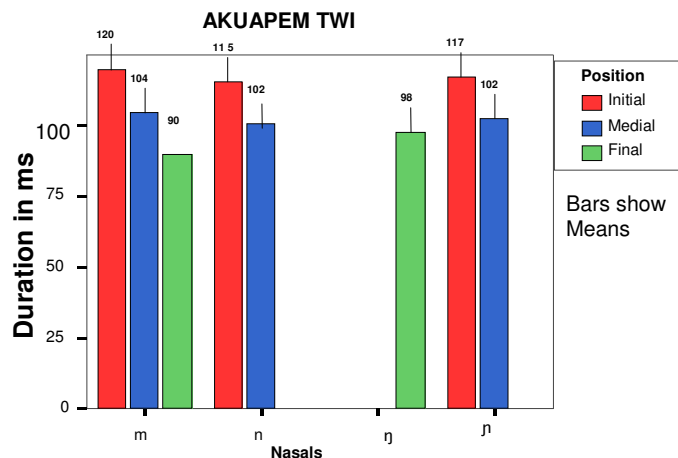


Fig. 5 bar charts showing nasal duration at different word positions for Akuapem Twi speakers

Agona Dialect

Table 5 below shows the result of nasal duration of Agona at word positions measured in milliseconds (ms). It was found out that at word initial [m] is 110 ms, [n], 102 ms and [ŋ] 101 ms. At word medial, [m] is 98 ms, [n] 98 ms, and [ɲ] 94 ms. At word final [m] is 82 ms, and [ŋ] 81 ms. It was also found out in Agona that at word-initial position, [m] has the highest duration, followed by [n], and [ɲ]. At word-medial, [m] and [n] have the same duration, but higher than [ɲ]. This could be that during the production of [n] at word-medial, some speakers stressed on the sound, therefore lengthening it. At word-final [m] is slightly higher than [ŋ]. It was also realized that at word positions the duration at word-initial is higher than the word-medial and word-final respectively. This shows that there is a sound modification or sound change due to the environment in which it occurs. The sounds in different environments are in complementary distribution. See also Fig. 6

Table 5 showing nasal durations in milliseconds at different word positions for Agona speakers

Agona Dialect	Nasal Duration in milliseconds				
	Word Position	m	n	ŋ	ɲ
Initial		110	102		101
Medial		98	98		94
Final		82		81	

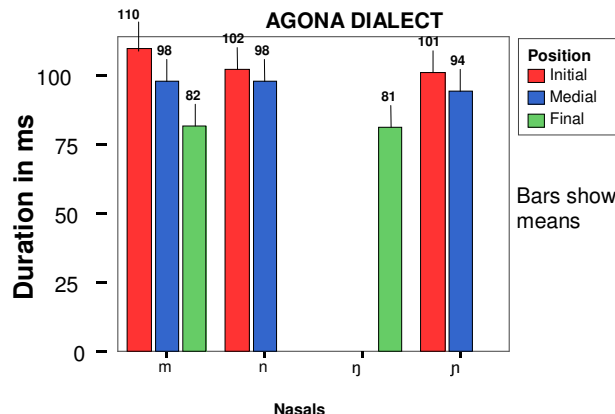


Fig. 6 bar charts showing nasal duration at different word positions for Agona speakers

Bremang Dialect

Table 6 below shows the result of nasal duration of Bremang at word positions measured in milliseconds (ms). It was found out that at word-initial and word-medial [m] has the highest duration, followed by [ɲ], as [n] records the lowest duration. At the word-final [ŋ] is higher than [m]. It is also realized that the nasals at word-initial have the highest duration, followed by word-medial and word-final respectively. See also Fig. 7

Table 6 showing nasal durations in milliseconds at different word positions for Bremang speakers

Bremang Dialect	Nasal Duration in milliseconds				
	Word Position	m	n	ŋ	ɲ
Initial		124	115		118
Medial		113	102		107
Final		82		83	

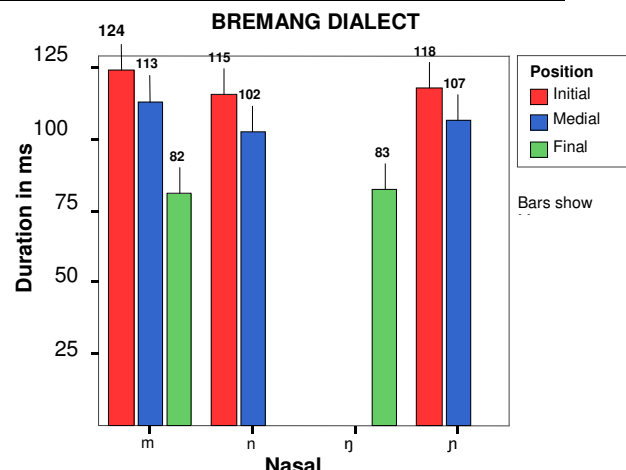


Fig. 7 bar charts showing nasal duration at different word positions for Bremang speakers

Asante Twi

Table 7 below shows the result of nasal duration of Asante Twi at word positions measured in milliseconds (ms). It was found out that at word-initial [ɲ] is higher than [m] and [n], which have equal duration. At word-medial [m] has the highest duration, followed by [ɲ], as [n] records the lowest duration. It is also realized that the nasals at word-initial have the highest duration, followed by word-medial and word-final respectively. See also Fig.8.

Table 7 showing nasal durations in milliseconds at different word positions for Asante Twi speakers

Asante Twi	Nasal Duration in milliseconds			
	Word Position	m	n	ɲ
Initial	105	105	106	
Medial	103	99	100	
Final	86			

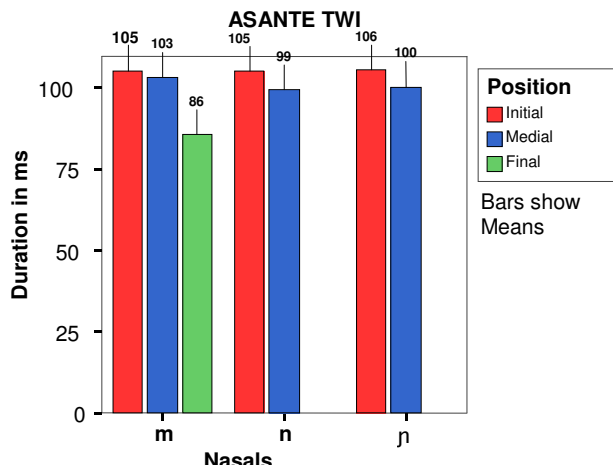


Fig.8 bar charts showing nasal duration at different word positions for Asante Twi speakers

Akyem Twi

Table 8 below shows the result of nasal duration of Asante Twi at word positions measured in milliseconds (ms). It was found out that at word-initial, word-medial and word-final, [m] has higher duration than [n] and [ɲ] respectively. It is also realized that the nasals at word-initial have the highest duration, followed by word-medial and word-final respectively. . See also Fig. 9 below.

Table 8 showing nasal durations in milliseconds at different word positions for Akyem Twi speakers

Akyem	Nasal Duration in milliseconds			
	Position	m	n	ɲ
Initial	134	129	133	

Medial	119	114	121
Final	91		

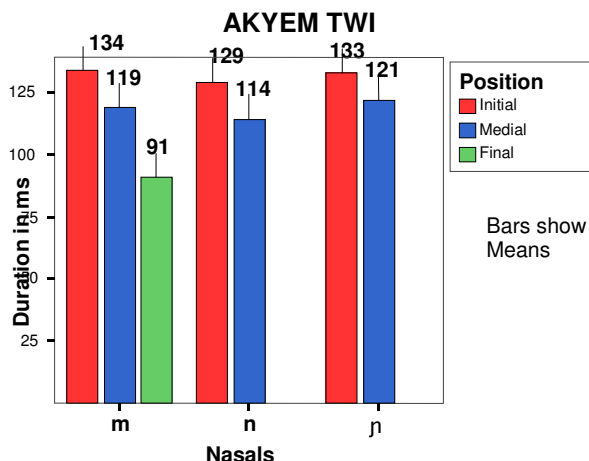


Fig. 9 bar charts showing nasal duration at different word positions for Akyem Twi speakers

Akan

Table 9 below shows the result of nasal duration of Akan at word positions measured in milliseconds (ms). It was found out that at word-initial, [m] has the highest duration. The alveolar nasal [n] is also higher than [ɲ]. At word-medial [m] has the highest duration, as [n] has the lowest. At word-final, [n] (based on Iguae Fantse alone) has highest duration as [m] has the lowest duration. It was also found that the nasals at word-initial have the highest duration, followed by word-medial and word-final respectively. See also Fig. 10

Table 9 showing nasal durational values in milliseconds at different word positions for Akan speakers

AKAN	Nasal Duration in milliseconds				
	Position	m	n	ɲ	ɣ
Initial	121	115		112	
Medial	108	104		105	
Final	85	92	87		

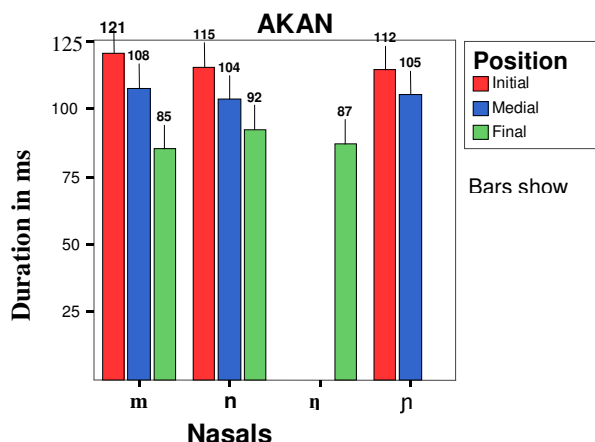


Fig. 10 bar charts showing nasal duration at different word positions for Akan speakers

IV. GENERAL DISCUSSIONS

The study shows that bilabial nasal [m] occurs at word-initial, word-medial and word-final positions in all dialects of Akan (see also Schachter and Fromkin 1968, Dolphyne 1988, Boadi 1997, and Abakah 2005. In terms of duration, it is realized that [m] has the longest duration than all the other Akan nasals (See Table 9 and Fig. 10). Again, the duration of [m] at word-initial, is the longest as that of word-final is the shortest of all nasals. The reason could be that at the word-final the nasal is unreleased. This is also identified in almost all the Akan nasals. The alveolar nasal [n] occurs in word-initial, word-medial and word-final positions in Iguae Fantse only. The rest of the Akan dialects, it occurs at word-initial and word-medial positions. The duration of [n] is longer than [ŋ] but shorter than [m]. It is also identified that [n] at word-initial has longer duration than that of word-medial, which is also longer than that of word-final positions. Palatal nasal [ɲ] in Akan occurs in word-initial and word-medial, but does not occur in word-final position. Again, word-initial has longer duration than that of word-medial. The velar nasal [ŋ] does not occur at prevocalic or intervocalic positions. It occurs at word-initial or word-medial when it is followed by velar stops. At the word-final position, it was realized that Akuapem, Agona and Bremang dialects use [ŋ], especially at the CVN stem (where 'N' is an alveolar nasal)

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