Transparent consonants

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0. Introduction

In this paper we discuss a well documented case in which an entire set of consonants - velars, uvulars, pharyngeals and laryngeals - are 'transparent' with respect to a 'vowel copy' process involving the three elementary vowel qualities **i**, **u** and **a**.[1] The relevant data come from Iraqw, a Cushitic language spoken in Tanzania, described in Mous (1992). It is in particular the inclusion of the velars in the set of transparent consonants which we will be concerned with.

McCarthy (1991) discusses similar phenomena in a number of Semitic languages under the heading of 'guttural transparency'. The crucial point for us in McCarthy's analysis is that the class of gutturals excludes velars and even a subset of the uvulars, viz. the uvular stops in those cases. The set of gutturals includes uvular fricatives, pharyngeal approximants and laryngeal consonants. McCarthy documents a number of cases in which the class of gutturals appears to be transparent with respect to 'vowel copy' processes, which he analyzes as cases of spreading. He then proposes a feature geometry which represents gutturals as 'pharyngeal' as opposed to 'oral'. The 'oral' class includes labials, coronals, velars and is involved in the representation of uvular stops. Without going into the particulars of their representation, McCarthy suggests that vowels are also exclusively 'oral'. Thus vowels are 'complementary' to gutturals and this accounts for their transparency with respect to vowel spreading.

We will discuss McCarthy's proposals in more detail in section 2, and it will then be clear why the Iraqw facts are relevant for his theory. We will explore how the inclusion of velars and uvular stops in the class of transparent consonants can be accommodated in McCarthy's model. It will become clear that the 'flexibility' of the feature [dorsal] allows us to apply this model to the Iraqw facts if we assume that velars and uvulars can be represented in two ways, depending on the language.

We will then reconsider the same problem in terms of a different model proposed in van der Hulst (1991) and show that in this model we can characterize the set of transparent consonants in the Semitic languages and in Iraqw

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[1] We would like to thank Ian Maddieson for bringing to our attention that the Iraqw property of taking velars and uvulars together goes against the current geometry of feature models.

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without requiring different representations for different languages. The 'price' paid for this is that we must conclude that transparency is not a unified phenomenon but may be the result of several independent factors.

In section 1 we will first give an overview of the relevant facts of Iraqw.

1. The facts

The consonant phonemes are displayed in the following chart. The palatal consonants in brackets are rare and occur mainly in loan words. The velar and uvular consonants have labialized counterparts. 'Glottalized' is used as a cover term to include all consonants produced with a glottal stop or with laryngealization, i.e. the ejective affricates **ts**, **tl** and **q**, and the pharyngeal fricative **‘** which is produced with creaky voice, and the glottal stop. The fricatives are all voiceless, except for **‘**. The approximants are central.

(1)	labial	alveolar	lateral	palatal	velar/ uvular		pharyn- geal	glot- tal
	1	2	3	4	5	6	7	8
voiced stop	**b**	**d**		**(j)**	**g**	**gw**		
vcless stop	**p**	**t**		**(ch)**	**k**	**kw**		
glottalized		**ts**	**tl**		**q**	**qw**	**‘**	**’**
fricative	**f**	**s**	**hl**	**(sh)**	**x**	**xw**	**hh**	**h**
nasal	**m**	**n**		**(ny)**	**ng**	**ngw**		
liquid		**r**	**l**					
approximant				**y**		**w**		

Phonetic description of the relevant consonants: **g** is a voiced velar stop; **k** is a voiceless velar stop. **q** is a voiceless uvular affricate, and is optionally pronounced as an ejective stop word-initially. **x** is a voiceless velar fricative. **ng** is a voiced velar nasal. Intervocalically, it is followed by an oral voiced velar stop. **‘** is a voiced pharyngeal constriction (not a stop) followed by creaky voice. **hh** is a voiceless pharyngeal fricative. **’** is a glottal stop. **h** is a voiceless glottal fricative. The velar and uvular consonants have labialized counterparts. The vowels are **i, e, a, o, u**, long and short, and the diphthongs **ay** and **aw**. The vowel **o** is fronted in the immediate environment of the pharyngeal consonants **‘** and **hh**. Homorganic nasal-obstruent clusters occur for all obstruents. The nasal is not homorganic in clusters with a pharyngeal or glottal obstruent, as in **qanhhi** 'egg', **pan'uuma** 'state of being an orphan', where the nasal is alveolar.

The rule that involves the class of back consonants, **g, k, x, q, hh, ‘, ’, h**, is a vowel copy process. We use the term copy as a neutral term and we leave aside how the process is expressed formally. The rule of vowel copying applies

to epenthetic vowels and involves the vowels **i, u, a**, but not **e**, or **o**. The copy process is progressive and applies only if the intermediate consonant is velar, uvular, pharyngeal or glottal. We distinguish two types of epenthetic vowels in Iraqw. One shows up as **i** if the conditions for copying are not met. This epenthetic vowel is restricted to verbal derivation and precedes the last derivational suffix in the word. The relevant derivational suffixes are **m** durative, **t** middle voice, **s** causative, which in combinations are always in this order. The length of the final vowel of the verb (**i/ii** for these derived verbs) is functional in the conjugation. For example:

(2) **aa xahlít** 'she kept quiet'
aa xahlíit 'he kept quiet'

The process of vowel copying is exemplified with the durative derivational suffix:

(3)

naa'	'cut hair'	**na'aam**
wa'alah	'exchange'	**wa'alahaam**
luu'	'hide'	**lu'uum**
kutsuhh	'pinch'	**kutsuhhuum**
daaq	'skin an animal'	**daqaam**
uruux	'pull'	**uruxuum**
hluuk	'bribe'	**hlukuum**
		iimu'uum 'start'

The following examples show that **e, o** do not trigger the process.

(4)

leehh	'carry'	**leehhiim**
oh	'seize, grasp'	**ohiim**
goo'	'carve'	**goo'iim** 'write'

In (5) we illustrate that the process is blocked if the intervening consonants are labial or coronal:

(5)

tutuuw	'open a new farm'	**tutuwiim**
'aay	'eat'	**'aayiim**
hamaatl	'wash'	**hamtliim**
baal	'defeat'	**baaliim**

The other epenthetic vowel shows up as **a** if conditions for copying are not met and its function is that of breaking up consonant clusters. There is some variation among speakers with respect to clusters that 'need to be broken up'. The **a**-epenthetic vowels are underlined:

(6) **xahl** 'keep quiet'

/xahl-ii-t/	**xahliit**	'keep quiet'
/xahl-a-m-ii-t/	**xahlamiit**	'keep quiet all the time'
/xahl-a-t-ii-s/	**xahlatiis**	'cause to be quiet'

Both epenthetic vowels undergo the copy process, although neither provides evidence for the transfer of all three qualities, given their default bias (i.e. **i** and **a**, respectively). Hence the fact that epenthetic **a** assimilates to **i**, as in **tliqimiis** (7) is the reason that we posit that the vowel **i** is a trigger. For default **i** the vowel copy process operates vacuously if the trigger is **i**, as in **tliqiis** and **tliqimiis**.

(7) **tliiq** 'press, throng'

/tliq-ii-s/	**tliqiis**	'beat'
/tliq-a-m-ii-s/	**tliqimiis**	'be beating'

tuu' 'swell'

/tu'-ii-t/	**tu'uut**	'to pound'
/tu'-a-m-ii-t/	**tu'umiit**	'to be pounding'

The vowel copy process also applies to the epenthetic vowels that break up consonant clusters in noun stems of the type CVCC.

(8)

du'(u)ma	'leopard'
bihhi'	'side'
guhh(u)láy	'club, stick'
bi'(i)ni	'wedge'
yuk(u)máy	'lid of corn store'

And similarly in verb roots:

(9)

hamtl	**hamáatl**	'wash:1.SG'
	hamtlíim	'be washing:1.SG'
ufhh	**ufáahh**	'blow:1.SG'
	uf(a)hhaam	'be blowing:1.SG'

The last example **uf(a)hhaam** shows that default vowels can trigger the copy process provided that they are inserted into the underived verb stem.

Vowels which are not epenthetic do not undergo the process. We can have for example forms such as **ga'éer** 'you watch, she watches'; and suffix vowels as in the nominalising suffix **-a** do not undergo the process.

(10) **duuq** 'sharpen' **duquut** 'be sharpening'
duuqa (f) 'sharpening'

There is a second vowel copy process which operates regressively. This regressive assimilation occurs through the glottal stop and the glottal **h**. The regressive assimilation is exemplified with the plural suffix **-'i**, where it affects the **a**-epenthetic vowel. Further it affects the feminine gender marker **ta** if a second person plural possessive suffix **-hung** follows and an epenthetic vowel after the masculine gender marker **ku** in the possessive pronoun **kwe'ée'** 'mine'. This example shows that the mid vowel(s) can trigger this regressive assimilation.

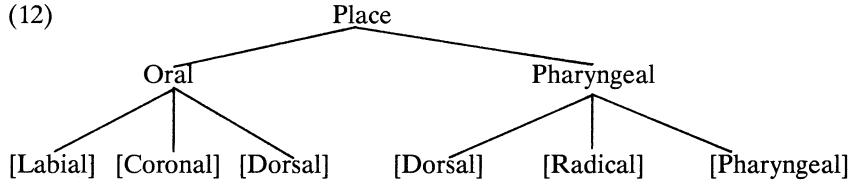
(11) **/'awtú-a̲-'i/** **'awti'i** 'monkeys'
/diwi-ta-húng/ **diwtuhúng** 'your (pl) salt'
/ku-a̲-'ée'/ **kwe'ée'** 'mine' (masc)

In this section we have discussed data that illustrate the relevant aspects of the progressive vowel copy process. In the next section we will examine the theoretical consequences of these data in the light of a proposal for feature organization in McCarthy (1991).

2. The analysis in McCarthy (1991)

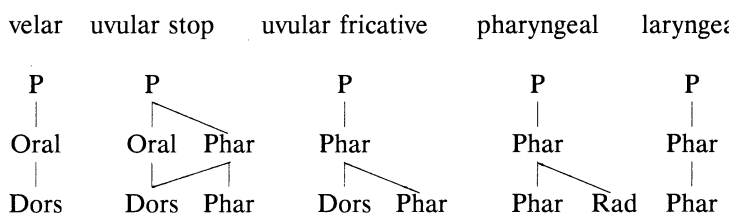
Consider McCarthy's proposal:

(12)



In comparison with earlier work, McCarthy's innovation is to postulate the binary opposition Oral/Pharyngeal. This division expresses that there are two major areas of articulation, which can be accessed by the articulators expressed at the lower level. The dorsal articulator has access to both places. The class of non-labial, non-coronal consonants in Semitic languages can now be represented as follows:

(13)



In this account gutturals all have the node Pharyngeal as their major place of articulation. Velars and uvular stops have the Dorsal node as their major place of articulation.

Let us see how McCarthy's proposal would apply to Iraqw. In order to include dorsals and uvular stop in the same class as the gutturals, we could represent the velars and all uvulars as Pharyngeal [dorsal, pharyngeal], i.e. using the representation which is used for the uvular fricatives in (13). Uvulars could then be differentiated from velars either in terms of the laryngeal property of glottalisation or by representing them as Pharyngeal [dorsal, radical, pharyngeal], which is the 'vacant' representation in McCarthy's system.

We believe that the first proposal of using glottalisation is badly motivated in view of the clear difference of place of articulation between velars and uvulars and because the glottalisation is only optionally present. Before we explore the second possibility, we will modify McCarthy's approach in one respect.

McCarthy proposes that the feature [pharyngeal] must be present under the Pharyngeal place node for 'technical' reasons:

> 'I allow this formal redundancy in order to maintain a consistent difference in usage between features like [Pharyngeal], which can mark phonological distinctions, and class nodes like Pharyngeal, which can only specify featural subgroupings. [...] The issue is a purely technical one, without real empirical consequences.'

We fail to see why the addition of a feature [pharyngeal] is either necessary or desirable.

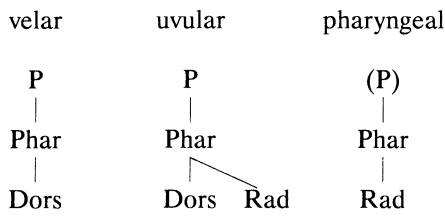
If [phar] is eliminated, the class of laryngeals poses a problem. What is the daughter here? We could follow E. Pulleyblank (1989) and assign the laryngeals the feature [radical] and make them identical to pharyngeals regarding place. They would then be distinct from pharyngeals in terms of their laryngeal features.

The other possibility is to assign no place at all to laryngeals, a proposal discussed in Steriade (1987). In Iraqw, laryngeals do have a privileged status, since only these consonants are transparent with respect to a leftward

spreading of *all* vowels. The special status of laryngeals could be explained by assuming that, at least in Iraqw, laryngeals are placeless, and hence non-radical. In Semitic languages, laryngeals can cause lowering of vowels, just like the other gutturals, and this would suggest that laryngeals *can* be provided with a 'place' of articulation, viz. [radical]. We will simply assume here that laryngeals can either be placeless or [radical], depending on the language.

Bearing in mind our remarks about the feature [pharyngeal], let us explore the consequences of representing the velars and uvulars as Pharyngeal segments. In this case the feature [dorsal] will occur under the Pharyngeal node only:

(14)



The main difference from McCarthy's representation for the Semitic consonants is that the feature [dorsal] can occur on its own under the Pharyngeal node. (In addition, we make no use of a feature [pharyngeal], cf. supra.) Languages, we would have to assume, can differ with respect to their representation of velar and uvular stops. In the Semitic languages discussed by McCarthy, these segments would include the Oral node in their representation, whereas Iraqw would have them as purely Pharyngeal.[2] The language learner will then adopt the purely Pharyngeal representation if velars and uvular stops appear to be transparent to vowel spreading.

We would still, of course, need an independent explanation for the fact that mid vowels fail to spread across the back consonants in Iraqw and we suspect that this might be related to their greater complexity which somehow makes these vowels less likely to cross the consonantal barrier.

Another point that merits further discussion concerns McCarthy's explanation for the reason why 'Back' consonants are transparent to vowels. The crux of his analysis is that 'gutturals' are transparent because they make no use of the Oral node, under which he locates the features for vowels.

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[2] In another Cushitic language, Rendille, additional support for the Iraqw style grouping of back consonants can be found. In Rendille, pharyngeals (**hh**), velar stops and fricatives (**x, g, k**), and the glottalized **d** have the effect of centralising adjacent vowels (see Pillinger 1989:214) which acoustically involves an increase in F1 (see Esser 1992:135-136).

A consequence of this approach is that McCarthy must abandon the idea that vowels and consonants make use of the same features. Whatever features he proposes to use, equations such as [low] is [radical] or [dorsal] is [back] (cf. Clements 1991) can no longer be made.

3. An alternative

In this section, we will explore an alternative analysis making use of the theory proposed in van der Hulst (1991). The main characteristics of this approach, relevant for our subject, are the following. Phonological features or components can be defined in terms of three parameters:

(15) - category: Manner, Place
- sonority: C, V (resp. low and high sonority)
- markedness: marked, unmarked

'Markedness' is related to sonority in that unmarked means 'optimal' in its sonority class. For example, for Manner, the sonority value C characterizes obstruents. Within this class, stops are unmarked when compared to continuants. Hence stops are more C-like than fricatives. For this reason van der Hulst uses the symbols c and v for representing the marked values. The component stop is defined as [Manner,C,c] and the component continuant is defined as [Manner,C,v].

A cross-classification of the parameter values defines a fixed set of components, four for each category. The phonetic interpretation of these components is determined by the status of the component as either head or dependent. The head-dependency relation holds between components which enter into a combination. It is proposed that such combinations can be 'strict' or 'loose'. Focussing on the place components, strict combinations characterize subdivisions within, for example, [coronal], whereas loose combinations characterize secondary articulations.

Let us now discuss the place components in somewhat more detail. As interpretations we have used articulatory based glosses which in most cases correspond to classical feature names. We do not, however, imply that components are exclusively or even primarily linked to articulatory interpretations.

(16)

		HEAD	DEPENDENT
[Place, C, c]	=	CORONAL	FRONT
[Place, C, v]	=	LABIAL	ROUND
[Place, V, v]	=	LOW	RETRACTED
[Place, V, c]	=	HIGH	ADVANCED

It will be noticed that 'dorsal' is not among the set of place components in (16). Indeed, the claim is made in van der Hulst (1991) that dorsal is an 'intermediate' consonantal component, neither marked nor unmarked: [Place,C].

Concerning manner components, we only need to know that these too are either of the C-type or of the V-type. The former characterize various kinds of stricture, the latter various kinds of approximation.

With this minimal background we can return to the issue of representing the 'back consonants'. We will assume that the velar and uvular stops have [C,c] and [C,v] (i.e. stop or continuant) as value for Manner, and that the gutturals have V-type components for Manner. All back consonants, except for laryngeal, have the neutral place component as head, [Place,C] i.e. 'dorsal'. With regard to Place, the 'gutturals' have in common that they have a [Place,V,v] component as a secondary articulation, i.e. as a loose combination. Both the uvular stop and the fricative have a [Place,V,v] component as a strict combination. Thus the representations are:

(17)

Velar stop	Uvular stop	Uvular fric.	Pharyngeal
[Manner,C]	[Manner,C]	[Manner,V]	[Manner,V]
|	|	|	|
[Place,C]	[Place,C]	[Place,C]	[Place,C]
	|	| |	|
(strict)	[Place,V,v]	[Place,V,v]	|
		|	|
(loose)		[Place,V,v]	[Place,V,v]

The laryngeals, we assume, have laryngeal components only.

The strict combination of Dorsal and Pharyngeal sets off the uvular stops from the plain velars. The class of uvulars is a natural one in this proposal: both stops and fricatives have a strict combination with [Place,V,v].

The crucial factors in taking the class of back consonants (excluding laryngeals) together is that they lack CORONAL and LABIAL and consequently all have the intermediate DORSAL place components as a head. We would like to suggest that it is this property which makes these consonants potentially transparent.

Laryngeals also lack CORONAL and LABIAL but in addition they are set off because they lack the consonantal component DORSAL.

Within the class of back consonants, gutturals form a natural class in two ways. Firstly, they all have a [Place,V,v] in a loose combination. We would like to suggest that because of this they also lack an obstruent-like manner, [Place,V,v] being the most sonorous place. Hence gutturals are close to vowels in terms of their stricture mode and the representation of this is that all the gutturals have the value V for Manner, which is the second property in common.

Let us now see how we can relate the representations in (17) to transparency. We claim, of course, that transparency results from the facts that back consonants are provided with an intermediate consonantal place component (i.e. dorsal) or no consonantal place component at all as in laryngeals. The reason why in Semitic languages a *sub*class of the back consonants is transparent, lies, we claim, in the fact that gutturals are approximants. Clear obstruent-stricture (i.e. either stop or fricative) poses a stronger barrier between vowels than approximants. It would seem then that transparency is partly related to the fact that the entire class of back consonants has no 'clear' place property like Coronal or Labial which would pose a barrier to the transfer of vowel place properties, while gutturals have the additional 'advantage' of not posing a stricture barrier.

Laryngeals simply happen to be included in the class of transparent consonants for a different, though related reason, i.e. because they lack both place and stricture. It is in fact the case that sometimes laryngeals are the only transparent consonants, which supports the idea that there is an independent reason for transparent behaviour. Note that if this is the explanation for their transparency, then laryngeals are transparent for several reasons. In the Semitic languages, where laryngeals are radical, their transparency results from a lack of labial/coronal and from a lack of stricture.

One problem which we do not solve, however, is that we offer no explanation as to why mid vowels cannot be copied (cf. our suggestion above).

A final point which we need to consider here is that cases have been reported in which coronal consonants behave transparently with respect to vowel copy processes (cf. Paradis and Prunet 1988). Paradis and Prunet explain this in terms of underspecification, basing their argument on the widespread idea that coronal place is unmarked vis-a-vis the other places. Again this is an issue that both McCarthy and ourselves must try to solve.

In our approach there is 'room' for underspecification. We conform to the usual claim that coronal is unmarked and we have a formal expression of this fact in the representation [Place,C,c]. We will simply assume that coronal can be represented by an empty place component [Place]. Unlike [Place,C], the intermediate component, [Place] is not 'wellformed' and must be spelled out at some point in the derivation as [Place,C,c]. The transparency of coronals,

then, is unrelated to the transparency of back consonants, but there is a common factor, viz. the fact that transparent consonants lack a consonantal place component underlyingly.

It might be argued that our decision of setting off the back consonants as we have done, could be made in McCarthy's model too, namely by universally representing dorsals and uvular stops as exclusively Pharyngeal. But this would have as a consequence that the lack of Oral features is no longer the complete explanation for transparency of gutturals in McCarthy's model because vowels would be partly under dorsal and thus under Pharyngeal. Using McCarthy's model we would then also have to argue that the Semitic gutturals are transparent due to their stricture properties. This would then eliminate the need for the Oral/Pharyngeal nodes and this is of course one of the major differences between McCarthy's model and that proposed in Van der Hulst (1991).

4. Conclusion

In this paper we have discussed the problem of representing transparent consonants. We have examined McCarthy's model and concluded that it can accommodate the difference between Iraqw and the Semitic languages if we assume that certain consonant types receive different representations in different languages.

We then analyzed the same phenomena using a model proposed in van der Hulst (1991). In this model, transparency is in all cases explained by representing transparent consonants as lacking the consonantal place components [labial] and [coronal] which in our view pose a barrier to vowel copying. However, there are various reasons for this lack of a clear consonantal place property:

- Laryngeals have no consonantal place property at all, no consonantal stricture, thus making them the 'best' transparent consonant.

- Uvular fricatives and pharyngeals lack a clear consonantal place property (i.e. labial or coronal) and in addition they lack a stricture barrier because they have a dominant vowel place component [pharyngeal]. This makes these segment types the next best transparent consonants.

- Velars and uvular stops also lack a clear consonantal place component which also allows them to be transparent.

- Coronals may be transparent due to the fact that an unmarked component may be left unspecified.

Transparency, then, results from lack of clear consonantal place which may be reinforced by the lack of clear consonantal stricture. Ultimately both factors can perhaps be reduced to a more general statement saying that the transparent consonants have a relatively high degree of sonority, if we assume that both place properties such as labial and coronal, and stricture properties such as stop and continuant reduce the sonority of consonants.

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