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THE FORMAL DYNAMISM OF CATEGORIES: STOPS VS. FRICATIVES, PRIMITIVITY VS. SIMPLICITY*

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ABSTRACT

Minimalist Phonology (MP; Pöchtrager 2006) constructs its theory based on the phonological epistemological principle (Kaye 2001) and exposes the arbitrary nature of standard Government Phonology (sGP) and strict-CV (sCV), particularly with reference to their confusion of melody and structure.

For Pöchtrager, these are crucially different, concluding that place of articulation is melodic (expressed with elements), while manner of articulation is structural. In this model, the heads (xN and xO) can license and incorporate the length of the other into their own interpretation, that is xN influences xO projections as well as its own and *vice versa*. This dynamism is an aspect of the whole framework and this paper in particular will show that stops and fricatives evidence a plasticity of category and that, although fricatives are simpler in structure, stops are the more primitive of the two.

This will be achieved phonologically through simply unifying the environment of application of the licensing forces within Pöchtrager's otherwise sound onset structure. In doing so, we automatically make several predictions about language acquisition and typology and show how lenition in Qiang (Sino-Tibetan) can be more elegantly explained.

KEYWORDS: Onset structure; fricative structure; stop structure; licensing; government phonology.

1. Theoretical background

In his thesis, Pöchtrager (2006) shows how standard Government Phonology (Kaye et al. 1990; Charette 1991) and Strict-CV, an sGP spin off, (Lowenstamm 1996; Scheer

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2004) could only arbitrarily account for a phonological phenomenon called "New York City English overlength". This is by no means restricted to New York City English and is a well known phenomenon whereby a three way length contrast exists for vowels.

In the language there are short and long vowels and when these vowels precede voiced consonants, in CVC words, they elongate resulting in a short vs. short + overlength and a long vs. long + overlength contrast. The whole process therefore can be summarised as vowel length x vs. vowel length x + overlength. Voiceless consonants, on the other hand, block the process:

(1) New York City English (Pöchtrager 2006:18)

Short Vowels	Long Vowels	Spellings
[bit] / [biːd]	[biːt] / [biːːd]	*bit/bid* vs. *beat/bead*
	[liːf] / [liːːv]	*leaf/leave*

Before we go any further it is important to point out that this effect is truly phonological and not phonetic. The evidence comes from the fact that in New York English this overlength is only a feature of certain word configurations, namely CVC words. If overlength was a purely phonetic phenomenon its justification would probably be that the vibration of the vocal folds is continued into the articulation of a voiced consonant; meanwhile, when a vowel comes before a voiceless consonant the vocal folds stop vibrating before the articulation of the voiceless consonant. This would give the vowel preceding a voiced consonant a longer sound than the vowel preceding the voiceless consonant. Although this seems perfectly logical, the phonetic explanation is not sufficient in explaining the data because the "physics" that might claim causes overlength will be just as true in CVC words as in CVCV words. However, in the latter class of words the overlength contrast is neutralised: in the words *bidder* and *bitter* the overlength found in the pair [biːd] vs. [bit] is neutralised: [bedə] vs. [betə] (Pöchtrager 2006). The MP explanation for the CVCV overlength neutralisation phenomenon in phonological terms (Pöchtrager 2006:127; Ulfsbjorninn 2008) need not trouble us further in this paper; suffice it to say that the overlength phenomena that are described in Pöchtrager (2006) and the licensing forces conjured to explain it (which will be refined in this paper) are phonological, not phonetic.

In constructing his theory Pöchtrager first shows the inadequacy of an sGP and strict-CV account. In order to explain this data, sGP would be forced to involve the element (H) into its analysis, as according to recent revisions of element theory in sGP (Kaye 2000) the only differential between a [t] and a [d] is the element (H).

Pöchtrager's objection comes from the disbelief that an element in the melodic tier could block length which in sGP (and still in MP) is viewed as a structural effect and thus applying to the constituent tier. Schematised in Fig. 1, it is obvious that melody cannot induce a structural effect.

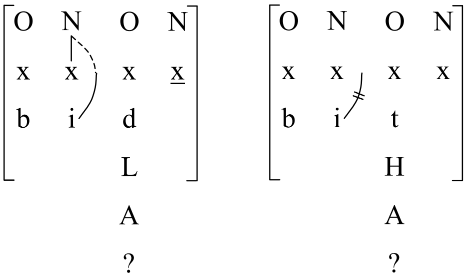

Figure 1. /biːd/ vs. /bit/ as analysed with the tools of sGP.

Also, what we see in Fig. 1 is sGP's representation of length, the attachment of melody to more than one skeletal point. Overlength, therefore, would seemingly produce an excrescence of structure which violates the s*tructure preservation principle* (Kaye et al. 1990). Even more damagingly, if this phonological process was to force the excrescence of a further skeletal point onto an already lexically long vowel, we would directly counteract the *binarity theorem* (Kaye et al. 1990; Pöchtrager 2006: 37) – see Fig. 2.

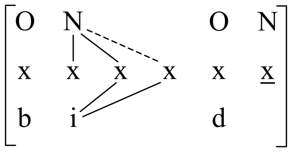

Figure 2. *Bead* analysed with sGP tools.

This objection appears even more catastrophic using the tools of strict-CV, although the actual problems are the same, structural excrescence and violation of the binarity theorem – see Fig. 3.

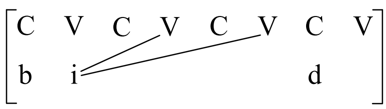

Figure 3. *Bead* analysed with Strict-CV tools.

All the while, the above structures struggle to explain why the elemental, melodic content of a consonant could block a structural length effect. A more natural analysis is one in which a structural effect is married to a structural analysis.

Pöchtrager thus supposed that in words like [liːf] *leaf* vs. [liːːv] *leave* the lexical structure of the fricative is "larger" than thought in sGP. The theory supposes that, fricatives are not flat structures (contra sGP see left half of fig. 4). In MP, a fricative onset structure contains not only an onset head (xO) but also a complement (x2) adjoined by a mediating projection (O′) – see right half of Fig. 4.

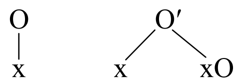

Figure 4. The structures of a fricative in sGP and MP respectively.

According to the theory, this un-annotated skeletal point is what creates the space for what otherwise look like ternary structures. Therefore, in Fig. 5, we see the nuclear head deriving length from both its own skeletal point (the complement of a nuclear projection) and the un-annotated skeletal point of the onset's structure (a complement of the onset projection). This is what MP views as the source of overlength. Importantly, in MP, the structure which produces overlength is a structural feature of the onset, not of the nucleus – see Fig. 5.

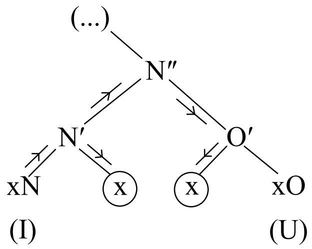

Figure 5. The relevant portion of [liːːv]: long vowel + overlength.

The arrows in Fig. 5 are the legacy of the element (H) in MP. The theory states that what we used to understand as (H) (encoding voicelessness) is actually a structural condition by which the onset head issues a licensing force known as m-command. We will discuss m-command in detail in the next part of this section but suffice it to say that when an onset head m-commands its own complement, this renders it unavailable to the licensing issued from the nuclear head. In short, an un-annotated skeletal point may not be incorporated simultaneously by the nuclear head and an onset head. This is the dynamism which produces the "trade-off" in skeletal points which may result in added length in the interpretation of the nuclear head (overlength).

So what was believed in sGP to be the element (H), MP sees as part of the fricative structure (seen in Fig. 6) being licensed by its own onset head. The voiced or lenis counterpart is thus lacking this m-command licensing but still possesses the fricative's distinctive structure; thus a lenis fricative is an onset head with an un-licensed, un-annotated skeletal point of a complement. The contrast can be seen in Fig. 6.

Figure 6. voiced and voiceless fricatives in MP.

We will explain the licensing effects which grew out of certain elements of sGP in the next part of this section; for the moment we should simply see that an MP analysis triumphs by understanding perfectly why "voicelessness" blocks overlength. It may do so because "voicelessness" itself is a structural characteristic. The licensing issued from the onset head inherently implicates more structure for the onset head than its "voiced" counterpart. The mechanism for such actions and its implications will be discussed shortly. However, Fig. 7 shows the overall consequence of this approach and its successful answer to overlength where sGP and strict-CV have failed (see Figs. 2 and 3, respectively).

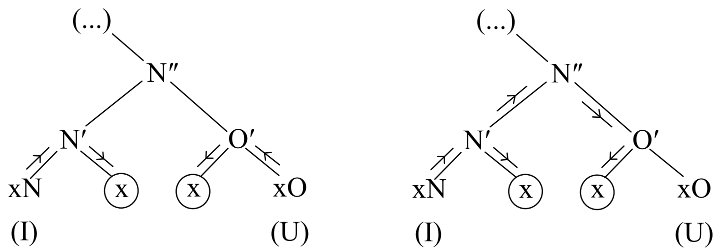

Figure 7. [liːf] *leaf*, long vowel vs. [liːːv] *leave*, long vowel + overlength.

1.1 The new onset structure

In this section, we will discuss the licensing relationships within the onset structure in MP.

In Pöchtrager's (2006) thesis, we see how standard Government Phonology elements (H) and (?) are removed from the melodic portion of phonological representations, thus leaving the expression of voicing/voicelessness and "stop-ness" to be expressed via structural configurations. A fricative, as we have seen, employs not one but two skeletal points; one which he labels as a head (xO) and another which is an (un-annotated) skeletal point (x2) interpreted as complement of the head (Fig. 6). This complement is adjoined by a projection, (O′). Together, this is one layer. The voicelessness which (H) was said to encode is replaced by m-command. This is a licensing relationship between the head and its complement (Fig. 6).

In "voiced" fricatives, this m-command is lexically absent from the onset head. Its complement, (x2), being un-annotated with elemental material, qualifies as an empty category and therefore requires some other source of licensing. This follows from *the licensing of x's* principle (Pöchtrager 2006: 76) which itself follows the *phonological empty category principle* of sGP (Kaye et al. 1990; Charette 1991). This un-annotated complement, (x2), can have its licensing requirement satisfied by the m-command of the preceding and adjacent head, (xN), even though it is a nuclear head (Fig. 7). The m-command issued by this adjacent nuclear head then spreads into the onset layers and licenses our un-annotated complement (x2). As a marker that the m-command is licensing a complement which is not a projection of its own head the length of this un-annotated complement (a skeletal point) is incorporated into the phonetic interpretation of the nuclear head, creating overlength.

This explains structurally why "voiced" consonants of New York English seem to induce "extra-length" to adjacent vowels in contrast to "voiceless" consonants which do not: *bead* [biːːd] vs. *beat* [biːt] (Pöchtrager 2006: 66).

Furthermore to our introduction of onset structure in MP, we note that in Pöchtrager (2006), and following Jensen (1994), stops are shown to be more complicated structures than fricatives. Stops are argued to be built up of two layers. The first layer is structurally identical to the corresponding layer in the fricative, an onset head and complement adjoined by a projection, (O′). The second layer is comprised of a further projection (O″), the maximal projection, which then branches to hold an un-annotated daughter, a second un-annotated complement skeletal point: (x1) (Fig. 8).

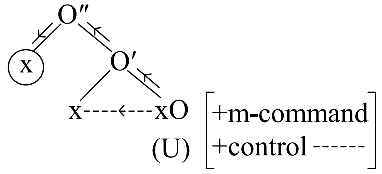

Figure 8. The two layer stop structure, circled is (x1) beneath is (x2).

Comparing Pöchtrager's fricative structure and his stop structure, there is a further difference to the latter's extra projection (O″) and complement (x1). In the former, the daughter of O′, the maximal projection of fricatives, is potentially licensed by the head's (xO) m-command. Conversely, this corresponding daughter of O′ in stop structures is unable to be m-commanded. The reason for this, hypothetically, is that with two points to m-command, we could also have the option of m-commanding only one, both or neither such complements; this would lead to too high a number of predicted types of stop, i.e. four non-melodic (i.e. non-articulatory) natural classes of stops alone (Pöchtrager 2006: 74). The conclusion that Pöchtrager draws from this is that the complement (x2) is never available to m-command, thus reducing his natural class of stops to his desired two (lenis and fortis).

However, Pöchtrager's stop structure has two layers and thus two complements. If m-command can only target (x1) and not (x2), then (x2) will need a further type of non-intrusive licensing, or the *licensing of x's* principle will crash the representation. Pöchtrager, therefore, formulates the licensed by a force called "control".

Control is a licensing force used by Pöchtrager to license the (x2) of a stop; in Fig. 8, it is represented by the straight arrow issuing from the onset head. Control is not a well understood licensing force but essentially Pöchtrager (2006: 77) claims that for an onset head to have control is a necessary condition on "stop-ness", and therefore it is found only in stops and essentially boils down to an essential difference between onset types:

(a) fricatives have one layer and no control (Fig. 6);
(b) nasals and liquids have two layers and elements in both the head and the complement position, (x2), thus here, (x2) is not an empty category and does not require licensing (Pöchtrager 2006:90);
(c) stops have two layers and the onset head issues the licensing force control to its complement (x2) (Fig. 8).

2. Theoretical problems

2.1. Some problems in Pöchtrager's onset structure

2.1.1. Ad-hoc distribution of control

When Pöchtrager (2006) states that control applies to the daughter of O′ (x2), he is forced to ad-hocly add that it applies only to the daughter of an O′ when it is part of a stop-structure. This specification is necessary as we do not find cases where control produces a three way contrast in fricatives: those with m-command, those without m-command and those with control – see Figures 9–11 overleaf.

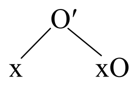

Figure 9. “Lenis fricative” /v/.

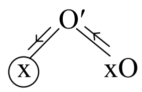

Figure 10. “Fortis” fricative /f/.

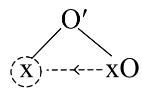

Figure 11. Unattested.

A product of this essay will be an understanding of why fricatives never have control. Control, lexically applied to (x2), it will be argued, is exactly what keeps (x2) part of the representation. This is because m-command, we will argue, can never, in any case, be applied to this position. If m-command can never be applied to the daughter of O′, then the only two ways to keep the O′ daughter in the representation are by:

(a) lexically filling it with melody (making the sonorant construction; Pöchtrager 2006);
(b) or, applying control.

As we will conclude with, in fricatives, when neither of these things happen, (x2) becomes unsupported by the structure and therefore must be deleted along with the resulting unary branching node O′.

The further problem we highlight in the current position on licensing within onsets may not seem drastic; however, the implications of even such a minor change leads to massive re-analysis of onset structure and its predictions and implications for the phonological system.

In Pöchtrager’s view of onset structure, the onset head maximally projects two times (up to O″), more than this is disallowed universally (Pöchtrager 2006). Pöchtrager’s view, further to that, is that in these two projections there is an upper and a lower layer in which the upper is host to m-command and *never* control and the lower layer is host to m-command *and* control (but never in the same structure-type). These two licensing forces, as they stand in Pöchtrager (2006), have the similar effect of licensing the empty compliment. Also, they can never be seen to work in the same layer of onset at the same time. Therefore, we are left with m-command effective in two daughters different in nature. One is the daughter of O″ which, as we have said, is the universal maximal projection of this head (we will call this the *ultimate maximal projection*), and another is the daughter of the primary projection (O′). Meanwhile, the daughter of O′ can be shown to reject m-command completely in all stops and be licensed by another force which is particular to it (control).

A further curiosity is that, in a lenis fricative, this very same daughter that rejected m-command in a fortis stop, requires m-command so violently that it even receives it from an *external* source (the preceding nucleus) when, hypothetically, there is a perfectly valid second type of *local* licensing available (control).

Considering this, it is hard to see why (x2) would opt for external licensing when another licensing force, specifically unique to this position (x2), exists in phonology.

2.2. (x2) in fricatives is actually identical to (x1) in stops

All of the little in-elegance we detect in Pöchtrager's analysis stems from the fact that m-command is not unified in its application.

It is quite clear there is a problem when discussing the application of licensing forces relative to specific locations in our phonological representations. Let us take the stop structure with its licensing to structure correlates. The description of each complement in both fricative and onset is described on two axes: (a) the two licensing forces, m-command and control; and (b) the three grades of application, *obligatory* application, *optional* application and *never* applied; the interrelation of licensing and complement are shown below in Fig. 12.

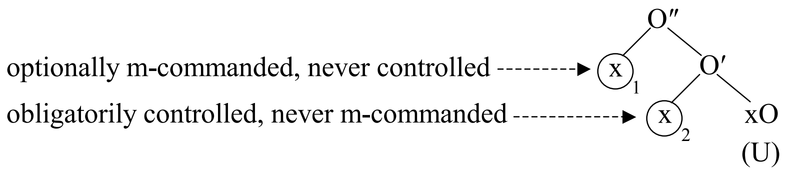

Figure 12. Licensing forces and their application within the stop.

We see in Fig. 12 that we can describe the daughters of all projections relative to their abilities to be licensed. Now, if we compare this to the fricative licensing to structure correlates, we see an ugly asymmetry – see Fig. 13.

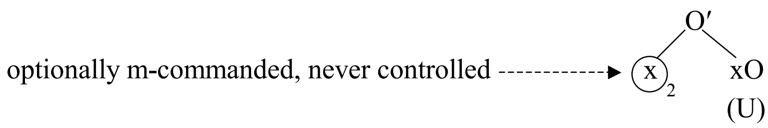

Figure 13. Licensing forces and their application within the fricative.

Comparing Figures 12 and 13, we see that the (x2) in fricative behaves nothing like this same position (x2) in stops. Crucially for our subsequent analysis, the (x2) in fricatives behaves exactly the same as the (x1) in stops. This leaves, the two (x2)'s, both, supposedly, daughters of the same projection (O′), looking nothing alike in terms of their licensing. We will argue in the next section that this is because (x2) in fricatives is actually derived from (x1) in a stop-like structure. Furthermore, we will show that this is a natural consequence of unifying our licensing environments.

The next part of this paper will explore how such a unification of the environments is possible.

2.3. Conditions on unification of licensing environments

2.3.1. Conditions on m-command

In order to unify the licensee on which m-command can be applied, we will claim that m-command can only ever be applied to the daughter of the ultimate maximal projection (O″). This eliminates any debate as to whether or not stops should have their lower layer m-commanded even though this layer is applicable for m-command in fricatives. As we will claim, this does not happen as m-command could not ever apply itself at this level.

The above statement can be formalised (to remain faithful to Pöchtrager's 2006 wording) as an amendment to the definition of m-command:

(2) Condition on M-Command

> Minimally, only the daughter of the ultimate maximal projection can be an m-commandee (x1) * (x2).

The simple application of (2) would seem to make fortis fricatives illicit, as Pöchtrager (2006) shows convincingly that the difference between a fortis and a lenis fricative lies in m-command. If we maintain Pöchtrager's [x2 [O′ [xO]]] (see Fig. 13) definition of onsets, then there should be no (x1) to m-command, and thus fortis and lenis fricatives would be differentiated by other means. There is, however, a simpler solution.

In order to maintain this fortis/lenis distinction in fricatives while allowing a neat allophonic jump from stop to fricative, we believe that in phonology we should be using what we call the *phonological ultimate maximal projection principle* (PUMPP); thus lexically every onset head (xO) projects maximally up to O″. This makes a valid m-command environment in fricatives which underlyingly would start out [x1 [O″ [x2 [O′ [xO]]]]] (see Fig. 12).

2.3.2. The phonological ultimate maximal projection principle

Basically, an onset can project maximally twice, i.e. O′ and O″. So, we claim it always does by default, thus creating the assumption that the ultimately maximally projected structures will be the most primitive (i.e. most primary underlyingly) carries the predictions that follow naturally from this principle: structures such as those in (Fig. 12) are the most unmarked, and thus should be the first acquired and most common typologically. We will discuss the ramifications of this in the later sections. Presently, we define the PUMPP:

(3) The Phonological Ultimate Maximal Projection Principle

Every onset head (xO) projects ultimately and maximally up to O″.

Notice that by this principle even fricatives have a daughter of the ultimate maximal projection O″ (x1) which allows us for the first time to unify the environment of the application of m-command. We can understand therefore why in a lenis fricative the complement to O′ (x2) begs for m-command (Fig. 14), while in a lenis or fortis stop the same complement of O′ (x2) can never receive m-command (Fig. 15). What seemed to Pöchtrager to be the complement of O′ (x2) was actually the complement of the ultimate maximal projection O″ (x1). Therefore, we no longer have a problem understanding why sometimes the complement of O′ (x2) requires and rejects m-command, it never requires it. The true complement of O′ (x2) is not a target for m-command at all.

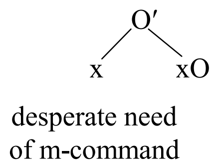

Figure 14. (x2) need of licensing in lenis fricative.

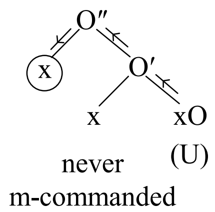

Figure 15. (x2) licensing in any stop.

2.3.3. The structure minimality principle

This does not mean, however, that we see fortis fricatives as being comprised of two layers. Pöchtrager (2006) argues convincingly that fricatives have a simpler structure than stops but not any less intrinsic length; this is why a two-layer vs. single-layer approach seems so appropriate, and we are not abolishing this representation at the surface form (SF). If, though, all onset heads project to O″, then we will need a tool to prune the two-layer structures into single-layerdom.

Conveniently, one such tool has already been discussed in the MP literature. We propose, therefore, that in opposition to the PUMPP is the *structure minimality principle* (as defined in but slightly adapted from Pöchtrager 2006):

(4) The Structure Minimality Principle (SMP)

(a) An unlicensed skeletal point without any recourse to licensing is removed from the representation.
(b) A unary branching node is removed from the representation.

2.3.4. Lexical specification of m-command and control

As the PUMPP automatically builds up an ultimately maximally projected structure, we have to first reach a stage where the layer to be deleted is a unary branching node. This, we believe, happens due to the lexical specification of the licensing forces the projecting head is endowed with. This will predict how many un-annotated points this head can support, and thus survive at SF.

For instance, if a head is specified as a fortis stop, then it will have m-command and control in its repertoire, and be able to support two un-annotated points. This leaves no unary branching and the structure is all preserved, as seen in Fig. 16.

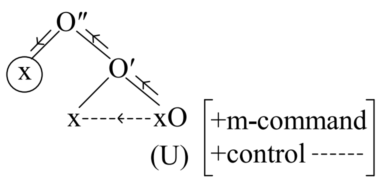

Figure 16. SF of an onset head lexically specified for both licensing forces.

If, however, the head is specified for a fortis fricative, then the head would be lexically specified only for m-command and not control. This would leave the daughter of the ultimate maximal projection O″ (x1) licensed but the daughter of O′ (x2) would be unlicensed. This would cause the latter complement to be unsupportable and thus deleted, reducing (O′) to a unary branching node which is itself pruned by the SMP (Fig. 17).

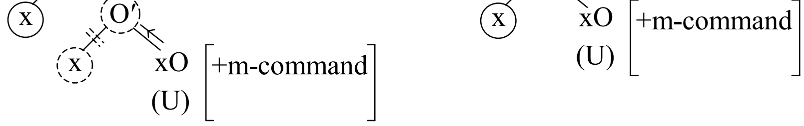

Figure 17. The derivation of [f] from UR to SF.

Ideologically, this puts us in a situation in which fricatives are seen to be less complex than stops and yet stops are more primitive. Although the PUMPP vs. SMP approach (in which structure is built up by default only to be then pruned back) may seem counterintuitive, there is some strong empirical evidence which supports exactly this. L1 acquisition, as we will show in the next section, is the clearest example in which stops are more primitive than fricatives (although more complex structurally).

3. Predictions and results from first language acquisition

3.1. The L1 acquisition data

It stands to reason that the simpler the structure, the easier it is to acquire. Meanwhile, the idea that fricatives are somehow more basic in their structure than stops is very established and predates sGP and MP where in the *Sound pattern of English* (SPE), we see a stop turning into a fricative being called "lenition", with all the meaning implied by the word (Chomsky and Halle 1968). Between SPE and Pöchtrager (2006), fricatives have been called "simple", "less consonanty", "more like vowels" and "easier to say" (Kirchner 2001; Nelson 1983; Shariatmadari 2006; Trask 1997, respectively). In one study, they were even shown to be the non-target products of drunks (Chin and Pisoni 1997). Even in Government Phonology, we have seen, in recent years, fricatives (particularly in reference to lenition) claimed to be in "positions of weakness", with their "integrity ruined" or "spoilt" (Scheer 2004; Szigetvári, p.c.). Seemingly, one way or another, everyone agrees that out of stops and fricatives, the latter are more basic (melodically in most cases but structurally in Pöchtrager 2006).

The implied prediction, particularly from the modern structural account, born of simple logic, is that as fricatives are more basic they should be acquired first. This, however, is disproved by the greatest majority of data from a great many languages, which show that, invariably, fricatives are not acquired before stops (Higginson 1985; Bernstein-Ratner 1994; Fikkert 1994; Bernhardt and Stemberger 1998; Costa and Freitas 1998; Guasti 2002; Zamuner et al. 2005).

Even when fricatives are first acquired, they are not as stable as stops and "relapse", being realised as their homorganic stops (Bernhardt and Stemberger 1998). Equivalent and further data shows that word-initial fricatives are dropped even relatively late into acquisition, in contrast to stops (and nasals), which in this initial position are not lost (Fikkert 1994; Bernhardt and Stemberger 1998; Costa and Freitas 1998).

3.1.1. The stop and nasal retained initially

	Target	Utterance	Child age and name	Gloss
(5)	/bal/	[ba]	1;2–1;5.01; Naomi	'ball'
(6)	/baɣi/	[baː]	1;2–1;3; Naomi	'stroller'

(7)	/baux/	[baw]	1;0.29; Annalena	‘belly’
(8)	/dʁauf/	[daw]	1;3–1;5; Annalena	‘on it’
(9)	/milç/	[miː]	1;2; Naomi	‘milk’
(10)	/nain/	[nai]	1;5.01; Naomi	‘no’
(11)	/naːzə/	[nana]	1;0.16; Annalena	‘nose’
			(German; Bernhardt and Stemberger 1998)	

3.1.2. The fricative dropped initially

	Target	Utterance	Child age and name	Gloss
(12)	/zaubə/	[abə]	1;2–1;5.01; Naomi	‘clean’
(13)	/zat/	[at]	1;2.019; Annalena	‘satisfied’
(14)	/vagn/	[aka]	1;2.016; Annalena	‘car’
			(German; Bernhardt and Stemberger 1998)	
(15)	/vis/	[is]	1;9.09; Jarmo	‘fish’
(16)	/fiːts/	[iːs]	1;9.09; Jarmo	‘bicycle’
			(Dutch; Fikkert 1994)	
(17)	/zebra/	[eba]	1;9.29; Luis	‘zebra’
(18)	/ves/	[es]	1;2.0; Marta	‘see’
			(Portugese; Costa and Freitas 1998)	

Fricatives are not only acquired later than stops and more unstable than stops in certain environments; they are also directly part of a continuum of acquisition for fricatives. The same children that delete the fricative in German will sometimes use the target fricative’s homorganic stop instead. Showing how stops are clearly more primitive in child acquisition and may even reflect adult phonological processes such as true post-vocalic lenition and maintain the strong continuity hypothesis of child acquisition (Guasti 2002).

3.1.3. The fricative surfacing as a stop

	Target	Utterance	Child age and name	Gloss
(19)	/zat/	[dat]	1;2.30; Annalena	‘satisfied’
(20)	/vagn/	[gaga]	1;1.019; Annalena	‘car’
(21)	/naːzə/	[nana]	1;0.16; Annalena	‘nose’
			(German; Bernhardt and Stemberger 1998)	

What this means for Pöchtrager (2006) is that there is an explicit case of the transition from stop to fricative and that the stop was the more primitive of the two structures.

This stop-to-fricative acquisition ordering runs directly counter to the prediction one would make based on the view that, in the lexicon, the stop's structure is a further complication to the fricative's structure; if onsets are built of up layers and they are built "bottom up", then the first constructed layer in a stop could already have a well formed independent existence (and phonological identity) itself, as a fricative. In this view fricatives must be seen as more primitive and *also* structurally simpler. This would seem to be the Pöchtrager view. This view, contrary to the data, would predict that fricatives should be acquired more quickly than stops; in order to attain the latter's structure we necessarily have to project twice from an onset head and once is already a fricative.

Those who take the opposing view, a pruning-back hypothesis, such as that presented in this study, would see things differently. For us, all onsets are inherently ultimately maximally projected; this would be the most primitive structure. In this view, fricatives would be derived by pruning back this primitive (ultimately maximally projected) structure into a simpler structure. The acquisitional ordering predicted by this hypothesis will be that stops, due to PUMPP, are primitive and, as such, they are the "default" onset structures; and that they would acquisitionally precede structures which are necessarily derived from these default structures. The claim is that children would start out with PUMPP structures and then acquire the licensing criteria, and this interaction with the SMP would produce fricatives. These theory-internally derived assumptions actually force the prediction that stops would be acquired before fricatives. This hypothesis' prediction is fully borne out by the data.

It should also be stated that this theory was not *constructed* on the well known child language acquisition data; rather, this theory was arrived at by simply unifying the environments of Pöchtrager's licensing forces within his onset structure. By unifying the environments we were essentially forced into what may seem unintuitive – the PUMPP. Highly encouragingly, however, the PUMPP actually *predicts* rather than describes child language acquisition of onsets.

4. Predictions and results from typology

4.1. The typology data

Another common and logically driven expectation is that a simpler structure will be the unmarked structure by virtue of it having the shorter description (Roberts 2008).

The consequence for typology will be that languages should, typically, have the more unmarked structures more frequently than the marked structures. This general expectation is commonly claimed to be borne out by cross-linguistic studies: /CV/, the most unmarked syllabic structure, is the only syllable configuration which is found in all the words languages.[1] The vowels /i/, /a/ and /u/, which are the most phonologically

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[1] Except Arrernte which is claimed to have no onset (initial) syllables (Breen and Pensalfini 1999), although this is highly debatable, and does not preclude the language's longer words being analysed as V.CV.CV etc.

simple (excluding schwa, which is a case apart in GP – see Charette 1990, 1991; Scheer 2004), are analysed as having only one phonological element; these, in fact, are the most common vowels in human languages and the only ones to be common to almost all languages.

When it comes to fricatives, therefore, and in a view that their more basic structure is also a more primitive structure, we should expect to find that fricatives are less typologically marked than stops. Although fricatives are by no means rare, as we will show shortly, they are certainly less common than the stop class. One can find whole language phyla in which fricatives are totally absent, such as the Australian languages (Peter Austin, p.c.).

The above argument can be quantified by the following relatively small typological comparative study of IPA charts of unrelated languages; these will be drawn completely and faithfully from the Speech Accent Archive (http://accent.gmu.edu). The "voicing" contrast is not of interest here, so we will not take voicing into consideration. In counting stops and fricatives, the deciding factor will be place of articulation, simply because both fricatives and stops are grossly equal in place of articulation.

To counter claims of bias in this small study, we should point out that, if anything, as we are predicting more stops than fricatives in the world's language inventories, fricatives have the advantage, as labio-dental and pharyngeal plosives are unattested, while their fricative counterparts are not. The fricative's advantage against my prediction, however, as we will see, is still not enough to mimic a preference for fricatives over stops cross-linguistically.

In Appendix 1 is the list of languages sampled for this study. We will be comparing the number of stops to the number of fricatives, both counted by the number of contrastive places of articulation.

The data is taken from the Speech Accent Archive (http://accent.gmu.edu). The archive collates what they find to be a representative sample of human languages, although there is a leaning towards Indo-European; this larger number of Indo-European, in turn, favours fricatives over stops, as the languages with few or no fricatives tend to be found in the Indo-Pacific regions. Again, though, this bias towards a fricative-heavy sample will not be enough to show that fricatives are more common typologically and thus suggest their phonological primitivity compared with stops.

Here we count from 78 languages and draw conclusions from these:

(22) 47.3% had more or many more ($x > +2$) stops than fricatives. There is even a non-Australian language family case in which there are no fricatives at all, Tamil. Crucially, the reverse of this, i.e. having fricatives but no stops, is completely unattested.

(23) 66.6% of the languages had stops in a wider distribution than fricatives. If a language had an equal number of stops and fricatives, the stops were spread equally from the bilabial to epiglottal parts of the mouth but the fricatives were all found from the bilabial to paleto-alveolar parts of the mouth. The stops in

these cases are seen to be significantly wider in their distribution.

(24) 89.7% is the percentage we attain by adding the languages with stops being in larger distribution than fricatives and the languages that have a 1:1 relationship between fricatives and stops. The latter is interesting, as it makes the stop and fricative classes look derivationally contrastive in structure terms (Scagani, p.c.).

(25) 7.69% is the percentage for languages which simply have more fricatives than stops.

(26) 0% is the percentage of languages with fricatives but no stops at all.

On the result in (26), it should be noted that, for Pöchtrager, PUMPP would not care for stop or nasal or lateral, as all of these have ultimate maximally projected structures, so for the important finding in (26) to be unverified, one would have to find a language without stops, nasals or laterals, while abounding with fricatives. To our knowledge, there is no such language, and PUMPP would not expect such a language ever to be found.

4.2. Conclusions from typology

Languages generally have more stops than fricatives despite there being more possibilities for the latter.

When a language has the same number of stops as fricatives, it is commonly found that the former have a wider distribution.

4.3. Collated conclusions from sections three and four

When we couple typology with language acquisition, we get the following points of interest:

(a) When we find roughly equal distribution of stops and fricatives, and reiterating Scagani's (p.c.) observation, we deduce that stops and fricatives seem to be in structural opposition to each other, i.e. stop /x/ has fricative /x/ equivalent and vice-versa. To know which is more primitive in these cases, we can go to language acquisition data in Section 3, in which we see that stops are acquired before fricatives, and stops surface in children's speech in place of fricatives, i.e. /d/ to /z/. This points to stops being developmentally and ontologically precursors to fricatives and not vice versa, as Pöchtrager's model would be forced to imply.

(b) Similarly, even when a language has more fricatives than stops (e.g. German), we see the data from Section 3, which shows stops to be the more primitive of the two "categories". Children are seen acquiring stops before fricatives and using homorganic stops in place of these fricatives (Bernhardt and Stemberger 1998). Also, Guasti (2002) discusses the fact that, universally, babies at 6 to 7 months babble and this babbling universally comprises of stop-vowel and nasal-vowel sequences, both of which are in accordance with the PUMPP.

(c) In conclusion for Section 4, and re-iterating the conclusions of Section 3: even though phonologists would generally understand stops as being more structurally complex than fricatives, we must understand that stops are more primitive even if structurally more complex. Note that this is only paradoxical if one is working with the assumption that phonological structure is built "upwards", as opposed to seeing phonological structure as being pruned "downwards", as the PUMPP would dictate.

5. Lenition made easier

5.1. The lenition data

In this section, we will show that there are clear positive applications from assuming that m-command in onset structure is exclusively applicable to the ultimate maximal projection while control is something exclusively found in stops. With this assumption we will more easily model stop "spirantisation" behaviour in Qiang (Tibeto-Burman).

Crucially, we will see that if we understand stops as being built from onset-heads upwards, then deriving fricatives from stops becomes highly un-economical. Conversely, if we prune our structures downwards, in accordance with the PUMPP, the whole process looks much neater and in tune with the phonological projection principle (Kaye et al. 1990).

The data shows that in Qiang some consonants, when word-initial, or in isolation, are stops or affricates, sometimes fortis, sometimes lenis (to use MPs wording). However, when this root-initial morpheme suffers the inclusion of a vocalic realisation before it, then the stop or affricate becomes a fricative. We ignore the otherwise tantalising schwa-zero alternations.

5.2. Qiang (LaPolla 2003)

(27)	p/f	[pʰə]	[ə.f]	'blow'	'imperative.blow'
(28)	kh/x	[kʰte]	[nə.xte]	'hit'	'past.hit'
(29)	k/R	[kə]	[da.R]	'go'	'go out'
(30)	dz/z	[dzue]	[əz][2]	'sit'	'impersonative.sit'

[2] Here, what La Polla (2003) refers to as "devoiced vowel" is not relevant.

In Qiang, the stop has the wider distribution of the two allophones when word-initial, after consonants, after certain morphemes and in isolation. The spirantised fricative occurs in post-vocal environments when morpho-phonological processes realise a vowel before the lexical stop.

Using this data, we can compare the theoretical necessities to describe the data, firstly from a "building upwards" approach, as delineated in previous sections, and then a "pruning back" hypothesis, which is consistent with the PUMPP.

We will use the alternation in (27) (/p/ to /f/) as a case study. In the ensuing diagrams, the solid arrows symbolise m-command, while the dashed ones – control.

We can start by showing the difference in UR and SF structures (/p/, /f/) in a Pöchtrager (2006) MP view and our current revised version in accordance to the PUMPP. As we see in Figures 18b and 19b, the difference appears tiny; however, we will show that this tiny contrast, based on our phonological principle PUMPP, makes a drastic difference and simplification in understanding the spirantisation data.

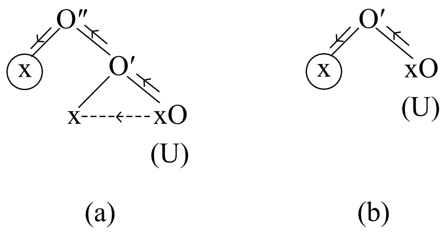

Figure 18. Traditional structures of /p/ and /f/ in MP.

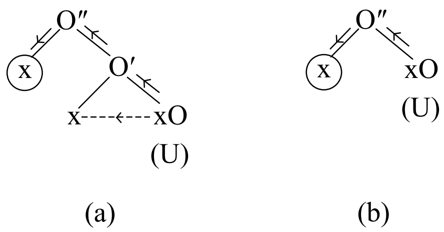

Figure 19. Structures for /p/ and /f/ in accordance with the PUMPP.

Using these two UR and SF pairs, we can deduce the logical process by which /p/ is spirantised to /f/. First we will look at the assumed Pöchtrager (2006) MP view, which we have said is essentially a "bottom up" approach. One way of gauging the minimality of these two approaches is that the UR is drawn in solid lines, while modification of the structure (i.e. its derivation) is drawn in dashed lines. So, the more dashed lines in the

SF diagram, the more the structure has been tampered with; thus, the lower its minimality.

5.3. From /p/ to /f/ "bottom up" in accordance with traditional MP guiding principles

Step one, loss of licensing of (x2), i.e. control:

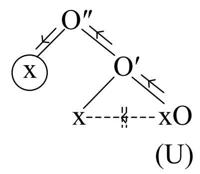

Figure 20. Loss of control.

Step two, loss of m-command, which renders (x1) unsupportable and thus deleted. This leaves the O″ projection as a unary branching node and thus is removed in accordance with the SMP.

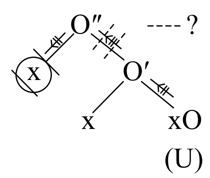

Figure 20a. Loss of m-command, (x1) becomes unsupportable and is deleted, and application of the SMP.

Step three, to make a fortis fricative, there is need for a post-lexical re-application of m-command to daughter of O′ projection.

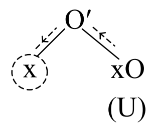

Figure 20b. Re-application of m-command.

It should be noted that these "steps" are not real "steps" in a derivational sense; rather, they are necessary occurrences or changes to the UR to attain the SF. In looking at this sequence of events, although they are not outlandish, the steps in Section 5.4 will be shown to more economic.

Before we show the benefits of the PUMPP to analyses of lenition, it should be pointed out that, at the end of the sequence in Section 5.3, there has been a loss of m-command and then a post-lexical re-application of m-command. This is precisely where our view of spirantisation (guided solely by the PUMPP) is preferable. In the model in Section 5.4 of spirantisation, licensing relationships are undone but not re-assigned. This is crucial, as such an analysis will inherently be more coherent with sGP's *projection principle* (Kaye et al. 1990), supposedly explicitly upheld by MP, in which any post-lexical re-assigning of licensing should be seen as suspicious.

5.4. From /p/ to /f/ in accordance with the PUMPP

Step one, loss of control, means that x daughter of O′ is unsupportable and, with no other source of licensing available, it is removed. As a consequence, O′ becomes a unary branching node and is accordingly deleted by the SMP.

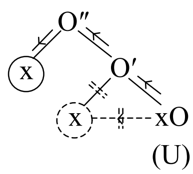

Figure 21. Loss of control, deletion of (x2) and SMP application.

Step two, as a consequence of step one, the top layer has "fallen down" like a stack and we are left with the structure for an /f/ with its licensing intact.

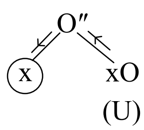

Figure 21a. The remaining structure and licensing is the target /f/.

In Section 5.4, we get a fortis fricative from a fortis stop with one suspended licensing relationship and the general notion of the SMP. In this PUMPP respecting approach, there is never a need for the re-assignment of m-command, as the m-command was never dissolved in the course of the derivation.

Contrasting this to the sequence of events in Section 5.3, in this sequence we see m-command applying to the daughter of O″ in /p/ and then the daughter of O′ in /f/, and when the two are derived from one another, we have had to remove (x1) and its projection O″; in doing so we have no choice but to suspend m-command at O″ and then re-assign it at O′.[3]

6. Conclusion

In essence, we saw in Section 5 that the derivation of a fricative from a stop is much cleaner and more minimalist in a theory that always has m-command to apply to the daughter of the ultimate maximal projection of an onset O″, as opposed to one that allows for m-command to apply to both the daughter of O″ *and* O′.

The implication is of course then that all onsets are built up maximally underlyingly. So, in this world view, fricatives derived from stops are onset heads that have "lost" control. Lexical fricatives are also claimed to be, underlyingly, maximally projected onset structures in which the lack of control has lead to a pruning of the structure with aid of the SMP.

Importantly, the motivation for this analysis was not drawn empirically but conceptually. By wanting specific licensing relationships to apply to specific structural positions, we were forced to assume a principle such as the PUMPP.

Encouragingly, this principle actually forces the assumption that stops are more primitive than fricatives. With such a notion the PUMPP view of onset structure makes at least two very strong predictions:

(a) Stops would be more common and more contrastive in distribution than fricatives and that in most cases stops and fricatives should be in structural contrast (Scagani, p.c.).
(b) Stops should be acquired before fricatives and even in place of them, showing some sort of continuum in their phonological acquistional process.

To anyone who believes their phonological structures are "built up", as opposed to "pruned back", a stop being more primitive than a fricative makes no sense, and they would not be able to make the above, empirically validated, predictions.

For someone who believes the opposite – that everything in onset phonology is ultimately maximally projected, in accordance with the PUMPP – and claims fricatives to

[3] Notice, importantly, that if /f/ to /p/ was actually a case of fortition (usually seen as rarer typologically, cf. Trask 1997; and ignoring the fact that /p/ has a wider distribution than /f/), although the "pruning back" hypothesis would have to claim this was lexical, and therefore in neither was it phonological. The Pöchtrager analysis however, would still involve dissolving and re-assigning licensing relationships post-lexically.

be a "pruning back" effect triggered by lack of lexical licensing potential and the reduction caused by the *licensing of x's principle* and the SMP, these predictions are exactly what one would expect.

We ended this study by examining spirantisation in Qiang (Tibeto-Burman) where we showed that a view of spirantisation based on the "bottom up" approach of standardly held in MP produced an economic derivation which most damagingly had to introduce the notion of post-lexical licensing applications which are in direct violation of the projection principle (Kaye et al. 1990).

Finally, we hope to have shown that there is strong empirical support for the predictions made by a principle, here introduced, based solely on the wish to have unified licensing to structural un-ambiguity.

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APPENDIX 1

Typology of stops to fricatives in terms of place of articulation contrast (the Speech Accent Archive at http://accent.gmu.edu).

Language	Stops	Fricatives	Conclusions
Afrikaans	5	4	more stops
Amharic	3	3	fricatives match their stop
Bai	4	4	fricatives match their stop
Bengali	4	3	more stops
Cantonese	3	3	fricatives match their stop
Catalan	3	3	stops have wider distribution
Chamorro	4	3	more stops
Dari	5	5	stops have wider distribution
Dinka	5	3	more stops
Farsi	5	4	more stops
Finnish	4	3	more stops
Frisian	4	4	stops have wider distribution
Ga	4	4	stops have wider distribution
German	3	4	more fricatives
Gujarati	5	3	more stops

Gusi	4	1	many more stops
Hausa	4	4	stops have wider distribution
Hebrew	4	6	more fricatives
Ilocano	4	2	more stops
Indonesian	4	2	more stops
Irish	4	6	more fricatives
Italian	3	3	stops have wider distribution
Javanese	4	2	more stops
Kannada	5	5	fricatives match their stop
Kazhak	5	5	stops in wider distribution
Khmer	4	2	more stops
KiKongo	4	3	stops wider distribution
Korean	3	2	more stops
Kurdish	5	5	fricatives match their stop
Lao	5	3	more stops
Latvian	4	4	stops in wider distribution
Lingala	4	3	more stops
Lithuanian	3	4	similar distribution
Luo	4	4	stops have wider distribution
Macedonian	5	6	similar distribution
Malay	5	2	many more stops
Malayalam	6	4	more stops
Maltese	4	4	stops wider distribution
Mandarin	3	5	more fricatives
Marathi	4	4	stops wider distribution
Mauritian	3	2	more stops
Mende	4	3	more stops
Mongolian	3	4	similar distribution
Mortlockese	4	3	more stops
Ndebele	4	5	similar distribution
Nepali	5	3	more stops
Oriya	5	2	many more stops
Oromo	4	4	fricatives match their stop
Pohnpeian	4	2	more stops
Polish	3	3	stops have wider distribution
Portuguese	3	3	stops have wider distribution
Quechua	3	3	stops have wider distribution

Russian	4	5	similar distribution
Sardinian	5	8	many more fricatives
Sarua	3	2	more stops
Sicilian	4	3	more stops
Sindhi	6	5	more stops
Sinhalese	4	2	more stops
Slovak	3	4	similar distribution
Somali	6	6	fricatives match their stop
Sundanese	5	2	many more stops
Tagalog	4	2	more stops
Taishan	4	3	more stops
Taiwanese	3	2	more stops
Tamil	6	0	no fricatives at all
Tatar	5	6	similar distribution
Telegu	6	5	more stops
Thai	4	3	more stops
Tibetan	5	3	more stops
Tigrinja	6	6	fricatives match their stop
Tok Pisin	4	3	more stops
Turkish	5	5	fricatives match their stop
Uygur	5	3	more stops
Uzbek	5	6	similar distribution
Vietnamese	4	4	nothing much to say
Welsh	4	6	similar distribution
Wolof	5	3	more stops
Zulu	3	5	more fricatives