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On laryngeal contrasts and the definition of 'emphatic' (or: When is a *ṭ* not a *ṭ*?)*

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0 Introduction and aims**

The core of this paper concerns the notion and nature of 'emphatic'. What is often called 'emphatic' is not always uniform, in that emphatic *ṭ* in one language is not the same as 'emphatic' *ṭ* in another.

Anyone asked to comment briefly on the phonology of Arabic is highly likely to mention 'emphatics', a set of sounds which have been the subject of much discussion. In the same breath, it may also be mentioned that the emphatics pattern with the pharyngeals. Emphatics, however, are not some strange quirk of Arabic. The Semitic languages in general have 'emphatics', although in many Semitic languages they are actually realised with glottalisation as ejectives. The reason given for this is historical in nature, as it is widely believed that the Arabic emphatics developed from glottalics. However, interesting as this may be, it is not the whole story. Some (varieties of) languages that have emphatics similar to those of Arabic are reported also to glottalise these segments. Confusingly, it is not always clear what exactly we are dealing with, since descriptive grammars often adopt slightly vague or ambiguous terms, and since it is conventional to transcribe both emphatics and ejectives with a subscript dot (e.g. *ṭ*); thus descriptive grammars, so often a rich source of data, often do not yield a harvestable crop.

This paper seeks not only to ask the question 'why?', but also to go some way towards answering it. In a nutshell, our concern is thus with what exactly 'emphatic' and 'ejective' are, in both physical and psychological terms, and with the nature of the correlation between the two (in Semitic). This involves investigating their shared history. Ultimately, we aim to identify the internal structure of these segments, with the expectation that each will have a similar status within the different phonological system in which it occurs.

This paper constitutes a small part of an ongoing investigation into the phonological status of 'pharyngeal', with Arabic emphatics as a central focus. Broadly, the investigation seeks to identify and account for the phonological, phonetic, historical and typological relatives of emphatics, or to reinvent a phrase from the grammarian Sībawayh, the 'sisters' of the emphatics.

1 Background

In this section we intend to contextualise the phenomena under investigation. Thus, we will look at what exactly we mean by 'ejective' and 'emphatic', since there is some overlap between the latter term and the realisations of the two phenomena. This overlap is what we are seeking to investigate and account for, and will be contextualised and detailed further in Section 2.

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* Answer: When it's a *t'* or a *t'*.

** Thanks are due to Kirsty Rowan, Monik Charette and John Harris for devoting time to helpful discussion and suggestions. The traditional disclaimer about errors being mine must also come here.

In Section 1, then, we first discuss ejectives, giving an overview of physical descriptions (in order to define the term 'ejective') and then of acoustic cues. We will then move on to an overview of the articulation of the Arabic emphatics (so that the reader knows exactly what we are referring to and may compare and contrast with ejectives), before then summarising the main acoustic characteristics. This will help us to identify the phonological representations of 'emphatics'.

1.1 Ejectives

An ejective is a segment made with glottalic egressive airstream mechanism. European languages in general are normally said not to have ejectives, and certainly it seems like an 'exotic' sound for a European monoglot; however, there are instances of glottalic egressive stops in English. For instance, in many varieties of British English it would not be considered pathological[1] for the word 'mistake' to be produced utterance-finally with a final glottalic egressive *k'*,[2] and Newcastle / Geordie English is unmistakeably characterised by oral stops which co-occur with glottal stops (although the oral stop appears to be unreleased, so really they are glottal stops with a secondary supralaryngeal gesture that has a comparatively small acoustic role).[3] Nevertheless, while in (certain varieties of) English they are a phonetic possibility, they are not phonologically contrastive.

Although to a European an ejective may seem exotic (or even, as Elliott's (1897) Ndebele dictionary says, "totally indescribable and impossible for a European to acquire"[4]), they are estimated by Henton et al (1992) to be the fourth most common type of stop cross-linguistically (the first three are voiceless unaspirated, voiced and voiceless aspirated, respectively), occurring in up to one fifth of the world's languages (Maddieson (1984) has "about 18%", Catford (1992) has "about 20%").

It is also notable that the Glottalic Hypothesis of Proto-Indo-European proposes that it had a series of 'glottalic' sounds commonly thought to have been ejectives, although most Indo-European languages have lost the glottalic series.[5] The relevance of this will be seen presently in our discussion of the ejective Proto-Afroasian 'emphatic' and its reflex in Ethiopic languages (ejective) compared with the cognate in other Semitic languages (emphatic as in Arabic or non-aspirated as in some varieties of Neo-Aramaic).

1.1.1 Realisation of ejectives

The most common type of ejective is a stop, although there are ejective fricatives. We shall discuss first the production of the former, before moving on to a discussion of fricatives.

[1] As Ladefoged (1983: 351) puts it: "what is a pathological voice quality in one language may be phonologically contrastive in another…one person's voice disorder is another person's phoneme."
[2] The segment is clearly ejective, although only the velar constriction is released, not the glottal. Thus, it only occurs in utterance-final position.
[3] This would explain why, for instance, it is not easy to auditorily differentiate Geordie 'Betty' from 'Becky' when heard on the radio or telephone (or indeed, the *Big Brother* voiceover!).
[4] Cited in Doke (1923: 707-7), quoted here from Fallon (2002: 4).
[5] Cf. Fallon (2002: 12-14), and references therein.

1.1.1.1 Stops

As previously noted, an ejective is characterised by two (normally) co-occurring constrictions, the first at the larynx (more specifically, the glottis) and the second at some point of the supralaryngeal tract. The glottal closure ensures that only the air trapped in the chamber between the larynx and the supralaryngeal constriction is used to generate the sound, hence the designation 'glottalic airstream mechanism' (as opposed to the pulmonic airstream mechanism which generates a 'plain' stop, so called because the airstream is generated by the lungs with no impediment to the flow caused by constriction beneath the main supralaryngeal gesture). The glottalic airstream is initiated by the abrupt upward movement of the entire larynx,[6] compressing the air trapped between the glottis and the supralaryngeal constriction locus,[7] and giving the effect of a 'piston'. This causes the characteristic 'popping' sound, since the release of the supralaryngeal constriction causes the air to rush outwards (i.e. egressively) rather quickly, in order to rebalance the air pressure behind the oral constriction with the ambient pressure (like the way in which a weather front between areas of differing pressure, shown as isobars, causes windy weather).[8]

Here, some comments would be in order concerning phonation and VOT. Firstly, the definition of ejective VOT, according to Catford (1983: 345), is the time-lag between the oral release and the onset of glottal vibrations. There is some cross-linguistic variation in glottal and oral release timing, since, as Kingston (1985a: 16-17) puts it: "the glottal closure may be released together with or soon after the oral one or it may be significantly delayed…Corresponding to this difference…is an impression that ejectives with simultaneous release of glottal and oral closures are less forceful than those where the glottal release is delayed." Fallon (2002: 271) details possible VOT lag length, the shortest reported VOT of any ejective apparently being 10 ms, in Abkhaz (Catford 1983), and the longest, in Bzedukh, 114 ms (Catford 1992).

Regarding the "less forceful" ejective release mentioned above, it is to be questioned whether these are really ejectives at all. For instance, (in some positions) in some languages (e.g. Hausa and Zulu), where an ejective is realised with simultaneous oral release and onset of voicing (a VOT of 0 ms), in terms of the voicing parameter the (weak) ejective has the acoustic characteristics of a 'plain' voiceless stop and, in Fallon's (2002: 271) words, may have "such weak ejection that merger with the voiced[9]

[6] Ladefoged (1982: 120; 1993: 130) notes a rapid upward displacement of the larynx by 'about one cm' in his observations of Hausa ejectives.
[7] The compression of air causes a rise in air pressure between the two constrictions of about two times that caused by the pulmonic mechanism. (Ladefoged & Maddieson, 1996: 78.)
[8] This can be contrasted with implosives, which employ glottalic *ingressive* airstream, i.e. the larynx (with vibrating vocal folds) moves downwards, enlarging the pharyngeal chamber and thus reducing oral pressure.
[9] Fallon (2002: 271) notes 0 ms VOT as one acoustic characteristic of a voiced stop. Therefore, what Fallon calls 'voiced' must be interpreted informally and is, strictly speaking, 'plain' voiceless (as opposed to aspirated voiceless and fully voiced stops), since we assume that the interaction of voicing and aspiration yields a possible four-way laryngeal opposition in plosives cross-linguistically, i.e. voiceless aspirated, 'plain' voiceless, fully voiced, voiced aspirated ('breathy'). This is in contrast to the traditional voiced-voiceless opposition, which implies the possibility of only a two-way laryngeal opposition in plosives cross-linguistically. In terms of VOT, we define 'voiceless aspirated' as having a significant VOT lag, 'plain voiceless' as having approximately simultaneous closure release and voicing onset (i.e. VOT value 0), 'voiced' as having significant pre-release onset of voicing, or VOT lead (i.e. a negative VOT value), and voiced aspirated as having both significant pre-release voicing onset and a period of post-release (voiced) aspiration (i.e. 'murmured' aspiration).

stops becomes a distinct phonetic possibility". Therefore, ejectives, when robust, have significant VOT lag, whereas they may in some cases be 'weak', having no VOT lag, and thus almost merging with 'plain' voiceless stops, which I treat as a case of lenition. Fallon (2002: 275) suggests that "the acoustic similarity between ejectives and voiced stops suggests a perceptual basis for the change of ejective to voiced", although bearing in mind that what Fallon calls 'voiced' here is actually 'plain' voiceless, I suggest that this 'change' is due to the lenition process where an ejective simply loses its glottalic characteristic, thus 'reducing' to a mere 'plain' voiceless plosive (deglottalisation). This will be relevant in later discussions in two respects: firstly, it will be proposed that ejectives are primarily glottals, with the oral stricture being in some way secondary; secondly, the 'reduction' of ejectives to either 'plain' voiceless obstruents or glottal stops will be likened to the 'reduction' of (Arabic-style) emphatics to either non-emphatic obstruents or pharyngeals.

As regards the issue of phonation, it is often said that ejectives are voiceless and that voiced ejectives are not physically possible; however, examples have of course then been cited of voiced ejectives. From the above description of the mechanisms involved in the production of ejectives, it will have been noted that the closure of the glottis is a prerequisite. In order to produce a voiced sound, the glottis must vibrate, the pulmonic initiation of air flowing through the glottis, creating regular (periodic) fluctuations in pressure. The air pressure is thus higher below the glottis. However, ejective release (the popping sound) is caused by air compression above the glottis, caused by the upward movement of the larynx while the glottis is closed so that trapped air cannot escape downwards. Therefore, an ejective cannot be truly voiced. It is, however, possible to pre-voice the stop, although the voicing must cease during the closure phase; alternatively, the 'ejective' could be a sequence of voiced stop closely followed by (necessarily voiceless) ʔ, and thus not strictly an ejective. In the discussion of fricatives below this point will be elaborated on.

1.1.1.2 Fricatives

Bennett (1998: 9) notes that a fricative ejective is "often heard as an affricate". This is presumably due to two factors, namely, the glottal stricture and the oral stricture.

Firstly, glottal closure prevents the continuous flow of air necessary for frication, since a fricative is produced by partial oral obstruction causing a build-up of pressure behind the constriction, due to the continuing flow of pulmonic air. The characteristic frication is caused by the flowing air being forced through the narrow gap (the wider the gap the slower the flow and the 'weaker' the perception of frication). Glottal closure, however, cuts off the airflow. This would therefore be perceived auditorily as a stop (acoustically, an abrupt sustained decrease in overall amplitude, seen as a spectral 'edge'). Since the segment would then reproduce the acoustic characteristics of both a fricative *and* a stop, this would be equated with perhaps the only other L1[10] segment to have such characteristics, i.e. an affricate.[11] In other words, the mapping is skewed, but not arbitrarily.

[10] Bennett is presumably referring to L2 speakers perceiving ejective fricatives as affricates.

[11] The sequence of events within the one segment, however, is reversed; i.e. in the affricate, the stop portion precedes the frication, and vice versa in the ejective fricative.

Secondly, the lack of complete stricture characteristic of fricatives allows the air to escape constantly through the oral obstruction, thus preventing the build-up of enough pressure to give the popping effect characteristic of ejectives. There are therefore four options available: (1) to allow only brief glottal closure towards the end of the fricative, which would effectively end the fricative by cutting off the requisite airflow (i.e. a fricative ended by a glottal); (2) to close the glottis first and then to release this glottal closure into a fricative (i.e. ʔ (or ø) followed by a fricative); (3) to form an oral closure simultaneously with the glottal closure (thus maximising the perception of the stop), with the oral closure being released into a fricative (thus also maintaining the fricated characteristic), therefore an ejective affricate; (4) to raise the larynx during frication and then close the glottis (as option 1), which also acoustically re-creates both fricative and ejective characteristics, but with the added bonus of the higher oral pressure ensuring a slightly more 'forced'-sounding frication (i.e. an ejective fricative).

Option (1) would not allow the build-up of sufficient pressure to create the strong release, or popping sound, often associated with ejectives, thus this option would appear to be the first stage of weakening, where the fricative quality is maintained at the expense of the typical ejective quality. Presumably it would then be easy for the segment to lenite (by de-glottalising) to a 'plain' fricative.

With option (2), the glottal closure is then hard to perceive, since it sounds simply like a 'gap' before the onset of the fricative. It is also not strictly an ejective, since in order to create the characteristic ejective release the most salient target, oral pressure, must be raised so that the obstruent is released with greater force (i.e. the rush of air outwards caused by pressure within the oral chamber greater than the ambient pressure; the greater the difference between the two, the faster the outward flow of air). In the case of a fricative, since there is no complete oral stricture, there can be no *significant*[12] pressure increase, as detailed above.

Option (3), on the other hand, maintains the ejective (glottal) quality, but compromises a little on the fricative quality. Although in terms of perception it may appear to be a form of fortition, I would argue that phonologically it is not fortition as such, but complexification (since the affricate is a contour segment), which maximises the salience of the 'ejective' quality while also maintaining some degree of frication. As a contour segment, this affricated ejective would perhaps be less prone to lenition, although we would predict that any lenition would take the form of de-buccalisation (loss of oral place, i.e. reduction to a glottal stop), due to coalescence (merging of the two parts of the contour – as will be demonstrated in Section 3.

With option (4), the ejective fricative has not such a distinctive release as an ejective stop, since the build-up of oral pressure cannot be maintained as effectively due to the incomplete oral closure. The 'ejective' salience of the ejective fricative in comparison with the 'plain' fricative is thus more marginal. In order to maximise the salience of the ejective-'plain' contrast, option (3) may be more viable.

To sum up and move on, we will propose in Section 3 that option (1), the fricative-closing glottal, is not a true ejective but a contour segment, that option (2), the fricativised glottal, is also a contour segment, that option (3), the glottalised affricate, as

[12] 'Significant' is to be understood as relative to the degree of raised pressure characteristic of ejectives.

discussed, is a contour segment and also a true ejective, and that option (4), the glottalised fricative, is phonologically the closest thing to a true ejective, although it is a contour segment, since the stop characteristic is shared by both constituents of the contour.

As a closing note, to give an example of fricative-ejective resolution in accord with one of the options outlined above, we note from Bennett (1998: 10) that in Jibbali there is a "glottalized ṣ (s')" corresponding to the Amharic ejective. He defines 'glottalized' as a consonant followed by a glottal stop, i.e. the glottis is not closed or raised during the articulation of the oral portion of the segment, and notes that it is thus possible to have a truly voiced 'glottalized' obstruent. This segment is clearly the result of the adoption of the first of the four options outlined above, and is not a true ejective in either phonetic terms (lacking the characteristic popping caused by build-up of air pressure), or, as proposed later, in phonological terms.

Now that we have given a description of the physical production of ejectives, we will look at auditory and acoustic cues, since that is what will be relevant in relation to our overall aim of comparing and contrasting the varying realisations of Semitic emphatics in order to arrive at the phonological definition(s) of the notion of an 'emphatic' segment.

1.1.2 Auditory and acoustic characteristics

There are several possible acoustic cues for ejectives. However, as may have been inferred from the above discussions, this is not homogenous across languages, or even within languages. For instance, Monaka (2001: 74) cites Lindau's (1984) investigation of Hausa and Navaho ejectives: "Hausa ejectives showed regular voicing at vowel onset whereas Navaho ejectives showed creaky voice after the release of the stop which continued into at least the first portion of the vowel." Monaka rightly concludes (2001: 74) that "These observations make the determination of cues for ejective stops in the languages of the world rather difficult, the different experimental techniques used by the researchers also being a contributing factor." In Section 3 of this paper, we will also attempt to account for these apparent inconsistencies.

Therefore, here we shall attempt a brief overview of the most salient cues, as this will have a bearing on our discussion later of the phonological representation of ejectives.

Firstly, we noted above that a 'weak' ejective may have little or no VOT lag. There also appears to be a direct correlation between VOT length and oral pressure. As noted earlier, and summarised neatly in Fallon (2002: 273), "laryngeal raising plays a major role in influencing changes in oral pressure (Po) and therefore, the intensity of the release burst which creates the distinct popping characteristic of ejectives." For instance, Tigrinyan ejectives, as shown by Fre Woldu's (1985, 1988) oral pressure measurements, have roughly twice the pressure of voiceless aspirated stops, and 3–4 times that of voiced stops. Fallon (2002: 274-5) further elaborates to clarify the interaction between larynx-raising and VOT: "Some of the most salient acoustic characteristics of ejectives are due to the increase of oral pressure, which largely derives from the raising of the larynx. When the compression is less, the burst is less intense, and the VOT is generally shorter." In other words, raised larynx, hence oral pressure, is associated with longer VOT, whereas with less oral pressure and shorter VOT, ejectives become perceptually closer to 'plain' voiceless obstruents.

In some languages (such as Navaho),[13] creaky voice appears also to be a factor involved in the production of ejectives. Creaky voice (laryngealisation) is caused by the arytenoid cartilages being held tightly together so that the vocal folds can vibrate only at the other end.[14] Since they thus vibrate more slowly, F0 will be shown to be comparatively low. Laryngeal activity can be measured by laryngography (electroglottography), as performed by Monaka (2001).[15] In this way, a cue for ejectives may be manifest in low measurements of fundamental frequency or in irregular vibration or alternating high and low amplitude of Lx traces at the onset of the following vowel.[16] However, Monaka (2001: 134) notes that other researchers have observed that "irregular phonation at vowel onset may not be a reliable cue for ejectives", as we noted earlier with Hausa having regular vowel-onset voicing, but Navaho having creaky voice. It is therefore a factor in some language systems but not others.

A final cue to be mentioned here is the high burst amplitude (of the release) typical of ejectives in languages like Tigrinya (Fre Woldu 1985) and Xhosa (Jessen 2002). This can be evaluated by measuring the rate of airflow at the lips. Since high burst amplitude is a direct result of significantly increased oral pressure, it will therefore be treated as integral to the cue.

Thus, the cues to be taken as typical for ejectives are: increased oral pressure along with a significant VOT lag. We will see that this is relevant in comparison with Arabic emphatics.

1.2 Emphatics

Arabic has often been described as a 'harsh' or 'guttural' language, well known for having sounds considered difficult for non-native speakers to articulate. In particular, it has a set of consonants known as 'emphatic' which are usually said to involve secondary pharyngealisation and/or uvularisation. It is interesting to note that ejectives are also perceived in auditory terms as 'harsh'. Nevertheless, we should observe here that emphatic segments are not particular to Arabic, any more than are pharyngeals; and although Semitic languages in general are well known for having both these types of segments, they are not even particular only to the Semitic languages (although emphatics are not especially common outside the Semitic language family). Bessell (1992: 23) looks at the typology of "pharyngealized" (i.e. emphatic) consonants, summarising that they "occur in 7/693 (1%) languages in Ruhlen (1975). Four of these are Arabic, two are Caucasian and one is a Berber language." This may not be a truly representative sample, since it is not always clear exactly what is meant by the term 'pharyngealisation', either articulatorily or acoustically. In this way, what may be

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[13] Cf. Monaka (2001: 74).
[14] Ladefoged (1993: 141).
[15] Hayward (2000: 230-31) notes that this method monitors changing patterns of vocal fold contact, by placing "electrodes…on the neck, at either side of the subject's thyroid cartilage. A weak current is then passed between them…If the vocal folds are vibrating, current flow will alternately increase and decrease as the extent of contact between the folds increases and decreases…the output waveform [Lx] shows a series of upward and downward movements, with each cycle corresponding to a cycle of vocal fold vibration." Contrast this with the Gx signal, of which Lx is a high pass filtered version, which records conductance change as the larynx is displaced, rather than the conductance change across the vocal folds recorded by the Lx signal.
[16] Monaka (2001: 74).

exactly the same phenomenon may be termed something else and thus not included. Moreover, 'pharyngealisation' may interact with other phenomena (such as e.g. retroflexion) and thus be included elsewhere in Ruhlen's categorisation. Nevertheless, this would indicate at least that the emphatic phenomenon is typologically less common than the ejective phenomenon. Why this should be so is elaborated on in Section 3.

1.2.1 Realisation of emphatics

Classical Arabic emphatics are usually cited as *ṣ ṭ ḍ ẓ* or *ṣ ṭ ḍ ḏ̣*,[17] although the dialects have widely differing inventories. However, most dialects include at least three of these four,[18] along with, most commonly, *ḷ ṛ ṃ ḅ*. The coronal emphatics are traditionally seen as 'primary', or 'phonemic', whereas any other emphatic segments are often described as 'secondary' or 'non-phonemic'.[19]

Coronal emphatics are produced with a coronal restriction, along with a secondary pharyngeal approximation. Impressionistically, they sound rather heavy and dull in comparison with 'plain' coronals.

The pharyngeal approximation in the articulation of emphatics involves moving the tongue dorsum back towards the upper pharynx simultaneously with the primary articulation (e.g. a coronal gesture). Ali & Daniloff (1972) observe that the upper pharyngeal wall is not actively involved in the articulation of emphatics, and al-Ani & el-Dalee (1984) also do not show movement of the pharyngeal wall in their x-ray tracings, only of the tongue. Ghazeli's (1977) films show that emphatics have greatest pharyngeal constriction at the upper pharynx, across from the second vertebrae. As already noted, in Arabic it is not only the coronals which may be emphatic, although the coronal emphatics are considered to be 'primary' emphatics, which may cause the spreading of the emphatic quality to other segments, whereas the 'secondary' emphatics (e.g. labials) are usually seen to have become emphatic under the influence of a primary (triggering) emphatic. It is notable that the uvulars appear to be velar emphatics, and this is how at least Kurmanji Kurdish treats them,[20] as well as on the evidence of Semitic languages with ejectives rather than emphatics, in which the reflex of *q* appears to be *k'*, i.e. the (plain-ejective) opposition *k-k'* is equivalent to the (plain-emphatic) opposition *k-q*.

1.2.2 Acoustic characteristics

Ladefoged (1993) describes one type of secondary articulation as the superimposition of a narrowing of the pharynx, arguing that as cardinal vowel 5 – [ɑ] – is the most back possible vowel without producing pharyngeal friction, it is the imposition of this vowel quality as a secondary articulation which causes what he calls pharyngealisation.[21] This

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[17] There has been a certain amount of debate over whether Classical Arabic ض was really *ḍ* or *ḏ̣*, or even some kind of lateral. Cf. Bakalla (1981), Magee (1950) and references therein.

[18] *ḍ* and *ẓ*~*ḏ̣* have merged in many dialects.

[19] Some researchers have argued that *ṛ* is a primary emphatic, and there have also been debates on the status of *ḷ*. Cf. Younes (1994), McCarthy (1994), Ferguson (1956 [1997]), Card (1983), among others.

[20] Kurmanji Kurdish has a process of 'pharyngeal dissimilation' whereby a phonological word may have only one emphatic / uvular / pharyngeal segment. In Arabic loanwords containing more than one of this group of segments, one of the segments will be dissimilated, such that e.g. *q* becomes *k*, as in Iraqi Arabic *ṭabaqa* → Kurmanji *ṭæbæk* ('level, floor'). Cf. Kahn (1976a & b), Hoberman (1989).

[21] Note that as a purely articulatory label, which is not in my opinion directly relevant to the mental representation of phonological primitives (in the sense that representations are mapped onto articulatory

is the view to be taken here, that is, 'pharyngeal' = ɑ (or A in element terms, as we will see presently).[22]

In acoustic terms, it has been well-documented that emphatics exhibit significantly lowered second formant and raised first formant transitions.[23] It is also noted that the pharyngeal segments *ħ* and *ʕ* have high F1 and low F2 transitions.[24] Notably, the mid-spectral convergence of the first and second formants is exactly the profile of the vowel [ɑ]. This should be contrasted with the vowel that has the lowest F2, which is that approximating the back (non-low) [u], since this vowel also has a very low first formant.

Another strong acoustic cue to the presence of an emphatic may be the quality of the release burst. This is particularly evident in a study performed by Fre Woldu (1986) of the (production and) perception of ejectives and emphatics by native Tigrinya and native Sudanese Arabic speakers. The study concludes that there is a "strong auditory similarity between Tigrinya ejective *ṭ* and Arabic emphatic *ṭ*."[25] The following extracts of the report are worth attention:

> The biomechanical and aerodynamic processes involved in the production of ejective /ṭ/...are totally different from those of emphatic ṭ...The main perceptual cues of emphatic stops are the release burst and the formant transitions. These two essential cues function reciprocally even when they are quite far removed from each other in time...[Native Tigrinya speakers] are perceptually lead [*sic*] [in their perception of emphatics] by the quality of the release, rather than the perceptually evident formant transitions. One possible definition as a first step in describing the auditory similarity between the two release bursts is the abruptness of the release bursts and its rapid decay...To my ear ejective releases are stronger in intensity and of much higher pitch...there is psychologically useful information in the release bursts that makes native and non-native listeners experience the two consonant types as perceptually the same...the main acoustic feature that differentiates /ṭ/ and /ṭ/ is therefore the approximation of formants due to pharyngealization in /ṭ/. It also follows that if pharyngealization could be added to ejective /ṭ/ its perceptual similarity to /ṭ/ would be total...the change from ejective to emphatic or vice versa would not require adaptation to a sound completely different.[26]

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targets in an attempt to reproduce, or mimic, the acoustic characteristics of given primitives), *uvularisation* may be a more accurate term, since emphatics have the upper pharyngeal approximation characteristic of uvulars (supported by acoustic evidence), rather than the lower pharyngeal approximation and inward displacement of the pharyngeal wall (also supported by acoustic evidence) characteristic of true pharyngeals. Cf. Ali & Daniloff (1972), al-Ani & el-Dalee (1984), Ghazeli (1977).

[22] Following on from the previous footnote, it should be reiterated here, however, that while the characteristics of [ɑ] may be manifested fully as the primary phonological prime of a segment, in other words in a pharyngeal segment, when not primary (i.e. not head of the expression), so in phonetic terms a secondary articulation, [ɑ] does not manifest its *full* characteristics. Therefore, it is not contradictory to claim that [ɑ] has primarily pharyngeal characteristics which are also manifest in uvular(ised) segments. The phonological evidence supports this view (cf. Bellem 2001).

[23] Cf. al-Ani & el-Dalee (1984), Kuriyagawa et al. (1988), Herzallah (1990), Zawaydeh (1998). Also Younes (1993) reports F2 drop in vowels affected by neighbouring emphatics, but does not mention the first formant. However, his spectrograms show higher F1 transitions in an emphatic environment, for example in comparing the minimal pair [daallaat] and [ḍaallaat] (pp.143–144).

[24] McCarthy (1994), Ghazeli (1977), Butcher & Ahmad (1987).

[25] Fre Woldu (1986: 136); original transcription retained.

[26] Fre Woldu (1986: 136-7).

Thus, where a Tigrinya speaker does not have *a*-quality in consonants (which are not purely pharyngeal), s/he may have to look for other perceptual cues in order to a) interpret, and b) reproduce the Arabic emphatic, relevant to the Tigrinya phonological system, and therefore produced as an ejective, since the most salient cue here appears to be the quality of the release burst effected by the raised oral pressure, which causes rapidity of airflow in the burst release. This is therefore something that will be taken into account in our theoretical hypothesis.

In section 2, we will move on to a diachronic overview of the genesis of emphatics, looking firstly at the Semitic language family, and then at the Proto-Semitic consonantal inventory, before finally looking at the realisation of Proto-Semitic *emphatics in languages of the Semitic family.

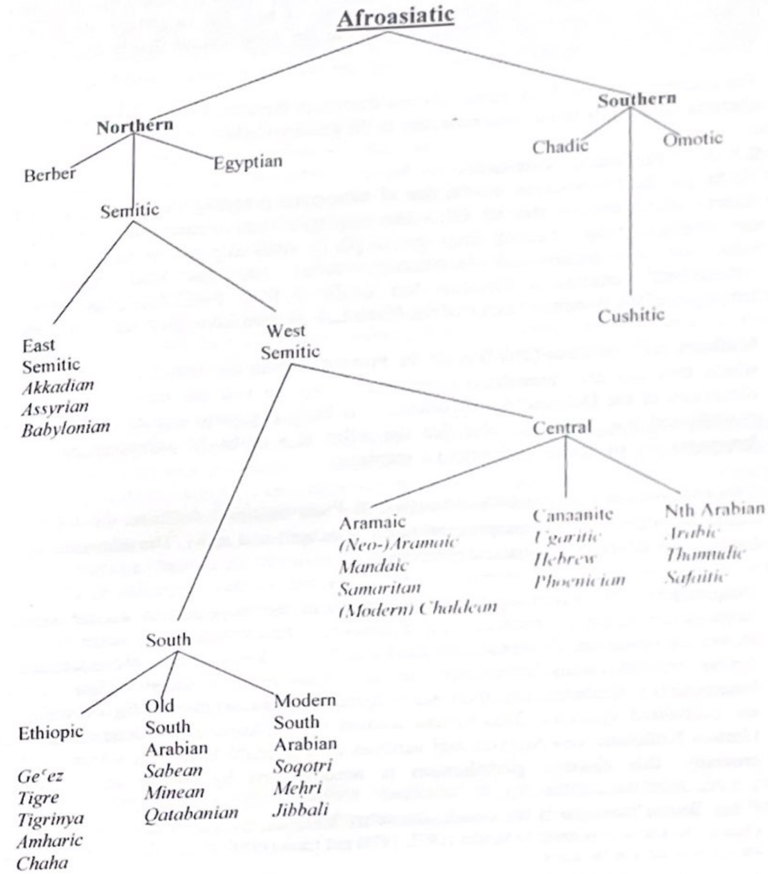
2 Historical background: Proto-Semitic

The Semitic languages comprise one sub-branch of the Northern branch of the Afroasiatic (also known as Afrasian and, more traditionally, as Hamito-Semitic) language family. Most of the Afroasiatic languages show three series of stops corresponding to the Semitic voiced, voiceless and emphatic obstruents, and most of these languages have, or show evidence of having had, postvelars (i.e. uvulars and / or pharyngeals).[27]

It has been widely proposed that the Afroasiatic language family is made up as per the following model (individual languages in *italics*):[28]

[27] Bennett (1998), original source: Greenberg (1950).
[28] Bennett (1998).

(1)



This classification has not been universally accepted, however, since other classifications have been argued for; as an example, there are those who argue that West Semitic is divided between South and Northwest Semitic languages, the former comprising Arabic, Ethiopic, Old South Arabian and Modern South Arabian, with the latter comprising Aramaic and Canaanite,[29] although this was perhaps a somewhat older classification. Nevertheless, the Semitic branch is the least disputed and most well documented. Bennett (1998: 22) also notes that the Omotic branch is particularly

[29] Cf. Bennett (1998) for further elaboration on the topic along with original sources.

disputed, and that some scholars still prefer the label 'Western Cushitic'.[30] Furthermore, a geographic classification is proposed by some, but again that has been disregarded here because it gives a false picture of how the languages are related morpho-phono-syntactically, focusing instead on the geographical distribution of the speakers of those languages.

The question as to the finer details of classification is therefore left open, since we have given as much elaboration as is necessary to the present work.

2.1 Proto-Semitic 'emphatics'

To tie the Semitic situation in with that of Afroasiatic generally, i.e. to give a slightly wider context, we note that all Afroasiatic languages seem to have some variation on the 'emphatic' theme. Semitic languages, as per the following discussion, have a wide range of (realisations of) 'emphatics', Berber languages have Arabic-style ('uvularised') emphatics, Egyptian had uvular *q* from Proto-Afroasian *ḳ*,[31] the languages of the Southern branch of the Afroasiatic phylum have ejectives.

Militarev and Stolbova (1987) posit for Proto-Afroasian the consonants *p ṭ č̣ ĉ̣ ḳ q*, which they say are "glottalised ('emphatic')". As we will see from the following discussion of the Dolgopolsky hypothesis, it is likely that these segments were indeed glottalicised (i.e. ejectives), and that the reflex in a particular subset of Afroasian languages (i.e. in subsets of Semitic) is emphatic.

The reconstructed consonantal inventory of Proto-Semitic[32] contains the following segments relevant for our purposes: *θ̣ ṭ ṣ ẑ*[33] *q*, as well as *h* and *ʕ*. The relevance of the latter three will become apparent presently.

Dolgopolsky (1977) investigates the realisation of the emphatics in ancient Semitic languages in order to postulate their realisation in Proto-Semitic. He notes the three different realisations of emphatics in the living Semitic languages. Firstly, emphatics in Arabic are "uvularised". Secondly, in the Ethiopian and Modern South Arabian languages (i.e. the languages of the South branch of West Semitic, cf. fig. 1) emphatics are glottalised ejectives. This is true also of some Neo-Aramaic dialects (such as Urmian Nestorian/Neo-Assyrian and varieties of Kurdistani Jewish Neo-Aramaic) but, crucially, this ejective glottalisation is accompanied by tongue retraction and

[30] For detailed discussion of the classification of the Afroasiatic phylum, in particular the status of Omotic, the reader is referred to Bender (1975, 1976) and Ehret (1979), who, as far as I'm aware, stand on opposite sides of the fence.

[31] Uvular *q* is, phonologically speaking, an 'emphatic' (i.e. retracted) *k*. The variation between *q* and *ḳ* is common, for instance Arabic cognates in Ethiopic or Modern South Arabian languages, which show a systematic realisation of cognate uvularised emphatics as ejectives.

[32] Bennett (1998).

[33] This is a "voiced lateral fricative" (Bennett, 1998). The previous discussion, however, noted the articulatory incompatibility of full voicing and truly contrastive glottalisation, and of the problems inherent in the realisation of ejective fricatives. I suggest therefore that this segment would have been realised either as a palatal / coronal ejective with a degree of creaky voice on release (for reasons which will become apparent in the next section), or, more likely, as a laterally affricated ejective coronal / palatal (for reasons which should be clear from the previous section). What may have induced the patterning of this segment with voiced obstruents (rather than voiceless, as with the other ejectives) is the (possibly retracted) lateral nature of the ejective release emphasising the onset of voicing, or rather, that laterals are sonorants, which by definition have spontaneous voicing, therefore the characteristics of the post-release lateral are maximally salient.

'recession' of either the adjacent vowels or of the whole word. Thirdly, Dolgopolsky suggests that in some other Neo-Aramaic dialects (e.g. Ṭūr ʿAbdīn) the opposition of emphatic and non-emphatic is actualised as an opposition of non-aspirated versus aspirated, respectively. This paper seeks to account for this variation systematically, and what follows below constitutes the basis for the phonological analysis proposed in Section 3 of this paper.

Dolgopolsky hypothesises that Proto-Semitic consonants had a three-way distinction between voiced/voiceless/emphatic; in other words, emphatics did not have a voiced-voiceless contrast, which he notes is unlike the situation in modern-day Arabic and Berber.[34] He postulates that this would be due to the glottalisation of emphatics in Proto-Semitic, where the triadic opposition of consonants would be manifest articulatorily in an opposition of the three main positions of the glottis: open glottis/vibrating vocal cords (i.e. approximated glottis)/closed glottis. Thus, if the Proto-Semitic emphatics were actually glottalised, it would not have been possible to have a voiced-voiceless distinction. This hypothesis is the crux of the present study, and will be formalised in a later section. First, however, we will look at how Dolgopolsky arrived at this hypothesis, and we will argue against one of his points.

2.2 The genesis of 'emphatics'

In concluding that Proto-Semitic emphatics were ejectives, Dolgopolsky posits the transition of ancient glottalisation to Arabic uvularisation by investigating the Neo-Aramaic dialects, which he says represent most of the stages of the transition. Firstly, the glottal articulation causes the recession of the 'emphatic' consonant and the adjacent vowels.[35] The non-emphatic voiceless counterparts are aspirated and not uvularised (i.e. there is no recession).[36] In the second stage, glottalisation is weakened to semi-glottalisation, and the distinction between emphatic and non-emphatic is now perceived as primarily that of aspiration vs. recession.[37] The third stage sees the complete loss of glottalisation, and emphatics are now distinguished from non-emphatic voiceless consonants as non-aspirated from aspirated and as recessive, which also causes the recession of adjacent vowels, from non-recessive.[38] Finally, aspiration is then lost and the emphatics are distinguishable only by recession (i.e. uvularisation), which is, according to Dolgopolsky, what we see in Arabic.

Thus, we can see that what is called 'emphatic' is not always uniform since one language's *ṭ* is not the same as another language's *ṭ*. (one being 'uvularised' and one being 'glottalised').

[34] This is not the whole story, however, and we will see that this voicing distinction is still relevant, at least in modern-day Arabic, although not in quite the same way as in Proto-Semitic.

[35] There is no indication as to why this should happen.

[36] This is the situation we see in Urmian Nestorian Neo-Aramaic (Neo-Assyrian) (the Christians of Urmia, in north-west Iran, also known as Rezaiye, South Kurdistan) and in Kurdistani Jewish Neo-Aramaic (he doesn't specify which part of Kurdistan, considering that the next stage is also exemplified by the Neo-Aramaic of Kurdish Jews).

[37] The stage found in the Neo-Aramaic of the Jews of Urmia, Salmās, Başkale and Gawar (Yüksekova) (all in Kurdistan, on either side of the Turkish-Iranian border, south of Armenia and north of Iraq).

[38] As in -Ṭūr ʿAbdīn Neo-Aramaic (south east Anatolia).

However, in contrast to one point of Dolgopolsky's hypothesis is my suggestion (based on observation), which would actually back up his theory of the emphatic trajectory, that Arabic does indeed have a three-way voicing contrast in plosives. It seems that the non-emphatic plosives are, as in English, voiceless aspirated and 'plain' voiceless, whereas the emphatics are 'plain' voiceless and voiced.

It has been observed by other researchers that the Arabic emphatics may be cued perceptually by a drop in pitch (i.e. F_0 manipulation).[39] There is a strong correlation between pitch and phonation, in terms of articulation, acoustics and phonology, such that we see, for instance, depressor consonants in tone languages, where voiced consonants induce a following low tone, such as in Zulu, or the opposite, i.e. tonal contrasts effecting voice contrasts, such as in Jabem.[40] Moreover, we often see that the historical development of (vowel) tones (tonogenesis) relates to the loss of consonantal voicing contrasts, where the contrasting feature instead spreads into the vowels.[41] Thus, if pitch drop cues the emphatic obstruents, we would expect this to be as a result of voicing. The situation is not quite so straightforward, however, since Arabic contrasts 'voiceless' emphatics with 'voiced' emphatics. The way in which this fits in with Dolgopolsky's hypothesis relates to the rather traditional designation 'voiced' and 'voiceless', which fails to take into account that many languages actually contrast stops for three or even four phonation types.[42] Thus, in Nepali we see:[43]

(2)	*pʰal*	'throw away'
	pal	'rear'
	bal	'burn'
	bʰal[44]	'forehead'

In this way, especially bearing in mind the previous discussion of ejectives, where it became clear that languages contrast ejective with voiced and voiceless stops, as in Proto-Semitic, it would not be at all surprising to discover that a Semitic language like Arabic has a three-way voicing contrast. This may have been obscured by three factors: the traditional binary viewpoint of the 'voiced' / 'voiceless' opposition; the primary perception of Arabic emphatics as 'retracted', 'dull', 'flat', 'dark', etc (analyses thus focusing on this aspect to the exclusion of phonation); the fact that Arabic actually has a maximal *four*-way contrast in stops. The reason that Arabic seems to have a three-way voicing contrast, yet a four-way stop contrast is due to the interaction of both voicing and 'uvularisation', since in Arabic it seems that the emphatics are a series lower than the non-emphatic plosives, in terms of voicing. That is, the non-emphatic stop series is voiceless aspirated and 'plain' voiceless (e.g. *t* [tʰ], *d* [t]) and the emphatic series is 'plain' voiceless and fully voiced (e.g. *ṭ*[t], *ḍ*[d]). Therefore, it could be said that the perception of emphatics involves not just recession but a voicing contrast (cued by aspiration in the 'voiceless' series *t* vs *ṭ* and voicing in the 'voiced' series *d* vs *ḍ*). To clarify the point, (3) shows an existing miminal triplet in Arabic, with an invented (but phonologically possible) fourth member of the set:

(3)	a)	voiceless aspirate:	*ti:n*	تين	[tʰi:n]	'figs'
	b)	'plain' voiceless:	*di:n*	دين	[ti:n]	'religion'
			ṭi:n	طين	[ti:n]	'mud'
	c)	fully voiced	*ḍi:n*	ضين	[di:n]	Ø

The table in (4) further clarifies this point, without the example data, but again using the coronal stops:

(4) **Inventory of coronal stops in Arabic**

Voicing status	*Non-emphatic*	*Emphatic*
Voiceless aspirated	*t* [tʰ]	
'Plain' voiceless	*d* [t]	*ṭ* [t]
Fully voiced		*ḍ* [d]

Up to this point the discussions in this section have centred on plosives; however, the status of fricatives should also be made explicit here. The fricatives do not seem to involve the three-way opposition that characterises the stops, as is usually the case cross-linguistically.[45] Arabic fricatives may be one of four types: voiceless non-emphatic, voiced emphatic, voiceless emphatic, voiced emphatic. Thus, there is only a two-way voicing contrast in fricatives, with the emphatics being true counterparts (in terms of voicing) of the non-emphatics, unlike the stops, which could not be said to be true counterparts.

With regard to the latter point, it is noteworthy that in most analyses of Arabic emphatics, the emphatics are compared with their so-called 'plain' counterparts, but, as seen in (3) and (4) above, this means that what is actually being compared are pairs which not only contrast for emphatic status, but are also of a different voicing status i.e. 'plain' voiceless (emphatics) are compared with voiceless aspirated (non-emphatic) and fully voiced (emphatics) with 'plain' voiceless (non-emphatics). In real terms, and certainly in acoustic evaluations, it may be more revealing to compare pairs of a similar voicing status, or like with like, i.e. voiceless 'plain' non-emphatic *d* with voiceless 'plain' emphatic *ṭ*. This is what is made explicit in (4), that the true counterpart of

[39] Michael Ingleby (p.c.) referring to acoustic analyses that he performed on Arabic emphatics. He analysed emphatic harmony as the spreading of the element L.
[40] Cf. Yip (2002).
[41] The correlation between the notions of pitch and voicing is formalised in the theoretical framework adopted in the next section, so that they are not two phenomena but one.
[42] Phonation types such as creaky voice are sometimes employed in addition to the voicing and aspiration contrasts. For instance, Ladefoged (1983: 353) details vowel contrasts in the Tibeto-Burman language Mpi, which has maximally 12 laryngeal variations, through the interaction of six tonal contrasts and a plain vs. laryngealised contrast.
[43] Ladefoged (1983).
[44] More strictly, *bʱal*.

[45] One could argue that since 'aspiration' is spontaneous in fricatives, i.e. is an integral part of the notion 'fricative', it cannot therefore be contrastive. In order to produce the airflow necessary, the glottis must have some degree of aperture. Thus, they cannot contrast for aspiration, leaving only a two-way voicing contrast.

Arabic *ṭ* is *ḍ*, and that *t* and *ḍ* have no strictly true counterpart since their voicing status is different.[46]

The issue of formally testing the voicing status of Arabic stops will be addressed in future experiments relating to ongoing work.[47]

3 The phonological status of 'emphatics'

This section of the paper sets out our proposals for a phonological analysis of the emphatic/ejective phenomenon, as a foundation for our ongoing investigation into the role of the pharynx in phonology. Here we will attempt to relate the notions of 'emphatic' and 'ejective' in the light of Dolgopolsky's hypothesis of the Proto-Semitic triadic stop opposition. We first summarise the theoretical background before moving on to the analyses themselves.

3.1 The elementary approach

Here, we present an overview of the theoretical framework which we will adopt to account for segmental representations, that of elements. The reasons for the adoption of this framework are outlined in detail in Bellem (forthcoming), but take up too much space to be discussed in any detail here. In brief, however, we could note that feature-based analyses fail to account for the phenomena in hand on at least one of the following issues: firstly, the glottal-state options are ternary (not binary); secondly, weakening (lenition) phenomena involves loss of contrast, thus loss of salient information from the speech signal; thirdly, articulatory gestures are the target in the attempt to reproduce salient acoustic information, i.e. the acoustic signal is the neutral code between speaker and listener, thus, for instance, a ventriloquist may vary the normal targets, employing the speech apparatus in a non-standard way, but still reproduce enough of the salient information to be understood as communicating the same information; fourthly, consonantal laryngeal contrasts correlate with vocalic, and we must therefore assume that this is encoded in the phonology.

In this section of the paper, then, we outline the theory and move straight into a discussion of the elements themselves.

3.1.1 Background

In the theory advanced in Government Phonology, the melodic primes which make up phonological segments are formally called elements, defined by Harris (1994: 138) as "cognitive categories which serve the grammatical function of coding lexical contrasts", combinable into phonological 'expressions', which are realised as segments.

Elements are not abstract categories for which a segment is specified, but independent units in themselves which are either absent or present from a segment, in the same way

[46] One notable exception to this is Fre Woldu's (1986) study, discussed in Section 1.2.2, of the perception and production of Arabic emphatics and Tigrinya ejectives. The experiments focus on the coronal series and compare emphatic/non-emphatic 'pairs' of the same voicing status, i.e. Sudanese Colloquial Arabic (SCA) *ṭ* is compared with Tigrinya ejective *t'*, which is also a 'plain' voiceless coronal stop, and thus, there is no voicing contrast between the two. As an aside, I suggest that it is this that goes some way towards conditioning the perception of Tigrinya *t'* as SCA *ṭ*, since both SCA and Tigrinya have *d* (IPA *t*, i.e. 'plain' voiceless non-emphatic/ejective), thus this would be perceived accurately. Perceptually, then, in relating one inventory to the other, *ṭ* and *t'* would be the closest stops.

[47] The reader is reminded that this is a working paper!

that the colour green is made up of blue and yellow. If we remove all traces of the primary colour blue from the compound colour green, we are left with the primary colour yellow. Elements can be seen as primary colours which exist in their own right (as a simplex segment), but which can mix with other primary colours to form compounds (a complex segment). Thus, the breaking-down of phonological segments into elements, rather than viewing them as unordered bundles of feature specifications, encodes the characteristic of privativeness, as we see in real-world objects, rather than equipollent oppositions, which do not encode an atomic world-view but an abstract notion of defining things to some extent by what they are not.

Implicit here, moreover, is the prediction that the primitives have independent phonetic interpretability. Harris (1990, 1994) and Harris & Lindsey (1995) provide much cross-linguistic evidence for each of the elements in processes of lenition, where historical 'weakening' such as vocalisation, debuccalisation and spirantisation is accounted for as the loss of salient acoustic information, thus an element, each element loss representing a stage of the lenition trajectory. The last stage of lenition, before deletion, therefore represents the expression of the last remaining element of the original compound. In this way, it is possible to pin down two things: the elements present in various compound expressions; the independent phonetic interpretation of the various elements. This will be demonstrated briefly in the next section.

Feature theories tend to view primitives as abstract articulatory categories which are then mapped onto phonetic categories at a 'surface level'. Elements, however, having independent phonetic interpretation at every stage of the derivation, are grounded in the acoustic signal and in this way are not entirely abstract codes, but rather, as already noted, 'cognitive categories which serve the grammatical function of coding lexical contrasts.'[48] Since the code which is neutral to both speaker and hearer is the acoustic signal, articulation is merely the attempt to reproduce that signal using the available tools. Thus, the elements directly encode particular speech signal patterns, which are then mapped onto articulatory categories.

3.1.2 The elements and their salient characteristics

To begin this section we should firstly note how exactly elements combine to form compounds. In a phonological expression, one element takes the role of head, while other elements of the compound assume operator (dependent) status. Within any phonological domain, any non-head must be licensed by the head of that domain in order to have expression.

This is not an abstract notion or an entirely arbitrary stipulation, but is the theoretical encoding of two main notions. Firstly, compound expressions have complex acoustic signals. However, the acoustic signal of a particular sound may have a signal with one maximally (or more) salient characteristic relating to one specific element, i.e. the head. For instance, the segment *ɛ*, a compound of the elements A and I, is closer to A than is *e*, which is also a compound of these two elements. Thus, in *ɛ*, the head is A (the expression is represented notationally as [A̲.I]), whereas in *e* the head is I (represented notationally as [A.I̲]). An element is said to impart its salient characteristic fully to an

[48] Harris (1994: 138).

expression when head.[49] Secondly, the head of an expression may be deduced through its phonological behaviour.[50]

Kaye, Lowenstamm and Vergnaud[51] (1985, 1990) and Harris (1990) originally proposed an inventory of ten elements, including the ATR element ɪ. One of the major developments in standard GP has been a reduction in the number of elements. It has been proposed[52] that all elements should be present in vocalic and consonantal expressions alike, and for this, and other, reasons, the ATR element ɪ was made redundant.[53] There have been attempts to limit the elements minimally to an inventory of five,[54] but commonly in current practice to six, although it is still a somewhat controversial area in element-based frameworks, and different researchers have proposed more (or different) elements or eliminated others. Here, however, we will be mostly following Harris (1994) and Harris & Lindsey (1995), with two essential differences.

Firstly, as will be discussed presently, the framework I adopt here does not consider that there is a phonological h element. Secondly, this framework omits the element @, the element that represents neutrality (other, earlier, versions of GP represented neutrality with the element ɪ). In vowels, this element represented the centralising effect of laxness, and in consonants it represented velarity. Acoustically, the element was said to have a "schwa-like auditory effect".[55] It is seen as having no active resonance properties, and thus fails to "contribute anything to an expression in which it occurs as a dependent".[56] Moreover, it is assumed that @ is latently present "as a dependent in all vocalic expressions and has the potential to become audible only when other elements in a compound are suppressed for some reason",[57] in other words, it can be thought of as an acoustic "base-line on which the well-defined sound patterns associated with A, I and U are superimposed".[58] However, in much the same way as sonorants are said to have spontaneous rather than active, contrastable voicing, which is therefore not phonologically represented, it could be said that all sounds must have an 'acoustic base-line' on which the elements superimpose their own salient characteristics, and that thus it is not phonologically represented since it is not contrastable, or an active property. We could therefore think of the salient neutral characteristic actually as the manifestation of nothing, so that what represents no acoustic resonance properties is no element. Somewhat rather counter-intuitively, in the '@ as neutral' view this 'lack of' is equated with the positive presence of an element (lack of maximally salient characteristic = the element @). In the schema represented in this thesis, for the reasons

[49] The reader is referred here to Harris & Lindsey (1995) for further exposition on these points.
[50] Again, we have not the space here to devote to this issue the detailed discussion it merits. It is discussed more fully in Bellem (forthcoming). The reader is referred to Harris (1994, 1998) and Harris & Lindsey (1995).
[51] Henceforth KLV.
[52] Kaye (1993) – postgraduate phonology seminar, as summarised in Charette & Göksel (1998) and Walker (1995). This insight follows the 'one-mouth' principle, so-called in Anderson (1985), but an issue already raised by Jakobson.
[53] Cf. Charette & Kaye (1993).
[54] Jensen (1994) terms this programme 'non-segmentalism'.
[55] Harris (1994: 108-9).
[56] Harris (1994: 111).
[57] Harris (1994: 111).
[58] Harris (1994: 109).

discussed, the notion of headlessness is preferred. If an expression has no head, there is not an element 'stronger' than the others and no one element can impart its *full* characteristics. Thus, a lack of maximally salient characteristics now corresponds with nothing ('lack of' = no head).

Headlessness can be seen in both vocalic and consonantal positions. In vowels, headless expressions represent lax vowels or ATR contrasts. Moreover, schwa-type vowels (so often involved in vowel-zero alternations) are said to be the manifestation of empty nuclear expressions (i.e. a nucleus containing no elements whatsoever). In consonantal positions, a headless expression represents a velar, thus a velar approximant is the manifestation of an empty consonantal expression, as will be seen the Turkish examples presently.

Moving on now to the eight elements which are used in our schema, figure (5) shows in table form the acoustic properties of these elements, and the articulatory means normally employed to represent those acoustic properties (i.e. the articulatory targets), which will then be discussed in further detail.

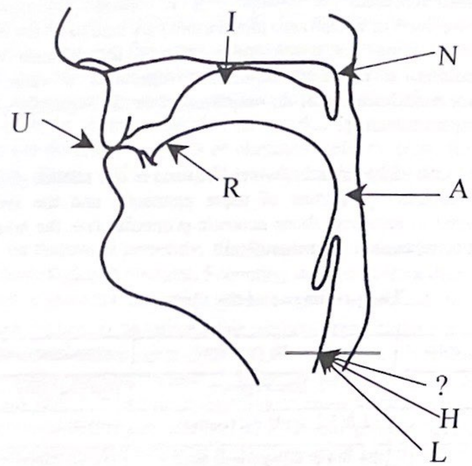
(5) **The properties of the elements**

element	*acoustic property*	*articulatory target*
A	F1 & F2: convergence	pharyngeality
I	F1 & F2: wide divergence	palatality
U	F1 & F2: downwards shift	(velar-)labiality
R	[59]	coronality
N	low broad-band intensity	nasality
?	abrupt energy drop	stop
L	F0: fall	slack vocal cords
H	F0: rise	stiff vocal cords

[59] The status of R is not especially clear. Harris & Lindsey (1995) pointed out that it is hard to pin down a clear speech signal pattern for this element, or, indeed, for the class of coronal articulations. Some researchers have proposed that R should be merged with (new) A, since, according to these researchers R and A never co-occur, R is found only in consonants, and A only in vowels. However, evidence for this was drawn only from Western European languages and there is no acoustic evidence. Evidence from languages like Arabic, which has A in pharyngeals, uvulars and emphatics, shows that A indeed associates to consonantal positions. Moreover, proposals that R should simply be eliminated go against the phonological evidence of R as a strong natural class, particularly in consonant harmony systems, which always involve coronals. Thus, while acknowledging that its status is yet to be resolved, we adopt the R element here in the representation of coronals. The reader is referred to Paradis & Prunet (1991), Rennison (2002), Williams (1998), Ploch (1993), Backley (1993), Ingleby & Brockhaus (2002).

The articulatory targets onto which the acoustic properties of the elements are mapped are shown in diagram form in (6). It could be said to portray the components of the speech apparatus normally employed in the attempt to reproduce the salient speech signal pattern characteristic of each of the eight elements:

(6)



The four elements A, I, U and R are resonance elements. A is the aperture element, the high F1 and low F2 re-created through pharyngeal constriction and jaw opening, causing open oral tract in relation to the pharyngeal tract. I is the close element, its characteristic divergence of the first and second formants being re-created by narrowing towards the front of the oral tract (at the hard palate), and openness of the pharyngeal tract caused by tongue fronting. U is the round element, the drop of both formants being re-created by maximisation of the oral tract, through labial approximation (and protrusion) along with the raising of the body of the tongue in the middle of the oro-pharyngeal tract (dorsal-velar approximation). R, as mentioned, is not so clear-cut, although Ingleby & Ali (2004) give it the acoustic characteristic of 'rise in spectral amplitude' (as opposed to the 'fall in spectral amplitude' of U). The articulatory target of R is a coronal gesture, performed by apical raising in the alveolar region.

The two manner elements are ?[60] and N.[61] The abrupt energy drop of ? is created by the gesture of closure preventing airflow, and is typical of stops. In isolation, since there is no supralaryngeal gesture (resonance element), the characteristic acoustic energy drop is created by glottal closure. The low frequency broad-band murmur of the nasal element N is created by the lowering of the velum, and concomitant approximation of the vocal folds, through which the air is driven in pulses, which creates the periodic energy visible on the spectrograph (typical of vocal fold vibration, i.e. voicing). The low frequency energy is created by the periodicity of nasal tract resonance. Thus, voicing in nasals is spontaneous.

Finally, the two laryngeal elements L and H are typically represented acoustically as, respectively, a fall in pitch (fundamental frequency) or a rise in pitch. The articulatory target of the re-creation of F0 drop is vocal fold approximation, where the folds are relaxed, or slack, enough so that when the air expelled from the lungs is driven through, they vibrate, causing the effect of pulses of air, which in turn creates regular cycles of pressure, modified by the supralaryngeal gesture. The voicing is present throughout the segment, vocal fold vibration (onset of voicing) beginning before the release of the supralaryngeal gesture. However, where this is true of actively voiced segments (non-sonorants), L has a slightly different effect on spontaneously voiced segments (sonorants), where the characteristic F0 drop is created articulatorily by compressing the vocal folds so that the vibration is slower, thus the frequency of periodic waves is lower (i.e. fewer vibrations per timing unit). Conversely, the articulatory target of H, in the re-creation of raised fundamental frequency, is the stiffening of the vocal folds so that vibration is prevented, and thus the onset of voicing does not begin (through the slackening of the folds) until after the release of the supralaryngeal gesture (i.e. there is a VOT lag). How does this affect vowels, which are spontaneously voiced? The rise in fundamental frequency characteristic of H is effected in vowels by raising the pitch, the articulatory gesture necessary to create this effect being the stretching of the vocal folds to narrow the approximation so that they vibrate more quickly, creating faster pulses of air, which in turn cause a higher number of pressure peaks per cycle.

It is to be noted here that H also functions as a manner element in this framework. Harris (1994) and Harris & Lindsey (1995) have the additional manner element h, which they note is characterised by aperiodic energy, as is typical of fricatives and the burst release of plosives, and which is created by the articulatory gesture of glottal opening which allows air to flow freely. However, there are phonological and phonetic reasons to doubt the existence of this element. Firstly, the acoustic characteristic of h is not phonologically contrastive but 'spontaneous' (like voicing in sonorants). No language phonologically contrasts e.g. released and unreleased stops (only in "coda" or utterance-final position). The only evidence I can see as plausible in arguing for the existence of h is that of spirantisation, where stops lenite to fricatives. I have no clear answer to that as yet, but the remaining evidence strongly suggests that H is the manner element responsible for fricatives. For instance, where stops frequently have a three-way contrast for voicing, fricatives almost always have only a two-way contrast: voiced and voiceless. This is compatible with the inherent existence of H in fricatives, so that they may have either H alone (voiceless), or both L and H (voiced). Moreover, since the mechanisms of human speech[62] necessarily involve the movement of air which has to pass through the glottis at some point, it is thus spontaneous, and modifiable firstly

[60] *This paper actually proposes that ? has a dual role, since it is not only a manner element, but also has a function in laryngeal contrasts, placing it on a level with H and L. This will be discussed on the evidence of ejectives, presently.*

[61] *It has also been proposed that L and N are actually the same element (L), since there is a close phonological correlation between voicing and nasality. There are said to be only a couple of cases of co-existence, i.e. languages that have nasalised vowels that contrast for (low) tone. Cf. in particular Ploch* (1999). However, Ploch (p.c.) has recently said that he no longer believes that the elements should be merged.

[62] Here, of course, we refer to the majority of human languages, with the notable exception of sign languages, which, although worthy of research, are not directly relevant to the current work.

by laryngeal activity (free-flowing with H, obstructable partially with L and fully with ?) and secondly by supralaryngeal activity (the resonance elements superimposing characteristic resonance, modified by ?, L and H).

To summarise then, in this framework, ? functions as both a manner and a larngeal element, and h is subsumed under H, which is thus both manner and laryngeal. This leaves us with L. There is no reason to suppose that it alone does not have a dual function, so what of the role it presumably has to play in manner contrasts? Possibly this is nasality, as already noted, although since this is not directly relevant here I have chosen to leave the matter open by adopting both L and N. However, I shall later propose that L is responsible for sounds which are (glottalic) ingressive, so that it does have a (perhaps marginal) 'manner' role. Further investigation is of course needed!

We shall now move on to look at some phonological support for the eight elements. However, for reasons of space, we obviously cannot present a full discussion of all the evidence offered by various researchers for each element. What we will do here is present some of the data given in discussions of lenition phenomena, which I believe provides a good summary.[63] There are various types of lenition, which phonologically encapsulate the loss of different (classes of) elements.

Firstly, vocalisation is the process that shows us evidence of the resonance (or place) elements which make up consonants. This is exemplified in (7) through (10):

(7) *p/m/v → w*
- Korean: *ki:p-t'a – kiw-ə* 'sew'
- Irish: *mo:r – wo:r* (fem.) 'big'
- Turkish: *avuç – [awuç]* 'palm'

(8) *t → r/ɹ*
- English: *a[tʰ]omic – a[ɾ]om*; *lot of- lo[ɾ]a / lo[ɹ]a*
- Korean: *si:t-t'a - siɾ-ə* 'to load'

(9) *t͡ʃ / d͡ʒ → y*
- Arbore: *gerrat͡ʃ – gerray-me* 'thief'
- Iraqi Arabic: *dujaj – diyay* 'chicken'

(10) *k → (ɰ→) Ø*
- Turkish: *inek → (ineɰi →) ine[Ø]i* 'cow'

The relevance of each set of data is as follows. In (7) we see the presence of U in the segments *p/m/v*, i.e. labial (nasal) stops and fricatives. In (8) we see how the coronal stop *t* vocalises (reduces) to an alveolar tap or approximant, the independent manifestation of R. (9) gives evidence for the presence of I in palato-alveolar affricates, and (10) shows a velar stop reducing through a velar approximant *ɰ*, as is still evident in some varieties of Turkish, to zero, as in Standard Turkish.

The second lenition type to be exemplified is the spirantisation → debuccalisation trajectory, whereby a plosive spirantises to a fricative and then loses its place to *H*:

[63] The reader is referred here to Harris (1994), where some of this data is presented. Harris (1998) is also the source of some of this data, and the remaining data is my own.

(11)
- a) Tiberian Hebrew: *malki* 'my king' – *melex* 'king'
- b) Liverpool English: *better – be[s]er*; *lot – lo[h]*
- c) SE British English: *a head – an [ɛ]d*
- d) Portuguese – Spanish: *furmiga – hormiga [ormiga]* 'ant'

Evidence of H (as a manner element) is shown in (11), with (11c & d) showing how *h* is a simplex segment [H] which frequently deletes to Ø.

The last lenition type here is loss of release → stop debuccalisation. This shows us evidence of the other manner element ?:

(12)
- a) English: 'get no' → ge[t˺]no → ge[ʔ]no
- b) Syrian Arabic: *qamr → ʔamr*
- c) (Iraqi) Arabic → Farsi: *ʃiʕr* → *ʃeʔr – ʃe:r*

I thus assume the eight elements A, U, I, R, L, H, N and ?.

3.2 Emphatic representation

In this section, we will propose representations for the segments discussed in Sections 1 and 2 above. The section proceeds as follows. We will work through the three-way glottal-state opposition proposed by Dolgopolsky (1977) for Proto-Semitic and then through Dolgopolsky's hypothesis of the emphatic trajectory, as exemplified by Neo-Aramaic. We will then look at the representation of the Arabic emphatics, and lastly summarise the status of the notion of 'emphatic' in the Semitic languages.

3.2.1 Proto-Semitic

Proto-Semitic, according to most researchers (that I'm aware of), has glottalised (i.e. ejective) emphatics. According to Dolgopolsky (1977), this series represented the 'closed' glottal state, and, unlike with the Arabic emphatics today, the 'emphatics' were not backed. Therefore, I represent the Proto-Semitic emphatics as 'true' ejectives.

In this section, we will firstly reiterate points from the previous discussion of ejectives in seeking to determine acoustic cues in order to identify the elements that make up the representation. Secondly, we will briefly discuss some of the phonological evidence given in typological studies.

It was noted in Section 2 that, according to the literature surveyed, the major cues to glottalisation are raised larynx with concomitant glottal-oral closure, leading to significantly increased oral pressure, leading to distinctive release burst (increased amplitude in comparison with non-ejective release bursts). We should also reiterate here that the cue to the presence of the element ? is an abrupt and sustained drop in overall amplitude (during the closure phase).

What appears to be particularly significant in terms of perceptual cues to ejective release is the VOT lag. Noticeably, this is not the same as the VOT lag evident with voiceless aspirates, since the duration of the aspirate lag is characterised by white noise, i.e. aperiodic energy, whereas the duration of the ejective lag is characterised by the sustained drop in energy (that characteristic of the ? element). It seems that in languages that contrast ejectives with voiceless aspirates, since both are cued by VOT lags, there must be a perceptual distinction between the two – this is visible in acoustic measurements (white noise vs edge). In order to differentiate the two types of VOT lag,[64] I shall term the former 'noise-lag' and the latter 'stop-lag'. Thus, a typical three-way plosive opposition is: noise-lag vs stop-lag vs no lag.

Noise-lag is typical of voiceless aspirates, segments characterised by the presence of the 'stiff' element H. Stop-lag is typical of ejectives, segments characterised by the presence of ?. However, since plosives are already necessarily represented by expressions containing the ? element, we need to investigate a little further to deduce what differentiates 'plain' plosives from ejectives.

We should note here that it seems typical that languages that have ejectives contrast them with voiceless aspirates and 'plain' stops.[65] Languages that neutralise laryngeal contrasts in certain positions seem to neutralise the ejectives and the voiceless aspirates to 'plain', indicating that ejective release behaves phonologically as a laryngeal contrast. Thus, it seems that in addition to the laryngeal elements L and H, ? may also behave as a laryngeal element. This is to be expected, since in isolation it is realised as a glottal stop (the glottis being located in the larynx). There are also languages that additionally contrast implosives, on which more presently. Moreover, typological studies also often correlate ejectives with creaky voicing (as mentioned earlier). We will also take this into account presently.

Since the element ? independently has closed vocal cords and raised larynx, they must be stiff (viz. pitch rise in ʔ). In this way, we can contrast 'stiff but open' (the element H) with 'stiff but closed' (the element ? manifesting its full characteristics) Thus, ? also displays pitch rise. This is very clear with, for instance, the glottal stop in glottalled "butter", i.e. [bʌʔə], in which the larynx is also raised, and there is a clear rise in pitch. It is said[66] that as the head of an expression, an element manifests its *full* characteristics. Thus, since ejectives seem to display the full acoustic characteristics of a glottal stop, we can surmise from the acoustic evidence that ejectives are represented by an expression headed by the element ?. In this way, the acoustic characteristic of ? being 'edge' is maximised in ejectives.

Evidence for ? also behaving as a laryngeal element is to be found not only in Semitic, but appears to be widespread in languages that have ejectives. Various typological

[64] The differing quality of the two bursts is very apparent in spectrographic comparison. With stop-lag, there is a clear double-release evident in two sharply-defined edges. The first of the two edges also shows strong formant transitions, indicating the resonance patterns of the oral stop, which quickly decay, with a significant energy gap before the next edge, which indicates the glottal release and vowel onset. Noise-lag is often shorter in duration, and the period of aspiration is not entirely aperiodic in that it does actually show some intensity at certain frequencies. In other words, formant patterns are detectable during the phase of aspiration. This seems to indicate the anticipatory nature of the aspiration (and even the stop itself), i.e. that the glottal frication is modified by the shape of the supralaryngeal tract in anticipation of the following vocoid.

[65] Cf. Steriade (1997), Fallon (2002).

[66] Cf. Harris (1994), Harris & Lindsey (1995).

studies[67] show that it is cross-linguistically common for many languages that have a three-way opposition of 'plain', aspirated and ejective plosives to exhibit laryngeal neutralisation in certain contexts, whereby voiceless aspirates and ejectives lose their laryngeal contrast, and all stops in these contexts neutralising to 'plain'. This clearly shows that ejectiveness patterns as a laryngeal contrast, and that the element responsible for this (?) behaves in ejectives as a laryngeal element.

More evidence that it is indeed ? that behaves as the 'ejective element' is to be found in the phenomenon of creaky voice. It is sometimes supposed that the two phenomena don't co-occur in the same language;[68] however, I shall argue that ejectives and creaky voice are in fact the same phenomenon manifested in two different types of segment. Firstly, creaky voice necessarily requires some sort of voicing, whereas ejectives are never phonologically voiced. Some notes concerning creaky voice are in order here. Firstly, Hayward (2000: 223-4) distinguishes two types of what is often called creaky voice, noting that one type may be achieved by holding the vocal cords more closely together than for modal voice, resulting in "a rather more tense quality, which we shall refer to…as *pressed voice*, though the term *creaky voice* is more frequently used." She then notes the confusion over terminology (creaky voice vs laryngealisation vs glottalised phonation), suggesting that '*pressed* is a better designation since *creaky voice* and *laryngealisation* may also imply the presence of irregularity like that found in low-pitched *creak*…while *pressed* suggests only a greater degree of vocal fold adduction. It thus allows for a further distinction between presence or absence of irregularity.' Thus, *pressed* refers to tense or more adducted vocal cords, whereas *creaky* refers to 'the more constricted type (closer to glottal stop).' Notably, the more constricted type of creaky voice is achieved by the partial closure of the glottis, along with the slackness of the remaining part of the glottis allowing vibration. Creaky voice therefore seems to be most commonly found as a contrasting phonation type in vowels. Where it is found in oral stops, it seems to be the release which is creaky. Bearing in mind, however, that it is sometimes said to occur with ejectives in the onset of the following vowel, it would appear that the element ? is simply spreading into the vowel. Thus, creaky voice may be thought of as the sonorant counterpart to ejectives. In obstruents, the headedness of ? characterises ejective phonation,[69] whereas in sonorants, the headedness of ? characterises creaky phonation.[70] Moreover, sonorants

[67] Cf. in particular Fallon (2002), which is a detailed study of the phonetics and phonology of ejectives, and thus has a good typological survey and an extremely comprehensive bibliography; Steriade (1997), which focuses on laryngeal neutralisation and contains some interesting case studies.

[68] There is an interesting summary of responses to a question on ejectives and creaky voice to be found on LinguistList 11.8 (11 January, 2000) ('Sum: Q:10.1720: Phonetics/Ejectives/Laryngealization') which can be viewed at: http://www.sfs.nphil.uni-tuebingen.de/linguist/issues/11/11-8.html.

[69] 'Phonation' may seem a slightly odd term to use here, as ejectives are not voiced, but bearing in mind that ejective stops typologically pattern as a class of laryngeal contrast, 'ejective phonation' refers to ejective release functioning as a class that contrasts with other phonation types (i.e. voiceless aspirate, voiced, etc).

[70] Two further notes should be made here. Firstly, it is outwith the scope of this paper to investigate the phenomenon of creaky vowels. Therefore, the assumption that they are headed by ? is made as a parallel with ejectives and sonorant consonants. The matter remains for further investigation. Secondly, the distinction made by Hayward (2000) between pressed and creaky is based in phonetic investigations. How far this may or may not be relevant to phonology also remains a matter of further investigation, viz. whether a single language contrasts the two types. Moreover, the literature investigated for the current paper does not clarify exactly what is meant by 'creaky voice' or 'laryngealisation'; as is so often the case, the two terms can often be used rather vaguely, with no clear definition, meaning that assumptions have to be made without justification, and analyses may be hindered. It may be that there are indeed

may be distinguished from obstruents in that sonorants are spontaneously voiced, and therefore their representation does not contain L;[71] obstruents, however, commonly contrast for H and / or L. Therefore, creaky voicing is normally the manifestation of ʔ-headedness in sonorants and voiced obstruents.

The final point to be made here concerns implosives. It is not unusual for languages with ejectives to contrast them with implosives. Both ejectives and implosives are non-pulmonic (glottalic egressive and glottalic ingressive, respectively).[72] Ladefoged (2001: 133) notes that implosives are made by lowering the larynx 'so that they suck air in'. By moving the larynx downwards, oral air pressure is decreased, so that when the oral closure is released air is sucked into the oral cavity. Implosives are normally said to be voiced.[73] With implosives, the lowering of the larynx also causes low pitch. Therefore, I propose[74] that voiced implosives are represented by L-headedness, and 'voiceless' implosives by L-headedness with a dependent H. This correctly predicts that 'voiceless' implosives are less common cross-linguistically than their voiced counterparts, since the representation is more complex.[75]

Going back now to the aim of this section, which is to identify the representation of Proto-Semitic obstruents, we recap that Proto-Semitic is said to have had a three-way stop contrast. Moreover, Dolgopolsky (1977) proposes that this represents the three states of the glottis: open, approximated, closed. This would be realised roughly as voiceless aspirated, voiced and glottalised. However, bearing in mind the typological evidence, and considering that in a three-way system, a language would be highly likely to have a 'default' plain series (i.e. one containing no laryngeal element), I suggest that Proto-Semitic should actually be represented with voiceless aspirated, 'plain' voiceless and ejective stops. This proposal is strengthened by the evidence of Arabic, since in Arabic, according to my proposal, the only truly voiced stops are the voiced emphatics, which developed as we will see presently. In this way, L has no role in Proto-Semitic, which seems typologically likely.

We therefore propose the following representations for the glottalised obstruents of Proto-Semitic:

phonologically two types of 'creaky voice', the tense / adducted version being the manifestation of H-head, and the irregular type being the manifestation of ʔ-head. This, of course, would be an interesting investigation to conduct in its own right.

[71] I note further that voiceless sonorants would probably have H in their representations. It would be interesting to investigate the interaction between voiceless sonorants and tone in languages that have the two.

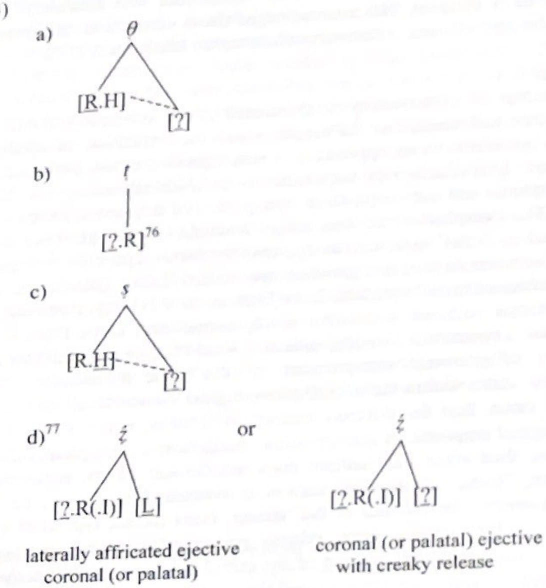
[72] As a passing note of interest, Hayward (2000: 268-9) mentions three types of non-pulmonic consonants: ejectives, implosives and clicks. The first two are glottalic, whereas the latter are velaric.

[73] Ladefoged (2001: 133) notes that 'when the vocal folds are pulled downwards…they leak a bit, and get set into vibration by the air that is passing between them…Most of the languages that have implosives produce them as voiced sounds, although it is possible to make them with the vocal folds tightly together so that they are voiceless'.

[74] It should be noted that these proposals are at this stage somewhat tentative, since time and space restrictions do not allow a full investigation here, and since it is not directly relevant to this paper. It thus remains for future research!

[75] Note that this is common to the laryngeal elements. That is, the most common type of plosive is voiceless 'plain', i.e. no L and no H. Three-way contrasts are less common than two-way, and four-way contrasts involving a combination of L and H (such as in breathy voice) are less common still.

(13)



3.2.2 The 'emphatic' trajectory

As noted in Section 2.2, Dolgopolsky (1977) maps out a trajectory of ejective-emphatic which can be traced through the Neo-Aramaic realisations of 'emphatics', with the final stage being represented by Arabic. The following subsections will discuss each stage of the trajectory in the light of the theory of elements discussed above. We will therefore propose representations for the 'emphatics' of each stage, which will enable us to identify the link between Arabic-style emphatics and ejectives.

3.2.2.1 Stage 1

The first stage of this trajectory is evident in Urmian Nestorian/Neo-Assyrian and varieties of Kurdistani Jewish Neo-Aramaic. The ejective glottalisation in these dialects is accompanied by tongue retraction and 'recession' of either the adjacent vowels or of the whole word. The non-emphatic voiceless counterparts, as in Proto-Semitic, are aspirated and there is no recession.

[76] Note that I do not consider that this confuses coronal stops and laterals, since the former in my view are characterised by R-head, while the latter are characterised by L-head. Since the L-head is integral to the definition of laterals, they therefore behave as sonorants in that L is not contrastive. However, since H could be contrastive, voiceless laterals are therefore possible, but it is predicted that they are typologically less common. Moreover, laterals are exclusively coronal and/or palatal, which indicates that the combination of ʔ and L-head is dependent on R in its interpretation as a lateral (thus, palatal laterals contain R and I, so that they pattern with both coronals and palatals). Again, it is not possible to investigate here the full implications of this proposal concerning the representation of laterals, and it is left to future research.

[77] It is not clear what exactly ẓ is, cf. footnote 32. We therefore give a couple of possible representations.

The 'emphatics' of this stage are therefore represented with a headed ? element, and additionally an A element. The association of the A element to consonantal positions containing the stop element is thus dependent on the headedness of ?.

3.2.2.2 Stage 2

The second stage of the trajectory is represented by the Jewish Neo-Aramaic dialects of north-west Iran and south-east Turkey, in which the opposition of emphatic and non-emphatic is actualised as an opposition of non-aspirated versus aspirated, respectively. In this stage, glottalisation is weakened to semi-glottalisation, and the distinction between emphatic and non-emphatic is now perceived as primarily that of aspiration vs. recession. The 'emphatics' of this stage, I would argue, are what are sometimes distinguished as 'lenis' ejectives, as opposed to 'fortis' ejectives.[78] It appears that the distinction between the two is a phonetic one, in that 'fortis' ejectives have a significant VOT lag, whereas 'lenis' ejectives have little or no VOT lag. Phonologically, I don't believe that this contrast is relevant to representations, since I am not aware of a language that contrasts the two realisations. I would therefore argue that the distinction is a matter of phonetic interpretation of the same phonological representation. However, the status within the overall phonological system of the language may not be entirely the same, thus the different realisation. That is, at this stage of the trajectory, the phonological emphatic vs non-emphatic distinction is perceptually that of aspiration vs recession, thus since the contrast does not depend on the perceptual salience of glottalisation, 'fortis' ejective realisation is weakened to 'lenis', i.e. the VOT lag shortens. However, the salience of the 'strong' burst release typical of ejectives is still maintained as the 'strong' burst release typical of recessed obstruents, since the pharyngeal constriction acts instead of the raised larynx to compress the oral tract and raise the pressure, and therefore to propel the air through the oral tract upon release.

In this phonological system, 'emphatic' contrasts primarily with aspiration. The voiceless aspirated consonants display laryngeal raising, whereas the larynx is not raised with the 'emphatics'. Phonologically, the three-way contrast is, as in stage 1, ø vs H vs ?-head and A.

3.2.2.3 Stage 3

The third stage, that of Ṭūr ʿAbdīn, sees the complete loss of glottalisation, and emphatics are now distinguished from non-emphatic voiceless consonants as non-aspirated from aspirated and as recessive, which also causes the recession of adjacent vowels, from non-recessive. Phonologically, we see the demotion of ? from head to dependent. The phonological contrast in this stage is therefore ø vs H vs A. Perceptually, there is a contrast between 'plain' obstruents, aspirated obstruents, and 'plain' but emphatic obstruents.

[78] Cf. Fallon (2002: 269 ff.) on Kingston (1985b), who gives typology of tense and lax (i.e. fortis & lenis) ejectives. These do not appear to be contrastive within one language. Kingston's typological investigation, according to Fallon (2002: 271), contains the observation that 'fortis ejectives are said to have stiff vocal folds, while lenis ones are lax.' However, this again seems to me to boil down to the traditional western notion of a two-way voiced-voiceless opposition, which does not hold true cross-linguistically. Particularly, as we have made explicit here, systems with ejectives often phonologically oppose them to voiceless aspirates and 'plain' voiceless segments, thus ejective is itself a laryngeal contrast.

3.2.2.4 The final stage

According to Dolgopolsky, the final stage is represented by Arabic, since he proposes that in this stage aspiration is lost and the emphatics are distinguishable only by recession. However, in my view, Arabic is slightly more complicated. Dolgopolsky's suggestion probably lies in the observation that Arabic has a contrast within emphatics of voiced vs voiceless, but I have proposed that Arabic emphatics are a series lower than non-emphatics, in terms of voicing. Dolgopolsky's suggestion, in my view, stems from the traditional notion of laryngeal contrasts as being two-way, as discussed previously. Were we to follow Dolgopolsky's hypothesis faithfully, it would seem that the fourth stage entails a two-way laryngeal contrast, where the non-emphatics have true laryngeal counterparts in the emphatics. I.e., voiceless *t* corresponds with voiceless *ṭ* and voiced *d* with voiced *ḍ*. However, we have argued here that the Arabic emphatics are not true counterparts of the non-emphatics in terms of voicing. Thus, we find voiceless emphatics having A and no laryngeal element and voiced emphatics having A and L. The difference between stages 3 and 4 is therefore that since emphatics contrast laryngeally in stage 3, they have developed voiced counterparts which are also distinguishable laryngeally, in that they are associated with an L element. The representation of the Arabic ('primary') emphatics is thus as follows:

(14)	*ṣ*	[R.A.H̲]
	ẓ	[R.A.H̲.L]
	ṭ	[R̲.?.A]
	ḍ	[R̲.?.A.L]

3.2.3 Ethiopic and Modern South Arabian

Finally, we turn full circle and come back to ejectives. Ethiopic and Modern South Arabian languages have glottalics, i.e. ejectives, where Arabic has emphatics. However, the ejectives are voiceless. We can surmise that these ejectives therefore have the same representations as those we have proposed above for Proto-Semitic, i.e. the three-way contrast in stops is one of voiceless aspirated vs 'plain' voiceless vs glottalised. This is grammaticalised in the phonology as stops containing H, having no laryngeal element, or being headed by ?. Fricatives are also as surmised for Proto-Semitic, i.e. they are contour segments (expressions which have not fully fused), with the ? contained in the dependent part of the contour spreading into the head expression.

We noted earlier that in Jibbali there is a glottalized *ṣ* (*s'*) corresponding to the Amharic ejective, and that it is thus possible to have voiced counterparts to these. They are also contour segments, as above, but the ? in the dependent expression does not spread into the head.

One final point to be noted here is vowel contrastivity in the environment of ejectives. Rose (1996) discusses Tigre, a North Ethiosemitic language which has the pharyngeals *ħ* and *ʕ* and the ejectives *t'*, *s'*, *c'*, *k'*, all of which lower a following *ə* to *a*. According to Rose, Tigre is one of very few languages known to have vowel-lowering ejectives. Much evidence has been provided in previous work to back up the proposal that pharyngeals are characterised by the A element.[79] However, the case of vowel-lowering ejectives is not so clear-cut, and I therefore suggest that there are a couple of possibilities. Either they are not only glottalised but also recessed (i.e. they contain a ?-head as well as A), or there is some other sort of spreading. It is possible that A is

[79] Bellem (2001).

spreading from a pharyngeal, or that pharyngeals have somehow become linked with ejectives, but A is not interpretable in the ejective segment and is therefore displaced onto the following nucleus. For now, however, this is mere speculation. It warrants further investigation, but is outside the scope of this paper.

3.3 Summary

Here, we summarise the main findings and proposals of Section 3. Firstly, ejectives are characterised by the element ? having the role of head in the expression. Secondly, the element ? acts as a laryngeal element when head. Therefore, what is perceptually crucial in the production of emphatics is not so much the recession (the presence of the element A) but the voicing opposition. In this way, 'emphatic' is actually a laryngeal contrast which in some languages (e.g. Arabic) has taken on secondary characteristics. In these languages, it is the pharyngeal characteristic of the emphatic which can affect the nature of a certain domain (i.e. the spreading process which I shall call here emphatic harmony), and it is this which therefore receives primary attention in the literature.

We have proposed that ejectives are primarily glottals, with the oral stricture being in some way secondary. We should also note here that the 'reduction' of ejectives to either 'plain' voiceless obstruents or glottal stops is akin to the 'reduction' of (Arabic-style) emphatics to either non-emphatic obstruents or pharyngeals. Where an ejective lenites to a 'plain' voiceless obstruent, the ? element is demoted to operator status; where it lenites to a glottal stop, the perceptual salience of the ? element is maximal, and therefore overrides the other elements, which are consequently de-linked from the expression. Where an Arabic emphatic lenites to a non-emphatic obstruent, the A element is de-linked, and in the case of a voiced emphatic, also loses L; where emphatics lenite to pharyngeals, the salience of the A element is maximised at the expense of the primary resonance element, which is then de-linked.

4 Conclusion

The status of 'emphatic' in Semitic is therefore not entirely straightforward. However, it appears that the common link between all types of 'emphatic' is in laryngeal contrasts.

We noted in Section 1.2 that emphatics are typologically less common than ejectives. From the findings of this paper, I suggest that this hinges on the function of glottalisation as a primary laryngeal contrast, whereas Arabic-style emphatics, although inherently encoding the laryngeal contrast, due to the additional secondary function of the A element, are more complex. It is perfectly reasonable to suppose that non-Semitic languages that have emphatics do not have the same laryngeal contrast. Nevertheless, since secondary articulations are anyway marked, these segments are bound to be less cross-linguistically attested.

The link between ejectives and Semitic emphatics is therefore intrinsic to the function of laryngeal contrasts.

One final point to be made here is that it is these areas which have been under-researched in many theories of phonological representation. The paper has highlighted many topics ripe for the plucking, so to speak, which could tell us much about phonological representations, certainly in terms of the theory of elements.

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