

SOME SARA VOWEL INVENTORIES AND VOWEL SYSTEM PREDICTIONS

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ABSTRACT

Formant measurements of six Sara languages confirm the general principle that vowels of a given system tend to be *sufficiently* dispersed and that systems are more filled on the *front* and/or *back* ranks than on the *high* one. But, in vowel system predictions, Sara languages which have at least 6 vowels do not always attest a phonemic [ɛ] which, according to Crothers [1], should appear "earlier" than phonemic [i] and [ə]. Still, in Sara languages, [ɛ] does tend to appear at the phonetic level.

The aim of this study is to confront some vowel inventories with *typological* [1, 4] and *computational* [2, 3] system predictions.

1. SARA VOWEL SEGMENTS

Sara (Central Sudanic family [5]) is a group of about twelve languages spoken in Chad and Central Africa. Formant measurements of vowel systems of six of these languages (Nar, spoken in Doro; Sar, spoken in Douyou; Mbay, spoken in Moïssala; Kaba, spoken in Paoua; and two varieties of Bedjond, spoken in Bediondo and Beda) provided us with the acoustic spaces shown below (fig. 1-6). Each vowel was inserted in a carrier sentence in a [...tVt...] context. Twelve repetitions of each sentence were

recorded, in a random order, by one speaker per language, in a soundproof booth. The corpus was digitized, and the vowel formants were measured (using the ICP's digital signal editor, EDISIG). Figures 1 to 6 display those measures with 90% dispersion ellipses.

At a surface phonology level, a language like Bediondo Bedjond [6] has 11 vowels that could be all interpreted as phonemic, because they can all contrast in more or less identical contexts: [ti:] *it swelled*, [té:] *he deceived him*, [tè:] *he married her many times*, [tá:] *he took it many times*, [tó:] *he tied up*, [tò:] *he blew on it*, [tú:] *he swallowed*, [tí] *to, into*, [tô:] *he deceived*, [tô:] *he blew on him*, [tô:] *he tied him*. But in underlying phonological representations, only [i, e, a, ɔ, o, u] are phonemic. Actually, [ə] and [i] are, respectively, allophones of [e] and [i]. Furthermore [ɛ, œ, ø] are respectively phonotactic fusions of [a+e], [ɔ+e] and [o+e]. In this study, such allophones or blends (empty ellipses) will be physically positioned with regard to other vowel realizations corresponding more closely to their underlying representations (filled ellipses). This analysis of Bediondo Bedjond is also valid for Beda Bedjond, Kaba, Mbay, Nar, and Sar [7, 8, 9, 10].

2. VOWEL DISPERSION

According to the Theory of Adaptive

Dispersion [3], vowels tend to be *sufficiently distant* in the so-called anthropophonic vowel triangle. At the same time, vowels of a given system tend to fill rather the *back* and/or *front* ranks than the *high* one.

Available phonological descriptions of Sara languages show that the Bedjond dialects, Kaba, Mbay, Nar and Sar all display an unbalanced *phonological* inventory: [i, e, a, ɔ, o, u]. But allophones and phonotactic blends tend to fill gaps and make the systems more balanced, except for Sar and Mbay. As a result, the system of Nar (fig. 3) is one of the most classically balanced.

Beda Bedjond presents a very centralized [e]; in fact, it is phonetically an [ə]. In Kaba (fig. 4), the central high vowels [i] and [ə] drift toward their front counterparts [i] and [e] without protruding the lips. (Note that generally, our Kaba speaker tends to have a narrow front-back space vs. one of the largest high-low dimension). From a general point of view, vowels of the same aperture degree are relatively well separated. The exceptions are [ø] and [ə] in Bediondo Bedjond, which are two very close allophones of different phonological vowels (cf. [8] for a study of this special case, [ø] like [œ], being clearly *rounded*).

3. VOWEL INVENTORIES AND THE LACK OF PHONEMIC [ɛ]

According to [1], languages with five or more vowels have phonemic [ɛ]. Most of the time, the five vowels are [i, e, a, ɔ, u]. The prediction of [ɛ] as the sixth vowel would require filling the front rank before the back one. The case seems to be reversed in Sara.

At the phonetic level, Sar has 7 vowels [i, e, a, ɔ, o, u, i]. According to the descriptions of [8] and [10], [i] is an allophonic variant of [i]. It is interesting

to notice that while Sar attests [i], it does not have [ɛ], although, from a typological point of view, one could expect an [ɛ] first. The acoustic vocalic triangle clearly shows here the gap left by this absence of [ɛ] (fig. 1).

Mbay has 8 vowels: 6 peripheral [i, e, a, ɔ, o, u] and 2 interior [i, ə] [9]. Mbay does not attest [ɛ]. The gap left by its absence appears also clearly in the acoustic space (fig. 2).

Nar also has 8 vowels. It attests [ɛ] but only at a *phonetic* level: [ɛ] is a result of [e] in a pre-consonantal position (fig. 3).

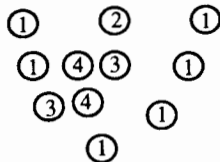
In Bedjond dialects [6], [ɛ:] (always realized long) is a combination of a final [...a#] with the pronoun [-e] "his" (e.g. [tâ:] *mouth* + [é] *his* → [tɛ:] *his mouth*). Only Kaba seems to have an [ɛ] which is not an allophone, from a surface phonology point of view. But the lack of analyses available for Kaba prevents us from giving firm phonological conclusions on this system.

4. THE ORDER OF APPEARANCE OF INTERIOR VOWELS IN SARA LANGUAGES

According to [1], six-vowel systems have [i, e, ɛ, ɔ, o, u] or [i, ɛ, a, ɔ, o, i]. The second system is said to be the most common. Generally, when languages have 9 vowels, there are 7 peripheral vowels [i, e, ɛ, a, u, o, ɔ]. The other 2 vowels are the front rounded [y, ø], the back unrounded [u, ʋ], or central [i, ə]. Sara languages do not have 9 phonemes, but they can display 9 phonetic vowels. For Sara dialects like Beda Bedjond and Kaba, that have already filled their peripheral positions with [ɛ], it seems easier to develop an [ə] after an [i] (as in all other Sara languages) rather than developing a completely different range of vowels like front rounded or back unrounded.

Bediondo Bedjond speakers realize 11

vowels (fig. 6). Thus, after using the central rank, Sara languages exploit the front rounded rank of vowels [ø, œ]. These vocalic systems allow us to suppose that when Sara dialects need to develop new vowels, beyond those cardinal and phonemic vowels represented in the following figure by ①,



the tendency is first to develop allophones at the high central position, ② (Sar); before filling the remaining cardinal (Nar and Beda Bedjond) or central (Mbay) positions, ③ (both, for Kaba); then, to exploit the front rounded positions, ④ (Bediondo Bedjond).

5. SARA LANGUAGES AND VOWEL SYSTEM PREDICTIONS

Again according to [1], "Languages with six or more vowels have ɔ and also either i or e, generally the former" and "Languages with seven or more vowels have e, o or i, ə". Sara languages have 6 phonemic vowels. In accordance with Crothers' prediction, they have [ɔ] and [e], but they do not have phonemic [i] and [ə]. But at a phonetic level, all of them have [i], and 4 of them also have [ə] (including [e] = [ə] of Beda Bedjond).

6. CONCLUSION

In regard to our formant measurements and to phonological analysis of Sara languages, one can say that while Sara vocalic inventories appear to maintain a sufficient distance between vowels in a given system, they show, typologically, that languages with five or more vowels do not obligatorily tend to give rise to

phonemic, or even surface, front rank filling with [e].

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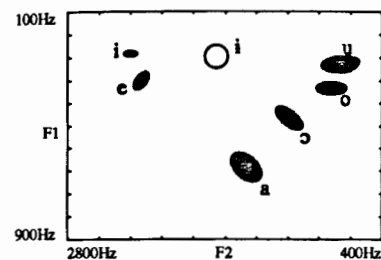


Figure 1: Sar

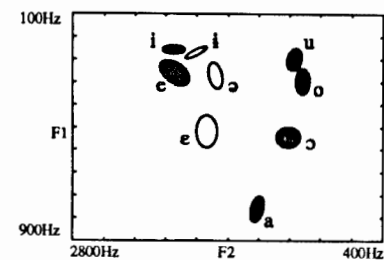


Figure 4: Kaba

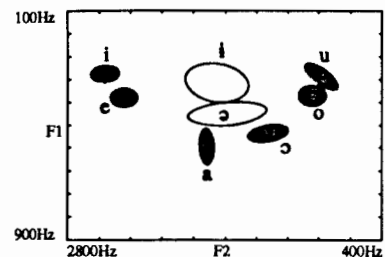


Figure 2: Mbay

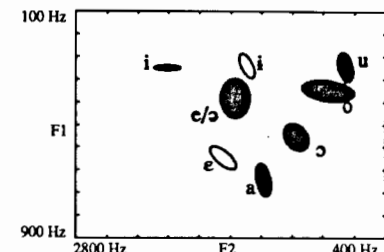


Figure 5: Beda Bedjond

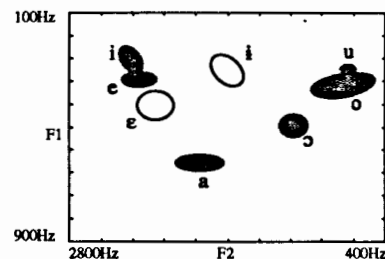


Figure 3: Nar

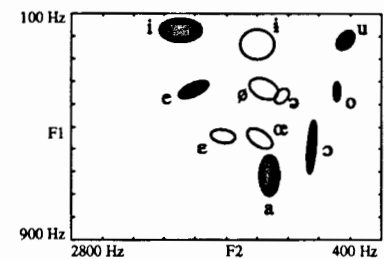


Figure 6: Bediondo Bedjond

Formant mean values

		i	e	ə	a	o	ɔ	u	ɨ	ɛ	œ	œ
Sar	F1	252	346		651	483	370	290	261			
	F2	2331	2250		1463	1120	798	723	1681			
Mbay	F1	328	411		580	535	401	336	359	467		
	F2	2520	2375		1746	1271	931	863	1664	1591		
Nar	F1	273	336	431	631	496	365	303	310			
	F2	2342	2286	2158	1821	1104	733	695	1621			
Kaba	F1	235	314	519	796	540	340	269	243	328		
	F2	2031	2010	1776	1393	1150	1036	1088	1848	1699		
Beda Bedjond	F1	305	401	631	700	558	386	305	305			
	F2	2091	1565	1648	1340	1086	853	721	1480			
Bediondo Bedjond	F1	168	375	546	680	581	386	201	214	400	375	550
	F2	1968	1874	1641	1281	950	765	683	1376	1198	1305	1346