FEATURES OF VOWEL ASSIMILATION IN GADE (A LANGUAGE IN EVOLUTION)

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This paper studies a particular case of vowel assimilation in the Gade language[1]. After describing the process, it will try to find out why it should be so, and make a statement about the way part of Gade's phonology is developing[2].

Cet article étudie la situation d'assimilation vocalique en langue gadé. Après une description du processus, il essaie de trouver pourquoi elle existe, et d'expliquer comment une partie de la phonologie se developpe.

1. VOWELS

Gade has nine phonemic vowels, all oral; there is any expanded set: **i, u, o, e**; and a non-expanded set: **ị, ụ, ẹ, ọ,** and **a. u** has a rounded counterpart **ũ**, and **a** has a centralized, expanded counterpart **ã** which turn up in some phonologically conditioned environments. The features high, low, front, expanded and rounded can account for all the distinctions:

1.

	i	ị	u	ũ	ụ	e	ẹ	o	ọ	a	ã
high	+	+	+	+	+	-	-	-	-	-	-
low	-	-	-	-	-	-	-	-	-	+	-
front	+	+	-	+	-	+	+	-	-	-	-
expanded	+	-	+	+	-	+	-	+	-	-	+
rounded	-			+				+			-

High, low, and front vowels are articulated respectively by a raising, a lowering, or an advancing of the body of the tongue from the neutral position. Expanded vowels are articulated by an advancing of the tongue root and a lowering of the larynx thereby creating an expanded vowel tract. The rounded vowels are articulated with lip rounding.

Phonetic distinctiveness: the vowel pair **ị** and **e**, as well as the pair **ụ** and **o**, have in practice lost much of their phonetic distinctiveness. One can only distinguish with any certainty, for example, **ị** from **e** by placing them in an environment where their influence on a neighbouring vowel betrays their underlying nature. This phenomenon is probably

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[1] Gade (a Hausa name for Rịbyẹ̀) is spoken in and around Abuja, the Federal Capital Territory of Nigeria. At the time this study was done (1976-1977) I estimated the number of Gade speakers (or Bàbyẹ̀, as they call themselves) to be between 80,000 and 100,000. I did my research in the village of Kuje, lying to the East of Gwagalada, itself on the Koton-Karfi to Abuja road.
Joseph Greenberg (1966) classifies Gade with Nupe, Gwari and Igbirra. Bennett and Sterk (1977) add Idoma to that group. In the area where Gade is spoken, we also find Koto (related to Igbirra), Ganagana and Kakanda (both probably closest related to Gwari). There seems to be no language, however, that shares a lexical cognacy with Gade that exceeds 50%. A computerized lexico-statistical count gave the following cognate percentages for the ten languages closest related to Gade: 1. Gwari (42%); 2. Idoma (40%); 3. Igbirra (39%); 4. Nupe (37%); 5. Yoruba (37%); 6. Igala (34%); 7. Ife Togo (33%); 8. Tunen (30%); 9. Eloyi (27%); 10. Jukun (26%). (Koto, Ganagana and Kakanda were not part of this study). Surprising in this count is the close relationship of Yoruba, which scores an equal cognate percentage with Nupe. As for Idoma, the late Professor Robert Armstrong once read through my thesis on Gade grammar and made marginal notes. These notes point to many similarities between Gade and Idoma, a language he had studied extensively. What sets Gade apart from the other members of its class, if not from most or all members of the Western type of Benue-Kwa, though, is the clear remnant of an active noun class system that one finds in it.

[2] This paper was presented at the 19th West African Languages Congress at Legon, Ghana, 2-6 April, 1990. I am grateful for comments and corrections made to an earlier draft of this paper by Dr. Philip Noss, Mr. Bruce Connell, and Professor Kay Williamson.

characteristic of a vowel system that is moving from nine to seven vowels (see the last paragraph of this paper).

Environment: assimilation between two vowels can be studied as it operates in different morphological and phonological situations. Its results vary depending on several factors, such as: whether the vowels are in direct contact; whether they are separated by a consonant; and whether a word boundary intervenes or not. The degree and nature of vowel assimilation varies also depending on the syntactic categories of the words involved. In this paper, in order to focus the research by narrowing the field, only one case is studied: that of vowels in direct contact across a word boundary, in one particular syntactic environment: that of a verb of the shape CV, and a noun object of the shape VCV. While verbs can end in any of the nine Gade vowels, the vowels in vowel-initial noun prefixes are limited to five: **i**, **ị**, **u**, **ụ**, and **a**.

Chart 2 lists the outputs that have been recorded during a large sampling of verb - noun object configurations where two vowels are in direct contact. The left column lists the final vowel of the verb, the top row lists the vowel of the noun prefix. The number after each output indicates the number of times each output has been encountered. Chart 2 may seem to present a confusing picture, but as will become clear, there is an underlying pattern to it.

2.

	i	ị	u	ụ	a
i	ii 2	ii 9	iu 1 ii 8	iu 4 ii 1 uu 1	ia 5
u	ui 1 ūi 3 ii 2	ii 6	uu 7	uu 7	ua 6
ị	ii 2	ịị 5	iu 2 uu 5 ii 3 ụụ 1	ịụ 2 ụụ 9	aa 5
ụ	ui 2 ii 4	ụị 2 ịị 3	ụu 2 uu 12	ụụ 4 ọọ 2	aa 5
e	ei 3 ee 2	ee 6	eo 2 oo 9	eụ 2 ụụ 5 ọọ 1	ea 5
o	oe 4 ee 1	ee 6	ou 1 oo 5	oụ 1 oo 5	oa 5
ẹ	ẹe 3 ee 4	ẹị 1 ẹẹ 2	ẹu 1 ẹo 10 ẹẹ 2 oo 5	ẹụ 4 ụụ 4 ọọ 9	aa 8
ọ	oi 2 oe 1 ee 1	ọị 4 ẹị 4	oo 6	ọọ 13	ọa 1 aa 5

a	ai 2	aị 3	au 3	aụ 3	aa 3
	ae 2	ẹị 2	aụ 2	aọ 2	
			ao 3	aa 3	
			aa 2	ọọ 4	

2. RULE-ORIENTED ANALYSIS

If one wanted to list a set of rules that would account for the process of assimilation documented in 2, one would have great difficulty. Invariably one would run into exceptions. Among these rules one would presumably include:

(1) A non-low vowel will be expanded in the environment of an expanded vowel; (this accounts for changes like **ịi** > **ii**; **uụ** > **uu**, but leaves **a** unchanged when in contact with an expanded vowel: **ua** > **ua**; **ea** > **ea**);

(2) A vowel will be non-high in the environment after a non-high vowel; (like: **ei** > **ee**; **ọụ** > **ọọ**; **au** > **ao**);

(3) If the first vowel is low, no complete assimilation takes place (**aị** > **ai**; **au** > **au**);

(4) Two vowels become identical following the process of anticipatory assimilation--subject to the various conditions stated in rules (1) through (3); (**iu** > **uu**; **ẹa** > **aa**).

A glance at chart 2 will show that although these rules and conditions account for most of the data, in many cases they do not. For example, against rule (1) we find **ẹi** > **ẹe** (three times). Nor can we demand that these rules be applied in sequence in order to account for the data. For example, the output **au** > **au** (rule 3) should not be possible after rule (2) has applied (**au** > **ao**), but both are found in the data. It is in fact as if outputs to all rules can be found simultaneously. Quite a few more rules or conditions on existing rules would have to be created to account for the data, and one may even wonder whether it is possible at all to write any one set of rules that would explain them all. It would appear in fact that assimilation in Gade is not a predictable, once-for-all change in vowel structure occurring when two vowels meet, but that it is a gradual transformation influenced by some independent variables, one that does not always follow the same paths.

3. ALTERNATIVE ANALYSIS

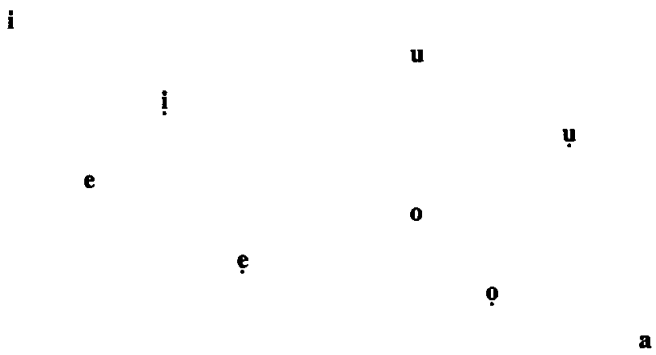
Rather than try to formulate a precise set of rules that have to be applied in sequence in order to account for the data, it is suggested here that a different type of analysis may be more enlightening. It will predict which type of output to expect, and it will in addition try to give an insight as to the reason why vowels in contact behave the way they do. In fact, eventually, an attempt will be made to justify this alternative analysis by making an appeal to the feature of naturalness in the articulatory process.

In 2, the vowels that assimilate completely are listed on a grid, together with those that assimilate only partially. This grid is summarized in 3, listing only the cases of complete assimilation (thereby narrowing the field even more and facilitating the drawing of first, clear conclusions). We note again that the vowels in the left column are listed from high to low, with the highest vowel in the topmost left corner; and the vowels of the top row are listed in their order of frontness, with the most fronted vowel appearing in the extreme left position.

3.	i	ị	u	ụ	a
i	ii	ii	ii	ii/uu	
u	ii	ii	uu	uu	
ị	ii	ii	uu/ii/ụụ	ụụ	aa
ụ	ii	ii	uu	ụụ/ọọ	aa
e	ee	ee	oo	ụụ/ọọ	
o	ee	ee	oo	oo	
ẹ	ee	ẹẹ	oo/ẹẹ	ọọ/ụụ	aa
ọ	ee		oo	ọọ	aa
a			aa	ọọ/aa	aa

We now compare this output with an ordinary vowel chart that lists all Gade vowels according to the usual conventions: the articulatory tract from larynx to lips is arranged from right to left, with the i sound articulated in the left top corner, and a in the bottom right corner. (We accept that such a chart is deficient in its representation, if only because the features of expandedness and rounding cannot be represented adequately.)

4.



If we make the comparison between charts 3 and 4 referred to above by mapping 4 onto 3, we find that, except for a, there is a great similarity between the position of the vowels in both. From this finding, we deduct the following principle:

(5) When two vowels assimilate completely to each other, the resulting (identical) vowels are determined in their height by the height of the first vowel of the pair, and in their frontness by the frontness of the second vowel.

To explain that this is so, we observe first of all that in 4 the vowels are charted according to height and according to frontness. Through convention their height is obtained from their left coordinate, and their frontness from their top coordinate. This, however, is exactly how the participating vowels in 3 are charted: the left column lists them from high to low, starting at the top, while the top row lists them from front to back, starting at the left. The coordinates of any of these two vowels in 3, one from the column and one from the row, will determine a position on the chart with the height of the first vowel and the frontness of the second. When we enter the results of assimilation onto 3, we find that these vowels correspond roughly in position and quality to those of 4. Using the coordinates of height and frontness, therefore, two charts, one plotting the place of articulation of nine vowels, and the other plotting the result of total assimilation between pairs of vowels using these coordinates for first and second vowel respectively, result in the same configuration. This means that in order to plot the place of

articulation of the vowels resulting from the assimilating process, we have to take the height coordinate of the first vowel, and the frontness coordinate of the second.

If we were to try to formulate (5) into a rule, we would run into many difficulties. In the end we would probably arrive at a set of rules very similar to those given previously, and we would be missing the important point that vowel assimilation in Gade, while not totally predictable, displays a definite pattern. So, basing ourselves on the findings in this section, we would like to suggest that vowel assimilation in Gade is not strictly rule-governed, but that all the same three main tendencies in vowel behaviour can be discerned:

(6) vowels tend to assimilate in height, and their assimilation is perseverative;

(7) vowels tend to assimilate in frontness, and their assimilation is anticipatory;

(8) an expanded vowel and **a** do not assimilate, while a non-expanded vowel tends to assimilate to **a**.

Note that a comparison between charts 3 and 4 cannot tell us anything further about the feature of expandedness in assimilation. Our earlier rule (1), can simply be reformulated as follows:

(9) the presence of an expanded vowel in the input will result in a tendency for both vowels to be expanded after assimilation.

So far we have not discussed the feature of lip-rounding, but it appears from chart 3 that if the second vowel of the pair is rounded, the result of the assimilation tends to be a rounded vowel as well.

4. NATURALNESS OF ARTICULATORY MOVEMENT

We have moved away from a rule-oriented analysis towards one which describes the process in terms of tendencies. We now want to move a step further, and try to describe vowel assimilation in Gade in terms of the articulatory movement. In that way we will not only describe what is happening, and perhaps be able to predict other cases of assimilation, but most importantly, we may be able to say why the changes we describe take place.

First of all, we have to distinguish between positions of the vocal tract that are 'once-for-all' ('on/off' switches), and others that are gradual. A case of the first is lip-rounding: one either rounds or one doesn't. An example of the second is tongue height: there are several positions in moving the tongue up gradually from the neutral position: two extremes, and many positions in between. It will be held here that in cases of vowel assimilation, the articulators assume from the start of the articulatory process some basic positions that are once-for-all. The gradual positions find their specific realisation in the general framework of the previously established 'once-for-all' configuration. Expandedness and rounding are seen as once-for-all features.

Secondly, it will be held that the assimilatory process originates from the larynx up, to end at the lips. This, of course, is the natural way nearly all speech is made. It will be held here, therefore, that assimilation fits into this pattern in a natural way, so as to explain the various surface forms of assimilation that we have encountered.

This, then, is how it is thought that assimilation operates in Gade:

(10) speech originates in the larynx with airflow passing from the lungs through the vibrating glottis (vibrating, because we are describing the merging of voiced sounds);

(11) the two participating vowels are recognized, and, presumably, on a signal from the brain, the first articulators, the larynx and the tongue root, are brought into play: if one of the vowels is found to be expanded, the larynx will lower and the tongue root will advance, thus creating the space for the expanded output of the assimilation (rule 1, or 9); in this way one of the once-for-all articulatory positions is taken up;

(12) at the same time, a second position is taken up: that of lip-rounding. If the second of the vowels is recognized as being rounded, the lips take on that feature, and this once-for-all position is assumed, thereby determining the general articulatory framework within which the details of the assimilatory process are to take place;

(13) after the possible movement of the tongue root forward (in the case of a participating, expanded vowel), the next feature is selected: tongue height. The brain, after acknowledging the quality of the two vowels, naturally selects the first one to give it its coordinate for vowel height (rule 6); (on naturally, see below);

(14) moving on, it will then place the tongue further into position by selecting its frontness; this will be the frontness adopted from that of the second vowel of the assimilation (rule 7);

(15) as for the vowel **a**, it has to be assumed that its special low back position equates it for all practical purposes with a once-for-all articulator: if **a** is present, the brain mainly desists from all efforts at arriving at other assimilatory movements of the articulators, and simply accepts the tongue and mouth position for **a** as a given that cannot be changed. This is especially the case if **a** is the first of the two assimilating vowels, but when **a** is second, it does coalesce with non-expanded vowels in an anticipatory form of assimilation: the **a** articulatory once-for-all position is simply extended to the other vowel involved. If the first vowel is expanded, however, no integration of the two articulatory positions is possible: they both occupy mutually exclusive once-for-all configurations, and assimilation is impossible. They are pronounced one after the other, starting with the vocalisation of the expanded vowel position, and moving on next to the articulation of **a**.

In rule (13), the word 'naturally' is important, but it would have to be proven by independent data that it is indeed a natural phenomenon and a language universal for tongue height to be chosen before tongue frontness. As for the Gade data, they seem to indicate that tongue height is indeed a feature that is dominant over others.

The whole process of assimilation has now been described, but the cautionary statement has to be repeated that the process is by no means obligatory, predictable, and fully operational in all the instances where it occurs. It is thought that factors which can influence the outcome are fastness of speech and 'colloquialness', but this has not been further investigated. In addition, if there exists much confusion in the output of the assimilatory process in Gade (as documented on chart 2), the cause may well be the fact that the language is in the process of moving from a nine vowel system to a seven vowel system. This change goes hand in hand with an increasingly diminishing role of expandedness as a phonemic feature, and this may be the main reason why chart 2 presents such an untidy picture. This point will be taken up in the next paragraph.

5. FUTURE DEVELOPMENT

Said in isolation, the non-expanded **ị** and the expanded **e** sounds are difficult to distinguish, and the same can be said of **ụ** and **o**. These vowel pairs are merging, leading naturally to a seven vowel system: **i, u, e, o, ẹ, ọ, a**. It is probable that expandedness is disappearing as a distinctive feature, but we should note that if we were to base ourselves strictly on the attribution of features as listed on chart 1, the disappearance of

expandedness is not a straight-forward process. If it were, ị would merge with **i**, ụ with **u**, ẹ with **e**, and ọ with **o**, and we would end up with a five-vowel system. What we observe is a two-step process: the merging of the vowel pairs is situated first on the level of tongue height, with the central high vowels joining their non-high counterparts: ị and ụ becoming [-high] first, and only then do **e** and **o** lose their expandedness, thereby completing the merger of the central vowels.

We may consider this in the light of the case of vowel assimilation that we have studied. Judging from the rules it would appear that expandedness is irrelevant as far as the results of assimilation go. It is the position of the body of the tongue, and not that of the root, which determines the outcome. The once-for-all framework of expandedness may or may not be present (depending on whether one of the participating vowels is expanded), but it does not have an effect on the height or frontness quality of the vowels resulting from the assimilatory process. Expandedness may drop out as a feature all together, and the process would carry on normally. It would seem, therefore, that once vowels have established their phonemic distinctiveness on the level of tongue height and tongue frontness, then eventually expandedness becomes redundant as a feature, and is dropped.

As for why ị merges with **e** and not with **i**, there is a simpler explanation than the one assuming a two-step process. It may simply be that chart 1 is not correct. Instead, it would be more precise to distinguish four levels of tongue height rather than the usually accepted three ([+high, -low], [-high, -low], and [-high, +low]). These levels would be:

level 1: **i**, **u**;
level 2: ị, **e**, ụ, **o**;
level 3: ẹ, ọ;
level 4: **a**.

If the feature of expandedness disappears, then ị merges with **e**, and ụ with **o**. The reason for ị merging with **e** and not with **i** is, therefore, that the non-expanded ị is on the same level of tongue height as the expanded **e**, but on a lower level than **i**, contrary to the notation of chart 1.

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