A Spectrographic Analysis of Akan Word-Final Nasals

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Abstract - *This study examines Akan nasals at different word positions, especially the alveolar and velar nasals at word-final positions, so that both Akan and English language teachers could apply them in teaching. It finds out which dialect(s) of Akan use(s) the velar nasal [ŋ] at the word-final position, and also whether Asante Twi uses palatal nasal [ɲ] at CVN syllable (where 'N' is a nasal consonant). 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 revealed that Iguae Fantse uses [n], as Akuapem Twi, Agona and Bremang Dialects use [ŋ]. Gomua Fantse, Asante Twi, and Akyem Twi do not use alveolar nasal consonant at word-final position at all because there is no occlusion, rather they may use high front nasalized lax vowel [ĩ] or high back nasalized lax vowel [ṽ] depending on whether the preceding vowel is + or –rounded[1].*

Key words - Akan, nasals, acoustics, spectrogram, bilabial, alveolar, palatal, velar

I. INTRODUCTION

> *When we are talking about the phonological oppositions within a single language, we can get away with casual descriptions of the phonetic facts. But when we are trying to compare languages, or to give accurate phonetic descriptions of a single language, then we must learn to reinterpret phonological oppositions in terms of complexes of the real phonetic elements of languages, (Ladefoged 1978:32).*

Akan is one of the major Kwa languages spoken in Ghana. Slightly more than 45 percent of Ghanaians speak it as their first language (Akpanglo-Nartey 2006:2). The Ahanta, Nzema, Sefwi, Aowin, Effutu, Awutu, Senya, Anum, Larteh, and Kyerepong, speak Akan as their second language. (See also Bosiwah 2011)

"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). It covers a wide range of socio-cultural domains in terms of usage. (Osam 2003:3). 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 (Boadi, 1997). Almost all studies that are reviewed by the researcher show that their major concern is on Asante Twi, Akuapem Twi and Fante, (See Dolphyne 1988, Eshun 1993, Boadi 1997, and Abakah 2005), neglecting the other dialects of Akan. The alveolar nasal identified with Fante in the studies conducted shows that the varieties of Fante have other phonetic representation as far as CVN syllable is concerned. Agona and Bremang speakers are forced to study Fante because their dialects are not written. Most Akyem Twi speakers are also compelled to study Akuapem Twi, even though their dialect is closer to Asante Twi. These discrepancies, generally affect their performances in the dialect of study, as well as the study of English language.

For effective teaching and learning, we take the syllabus, textbooks, language teaching materials, test designing, and the methodology into consideration, (see Lado 1957, Fries 1945, Larsen-Freeman & Long 1991, Ferguson 1965, Ellis 2006, and Yule 1996). Both the syllabus designer, and the textbook writer, need to know the culture of the people (the learners), and predict the areas of similarities and difficulties, in order to achieve the set objectives. This acoustic study will actually portray how Akan nasals behave, to enable the English language teacher predicts the areas of similarities and difficulties and address them (Lado 1957).

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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Schachter and Fromkin (1968) compared a part of the phonological systems of Akuapem, Asante, and Fante, the major dialects of Akan. Their comparison reveals the features common to all the three dialects as well as the features, which distinguish the dialects from one another. They presented their description of the phonological systems of these dialects within the framework of generative phonology. They came out with some findings, especially in CVN syllable, (where 'N' is Nasal Consonant) that Fante (also called Fantse or Mfantse), Akuapem Twi and Asante Twi produce [n ŋ ɪ̃] respectively.

This is supported by Dolphyne (1988:31,47), Boadi (1997: 14), and Abakah (2005:49, 50), that the alveolar nasal /n/ occurs in word-final position in Fante, velar nasal [ŋ] occurs in word-final position in Akuapem Twi only, while Asante Twi uses a nasalized high front vowel [ɪ̃]. Dolphyne 1988:109 goes further to argue that in Asante Twi, the /n/ in CVN syllable is realized as palatal nasal [ɲ] or a labialized velar nasal [ŋʷ] depending on whether the vowel is front or back respectively. The final nasal consonant position may not be reached where the vowel of the stem is a non-high vowel, so that the stem may end in a nasalized high vowel [ɪ̃], (see Table1).

Table 1 showing alveolar nasal /n/ at word-final position in Asante Twi

Word	IPA Trascription	English Gloss
kan	[kaɲ / kaɪ̃]	read
din	[diɲ]	name
sɛn	[sɛɲ / sɛɪ̃]	how much
tɔn	[tɔŋʷ / tɔʊ]	sell
hon	[hʊŋʷ]	swell
ben	[bɪ̃ɲ]	be cooked

Adapted from Dolphyne 1988: 109

Based on the above statement, it has become necessary to find out which Akan nasal sound is used, especially at the word-final position within the parameters of formant frequency and how it affects language teaching, hence this comparative study.

II. PROCEDURE FOR THE STUDY

When we speak to each other, the sounds that we make have to travel from mouth of the speaker to the ear of the listener. This is true whether we are speaking face to face, or by telephone over thousands of miles. What is important for us in our study of speech is that this acoustic signal is completely observable: we can capture everything the listener hears in the form of recording, and then measure which ever aspect of the signal that we want to know about, (Roach 2001: 39).

A. Selection of Akan Communities

70 people were recorded from seven Akan speaking communities. 35 males and 35 females between the ages of 30 and 64years, who had stayed there almost all their life time and could at least read simple sentences in any of the Akan dialects, were selected. The communities selected are Iguae (Cape Coast) Fantse, Gomua (Gomua Eshiem) Fantse, Akuapem (Akropong Akuapem) Twi, Agona (Agona Bobikuma), Bremang (Bremang Nwomaso), Asante (Asante Mampong) Twi, and Akyem (Akyem Kade) Twi. The selected areas cover Central, Eastern and Ashanti Regions of Ghana. This was done through interviews, and observations. The communities were selected because it was anticipated that the speakers in such communities use the nasal sounds appropriately as required for the research. The participants (speakers) were giving the sentences in the carrier frames to read. They were then recorded, brought to the Phonetics Laboratory, captured and analyzed.

Two varieties of Fante (Iguae and Gomua Fantse) were selected for the study. This is to find out the similarities and differences between them at different word positions. Agona and Bremang dialects, which some people claim to be varieties of Fante (see Dolphyne 1988a and Osam 2003, Lomotey 2006), contrary to National Census Report (Ghana Statistical Service (2002), were also selected to examine their stand in the Akan language. The study finds out their relationship with the three major dialects of Akan, (Fante, Asante and Akuapem Twi). Akyem Twi was also selected. This is due to the fact that even though Akyem Twi and Asante Twi are alike, geographically they are closer to Akuapem Twi, (see Fig 1). The majority of them including those in Akyem Kade study Akuapem Twi in schools as a few of them also study Asante Twi, since theirs is not written. Bono Twi in the Brong Ahafo Region was not selected because the pilot study conducted revealed that at the CVN syllable, where 'N' is an alveolar nasal, the speakers use CVNV, which is not relevant to the present study. For example, *ban* (fence) is in Bono as [banɪ].

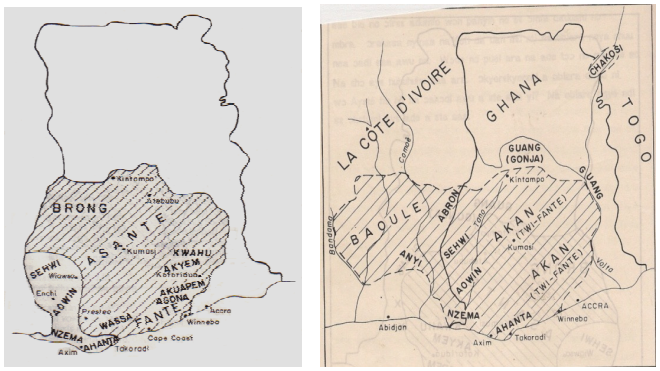

Fig. 1. Map of Ghana, and part of La Cote D'voire and Togo showing the distribution of Akan (Twi –Fante) Language and some of its major dialects and Tano Language spoken by Akan ethnic group
(Adapted from Dolphyne 1988:195,196)

B. Selection of Speakers

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.

C. Data Collection

The target syllables/stem 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, (See Table 2). 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. 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. This was done in a relaxed and informal atmosphere. The digital recorder was placed about 45^0, 4 centimeters away from their mouth, in order to reduce noise.

Table 2: Akan word list

Word	IPA Transcription	English Gloss
Ɔman	[Ɔman]	country
nkwan	[ŋkʷan / ŋkʷaŋ / ŋkʷaɪ]	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 /baɪ̃ /]	fence
nam	[nam]	fish
ampa	[ampa]	true

(See Bosiwah 2011:154)

D. Data Analysis

The nasal consonants were digitized using Kay Elemetrics Computerized Speech Laboratory (CSL) model 4500 software at a sampling rate of 11025Hz, filter order 12, pre emphasis 0.900, <500 bandwidth, frame count -360 msec, using Blackman window with a frequency range between 0Hz and 5,900Hz 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). The analysis column was used to display the spectrogram and the formant history for all data. The sounds were played to locate the actual nasal sound used for the study. Table 2 and fig 3 show the spectrograms from which the measurements were taken.

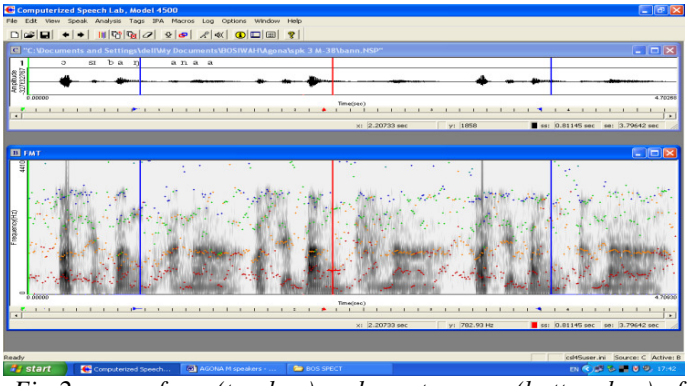

Fig 2 a waveform (top box) and spectrogram (bottom box) of Agona male speaker repeating ***[ɔsɪ baŋ anaa]*** *three times*

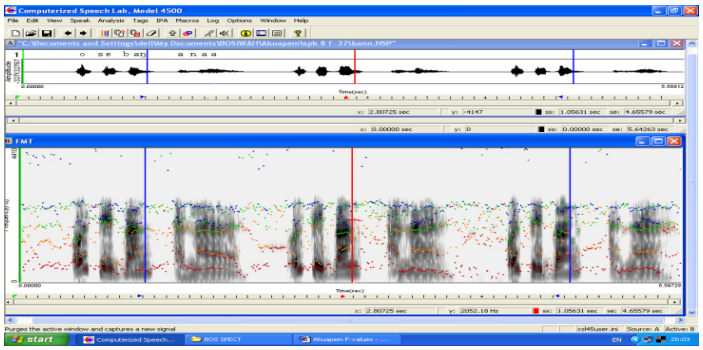

Fig 3 a waveform (top box) and spectrogram (bottom box) of Akuapem Twi female speaker repeating ***[ose baŋ anaa]*** *three times*

Position of Nasals in Hz			m	n	ɲ
Iguae Fantse	Initial	F1	308	418	349
		F2	1092	1345	2155
	Medial	F1	337	432	371
		F2	1129	1332	2163
	Final	F1	304	420	
		F2	1103	1339	

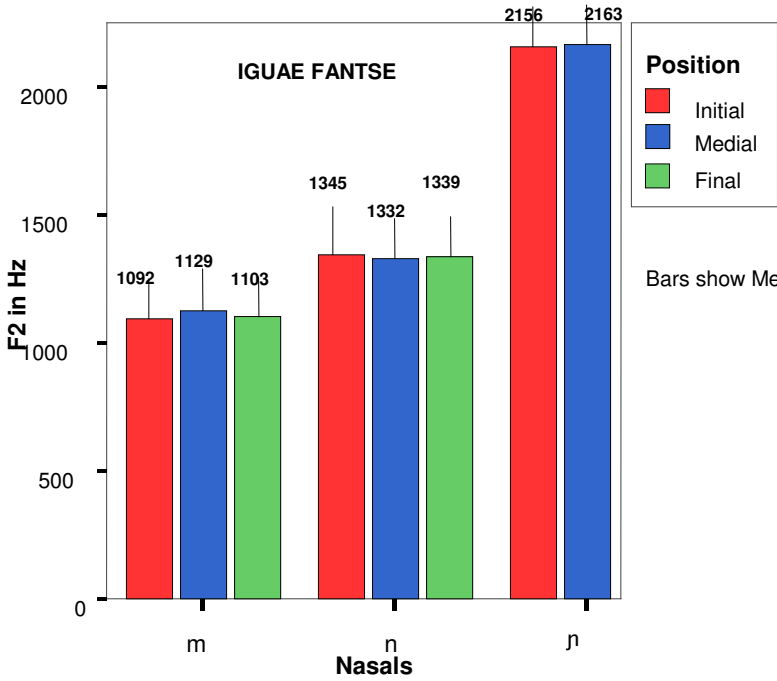

Fig 4 bar charts showing F2 nasal values at different word positions for Iguae Fantse speakers in Hertz

III. PRESENTATION OF RESULTS

A. Nasals at Different Word Positions in Iguae Fantse

The F1 and F2 values for [m] are word-initial 308Hz and 1092Hz, word-medial 337Hz and 1129Hz, and word-final 304Hz and 1103Hz respectively. The F1 and F2 values for [n] are word-initial 418Hz and 1345Hz, word-medial 432Hz and 1332Hz, and word-final 420Hz and 1339Hz. The F1 and F2 values for [ɲ] are word-initial 349 Hz and 2155Hz, word-medial 371Hz and 2163Hz (see Table 3 and Fig 4).

When F1 and F2 results of Iguae Fantse nasals at various positions were compared, it was found out that F1 value of [m] in word-initial position is the lowest. [m] in word-medial has high formant frequency values than that of [m] word-final, as the [m] in word-final is also higher than [m] at word-initial. [n] in word-initial is lower than that of [n] word-medial but higher than [m] in word-final. [n] in word-medial is also higher than that of [n] in word-initial, but lower than that of word-final [n]. [ɲ] in word- initial is lower than [ɲ] in word-medial. Comparing [m], [n] and [ɲ] at F1 level it is also found that [ɲ] is lower than [n], but higher than [m]. At the F2 level, [m] in word-initial position is the lowest. [m] in word-medial has the highest formant frequency. [n] in word-initial has the highest formant frequency, as [n] in word-medial is the lowest. [ɲ] in word- initial is lower than [ɲ] in word-medial (See Table 3 and Fig 4).

Table 3 showing F1 and F2 nasal values in Hertz at different word positions for Iguae Fantse speakers

B. Nasals at Different Word Positions in Gomua Fantse

The F1 and F2 values for [m] are word-initial 344Hz and 1127Hz, word-medial 320Hz and 1105Hz, and word-final 343 Hz and 1105 Hz respectively. The F1 and F2 values for [n] are word-initial 444Hz and 1303Hz and word-medial 445 Hz and 1297Hz. The alveolar nasal [n] has no final because there is no closure. The F1 and F2 values for [ɲ] are word-initial 346Hz and 2388Hz, word-medial 369Hz and 2301Hz. Again, the palatal nasal [ɲ] does not occur at word-final position in Gomua Fantse, (see Table 4 and Fig 5).

F1 and F2 nasals were compared at various positions. It was found out that F1 values of [m] in word-initial position are higher than [m] in word-medial, but lower than that of [m] in word-final. [n] in word-medial is also higher than that of [n] in word-initial. [ɲ] in word-initial is lower than [ɲ] in word medial. Comparing [m], [n] and [ɲ] at F1 level it is found out that [ɲ] is lower than [n], but higher than [m]. At the F2 level,

[m] in word-initial position is higher than [m] in word-medial and final which have the same formant frequency. [n] in word-initial has higher formant frequency than [n] in word-medial. [ɲ] in word- initial is higher than [ɲ] in word-medial, (See Table 4 and Fig 5).

Table 4 showing F1 and F2 mean values in Hertz at different word positions for Gomua Fantse speakers

Position of Nasals			m	n	ɲ
Gomua Fantse	Initial	F1	344	444	346
		F2	1127	1303	2388
	Medial	F1	320	445	369
		F2	1105	1297	2301
	Final	F1	343		
		F2	1105		

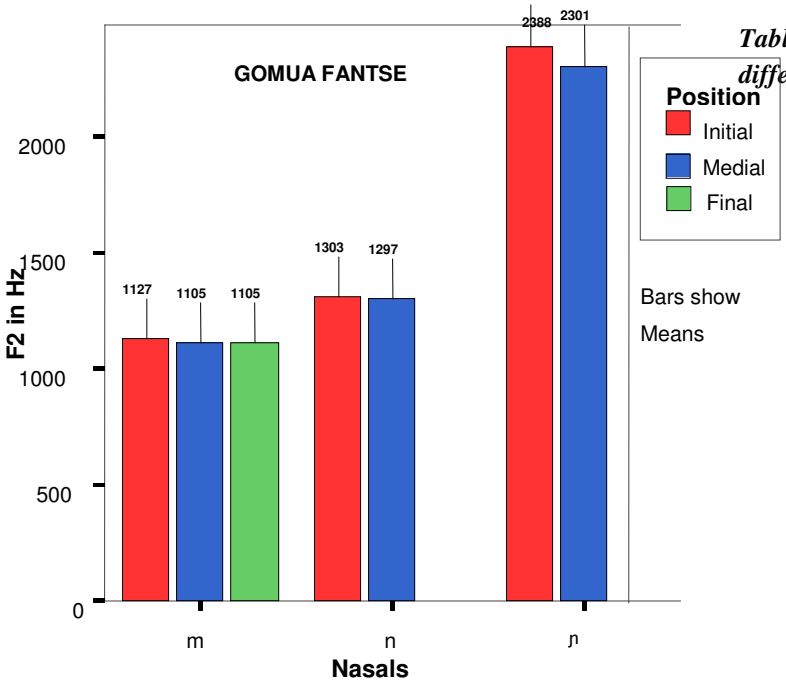

Fig 5 bar charts showing F2 nasal values at different word positions for Gomua Fantse speakers in Hertz

C. Nasals at Different Word Positions in Akuapem Twi

The F1 and F2 values for [m] are word-initial 305Hz and 1079Hz, word-medial 320 Hz and 1075Hz, and word-final 307Hz and 1068Hz respectively. The F1 and F2 values for [n] are word-initial 399Hz and 1314Hz, and word-medial 416Hz and 1312Hz. The alveolar nasal [n] does not occur at word-final; rather, it changes to [ŋ]. The F1 and F2 values for [ŋ] at word-final are 494Hz and 1488Hz. The F1 and F2 values for [ɲ] are word-initial 336 Hz and 2253Hz, word-medial 353Hz and 2267Hz. Again, the palatal nasal [ɲ] does not occur at word-final position in Akuapem Twi, (see Table 5 and Fig 6).

F1 and F2 nasals were compared at various positions. Comparing the F1 values of [m] in word positions, it was found out that the word-medial is the highest as that of initial is the lowest, but lower than that of [m] in word-final. [n] in word-medial is also higher than that of [n] in word-initial. At the word-final position [ŋ] which is an allophone of [n] has the highest F1 value. [ɲ] in word-initial is lower than [ɲ] in word-medial. Comparing [m], [n], [ŋ] and [ɲ] at F1 level it is found out that [ɲ] is lower than [n], but higher than [m], while [ŋ] has the highest F1 values. At the F2 level, [m] in word-initial position is higher than [m] in word-medial which is also higher than that of the word-final. [n] at word-initial has higher formant frequency than [n] in word-medial. [ŋ] has high formant value, which is far above [n]. [ɲ] at word- initial is higher than [ɲ] at word-medial, (See Table 5 and Fig 6).

Table 5 showing F1 and F2 mean values in Hertz at different word positions for Akuapem Twi speakers

Position of Nasals			m	n	ŋ	ɲ
Akuapem Twi	Initial	F1	305	399		336
		F2	1079	1314		2253
	Medial	F1	320	416		353
		F2	1075	1312		2267
	Final	F1	307		494	
		F2	1068		1488	

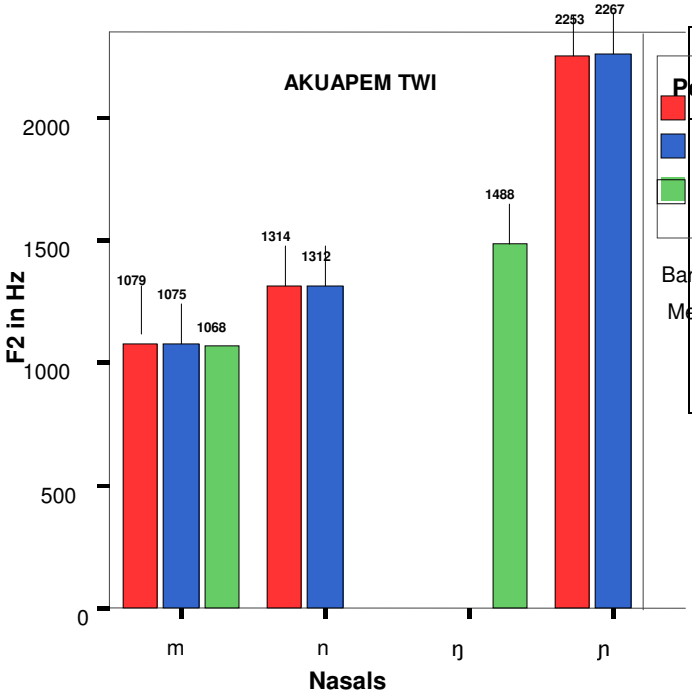

Fig 6 bar charts showing F2 nasal values at different word positions for Akuapem Twi speakers in Hertz

different word positions for Agona Dialect speakers

Agona Dialect	Position of Nasals		m	n	ŋ	ɲ
	Initial	F1	343	410		363
		F2	1122	1336		2390
	Medial	F1	331	417		381
		F2	1130	1302		2333
	Final	F1	348		514	
		F2	1116		1515	

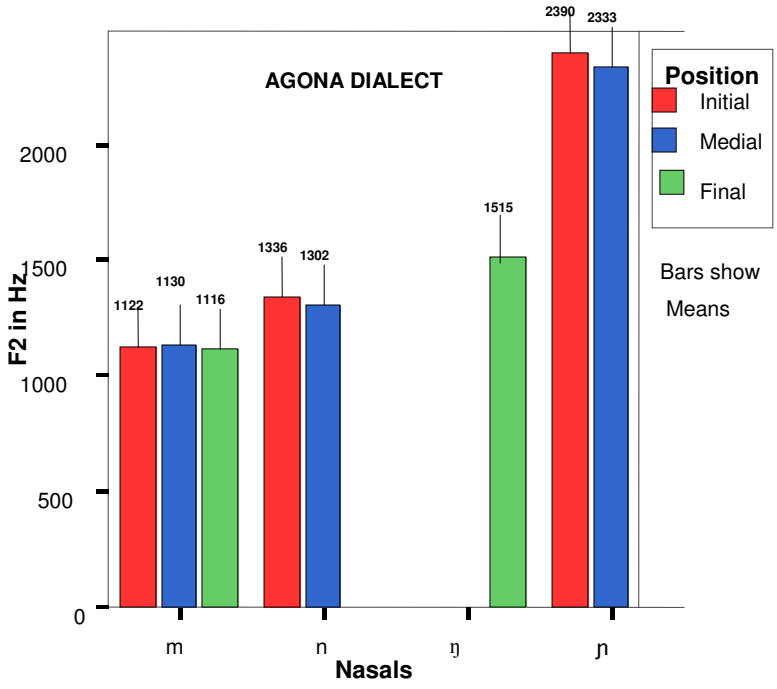

Fig 7 bar charts showing F2 nasal values at different word positions for Agona speakers in Hertz

D. Nasals at Different Word Positions in Agona Dialect

The F1 and F2 values for [m] are word-initial 343Hz and 1122Hz, word-medial 331Hz and 1130Hz, and word-final 348 Hz and 1116 Hz respectively. The F1 and F2 values for [n] are word-initial 410Hz and 1336Hz, and word-medial 417Hz and 1302Hz. The F1 and F2 values [ŋ] at word-final are 514Hz and 1515Hz. The F1 and F2 values for [ɲ] are word-initial 363Hz and 2390Hz, word-medial 381 Hz and 2333 Hz. Again, the palatal nasal [ɲ] does not occur at word-final position in Agona dialect, (see Table 6 and Figure 7).

F1 and F2 nasals were compared at various positions. It was found out that F1 values of [m] at word-initial position are higher than [m] at word-medial, but lower than that of [m] in word-final. [n] at word-initial is also higher than that of [n] in word-medial. At the word-final position [ŋ] that becomes allophone of [n] has the highest F1 values. [ɲ] at word-initial is lower than [ɲ] in word-medial. Comparing [m], [n], [ŋ] and [ɲ] at F1 level it is found out that [ɲ] is lower than [n], but higher than [m], whilst [ŋ] has the highest F1 values. At the F2 level, [m] in word-final position is higher than [m] in word-initial but lower than that of word-medial. [n] at word-initial has higher formant frequency than [n] in word-medial. [ŋ has high formant value than [n]. [ɲ] at word- initial is higher than [ɲ] in word-medial, (See Table 6 and Fig 7).

Table 6 showing F1 and F2 mean values in Hertz at

E. Nasals at Different Word Positions in Bremang Dialect

The F1 and F2 values for [m] are word-initial 317 Hz and 1108Hz, word-medial 309Hz and 1100Hz, and word-final 336Hz and 1108Hz respectively. The F1 and F2 values for [n] are word-initial 424Hz and 1300Hz, word-medial 414 Hz and 1294Hz. The F1 and F2 values for [ŋ] at word-final position are 505Hz and 1505Hz. The F1 and F2 values for [ɲ] are word-initial 342Hz and 2213Hz, word-medial 356Hz and 2359Hz. Again, the palatal nasal [ɲ] does not occur at word-final position in Bremang dialect, (see Table 7 and Fig 8).

F1 and F2 nasals were compared at various positions. It was found out that F1 values of [m] in word-initial position

are higher than [m] in word-medial, but lower than that of [m] in word-final. [n] at word-initial is also higher than that of [n] in word-medial. [ɲ] at word-initial is lower than [ɲ] in word-medial. Comparing [m], [n], [ŋ] and [ɲ] in Bremang Dialect at F1 level, it was found out that [ɲ] is lower than [n], but higher than [m], whilst [ŋ] has the highest F1 values.

At the F2 level, [m] in word-initial position is higher than [m] in word-medial, but equal to that of word-final. [n] at word-initial has higher formant frequency than [n] in word-medial. [ɲ] in word- initial is lower than [ɲ] at word-medial(see Table 7 and Fig 8 below).

Table 7 showing F1 and F2 mean values in Hertz at different word positions for Bremang speakers

Position of Nasals			m	n	ŋ	ɲ
Bremang Dialect	Initial	F1	317	424		342
		F2	1108	1300		2213
	Medial	F1	309	414		356
		F2	1100	1294		2359
	Final	F1	336		505	
		F2	1108		1505	

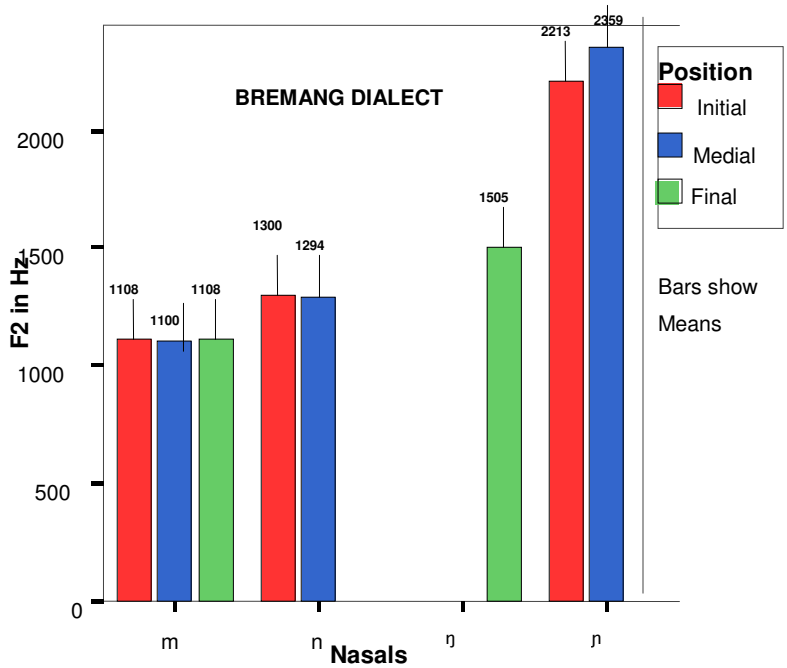

Fig 8 bar charts showing F2 nasal values at different word positions for Bremang speakers in Hertz

F. Nasals at Different Word Positions in Asante Twi

The F1 and F2 values for [m] are word-initial 350Hz and 1079Hz, word-medial 363Hz and 1132Hz, and word-final 338Hz and 1099Hz respectively. The F1 and F2 values for [n] are word-initial 466Hz and 1307 Hz and word-medial 480Hz and 1323Hz. The alveolar nasal [n] has no final because there is no closure. The F1 and F2 values for [ɲ] are word-initial 357 Hz and 2298 Hz, word-medial 388Hz and 2273Hz (see Table 8 and Fig 9).

F1 and F2 nasals were compared at various positions. It was found out that F1 value of [m] in word-initial position is higher than [m] in word- final, but lower than that of [m] in word- medial. [n] in word-medial is also higher than that of [n] in word-initial. [ɲ] in word- initial is lower than [ɲ] in word-medial. Comparing [m], [n] and [ɲ] at F1 level it was found out that [ɲ] is lower than [n], but higher than [m]. At the F2 level, [m] in word-final position is higher than [m] in word- initial but lower than word-medial. [n] in word-initial has lower formant frequency than [n] in word-medial. [ɲ] in word-initial is higher than [ɲ] in word-medial, (See Table 8 and Fig 9).

Table 8 showing F1 and F2 mean values in Hertz at different word positions for Asante Twi speakers

Position of Nasals			m	n	ɲ
Asante Twi	Initial	F1	350	466	357
		F2	1079	1307	2298
	Medial	F1	363	480	388
		F2	1132	1323	2273
	Final	F1	338		
		F2	1099		

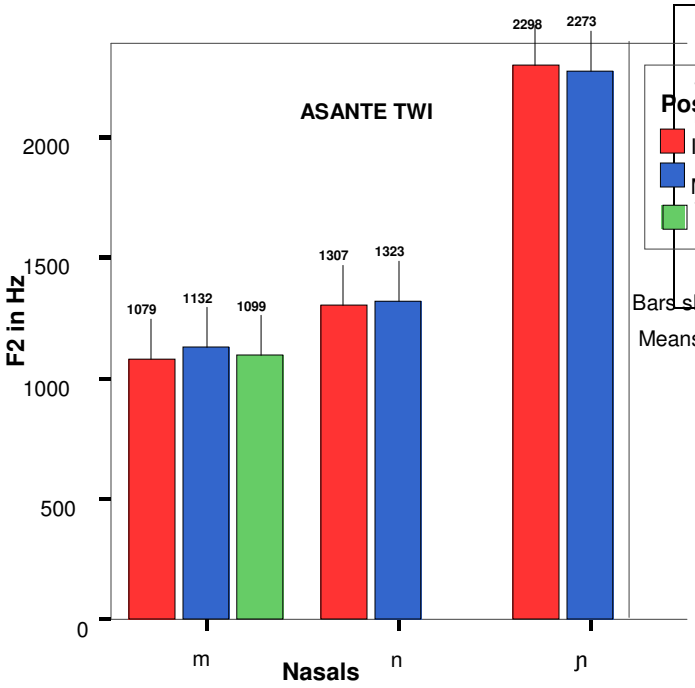

Fig 9 bar charts showing F2 nasal values at different word positions for Asante Twi speakers in Hertz

G. *Nasals at Different Word Positions in Akyem Twi*

The F1 and F2 values for [m] are word-initial 311Hz and 1098Hz, word-medial 310Hz and 1085Hz, and word-final 341Hz and 1077Hz respectively. The F1 and F2 values for [n] are word-initial 410Hz and 1296Hz, and word-medial 410Hz and 1395Hz. The alveolar nasal [n] has no final because there is no closure. The F1 and F2 values for [ɲ] are word-initial 324 Hz and 2268 Hz, word-medial 355Hz and 2203Hz (see Table 9 and Fig 10). F1 and F2 nasals were compared at various positions. It was found out that F1 value of [m] in word-initial position is higher than [m] in word-medial, but lower than that of [m] in word-final. [n] in word-medial is also higher than that of [n] in word-initial. [ɲ] in word- initial is lower than [ɲ] in word-medial. Comparing [m], [n] and [ɲ] at F1 level it is found out that [ɲ] is lower than [n], but higher than [m]. At the F2 level, [m] in word-initial position is higher than [m] in word-medial and final which have the same formant frequency. [n] in word-initial has higher formant frequency than [n] in word-medial. [ɲ] in word- initial is higher than [ɲ] in word-medial, (See Table 9 and Fig 10).

Table 9 showing means at different word positions for Akyem Twi speakers

Position of Nasals	m	n	ɲ
Initial	F1	311	410	324
	F2	1098	1296	2268
Medial	F1	310	410	355
	F2	1085	1305	2203
Final	F1	341		
	F2	1077		

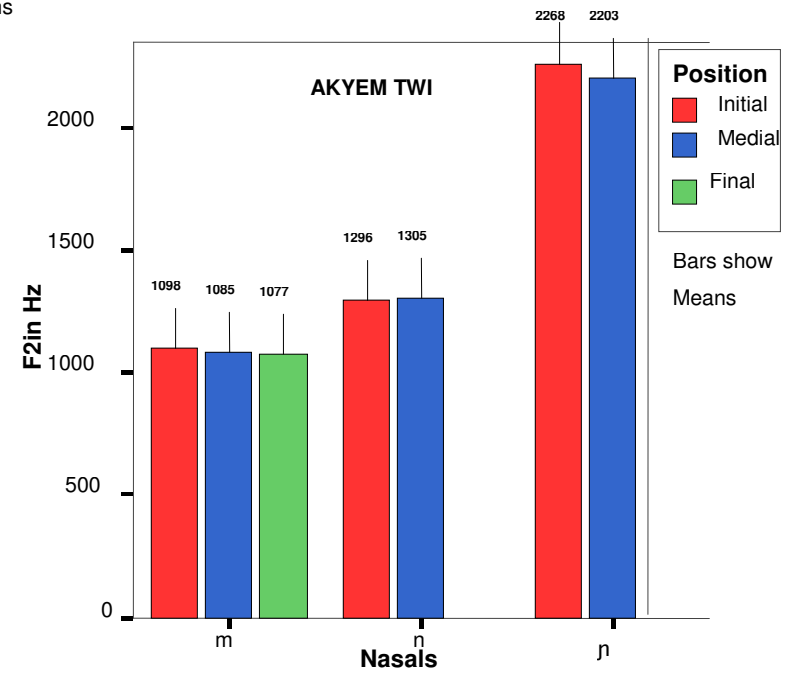

Fig 10 bar charts showing F2 nasal values at different word positions for Akyem Twi speakers in Hertz

H. *Nasals at Different Word Positions in Akan*

The F1 and F2 values for [m] are word-initial 325Hz and 1099Hz, word-medial 327Hz and 1108Hz, and word-final 331Hz and 1096Hz respectively. The F1 and F2 values for [n] are word-initial 424Hz and 1316 Hz, word-medial 430 Hz and 1314Hz, and word-final 420Hz and 1339Hz [n], and 504Hz and 1502Hz [ŋ]. The F1 and F2 values for [ɲ] are word-initial 331Hz and 2281Hz, word-medial 368Hz and 2250Hz (see Table 10 and Fig 11).

F1 and F2 nasals were compared at various positions. It was found out that F1 values of [m] in word-initial position

are higher than [m] in word-medial, but lower than that of [m] in word-final. [n] in word-medial is also higher than that of [n] in word-initial. [ɲ] in word- initial is lower than [ɲ] in word-medial. Comparing [m], [n] and [ɲ] at F1 level it is found out that [ɲ] is lower than [n], but higher than [m]. At the F2 level, [m] in word-initial position is higher than [m] in word- final, but lower than that of word-medial. [n] in word-initial is higher than [n] in word-medial, but lower than [n] at word-final. [ŋ] has high F2 values around 1502 Hz, which is higher than [n], which is around 1315 Hz. [ɲ] in word- initial is higher than [ɲ] in word-medial, (See Table 10 and Fig 11). It was found out that the nasal [n], has three allophones at word-final. These allophones are: [n] for Iguae Fantse (F1 420Hz, F2 1339Hz), [ŋ] for Akuapem Twi (F1 494Hz, F2 1488Hz), Agona (F1 514Hz, F2 1515Hz, Bremang (F1 505Hz, F2 1504 Hz). The third one is not a consonant, but rather a high lax front nasalized vowel [ɪ̃].

Table 10 showing F1 and F2 mean values in Hertz at different word positions for Akan speakers

Position of Nasals			**m**	**n**	**ŋ**	**ɲ**
Akan	**Initial**	F1	325	424		331
		F2	1099	1316		2281
	Medial	F1	327	430		368
		F2	1108	1314		2250
	Final	F1	331	420	504	
		F2	1096	1339	1502	

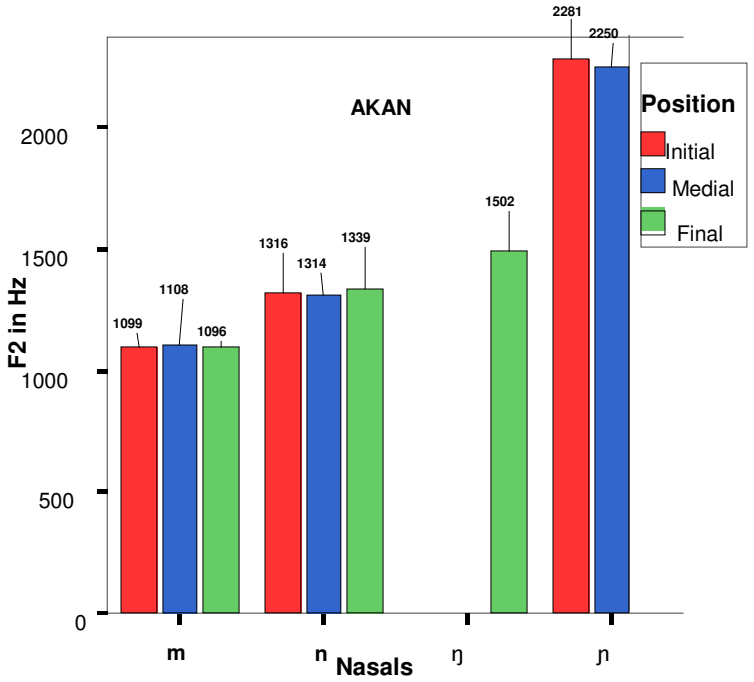

Fig 11 bar charts showing F2 nasal values at different word positions for Akan speakers in Hertz

IV. GENERAL DISCUSSIONS AND CONCLUSION

Akan nasals have been examined in this paper at the level of formant frequency, by means of spectrographic analysis. The analysis has been based on seven Akan communities, made up of two varieties of Fante (Iguae Fantse and Gomua Fantse), Akuapem Twi, Agona, Bremang, Asante Twi and Akyem Twi. On formant frequencies, the attention was on F2 (which is the most reliable formant value to distinguish nasals both in the nasal segment itself and in the surrounding phonemes because of its sensitivity to place of articulation, see Qi and Fox 1992, and Kaiser 1997, Mou and Stevens 2005).

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. The F1 value for [m] is around 300Hz and is the lowest among all the Akan nasals. This also confirms the results of Fujimura 1962, Lambacher 1995, Stevens 1998, and Ladefoged 2006.

The alveolar nasal [n] occurs in word-initial, word-medial and word-final positions in Iguae Fantse only. In the rest of the Akan dialects, it occurs at word-initial and word-medial positions. The F1 value for [n] is around 400Hz and it is higher than [m] and [ɲ], but lower than [ŋ], (see also Fujimura 1962, Lambacher 1995, Stevens 1998, and Ladefoged 2006). It has been established that F2 of [n] is around 1200Hz-1300Hz. In terms of word positions, it does not show much difference. The

result shows that Gomua Fantse, a variety of Fante, does not use alveolar nasal at word-final position always. Asante Twi and Akyem Twi do not use alveolar nasal at all at word-final position, because there is no closure (see Tables 8 and 9, and Figs 9 and 10). Akuapem Twi, Agona and Bremang dialects of Akan use [ŋ], which is within the F2 quantal region of around 1400Hz-1500Hz at word-final positions (see Tables 5, 6 and 7, and Figs 6, 7 and 8 respectively).

Palatal nasal [ɲ] in Akan occurs in word-initial and word-medial, but does not occur in word-final position. It has a low F1 values, but higher than [m]. It has the highest F2 values around 2000Hz-2500Hz.

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 it, especially at the CVN syllable (where 'N' is an alveolar nasal). The velar nasal [ŋ] is between 1400Hz and 1500Hz.

The study has revealed that it is not only Akuapem Twi, which uses [ŋ] at word-final position, but also Agona and Bremang dialects of Akan spoken in the Central Region of Ghana. Furthermore, Asante Twi, Akyem Twi and at least Gomua Fantse using [ɪ̃], is a sign of mutual intelligibility, between Fante and Twi as dialects of Akan. As far as this research is concerned, Asante Twi uses [ɪ̃] and not [ɲ] or [ŋʷ] at the word-final position.

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REFERENCES

[1] Abakah, E. N., (2005) "Phonological analysis of word-final consonants in Akan". Africa & Asia, No 5, pp 47-65.

[2] Akpanglo-Nartey, J. N., (2002). *A Phonetic Course for Non- Native Speakers of English (2nd ed)*, Published by Tema Sakumo Books.

[3] Akpanglo-Nartey, J. N., (2002). *An introduction to linguistics Course for Non- Native Speakers of English (2nd ed)*, Published by Tema Sakumo Books.

[4] Akpanglo-Nartey, J. N., (2006) "Application of Phonetics in Language Education in Ghana" UEW – PAL , Papers in Applied Linguistics, No. 1 – 2006, 1-8.

[5] Akpanglo-Nartey, Rebecca A. (2006) "Vowels of GaDangme – A Spectrographic Study. UEW – PAL, Papers in Applied Linguistics, No. 1 – 2006, 9-93.

[6] Akpanglo-Nartey, Rebecca A., & Jonas N. Akpanglo-Nartey, (2006): "An Acoustic Description of the English of Ghana". Paper presented at the UEW, 2nd Applied Linguistics Conference, on November 7-11, 2006.

[7] Boadi, L. A. (1997): *Forms and Meaning in Akan*, Department of Linguistics, University of Ghana, Legon. Manuscript.

[8] Bosiwah, Lawrence (2011) "Duration correlates of nasal consonants in Akan". C*anadian Journal on Scientific and Industrial Research Vol. 2 No. 3, March 2011, pages 153-159. ID: SIR-1103-012*

[9] Byrd, Dani. (1993): *54,000 American Stops*. UCLA Working Papers in Phonetics, 83, 97-116

[10] Catchpole, Brian & Akinjogbin (n.d.): *A History of West Africa in Maps & Diagrams***.** Staples, St. Albans Ltd., Hertfordshire ALI IJK, UK.

[11] Dolphyne, Florence A. (1988): *The Akan (Twi- Fante) Language, Its Sound Systems and Tonal Structure.* Accra: Ghana University Press.

[12] Dolphyne, F. A., & Dakubu, M. E. K. (1988). The Volta-Comoe languages. In M. E. K. Dakubu (Ed.), The languages of Ghana (pp. 50-90). London: Kegan Paul International.

[13] Ellis, Elizabeth M. (June 2006): *Language Learning Experience as a Contributor to ESOL Teacher Cognition* Volume 10, Number 1

[14] Eshun, F. B., (1993): "An Aspect of Akan Phonology". In: Abaka, E. N., (2005), *Phonological Analysis of Word-final Consonants in Akan.* Africa & Asia, No 5, pp 47-65

[15] Ghana Statistical Service (2002). 2000 Population and housing census: Summary report of final results. Accra: GSS.

[16] Fries, C. C., (1945): *Teaching and Learning English as a Foreign Language*. Ann Arbor: University of Michigan Press.

[17] Fujimura, Osamu. (1962): "Analysis of Nasal Consonants". *The Journal of the Acoustical Society of America*, *34*(12), 1865-1875.

[18] Gbegble, Nada (2006)**:** *A spectrographic analysis of Ewe vowels.* M. Phil Thesis. UEW – PAL, Papers in Applied Linguistics, No. 1 – 2006, 94-174

[19] Kaiser, Ed (1997*):* "Introduction to Spectrogram Reading". *PST Structure of Spoken Language: Spectrogram Reading* Nikos Drakos, Computer Based

[20] Ladefoged, Peter (1964): *A Phonetic Study of West African Languages*. Cambridge: Cambridge University Press.

[21] _____. (1978): "Phonetic Differences Within and Between Languages". Paper given at the 52nd Annual Meeting of the Linguistic Society of America WPP 41: 32- 40, UCLA Phonetics Lab.

[22] _____. (2006): *A Course in Phonetics, (5th edition)* Harcourt Brace Jovanovich, New York.

[23] Ladefoged, Peter and Ian Maddieson, (1996): *The Sounds of the Worlds Language***.** Blackwell Publishers Ltd. UK.

[24] Lado, Robert (1957): "How to compare two sound systems". *Linguistics across Cultures: Applied Linguistics for Language Teachers*. Ann Arbor: University of Michigan Press.

[25] _____. (1964): *Language Teaching: a scientific approach*. McCraw Hill, p.21

[26] Lambacher, Stephen G. (1995): *No Title*, The University of Aizu. http://www.u-aizu.ac.jp/

[27] _____. (1996) *Nasal Sounds: A Review of Articulatory and Acoustic Properties.* Nikos Drakos, Computer Based Learning Unit, University Of Leeds. Latez2htmlrsound2.tex.

[28] Larsen-Freeman, D. & Long, M., (1991): *An Introduction to Second Language Acquisition Research*. New York: Longman.

[29] Lindau, M. (1977) *Vowel Features*. UCLA, Working Papers in Phonetics No. 38, pp.49-81

[30] Osam E. K. (2003): "An Introduction to the Verbal and Multi-Verbal System of Akan". Proceedings of the workshop on Multi-Verb Constructions Trondheim Summer School 2003 Dorothee Beermann and Lars Hellan (Editors) 2003

[31] Roach, Peter (2001): *Phonetics***.** London: Oxford University Press.

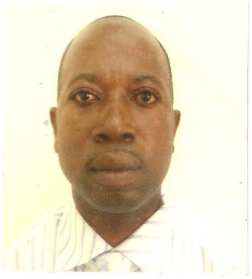
[32] Roach, Peter (2002) *A Little Encyclopedia of Phonetics*, Cute PDF evaluation edition www.CutePDF.com

[33] Schachter, P. and Fromkin, V., (1968.): "A phonology of Akan: Akuapem, Asante, and Fante", Working Papers in Phonetics (UCLA) 9. In Abakah, E. N., (2005): *Phonological analysis of word-final consonants in Akan*. Africa & Asia, No 5, pp 47-65.

[34] Ward, W.E.F. (1967): *The History of Ghana (4th Edition).* Novello and Company Ltd.

[35] Welmers, William E. (1946): "A descriptive grammar of Fante", Language, 22.3, Supplement. In Ladefoged, Peter (1964): *A Phonetic Study of West African Languages*. Cambridge: Cambridge University Press.

BIOGRAPHY



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