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A GENERATIVE ACCOUNT OF CONSONANT ALTERNATIONS IN BABA 1[1]

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This paper analyses and accounts for various patterns of alternations exhibited by consonants as they interact within morphemes in Baba 1. Most of the alternations manifested by the consonantal segments of this language are in accordance with general phonological principles. Nevertheless, there are some apparently complex alternations that may not be sufficiently accounted for using simple phonetic logic, and that exhibits some typological novelties, which may be of some theoretical interest to specialists in the field. Moreover, the underlying consonant system of this language constitutes a typological curiosity rarely documented in the world's languages. The contrast between voiced and voiceless consonants is highly restricted, appearing only with labio-dental, but never alveolar sounds.

1. Introduction.

This paper applies the generative theoretical framework in making a comprehensive analysis of alternations in consonant phonemes of morphemes and words in Baba 1, a Grassfields Bantu language of Cameroon spoken by about 15,000 people. This descriptive analysis will not only provide data on Baba 1, an understud-

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ied language, it will also show that some general principles governing surface data in the language can be easily explained by using formalised mental rules.

1.1. Geographical location. The name Baba 1[2] is used to refer to a village, people and language. This language, which Dieu et al (1983) variably refer to as Bapa or Bapakum, is spoken by the people of one of the thirteen settlements/villages in the Ndop plain, Ngoketunjia Division of the North-west province in the Republic of Cameroon. More precisely, it is located at (6.06′N, 10.49′E). The speakers call their language 'su papiax', translated as 'the speech of the Baba 1 people'.[3] Grimes (1996) also refers to the language as Papia, Bapa, Bapakum; it has the Ethnologue code BBW.

1.2. Phonological processes. There are phonological alternations that arise as a result of morphological/syntactic processes. Alternations in Baba 1 include assimilation, strengthening processes, and deletion. The processes described will not only present general and language-specific phenomena, they will also reveal somewhat curious phonological manifestations peculiar to this language. These include the lateral becoming a corresponding stop when preceded by a nasal in word initial position but a trill becoming a retracted affricate in the same environment. Nasals are also seen to be deleted in the environment of voiceless fricatives. Moreover, the voiced velar fricative [γ] and the velar stop [g] are allophones occurring in mutually exclusive environments. In initial position, [g] occurs exclusively before the high front vowels [i,ü], while the velar fricative precedes the remaining vowels. Finally, there is a highly restricted stop voicing rule, which voices the bilabial stop /p/ between two voiced sounds, but the other stops are unaffected in the same environment.

With these issues raised, we now present the phones of Baba 1 in (1).

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[2] This should be differentiated from Baba 2, which is a different village in Mezam division of the Republic of Cameroon, and whose language, which is not mutually intelligible with that of Baba 1, is classified under the Ngemba languages.

[3] The translation is that of the author who is a native speaker of the language and presently a technical adviser to the language committee of the language.

(1) Phones

a. *Consonants*

p	t		k	kp	ʔ
[b]*	[d]*		[g]*	gb	
m	n	ɲ	ŋ	ŋm	
f	s	ʃ	x		
v			ɣ		
	ts	tʃ			
	[dz]*	[dʒ]*			
	l				
	r				
		j		[w]*	

b. *Vowels*

i	ɨ	u
e	ə	o
	a	

The sounds marked with asterisks are allophones as follows: /p/ → [b], /l/→[d], /ɣ/→[g,w], /r/→[dz] and /j/→[dʒ]. It is seen that apart from the voiced labio-velar stop, which contrasts with its voiceless counterpart as a separate phoneme, all of the other voiced stops and affricates in this language are allophones of other phonemes, as will be clearly illustrated in our analysis. Another peculiarity of this language is the presence of a contrast between voiced and voiceless labial fricative and the absence of such a contrast for their non-labial counterparts.

Before we begin with the analysis of the attested processes responsible for consonant alternations in Baba 1, it will be helpful to give some phonotactic facts about the language. With respect to the data of the language, the following remarks can be made. First, words in this language end with no consonant other than [p, m, ŋ, ʔ, r, x]. Second, there are no vowel-initial roots whatsoever, but single vowel segments can function as grammatical morphemes. The nasals of the language [m, n, ɲ, ŋ] are not affected by a following vowel, but they are affected when preceding a consonant in initial position. Finally, the language does not have [z] or [ʒ], but there are [dz] and [dʒ]. With these facts in mind about Baba 1, we now examine the attested assimilatory processes such as a consonant assimilating consonant feature and a consonant assimilating vowel feature as analysed below.

In this language, there are varied forms of consonant assimilation. A nasal takes on the place features of a following consonant, and a consonant may take the voice feature of surrounding sounds. The former describes exclusively the behaviour of nasals in word-initial position while the latter describes a bilabial stop between a nasal and a vowel. Rule (2) expresses this formally.

(2) Nasal place of assimilation.

$$[+\text{nas}] \rightarrow \begin{bmatrix}\alpha\text{ant}\\ \beta\text{cor}\end{bmatrix} / \# \_\_\_\_ \begin{bmatrix}\alpha\text{ant}\\ \beta\text{cor}\end{bmatrix}$$

Data in (3) and (4), wherein a noun class prefix and the first person singular subject marker respectively are used, illustrate the validity of our nasal assimilation rule. The language has certain nouns whose plural marker is a nasal prefixed to the noun. Similarly, the first person singular subject marker is usually a nasal prefixed as a clitic to the verb during sentence construction. These two items are used to illustrate nasal assimilation below.

(3) Assimilation of nasal in word-initial position.

Singular nouns		*Plural*	
kù	'foot'	ŋ-kù	'feet'
tóŋlə́	'ear'	n-tóŋlə́	'ears'
kóxtə́	'knee'	ŋ-kóxtə́	'knees'
tʃɨ̀ŋlə̀	'buttock'	n-tʃɨ̀ŋlə̀	'buttocks'[4]

(4) 1st person subject pronoun. (asp = aspectual marker)

/**Ǹ**-tá mə́ wó/ I-kick asp stone	[**ǹ**tá mə́ wó]	'I have kicked a stone'
/**Ǹ**-tím mə́ kɨ̀ŋ/ I -carry asp pot	[**ǹ**tím mə́ kɨ̀ŋ]	'I have carried a pot'
/**Ǹ**-kàŋ mə́/ I -cry asp	[**ŋ̀**kàŋ mə́]	'I have cried'
/**Ǹ**-kpì mə́/ I -absent asp	[**ŋ̀**kpì mə́]	'I am absent'
/**Ǹ**-gbàr mə́ sú/ I -cut asp fish	[**ŋ̀**gbàr mə́ sú]	'I have cut a fish'
/**Ǹ**-mòm mə́/ I-attempt asp	[**m̀**mòm mə́]	'I have attempted'

[4] The nasal in this word does not assimilate the palatal place of articulation of the following consonant here because the sound [tʃ] is not considered a pure palatal in this language, but is better described as a prepalatal.

/**Ǹ**-nè mə́/ I-block asp	[**ǹ**nè mə́]	'I have blocked'
/**Ǹ**-ɲà? mə́/ I-write asp	[**ɲ̀**ɲà? mə́]	'I have written'
/**Ǹ**-ŋɔ́m mə́ tíɨ́/ I -bend asp tree	[**ŋ̀**ŋɔ́m mə́ tíɨ́]	'I have bent a tree'

Since we do not have an argument strong enough to decide which among the attested nasals (*m, n, ŋ, ɲ*) is underlying in this language, it is more convenient to assume an underlying nasal /N/ without any place of articulation feature. This nasal will only acquire a place feature on the surface from the following consonant.

Our rule in (2) applies to a nasal before a consonant in root initial position, as indicated by the word boundary, in order to account for the parallel examples in (5) below, where there is no assimilation.

(5) Non-assimilation of nasal within a word

mbù**m**tə̀	'weevil'	tó**ŋ**lə́	'ear'
wù**m**tə̀	'umbrella'	fò**ŋ**lə̀	'among'
lə́**m**lə̀	'delay'	sí**ŋ**tə́	'name of a village'
və̀**m**tə̀	'soft part of bamboo'	só**ŋ**lə̀	'speech'
ɣà**m**tə̀	'help'	kà**ŋ**lə̀	'friendship'
mò**m**tə́	'to test'	fè**n**tə́	'to lock'
ʃáŋtə́	'to count'	sé**n**tə́	'to break'

The data above clearly illustrate that our proposed rule (2) applies exclusively in stem initial position in the presence of a preceding word boundary as indicated by data of (3,4), and not elsewhere within the word.

The next issue to be addressed is a case where a sound takes on features from both preceding and following sounds. This is the curious case of the bilabial stop, which is voiced between a nasal and a vowel, whereas no other stop is voiced in this environment. This is formalized in (6) below.

(6) Bilabial stop becomes voiced between a nasal and a vowel.

$$\begin{bmatrix} +\text{ant} \\ -\text{cont} \\ +\text{lab} \\ -\text{voice} \end{bmatrix} \rightarrow \quad [+\text{voice}] \ / \ [+\text{nas}] \_\_\_ [+\text{syll}]$$

This rule is exemplified by the data in (7) below where we use a nasal that serves as marker for plural nouns in (a) and another nasal used as first person singular subject pronoun in (b).

(7) a.

pó	'hand'	**m**-bó	'hands'
pàm	'bag'	**m**-bàm	'bags'
páŋ	'tin'	**m**-báŋ	'tins'

b.

/**Ǹ**-póx mə́/ I-struggle asp	[**m̀**bóx mə́]	'I have struggled'
/**Ǹ**-pá mə́/ I-mad asp	[**m̀**bá mə́]	'I am mad'
/**Ǹ**-púptə́ mə́/ I-spoiled asp	[**m̀**búptə́ mə́]	'I have spoiled'
/**Ǹ**-pə́m mə/ I-agree asp	[**m̀**bə́m mə́]	'I have agreed'

Compare [ntá mə́] in (4), where other stops do not change.

Another instance where a consonant takes on the feature of neighbouring sounds is when the voiceless bilabial stop and the velar fricative become voiced in this language. We simply give a single rule that takes care of these two contexts. The rule says: "a bilabial stop and a velar fricative are voiced between two vowels". This rule above describes a single unified process in Baba 1. Unfortunately the two sounds involved do not form a single natural class. For purpose of simplicity, we collapse the two rules to give the formalism in (8).

(8) Voiceless bilabial stop and velar fricative become voiced

[p,x] → [b,γ] / [+syll] ___ [+syll]

$$\left\{\begin{bmatrix}+\text{cons}\\+\text{ant}\\+\text{lab}\\-\text{voice}\end{bmatrix}\right.$$
$$\left.\begin{bmatrix}+\text{cons}\\+\text{back}\\+\text{cont}\\-\text{voice}\end{bmatrix}\right\} \rightarrow [+\text{voice}] / [+\text{syll}] + \_\_\_ [+\text{syll}]$$

Our rule in (8) will apply to give the surface forms in the data in (9) and (10), where 1sg refers to first person singular possessive/direct object pronoun, and "+" indicates a morpheme boundary.

(9) Bilabial stop voicing

a. *Noun citation form*		*Nouns + possessive*		
táp	'shoe'	/táp +á/ shoe-1sg	[tábá]	'my shoe'
ŋgùp	'mat'	/ŋgùp+à/ mat -1sg	[ŋgùbà]	'my mat'
ŋkìp	'left'	/ŋkìp+à/ left -1sg	[ŋkìbà]	'my left'
sàp	'proverb'	/sàp +à/ proverb-1sg	[sàbà]	'my proverb'

b. *Verb citation form* *Verb + direct object*

lə̀p	'to beat'	/lə̀p+á/ beat-1sg	[lə̀bá]	'Beat me!'
sòp	'to stab'	/sòp+á/ stab-1sg	[sòbá]	'Stab me!'
pɪ́p	'to wait'	/pɪ́p+a/ wait-1sg	[pɪ́bá]	'Wait for me!'
jŏp	'to sing'	/jŏp+á/ sing-1sg	[jòbá]	'Sing me'

(10) Velar fricative voicing

a. *Noun citation form* *Nouns + possessive*

póx	'parcel'	/póx +á/ parcel-1sg	[póɣá]	'my parcel'
láx	'calabash'	/láx +á/ calabash-1sg	[laɣá]	'my calabash'
ɲáx	'aubergine'	/ɲáx +à/ aubergine-1sg	[ɲáɣà]	'my aubergine'
lóx	'poison'	/lóx +á/ poison-1sg	[lóɣá]	'my poison'

b. *Verb citation form* *Verb + direct object*

ɣàx	'to grind'	/ɣàx +á/ grind-1sg	[ɣàɣá]	'Grind me!'
mòx	'uproot'	/mòx +á/ uproot-1sg	[mòɣá]	'Uproot me!'
ɲàx	'kill'	/ɲàx+á/ kill -1sg	[ɲàɣá]	'Kill me!'
kjàx	'promise'	/kjàx +á/ promise-1sg	[kjàɣá]	'Promise me!'

The rule in (8) requires a restriction, such that it applies only to root-final position as indicated by the presence of a morpheme boundary. This is shown by the existence of forms in the language like *ʃə̀pún* 'spoon', *tépə̀rə̀* 'table', *pə́pə̀* 'we/us', *sə́pó* 'finger', *ǹdə̀pà?* 'tobacco' in which the bilabial stop is not voiced between vowels. However, there is one peculiar case where the bilabial stop is voiced in a context other than root-final. This is the case of the word *və́bə́* 'bitter leaf'. Nevertheless, this is the only word so far attested whereby our voicing rule seems to apply in root-internal position, thus posing as an exception.

One other case of a consonant alternation, resulting from its contiguity with a vowel, is the velar fricative which becomes an approximant when preceding a back rounded vowel, but a stop if the vowel is high and front. This can be expressed by a rule which states: "a velar fricative becomes a glide when preceding back rounded vowels, but a corresponding stop if the vowel is front and high." For the purpose of simplicity and ease of stating the restrictons involved, we represent this rule as (11a) and (11b) below:

(11) a. $\begin{bmatrix} +\text{cons} \\ -\text{ant} \\ +\text{cont} \end{bmatrix} \rightarrow [-\text{cont}] / \#\ \_\_ \begin{bmatrix} +\text{syl} \\ -\text{back} \\ +\text{high} \end{bmatrix}$

b. $\begin{bmatrix} +\text{cons} \\ -\text{ant} \\ +\text{cont} \end{bmatrix} \rightarrow [-\text{cons}] / \#\ \_\_ \begin{bmatrix} +\text{syl} \\ +\text{back} \\ +\text{round} \end{bmatrix}$

Our rules in (11) apply in discontinuous dependency, because the same underlying representation provides two different surface forms depending on the context. The same fricative becomes a stop if the following vowel is high and front (11a), but an approximant if and only if the following vowel is back and round (11b). These rules can only apply in stem initial position, as shown by the existence of pronominal forms in the language such as *poɣo* 'we (excl.), *puɣi* 'we (dual)'. The data in (12) exemplify the application of the rules in (11) where a velar fricative becomes a stop and an approximant respectively.

(12) a. Velar fricative becomes a stop

/ɣìm/	[gìm]	'to hold'
/ɣí/	[gí]	'to mourn'
/ɣiʔlə/	[giʔlə]	'to shape'
/ɣiéʔlə/	[giéʔlə]	'kernel'
/ɣìáŋ/	[gìáŋ]	'to frame'
/ɣié/	[gié]	'to be nice'
/ɣúíáx/	[gűáx]	'to throw way'[5]

b. Velar fricative becomes an approximant

/ɣùmtə̀/	[wùmtə̀]	'umbrella'
/ɣúáʔ/	[wúáʔ]	'type of vegetable'
/ɣó/	[wó]	'stone'
/ɣú/	[wú]	'death'
/ɣóx/	[wóx]	'pride'
/ɣúptə́/	[wúptə́]	'to measure'
/ɣòptə́/	[wòptə́]	'to entangle'
/ɣúkə́r/	[wúkə́r]	'adults'

c. Velar fricative unaltered before vowels other than [i,ü] and [u,o]

wù ɣɨ-mə́ nù	'you have done a thing'
2sg do-asp thing	
ɣɨ́r	'ability'
ɣé	'thief
ɣə́m	'ten'
ɣàmtə̀	'help'

[5] The vowel /ü/ in this word is not basic in the language. It is derived by a rule whereby a high back vowel is fronted when followed by a high front vowel and another vowel within the same syllable. The language does not allow a sequence of three vowels within the same syllable in words. If this happens, the second of the three vowels in such a sequence is deleted. In our example, /guiax/ is realized as [güax], meaning that after triggering the fronting of [u], [i] is deleted. It should be noted that vowel-fronting rule applies before consonant strengthening, so as to avoid the velar fricative becoming a glide. We will not belabour the rule where /u/ becomes [ü] since vowel alternation is not within the scope of this paper whose focus is on consonants.

In this language, the sounds [ɣ], [g] and [w] are seen to exhibit a sort of complementarity in their distribution, occuring in mutually exclusive environments with respect to the vowels they precede in word initial position. The data in (12a-c) illustrate that /ɣ/ can precede all other vowels in initial position except the high front and back rounded vowels. In addition, *ɣ* and *w* become [g] when preceded by a nasal as elaborated by data (14b). The data in (12a) reveal one of the curiosities of Baba 1. The behaviour of the velar fricative in (12b) can be accounted for using articulatory logic, i.e it assimilates the rounded quality of the following vowel. However, in (12a), *ɣ* is already high, hence there is no apparently logical phonetic explanation for it becoming a stop before a high vowel.

The next type of alternation to be examined is consonant hardening/ strengthening.

2. Consonant Hardening.

There is a phonological process in this language whereby /l, ɣ, r, j/ become [d, g, dz, dʒ] respectively after a nasal. To be more precise, we need a fortition rule which states: "continuants become corresponding stops and affricates when preceded by a nasal." This rule is formally presented in (13).

(13) [+cont] → [-cont] / [+nas] ___

The validity of the preceding rule is illustrated by the data in (14) below, where (asp) is the aspectual marker.

(14) a. Lateral becomes a stop.

/Ǹ-ɾíí mə́/ I-sleep asp	[ǹɗíí mə́]	'I have slept'
/Ǹ-lòʔ mə́ mù-à / I-take asp child-my	[ǹdòʔ mə́ mùà]	'I have taken my child'
/Ǹ-lúé mə́/ I-beg asp	[ǹdúé mə́]	'I have begged'
/Ǹ-làà mə́/ I-pass asp	[ǹdàà mə́]	'I have passed'

b. Velar becomes a stop

/Ǹ-ɣù mə́/ I-fall asp	[ŋgù mə́]	'I have fallen'
/Ǹ-ɣúptə́ mə́/ I-measure asp	[ŋgúptə́ mə́]	'I have measured'
/Ǹ-ɣóx mə́/ I-big asp	[ŋgóx mə́]	'I have become big'
/Ǹ-ɣòʔ mə́/ I-swim asp	[ŋgóʔ mə́]	'I have swum'
/Ǹ-ɣè mə́ nté/ I-go asp market	[ŋgè mə́ nté]	'I have gone to the market'
/Ǹ-ɣɨ́ mə́ jù/ I-do asp thing	[ŋgɨ́ mə́ jú]	'I have done a thing'
/Ǹ-ɣàmtə́ mə́/ I-help asp	[ŋgàmtə́ mə́]	'I have helped'
/Ǹ-ɣə́mtə́ mə́/ I-welcome asp	[ŋgə́mtə́ mə́]	'I have welcomed'
/Ǹ-ɣə́ptə́ mə́ pó/ I -curve asp hand	[ŋgə́ptə́ mə́ pó]	'I have curved the hand'

c. A retracted trill becomes an affricate.

/Ǹ-rì mə́/ I-old asp	[ǹdzì mə́]	'I have become old'
/Ǹ-ràŋ mə́ ndzòx/ I-tap asp wine	[ǹdzàŋ mə́ ndzòx]	'I have tapped wine'
/Ǹ-rùtə́ mə́/ I-shake asp	[ǹdzùtə́ mə́]	'I have shaken'
/Ǹ-rɨ̀ʔtə́ mə́/ I-end asp	[ǹdzɨ̀ʔtə́ mə́]	'I have ended'
/Ǹ-ròp mə́/ I-delay asp	[ǹdzòp mə́]	'I have delayed'

d. A palatal glide becomes an affricate.

/Ǹ-jə̀m mə́ ndáp/ I-round asp house	[ǹdʒə̀m mə́ ndáp]	'I have gone round the house'
/Ǹ-jé mə́ yú/ I-see asp thing	[ǹdʒé mə́ yú]	'I have seen something'
/Ǹ-jòŋ mə́ mə̀ŋgə́p/ I-chase asp fowl	[ǹdʒòŋ mə́ mə̀ŋgə́p]	'I have chased a fowl'
/Ǹ-jàŋ mə́/ I-shout asp	[ǹdʒàŋ mə́]	'I have shouted'
/Ǹ-jòp mə́ ntʃì/ I-sing asp song	[ǹdʒòp mə́ ntʃì]	'I have sung a song'

The last part of our description deals with the deletion of nasal consonants.

3. Consonant Deletion.

Voiceless fricatives never appear after nasals in this language. A rule that explains this fact states: "a nasal is deleted when it precedes a voiceless fricative". This rule is concerned with *s*, *f*, *x* and *ʃ*.

(15) /**N**/ → Ø / _ [s, f, x, ʃ]

$$[+\text{nas}] \rightarrow \emptyset \; / \; \_\_\_ \begin{bmatrix} -\text{voice} \\ +\text{cont} \end{bmatrix}$$

The rule in (15) explains the occurrence of the surface constructions obtained from the underlying forms of the data in (16) below. Here, (asp) as usual refers to aspectual marker. In deliberate slow speech, there may be a short schwa where the deleted nasal was (compare [à fú mə́] 'it has grown', [(ə̀) fú mə́] 'I have grown'. After the deletion of the syllabic nasal, its low tone remains and needs vocalic support to be phonetically realised. However, that vowel is not realized in ordinary speech: this process will need to be the subject of a separate study.

(16) Deletion of nasal in pre-fricative position.

Underlying forms	*Surface forms*	*Gloss*
/Ǹ-fú mə́ ŋgbí / I-return asp farm	[ə̀ fú mə́ ŋgbí]	'I have returned from the farm.'
/Ǹ-sé mə́ láx/ I-break asp calabash	[ə̀ sé mə́ láx]	'I have broken a calabash.'
/Ǹ-sùʔ mə́ ndzə́/ I-wash asp dresses	[ə̀ sùʔ mə́ ndzə́]	'I have washed dresses.'
/Ǹ-ʃíi mə́ nìàx/ I-cut asp cow	[ə̀ ʃíi mə́ nìàx]	'I have slaughtered a cow.'
/Ǹ-xɨ̀ò mə́ ŋmè/ I-laugh asp person	[ə̀ xɨ̀ò mə́ ŋmè]	'I have laughed at a person.'
/Ǹ-xɨ̀ʔlə́ mə́ məmvɨ́/ I-frighten asp dog	[ə̀ xɨ̀ʔlə́ mə́ məmvɨ́]	'I have frightened a dog.'

It is interesting here to use parallel examples to show that the voiced counterparts of these fricatives in similar environment do not delete as illustrated in (17).

(17) Non-deletion of nasal in the context of N+voiced fricative.

/Ǹ-vám mə́ ɲí/ I-search asp cutlass	[m̀vám mə́ ɲí]	'I have searched for a cutlass.'
/Ǹ-vù mə́ ndáp/ I-construct asp house	[m̀vù mə́ ndáp]	'I have constructed a house.'
/Ǹ-yè mə́/ I-go asp	[ŋ̀gè mə́]	'I have gone.'
/Ǹ-yáxlə́ mə́/ I -choke asp	[ŋ̀gáxlə́ mə́]	'I have choked'

In the last two constructions in (17) above, rule (13) has applied to harden the velar fricative.

4. Conclusion.

Our description of alternations in Baba 1 has revealed that, although most of the changes undergone by the various consonants take place in the vicinity of a nasal in stem initial position, nasals nevertheless tolerate somewhat curious patterning with other consonants within the word. Similarly, certain language specific tendencies have been revealed. A case in point is the hardening of velar fricative before high front vowel and the deletion of nasals preceding voiceless fricatives, which are not too common phenomena documented in Bantu languages.

Moreover, in documenting these alternations, the paper has provided a considerable amount of data which can serve as a source of reference for the investigations into some of the unexplained issues raised in the paper.

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