somewhat "illegal" occurrence in some function words and words starting with [ə] followed by a heavy consonantal cluster. In the former case the original empty nucleus fails to be properly governed and hence the structure is realised phonetically. In the latter case the empty nucleus preceding the clusters is manifested phonetically due to the failure of *Magic licensing*, which might be viewed as a parameter.

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Licensing constraints and vowel harmony in Turkic languages*

Monik Charette and Asli Göksel

1. Introduction

The role of licensing constraints is a relatively new area of study in phonology. Licensing constraints were first introduced to take over the function performed by charm in the theory of Charm and Government (Kaye, Lowenstamm and Vergnaud 1985). The purpose of this paper is twofold: to enable us to understand the explanatory power of licensing constraints in general, and to derive vowel harmony processes in certain Turkic languages from a set of licensing constraints which also underlie the vocalic inventory of these languages.

Harmony, we claim, is an instantiation of an element licensing itself in a position it governs. The Turkic languages we discuss in this paper, Turkish, Yakut, Kazak, Kirghiz and Old Anatolian Turkish, all have unrestricted I-harmony but differ with respect to U-harmony. This is a joint effect of the absence of a licensing constraint on the element (I), a restraint requiring the element (U) to be head of a phonological expression, and the availability of role-switching in the language. A licensing constraint preventing the element (A) from licensing an operator within a phonological expression also explains the absence of A-harmony in Turkic languages.

The paper is organised as follows: section 2 is a presentation of certain aspects of the Revised Theory of Elements which are relevant to the analysis of vowel harmony in Turkic languages. In 3 we provide a summary of the distributional properties of Turkish vowels. This is followed in 4 by an introduction to the licensing constraints we propose for Turkic languages and to the representation of vocalic expressions in Turkish. Section 5 looks at vowel harmony and how the spreading of elements is derived from the licensing constraints. We then focus on U-harmony and discuss the notion of switching which plays a crucial

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role in explaining the behaviour of the element (U). In 6 we concentrate on variations in the conditions on switching in Yakut, Kazak and Kirghiz. Finally, in section 7 we turn to Old Anatolian Turkish to explore the correlation between the distribution of vowels and the presence of harmony.

2. Theoretical background

The analysis of vowel harmony proposed in this paper is couched in the framework of Government Phonology (Kaye, Lowenstamm and Vergnaud 1985, 1990) and is based on and assumption shared by Dependency Phonology (Anderson and Jones 1974, Anderson and Ewen 1987, Durand 1990), Particle Phonology (Schane 1984) and the work of van der Hulst (1989), namely, that phonological expressions are composed of elements. Following Kaye *et al.* (1985), a simplex expression contains a single element and a complex expression consists of two or more elements which combine as a result of a fusion operation, one of the elements behaving as a head and the other(s) as operator(s).

The inventory of elements as proposed in Kaye *et al.* (1985, 1990) and Harris (1990) consists of (I, U, A, N, ɨ, R, h, ʔ, H, L). Since unconstrained combinations of these ten elements overgenerate beyond the vocalic expressions found in languages, Kaye *et al.* (1985) attribute a charm value to the elements and constrain the fusion operation by means of charm.[1] Charmed elements of identical value are unable to combine and there is an attraction between elements of different charm, this reducing the number of possible phonological expressions. While constraining the fusion operation by means of the charm value of the elements succeeds in reducing the number of phonological expressions and gives desirable empirical results, it is not without problems. An example is the inability of the positively charmed element (N) to combine with the positively charmed element (A), which incorrectly precludes the nasalised low vowels found in many languages. Moreover, although charm succeeds in constraining the combinations of elements, the fusion operation still overgenerates.

The Revised Theory of Elements avoids these problems (cf. Kaye 1993). The main idea is to eliminate charm and to overcome the overgeneration of phonological expressions by reducing the number of elements. In other words, the fusion operation is no longer constrained; instead the number of elements is reduced.

As a starting point, Kaye's proposal is that the role an element can occupy within an expression should not be restricted to that of operator – as this is the case with the ATR element (ɨ) – and all elements should be present in vocalic and consonantal expressions alike. This implies that (ɨ), which is never the head of an expression and which is only present in vowels, and (R), (ʔ) and (h), which

[1] (A), (N) and (ɨ) are positively charmed, (H) and (L) are negatively charmed and (I), (U), (R), (h) and (ʔ) are charmless.

are only found in consonants, should be eliminated from the set of elements (see Kaye 1993) for discussion on the loss of ATR, (N)=(L) and (R)=(A), Harris and Lindsey 1995 on the loss of ATR, Jensen 1994 on the loss of (ʔ), Backley 1993 on the loss of (R), Ploch 1995 on (N)=(L) and Cyran 1997 on deriving noise by means of the headedness of the resonance elements). This leaves us with the five elements (A, I, U, L, H) which freely combine, generating all and only those phonological expressions present in languages.

The task is then to find a way of discovering the segmental inventories of particular languages, which naturally consist of a subset of all the possible combinations of elements. This is achieved by means of licensing constraints, i.e. licensing properties of elements, to which we now turn.

2.1. Licensing constraints

In the Revised Theory of Elements the preclusion of certain combinations of elements in particular languages is achieved by means of constraints which define the licensing properties of elements. There are two types of licensing constraints, those which refer to the headhood of an element and those which refer to the ability of an element-head to license an operator. Let us consider the two types of constraints in turn.

The unconstrained nature of the fusion operation naturally leads to elements being free to occupy either the role of head or of operator within a complex expression. For example, in a language where (I) and (U) can combine there are only two possible headed phonological expressions containing (I) and (U): one in which (I) is the head and licenses the operator (U), and another where (U) is the head and licenses the operator (I). These two expressions are found in certain Scandinavian languages and correspond to the two high front rounded vowels which, in the orthography, correspond to *u* and *y*. But how can one explain why languages like French and German, where the elements (I) and (U) can also combine, only have one vowel *ü*? The difference between certain Scandinavian languages (e.g. Norwegian and Swedish) and languages such as French and German lies in the licensing properties of the elements in those languages. If, as claimed by Charette (1994) for French and Ploch (1993) for German,[2] the element (U) is only licensed in the position of head within a phonological expression, it follows that the expression (U•I), where (I) is the head and (U) the operator, will not be found in those languages. Those Scandinavian languages which lack constraints on the position (I) and (U) occupy within an expression allow the free combination of these two elements.

The second type of licensing constraint concerns the ability of certain elements to license an operator. This type of constraint may be needed to generate a ten vowel system such as that found in certain West African languages like

[2] Ploch now proposes that the correct licensing constraint for German is *nothing can license (U)*.

Vata spoken in the Ivory Coast, the vocalic system of which consists of five ATR and five non-ATR vowels.[3]

(1)

ATR				*-ATR*			
i	(I)	u	(U)	ɪ	(I)	ʊ	(U)
e	(A•I)	o	(A•U)	ɛ	(A•I)	ɔ	(A•U)
		ʌ	(A)			a	(A)

In the Revised Theory of Elements ATRness is expressed in terms of headedness. ATR (i.e. tense) vowels are headed – represented here with an underlined element – and non-ATR (i.e. lax) vowels are headless.[4] The relevant issue here is how to allow the combination of elements, i.e. generate the complex expressions that Vata has, while at the same time limiting the combinations so that they do not lead to overgeneration. Notice that the possibility of having all three elements as heads and as operators leads to a system where, say, (A) can combine with (I) as head (i.e. (A•I)) or as operator (i.e. (A•I)), yielding two ATR *e* vowels. The same applies to the combination of (A) and (U). However, such a vowel system does not correspond to the facts in Vata which has only two complex headed expressions containing (A) and not four. Preventing such overgeneration could be achieved by proposing a licensing constraint *(A) does not license operators*, ruling out the two expressions (A•I) and (A•U) but allowing those where (A) occurs in operator position (e.g. (A•I), (A•U)).[5]

Having discussed the types of possible licensing constraint, we now turn to the vocalic system and harmony processes in Turkish with a view to investigating further the nature and role of these constraints.

3. Turkish

This section focuses on Turkish and how licensing constraints can account for both a language-specific vocalic system and the process of vowel harmony.

3.1. The Turkish vowel system

Turkish has a vowel system with a contrast between eight vowels represented in the orthography by *i, ü, u, e, ö, o, a, ı*, as shown below.

[3] Walker (1995) proposes a different analysis. She claims that the element (A) cannot be a head in Vata and that the so-called ATR low vowel is the phonetic manifestation of an empty expression. It is beyond the purpose and scope of this paper to look at Vata in depth. We only use it to exemplify a type of licensing constraint which we will return to in our analysis of Turkish.

[4] See also Cobb (1995), van der Hulst (1989, 1992), Kaye (1993) and Walker (1995) for a discussion of these issues.

[5] Notice that a proposal such as *(I) and (U) must be head* would be incorrect since these two elements are not heads in the headless expressions corresponding to the vowels [ɪ] and [ʊ].

(2)

kil	'clay'	kül	'ash'	kul	'subject'
kel	'bald'	kör	'blind'	kol	'arm'
kal	'stay'	kıl	'hair'		

These vowels phonetically correspond to: [i, ü, u, ɛ, œ, ɔ, a, ɨ].

Stems in Turkish are generally monosyllabic and they display the full range of the vowels of the language. Suffixation is the only word-formation process. Words can contain up to 12 suffixes and vowel harmony is realised in all of them, with the exception of a few bound morphemes which can historically be traced back to verbal stems (e.g. *-iyor* (aspectual marker), *-ıver* (modality marker)). From a phonological point of view the suffixation system of the language has a contrast between two sets of suffixes: one set where the vowel alternates between *a* and *e*, and another set with the vowels alternating between *ı, i, u, ü*. The former is the manifestation of front harmony, the latter the manifestation of both front and round harmony. The examples below illustrate these alternations.

(3)

Stems	*Gloss*	*Plural*	*2nd person possessive*
kil	'clay'	kil-ler	kil-in
kül	'ash'	kül-ler	kül-ün
kul	'subject'	kul-lar	kul-un
kel	'bald patch'	kel-ler	kel-in
köy	'village'	köy-ler	köy-ün
kol	'arm'	kol-lar	kol-un
kas	'muscle'	kas-lar	kas-ın
kıl	'hair'	kıl-lar	kıl-ın

The first type of suffix, that which displays *a*–*e* alternation, illustrated in (3) by the plural suffix -lar/ler, divides the vowel system into two groups: *a* occurs after *a, ı, o, u*, and *e* occurs after *e, i, ö, ü*. The second type, illustrated by the second person possessive marker *in/ün/un/m*, divides the vowel system into four groups: *u* occurs after *u* and *o*, *ü* occurs after *ü* and *ö*, *i* occurs after *i* and *e*, and, finally, *ı* occurs after *ı* and *a*. We henceforth refer to these as type 1 and type 2 suffixes respectively. This pattern applies not only to suffixes but also to native stems which have more than one vowel.

(4)

Vowel in the stem	*Vowel in the suffix or in N_2 of stems (native words)*	
	type 1	*type 2*
a or ı	a	ı
e or i	e	i
o or u	a	u
ö or ü	e	ü

In other words, the vocalic expression in a non-initial nucleus is jointly determined by the lexical properties of the suffixal vowel and the nature of the stem vowel. This is schematised below with further examples of suffixation in (5a) and bisyllabic stems in (5b).

(5) a.

Stem	*Gloss*	*Relativiser (type 1)*	*Imperative (type 2)*
gir	'enter'	gir-en	gir-in
gül	'laugh'	gül-en	gül-ün
kur	'establish'	kur-an	kur-un
kes	'cut'	kes-en	kes-in
gör	'see'	gör-en	gör-ün
sor	'ask'	sor-an	sor-un
kal	'remain'	kal-an	kal-ın
kıs	'reduce'	kıs-an	kıs-ın

b. *Bisyllabic words*

(type 1)		*(type 2)*	
kireç	'lime'	kilit	'lock'
güneş	'sun'	gümüş	'silver'
kulak	'ear'	kuruş	'pence'
kemer	'belt'	kemik	'bone'
köpek	'dog'	köpük	'foam'
sopa	'stick'	oyun	'game'
maşa	'tongs'	Salı	'Tuesday'
sıra	'desk'	ısı	'heat'

As shown in the examples, not only is the front and round quality of the vowels occurring in recessive positions predictable, but only *a, e, ı, i, u* and *ü* are found in these positions. The two vowels *o* and *ö* are restricted to N_1. That is, the combination of a stem and a type 1 suffix never yields words such as *köllör, kollor* (it yields *köller, kollar*) and a stem and a type 2 suffix never yields words such as *görön* and *soron* (it yields *görün* and *sorun*). In short, vowel harmony in Turkish is not free, but is subject to a number of constraints which will be explored below.

At this point we would like to draw attention to references in the literature which reject the claim that *o* and *ö* are restricted to initial nuclei (cf. Clements and Sezer (1982) among others). There are four types of apparent counterexamples: i. loan words, ii. words containing the so-called soft-g, iii. reduplication and iv. suffixes such as *-iyor* (aspectual marker). None of these are genuine counterexamples. The fact that loan words can contain *o* and *ö* in non-initial nuclei (e.g. *doktor* 'doctor', *tümör* 'tumour') is most probably the result of mechanisms unrelated to harmony. For example, it might be the case that loan words are not generated by the rules of the language at all, or they might be treated as compounds, so that the processes which derive them would be external to the domain of vowel harmony. The case of the soft-*g* (e.g. [yoort] *yoğurt* 'yoghurt') involves vowel lengthening/coalescence. Reduplication cannot be considered a counterexample since it involves the addition of a prefix whose vowel is a copy of the first vowel of the stem (e.g. *mos-mor* 'completely purple', *dop-dolu* 'full to the brim', *kos-kocaman* 'huge'). We refer the reader to Piggott (1990) and Kaye (1991) for an analysis of reduplication. As for suffixes such as *-iyor*, these are complex suffixes composed of an empty nucleus, (_), and a stem (i.e. (_)*-yor*). The fact that *-yor* never undergoes harmony (i.e. **yör*) is itself an indication that it forms a separate domain. This is supported by the claim that *-yor* is a derived form of the Old Turkish auxiliary verb *yorumak* 'to walk, to continue' a verb which is fully inflected, as in *gide yorur* 'he/she is in the process of going' (see Ediskun 1985). In short none of these constitute counterexamples to vowel harmony and to our claim that *o* and *ö* are restricted to N_1.

4. The internal representation of vocalic expressions

4.1. The licensing constraints of Turkish

What does the vocalic system of Turkish look like? What are the factors conditioning the quality of the vocalic expressions in recessive nuclei? We claim that the following licensing constraints provide the answer to both questions.

(6)

Operators must be licensed
(A) is not a licenser
(U) must be head

Below we motivate each licensing constraint by analysing the structure of simplex and complex expressions.

4.1.1. The representation of simplex expressions

There is only one vowel in Turkish the representation of which is not the result of a licensing constraint. This is the vowel *ı* as in *kıl* 'hair'. Without going into a detailed analysis of the phonological behaviour of this vowel, we suggest that it has all the properties of a sound corresponding to the interpretation of an unlicensed empty nucleus.[6] In addition to its alternation with zero (e.g. *karı-n* 'stomach', *karn-ı* 'his stomach' vs. *kapan* 'trap', *kapan-ı* 'his trap' **kapn-ı*), we will shortly see that, by virtue of being unconstrained with respect to harmony, it behaves like an identity element.

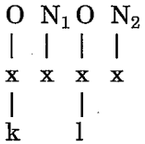
Turning now to the lexical vowels, the first point to take into consideration regarding their representation is that Turkish does not have a contrast between

[6] See, among others, Charette (1991), Kaye (1990a) for an analysis of empty nuclei in Government Phonology.

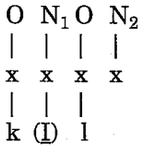
tense and lax vowels; in Government Phonology terms, it does not have a contrast between headed and headless expressions and we therefore propose that all vocalic expressions in Turkish are headed; an explanation for this headedness is put forward in our discussion on vowel harmony. The lack of headless expressions, we claim, follows from a language-specific constraint which forces operators to be licensed. That is, an element can only occupy the role of operator within an expression if there is an element in head position to license it. Thus, the first licensing constraint for Turkish is: *Operators must be licensed.*[7]

This constraint excludes the possibility of headless expressions such as (I), (U), (A) which contain an operator that is not licensed by an element in head position, and means that the vowels *i*, *u* and *a* will be represented as the simplex headed expressions (I), (U) and (A), respectively. The vowels *i*, *u*, *a* and *ı*, which is a manifestation of an unlicensed empty nucleus, are represented in (7) below.

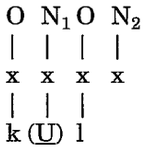
(7) a. kıl



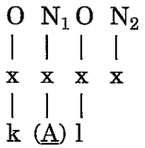
b. kil



c. kul



d. kal



The constraint *Operators must be licensed* naturally captures nothing more than the fact that all expressions must be headed. We now turn to the representation of complex expressions in order to arrive at a better understanding of the function of the remaining licensing constraints *(U) must be head* and *(A) is not a licenser*.

4.1.2. The representation of complex expressions

The constraint that expressions must be headed allows for a multitude of representations such as (A•U) and (A•U) for *o*, (A•I•U), (A•I•U), (A•I•U) for *ö*, etc. In order to reduce the number of complex phonological expressions to four, i.e. *e*, *o*, *ö*, *ü*, two further constraints are required. Let us assume that one of these constraints involves the necessary headhood of some element, guaranteeing its

[7] This might be implementable as a parameter, but we will not go into this here.

role as a head when it is in a complex expression. There are three candidates for such a constraint.

(8)

(I) must be head
(A) must be head
(U) must be head

Any one of these constraints yields five possible representations for the remaining four vowels. For example, suppose that *(I) must be head* is a constraint in Turkish. The vowel *e* would then be represented as (A•I), *ü* as (U•I) and *ö* as (A•U•I). But this constraint would have nothing to say about the representation of *o*, which, lacking the element (I) in its composition, could either be (A•U) or (A•U). In order to represent *o* a further constraint would be required: either *(U) does not license operators* (yielding (U•A)), or *(A) does not license operators* (yielding (A•U)). Notice that assigning an element a certain role, such as head, excludes the possibility of another element occupying the same role, as this would make it impossible to represent complex expressions. To give an example, it would be impossible to represent the vowel *ü* if both (I) and (U) had to be heads. The same argumentation applies to the other options in (8). A constraint such as *(A) must be head* leaves *ü* undetermined, and a constraint such as *(U) must be head* leaves *e* undetermined. Therefore, in addition to the constraint barring headless expressions we have proposed earlier, Turkish requires two other constraints, one requiring a specific element to be head, and a further constraint which imposes a condition on the licensing properties of one of the remaining elements. We thus have six options altogether, any one of which could account for the representation of *o*, *e*, *ü*, *ö*. These options are illustrated in the chart below.

(9)

i. *(A) must be head*
(I) does not license operators

o	(U•A)
e	(I•A)
ö	(U•I•A)
ü	**(I•U)**

ii. *(A) must be head*
(U) does not license operators

o	(U•A)
e	(I•A)
ö	(U•I•A)
ü	**(I•U)**

iii. *(I) must be head*
(A) does not license operators

e	(A•I)
ü	(U•I)
ö	(A•U•I)
o	**(A•U)**

iv. *(I) must be head*
(U) does not license operators

e	(A•I)
ü	(U•I)
ö	(A•U•I)
o	**(A•U)**

v. *(U) must be head*
(I) does not license operators

o	(A•U)
ö	(A•I•U)
ü	(I•U)
e	**(A•I)**

vi. *(U) must be head*
(A) does not license operators

o	(A•U)
ö	(A•I•U)
ü	(I•U)
e	**(A•I)**

The presentation of Turkish given so far is not sufficient to force a choice among these options as they are all theoretically possible. Based on evidence given by vowel harmony, which we explore in detail in the next section, we propose that the element which has to occupy the role of head is (U) and the element which does not license operators is (A). These two constraints taken together reduce the number of complex expressions to the desired four in (9vi), providing the vocalic inventory represented below.[8]

(10)

i	(I)	ü	(I•U)	u	(U)	ı	(_)
e	(A•I)	ö	(A•I•U)	o	(A•U)	a	(A)

These constraints will also derive the desired results when harmony takes place. The constraint on the headhood of (U) will be seen to account for the absence of *o* and *ö* in recessive positions. As for the constraint on (A), we go a step further and derive it from a more general constraint regarding this element, that is, *(A) is not a licenser*. Such a statement not only helps reduce the number of vocalic expressions in the language, but also explains the absence of A-harmony. Thus, both constraints are directly tied in with the nature and behaviour of harmony, which we now explore in more detail.

5. Harmony

The literature on vowel harmony is vast and the facts about this aspect of Turkish phonology are uncontentious. For example, it is well known that any vowel can occur in N_1 (i.e. the first nucleus of the domain) while those occurring in the recessive nuclei N_2, N_3 etc. are quite restricted. It is also known that Turkish has both front harmony and round harmony and that the former has a wider area of application than the latter. The main questions in relation to these points are "Why is there a discrepancy between front harmony and round harmony?" and "Why is there a discrepancy between the vowels that occur initially and

[8] In previous work (Charette and Göksel 1996) we argued that the representation of a lexical *e* was (I) headed and that the constraint deriving this vowel was *(I) does not license operators*. We now believe that there is a flaw in this argument in that if (I) does not license operators, there is no explanation as to how it can license itself to spread (see section 5). An additional advantage of replacing this constraint with *(A) is not a licenser* is that this latter can account for the absence of A-harmony in Turkish.

those that occur word internally, i.e. why do *o* and *ö* never appear in recessive nuclei? One part of the answer can be found in the lexical properties of the two types of suffixes, or to put it more generally, the nature of recessive nuclei. We claim that these are either lexically empty or contain the element A. The surface manifestation of word-internal vocalic expressions is a joint result of the lexical content of recessive nuclei and the presence (including scope) or absence of a particular harmony process.

In what follows we will refer to the licensing constraints of Turkish to explain the nature and scope of its harmonic processes. Using the same tools for explaining the internal representation of lexical phonological expressions and the properties of harmony is a natural move within the framework of Government Phonology, in view of the fact that conditions in this system are characterisable as constraints on elements, in this case the elements (A), (I) and (U). Vowel harmony involves the spreading of an element from a governing nucleus onto a nucleus it governs; thus, we propose that spreading is an instantiation of element-licensing. That is, an element (X) occurring within a governing nucleus licenses the presence of this element (i.e. itself) in the expression of the nuclei it governs. Front harmony can then be defined as I-spreading and round harmony as U-spreading. Let us demonstrate these points starting with evidence for the presence of a lexically empty nucleus and the unconstrained nature of (I) and (U) spreading into this position.

(11)

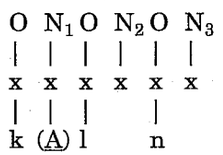
	Stem	*Gloss*	*Imperative (type 2)*
a.	kal	'remain'	kalın
	kıs	'reduce'	kısın
b.	gir	'enter'	girin
	kes	'cut'	kesin
c.	kur	'establish'	kurun
	sor	'ask'	sorun
d.	gül	'laugh'	gülün
	gör	'see'	görün

The examples are divided into four groups. The lexical representation of a type 2 suffix contains an empty nucleus which is phonetically manifested because it is not p-licensed.[9] In the forms given in (11a) the suffixal vowel is realised as *ı*, showing that no element spreads from the stem vowel. The first form also shows that A does not spread since the imperative form of the verb *kal* 'remain' is not *kalan*.[10] Therefore the suffixal vowel is realised as *ı*, exemplified below.

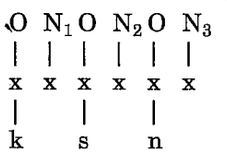
[9] See note 6.

[10] The word *kalan* 'remaining', the relativised form of *kal* 'remain', is grammatical but is composed of a stem and a type 1 suffix which, as we will shortly see, has a lexical (A) in its representation.

(12) a. kal-ın

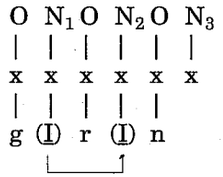


b. kıs-ın

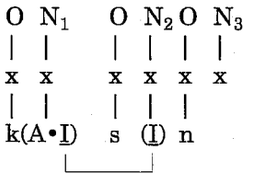


The forms in (11b) and (11c) show that unlike the element (A), both the elements (I) and (U) spread into an empty nucleus.

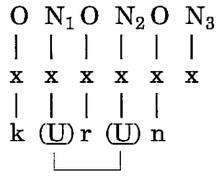
(13) a. gir-in



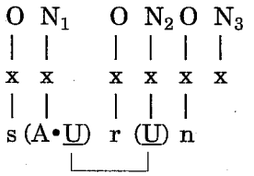
b. kes-in



c. kur-un

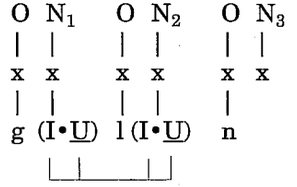


d. sor-un

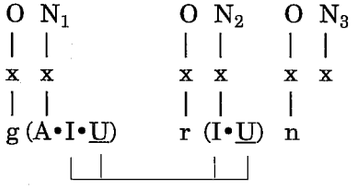


Finally, the suffixal vowel in (11d) shows that when both the elements (I) and (U) are present in the representation of the stem vowel, both elements spread, as shown below. We assume that (U) is the head of the harmonised nucleus, a claim which is subsequently substantiated.

(14) a. gül-ün



b. gör-ün



The examples above show that both (I) and (U) are free to license themselves into empty positions which are not p-licensed. This behaviour is expected since none of the constraints proposed above are violated. (U) spreads as a head in all cases in conformity with *(U) must be head*. As for (I), there are no conditions on its licensing properties. It can spread from and into a head position (*girin*, *kesin*), from operator to operator position (*gülün*, *görün*) and, as we will shortly see, from a head position into an operator position (*filde*). The final empty nucleus, if not stressed, will not be phonetically expressed since word-final empty nuclei are p-licensed in Turkish.[11] The initial empty nucleus of a suffix such as *-m*, however, will receive an interpretation because it lacks a proper governor. It should be clear by now that recessive positions are either lexically empty or contain the element (A) alone, and the only occurrence of the elements of (U) and (I) in these positions is a result of harmony.

We would like to consider two types of apparent counterexamples to the claim that *i* and *u* do not lexically occur in recessive nuclei. One of these is suffixes such as *-adur* 'to keep on' and [dʒi:z] *-ceğiz* 'future 1st person plural', the latter pronunciation being found in the native Istanbul dialect. Of these *-adur* is complex, with *-dur* signalling the beginning of a separate domain. This is supported by the fact that *-dur* does not undergo harmony (although *a* does) and is derived from the Old Turkish auxiliary verb *durmak* 'to remain', a fully inflected verb (see Ediskun 1985). As for *-ceğiz*, we claim that this too marks the beginning of a phonological domain which is not visible to harmony processes, hence [yapıdʒi:z], *[yapıdʒı:z) 'we will make', [durudʒi:z], *[durudʒu:z] 'we will stay'.

The second type of counterexample is exemplified by words such as *tavuk* 'chicken', *kavun* 'melon', *sebük* 'pond', which might suggest that non-initial U-vowels may be lexical. Interestingly, this type of word often has a consonant containing (U) before the vowel. Taking *kabuk* 'crust' as an example, we propose that its second nucleus is lexically empty (i.e. k(A)b(_)k(_)) and that (U) spreads into the empty nucleus from the consonant preceding it. See Clements and Sezer (1982) and Yavaş (1980) for a discussion of counterexamples to our claim that only (A) and empty nuclei are lexically found in recessive positions.

We now turn to cases where the harmonic processes are restricted as a result of licensing constraints. We start with the constraint on the element (A).

5.1. Constraints on harmony

5.1.1. (A) is not a licenser

The constraint *(A) is not a licenser* accounts for the absence of A-harmony in Turkish. The element (A) does not spread, as we have seen above in (12a), because it does not have the property to license itself, in line with the definition we have provided for harmony as an element licensing itself in a nucleus it governs.

[11] See Charette (in prep.) for an analysis of word-final empty nuclei in Turkish.

Another area of application of this constraint is the inability of (A) to license operators within a phonological expression. In accordance with this claim, the lexical representation of *e* in Turkish is (A•I) as discussed earlier.

But what about the representation of *e* in a harmonised nucleus? Consider the examples below which demonstrate I-spreading into the locative suffix *-da*, a type 1 suffix.

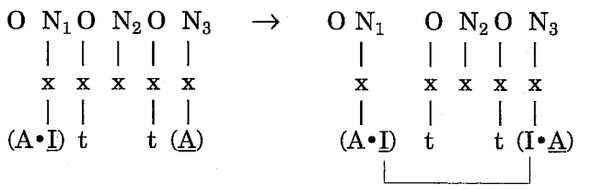
(15)

Stem	*Gloss*	*Locative*
fil	'elephant'	fil-de
et	'meat'	et-te
süt	'milk'	süt-te
göz	'eye'	göz-de

In these examples, the element (I) present in N_1 spreads into the suffixal expression which contains (A), yielding *-de*.

(16) et-te 'in the meat'

a. b.



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Notice that the representation of lexical *e* (i.e. in N_1) is different from the representation of *e* which is the result of an I-harmonised *a* ((I•A) and (I•A), respectively). This raises questions regarding the motivation for two distinct representations and the status of the licenser of the element (I) in the harmonised expression. If the representation of the *e* in the suffix were the same as in the stem vowel, this would force (A) in the suffix to change its role from head to operator. As will be discussed below in 5.1.2.1, evidence from U-harmony rules this out. In Turkish an element cannot change its role within an expression. Hence the phonology of the language forces two representations for *e*. The possibility of having two separate representations for the same sound is supported by cross linguistic evidence, as found in French (see Charette and Göksel 1996), as well as by independent facts internal to Turkish.

Turkish does, in fact, have two different sounding *e*'s and *a*'s, as in *eller* 'hands', *elden* 'from the hand' vs. *elde* 'on the hand', and *odalar* 'rooms', *odadan* 'from the room' vs. *odada* 'in the room' (the vowels in bold face sound lower when they are followed by an empty nucleus than when they occur word-finally). At first glance, this might be taken as evidence supporting our proposal that *e* must have two representations. However, for reasons which are not yet fully understood,

there might be a phonological process according to which expressions having the element (A) as head become empty-headed when they precede an empty nucleus (see Charette and Göksel, in prep.). The reader is referred to Charette (1994) and Lowenstamm and Prunet (1988) for a discussion of head-alignment.

As for the licenser of (I) in the suffix, the question is how its status as an operator within the harmonised nucleus (I•A) can be reconciled with the licensing constraint *(A) is not a licenser*. The answer to this is given in the very definition of spreading. When (I) spreads from the stem vowel into the suffixal expression, it licenses itself in the expression to which it spreads. This means that an element which spreads into a filled expression is not licensed by the element already present in the expression, but by itself. Whether it lands in head or operator position does not depend on the licensing properties of the element it adjoins to. The licenser of (I) in this case is not (A), but the (I) in the preceding expression.

It therefore follows from the constraint *(A) is not a licenser* that Turkish does not have A-harmony ((A) cannot license itself) and that the element (A) is never head of a complex *lexical* expression ((A) cannot license operators). (A) can be a head when it occurs alone (a = (A)) and in complex derived expressions, but is an operator in the lexical expressions corresponding to *e* = (A•I), *o* = (A•U), and *ö* = (A•I•U). Note that the fact that (A) is an operator within the expressions corresponding to the vowels *o* and *ö* also follows from the licensing constraint *(U) must be head* which we now turn to.

5.1.2. (U) must be head

When (U) spreads into a type 2 suffix, be it with (I) or alone, it occupies the head position as demonstrated in (13c), (13d), (14a) and (14b). These examples also demonstrate that (U) obligatorily spreads into an unlicensed empty position, thus causing the suffix to be realised as *-um/-üm* and not *-ım/-im*. Further examples are given below.

(17)

Stem	*Gloss*	*Possessive*	*Predicate emphatic*
kuş	'bird'	kuş-um	kuş-tur
		*kuş-ım	*kuş-tır
yük	'load'	yük-üm	yük-tür
		*yük-im	*yük-tir
ok	'arrow'	ok-um	ok-tur
		*ok-ım	*ok-tır
göz	'eye'	göz-üm	göz-dür
		*göz-im	*göz-dir

Now consider the following cases where a stem containing (U) is followed by a type 1 suffix.

(18)

Stem	*Gloss*	*Dative*	*Plural*
kuş	'bird'	kuş-ta	kuş-lar
		*kuş-to	*kuş-lor
yük	'load'	yük-te	yük-ler
		*yük-tö/ta	*yük-lör/lar
ok	'arrow'	ok-ta	ok-lar
		*ok-to	*ok-lor
göz	'eye'	göz-de	göz-ler
		*göz-dö/da	*göz-lör/lar

It is clear that (U) does not spread into an expression containing (A), unlike Khalkha Mongolian (see Charette 1989) and Yakut, Kazak and Kirghiz, which will be discussed shortly. This is true whether (U) occurs alone (cf. u = (U)) or with an operator (cf. o = (A•U), $ö$ = (I•A•U), $ü$ = (I•U)). What needs to be cleared up at this point is what prevents (U) from spreading into (A) but not into an empty expression, as this cannot be predicted from any of the licensing constraints given above.

5.1.2.1. The restrictions on U-harmony: Why switching is forbidden in Turkish

Harmonising the expression (A) by spreading (U), as might be expected to happen with the dative suffix *-da* or the plural suffix *-lar* would yield ungrammatical forms such as **ok-lor* and **kuş-lor*.

There would be two options for (U) if it were to spread into the expression (A). It would spread either into the operator position (i.e. (U•A)) or into the head position (i.e. (U•A)). In the first option an U-head in the governing nucleus (i.e. in N_1) would license itself in the role of operator in the position it governs. In the second option U-head would license itself to occupy the role of head within that governed expression.

The first option is straightforwardly ruled out by the constraint *(U) must be head* which is independently required to derive the lexical complex expressions containing both the elements (A) and (U). Recall that it follows from the constraint *(A) is not a licenser* that this element does not spread and that it does not occupy the role of head within lexical complex expressions. To capture the fact that Turkish has only two complex expressions containing the elements (A) and (U), the constraint *(U) must be head* is required. A significant outcome of this is that the lexical restrictions according to which: i. (U) can only occupy the role of head within an expression and ii. (A) cannot license operators within a complex expression, carry over to their licensing properties in the phonology.[12]

[12] Note that if, contrary to what we propose (cf. section 3), Turkish had a series of headless expressions instead of a series of headed ones, (U) would spread from and into an operator position. If this were the case it would be impossible to explain why U-spreading is restricted to empty expressions.

Let us now consider the second strategy whereby (U) would spread as a head and move (A) into the operator position (from its original head position). We will henceforth refer to the shifting of a role within a phonological expression as *switching*.

The expression (U•A) whereby (A) moves into the operator position leaving (U) occupying the role of head does not violate any of the licensing constraints given above: the expression is headed, it has (U) as its head and (A) is an operator. What this strategy would require is a mechanism which would switch the element (A) from the head position it lexically occupies into the operator position. Although nothing in the theory rules out switching as a possible phonological process, this does not seem to be an option for Turkish. If it were, the dative and plural suffixes *-da* and *-lar* would be realised as *-do* and *-lor* respectively, which is not in accordance with the facts. This also explains why it is necessary to have two representations for *e*, as discussed in 5.1.1. However, Turkish itself does not shed light on the nature of switching and the conditions that preclude it. For this we need to look at U-harmony in other Turkic languages.

6. Other Turkic languages

The Turkic languages that we discuss below, Yakut, Kazak and Kirghiz, are similar to Turkish in that they have the same vocalic system and two types of harmony. There are no restrictions on I-harmony in any of them. We first look at additional conditions regulating U-harmony in these languages, and finally turn to the absence of U-harmony in Old Anatolian Turkish.

6.1. U-harmony in Yakut

Yakut, also known as Sakha, is a Turkic language spoken in north-eastern Siberia. While in Turkish U-spreading is restricted to empty expressions, this element spreads more freely in Yakut. It not only spreads into an empty expression, but into (A) as well. For the latter kind of spreading to take place the expression that (U) spreads from must also contain the element (A). In other words, (U) spreads into (A) from the vowels *o* and *ö*, but not from the vowels *u* and *ü*.[13] [14]

(19)

	Stem	*Gloss*	*Accusative*	*Plural*	*Dative*
a.	bulčut	'hunter'	bulčut-nu	bulčut-tar	bulčut-ka
	kuş	'bird'	kuş-nu	kuş-tar	kuş-ka

[13] According to Kenstowicz (1994), this is not in line with Krueger (1962), who claims that in Yakut, U-harmony of *a* is triggered by the vowel *o* but not by the vowel *ö*. Our data, collected from four native speakers, contradict Krueger's data.

[14] This is also the case in Khalkha Mongolian: [mu:r-a:] 'one's own cat', [nüd-e:] 'one's own eye', [nom-o:] 'one's own book', [öndög-ö:] 'one's own egg'.

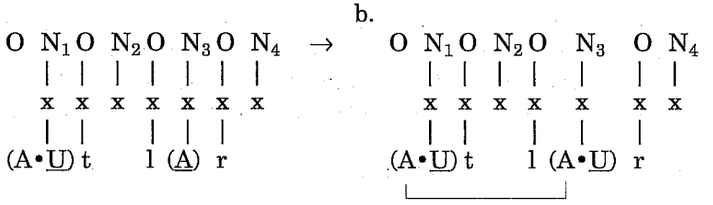
b.	tünnük	'window'	tünnük-nü	tünnük-ter	tünnük-ke
	üt	'hole'	üt-nü	üt-ter	üt-ke
c.	ot	'grass'	ot-nu	ot-tor	ot-ko
	oɣo	'child'	oɣo-nu	oɣo-lor	oɣo-ɣo
d.	börö	'wolf'	börö-nü	börö-lör	börö-ɣö
	töbö	'head'	töbö-nü	töbö-lör	töbö-ɣö

We have found no evidence for the presence of a set of different licensing constraints in Yakut. We therefore propose that when (U) spreads into (A) the former occupies the role of head (i.e. (A•U)). The element (U) occurring in the head position of the stem licenses itself to occupy the role of head within the expression of the nucleus it governs.

The possibility of (A) moving into the operator position in Yakut and not in Turkish could be taken as resulting from a difference between the licensing properties of (U) in these languages. So, for example, one could claim that in Yakut (U) licenses switching while in Turkish it does not. This presupposes that the process of licensing (A) to switch roles takes place from within the expression. However, if U were the switching-licenser of A in Yakut, there would be no reason why it should not spread into (A) from an expression which does not contain the element (A). As the examples show, the vowels *u* and *ü* do not trigger U-harmony into (A) (viz. *üt-ter* but **üt-tör*). The harmonising of (A) by (U) in Yakut, then, is a case of spreading *from* and *into* expressions containing (A).

This condition can be expressed in terms of the notion of an *A-bridge*. The two elements (A) would merge into one as the result of an OCP effect and when fused they would form a *bridge* for (U) to spread.

(20) ot-tor 'grasses'



As illustrated above, switching involves alignment. (A) can switch if it aligns itself with (A) in the domain-head position. It therefore seems that the licensing of switching, just like the licensing of spreading, is invoked from an element which is external to the expression where switching takes place. In this case, an (A) operator in N_1 licenses an (A), i.e. itself, to occupy the same role in the adjacent position. In conclusion, the difference between Yakut and Turkish with respect to U-harmony can be stated in terms of an OCP effect on (A) being active in the former language but not in the latter.

This analysis leads us to propose two different representations for *e* in Yakut, just as we did in Turkish. (I) spreading into (A) from the vowel *e* (i.e. (A•I)) triggers switching, unlike (I) spreading into (A) from the vowels *i* and *ü*. This gives two distinct representations for the harmonised (A) in Yakut, (A•I) and (A•I), the former being the same as lexical *e*. The difference between Turkish and Yakut is that one has a disjunction between the representation of a lexical and a derived *e*, while the other has a disjunction between two derived *e*'s.

We have shown that U-spreading is more restricted than the spreading of (I) in Turkic languages. In Turkish (U) can only spread into an empty expression and in Yakut it spreads into the expression (A) in the presence of an *A-bridge*. However, as we will see below, attributing of switching to an OCP effect misses a generalisation which can be captured by looking at similar data in Kazak.

6.2. U-harmony in Kazak

In the dialect of Kazak spoken in the province of Xin Jiang in China, (U) spreads into a following unlicensed empty expression.

(21)

Stem	*Gloss*	*Possessive*
murun	'nose'	murun-um
süt	'milk'	süt-üm
qol	'hand'	qol-um
čöp	'grass'	čöp-üm

The spreading of (U) into (A), however, is again more restricted than I-spreading. It can take place optionally if I-harmony also takes place.

(22)

Stem	*Gloss*	*Plural*
murun	'nose'	murun-lar/*lor
süt	'milk'	süt-ter/tör
qol	'hand'	qol-lar/*lor
čöp	'grass'	čöp-ter/tör

As illustrated in the examples above, the element (U) can optionally spread into (A) from the vowels *ü* and *ö*, but not from *u* and *o*, a result quite different from the facts in Yakut where the spreading appears to be dependent on the presence of an *A-bridge*. However, in Kazak, because (U) can spread into (A) from the expression (I•U), the switching-licenser of (A) cannot be an element (A) occurring in the governing expression. At first glance, U-harmony seems to be parasitic on I-harmony. Notice, however, that the spreading of (U) is not always dependent on the spreading of (I), since, as we have seen in (21), (U) spreads into an empty expression from all expressions containing (U). This clearly shows

that U-harmony is not parasitic. Rather, the switching of (A) within a governed expression has to be licensed by an I-operator occurring both in the governing and in the governed expressions. This indicates that the process of switching is contingent on the presence of an operator in N_1 and not on an OCP effect, something which the data in Yakut might have suggested. In Yakut the switching-licenser is the element (A) and in Kazak it is (I). In other words, the licenser for switching is the presence of a particular operator in the governing nucleus.

6.3. U-harmony in Kirghiz

The facts of U-harmony in Kirghiz are particularly interesting as the outcome seems to be a combination of the conditions found in Yakut and Kazak. (U) spreads freely into an unlicensed empty position and spreads into (A) from all the *complex* expressions containing (U). As in Yakut, it spreads in the presence of the element (A) in operator position (spreading from *ö* and *o*). Likewise, as in Kazak, (U) spreads when there is an (I) in the operator position (spreading from *ü* and *ö*). And as in all the languages discussed, it never spreads from *u* into (A), as illustrated below (data taken from Halle and Clements 1983).[15]

(23)	*Stem*	*Gloss*	*Definite past*	*Past participle*
	kül	'laugh'	kül-dü	kül-gön
	kör	'see'	kör-dü	kör-gön
	tut	'hold'	tut-tu	tut-kan
	bol	'be'	bol-du	bol-gon

To summarise, we have seen that switching requires licensing from an external position: in Yakut, it is licensed by the presence of the operator (A), in Kazak by the operator (I) and in Kirghiz by either of these elements. It is not possibile for the operator (U) to act as a switching-licenser in these languages, as it must be a head.

We conclude our discussion on the asymmetric behaviour between I-harmony and U-harmony with a brief discussion of Old Anatolian Turkish.

7. From Old Anatolian Turkish to Modern Turkish

The analysis of harmony processes in the four Turkic languages we have looked at reveal an asymmetry between the elements (I) and (U), with the spreading of (U) being more constrained than the spreading of (I). This difference is not surprising in view of the fact that there is a licensing constraint on the role of (U) but none on the role of (I). In this section we look at Old Anatolian Turkish

[15] The data are supported by our Kirghiz informants.

(OAT) which, unlike Modern Turkish, has only one type of harmony: I-harmony. U-harmony is completely absent.[16]

The absence of U-harmony in OAT correlates with the presence of fewer constraints on vowels occurring in recessive nuclei. The two expressions (A), (U) and an empty nucleus are allowed in non-initial positions, as opposed to Modern Turkish, which has a richer harmonic system and a more restricted set of vocalic segments in recessive positions ((A) and an empty nucleus).

In OAT, as in Modern Turkish, any of the eight vowels can occur in N_1. In recessive positions however, *u* and *ü* can follow an initial vowel lacking an element (U) in its internal representation.

(24)		*OAT*	*Gloss*	*Modern Turkish*
a.	i.	gel**üp**	'upon coming'	gel**ip**
	ii.	kend**üleri**	'themselves'	kend**ileri**
	iii.	ad**lu**	'named'	ad**lı**
	iv.	yat**ur**	'lies down'	yat**ar** / yat**ıyor**
	v.	karş**u**	'against'	karş**ı**
	vi.	yaral**u**	'wounded'	yaral**ı**
	vii.	gazin**ün**	'of the Ghazi'	gazin**in**
	viii.	id**üp**	'upon doing'	ed**ip**
b.	i.	bölüg**i**	'his batallion'	bölüğ**ü**
	ii.	buyurd**ı**	'he ordered'	buyurd**u**
	iii.	günüydi	'it was the day of ...'	günüydü
	iv.	oldılar	'they became'	oldular
	v.	sözi	'the word of (acc)'	sözü[17]

The examples given in (24a) show that in OAT *u* is found in the recessive nuclei of words which do not have the element (U) in the representation of their stem vowel. This clearly shows that word-internal *u* is not derived, but lexical, contrasting sharply with Modern Turkish where words with word-internal *u* always have the element (U) in the first nucleus. The words in (24b) have an initial vowel containing the element (U) in their internal representation and we observe that, unlike Modern Turkish, (U) does not spread into a following empty

[16] There is a considerable amount of literature on the transition period from OAT to Modern Turkish, that is, the period when U-harmony established itself. It is generally believed that the change took place at the end of the 17th century. For a discussion of this issue see Johanson (1978-79).

[17] The data are taken from two sources, the first of which is a manuscript written by Derviş Aşıki, who is cited in the catalogue of the Bodleian Library as a contemporary of Osman I, who reigned between 1299-1326. The other source is Envārü'l- Āşıkīn, written by Yazıcıoğlu circa 1451 and copied in 1560. This source is cited in Iz (1964). The exact locations of the examples are as follows: (a) i. Iz (1964) p.92, 8, ii. ibid. p.93, 2, iii. ibid. p.93, 24. iv. ibid. p.93, 10, v. ibid. p.93, 2, vi. ibid. p.92, 9, vii. Derviş Aşıki f.1v7, viii. ibid. f.1v18 (b) i. ız (1964) p.92, 9, ii., iii. ibid. p.92, 6, iv. Derviş Aşıki f.1v15, v. ibid. f.1v18.

expression, e.g. OAT *sözi*, **sözü*, M.T. *sözü*, **sözi*. That is, OAT does not have a process of U-harmony.[18]

It seems then that harmony processes correlate with the constraints imposed on lexical vowels in recessive nuclei, as the contrast between OAT and Modern Turkish indicates. However, it is unlikely that the correlation between the absence of lexical (I) and lexical (U) in recessive positions and the presence of (I) harmony and (U) harmony can be generalised. There are languages like Chichewa (Harris 1994), Finnish (Gibb 1992) and Mongolian (Charette 1989), Hungarian (Pogany in prep., Ritter 1995), which appear to have (A), (I) and (U) harmony respectively, and in which the vowels *a*, *i* and *u* are said to be lexically found in recessive nuclei. Our proposal is that in a language where an element (X) spreads, this element (X) will never lexically occur in a position of *operator* word-internally.

8. Conclusion

Our analysis of Turkic languages shows that licensing constraints not only determine the vocalic inventory but also explain how vowel harmony operates. We propose that harmony, or spreading, is an instantiation of element-licensing. When spreading takes place, an element can only license itself in a position it can lexically occupy. This explains why (U), which unlike (I) must be the head in these languages, can never license itself in an operator position. A case in point is the inability of (U) to harmonise *a* in Turkish and the requirement that switching take place within harmonised expressions in Yakut, Kazak and Kirghiz.

It is interesting to note that switching, where allowed, is contingent on the presence of an operator in the governing nucleus, and that (U) does not spread into (A) from the simplex expression (U). This suggests that switching requires licensing and that the licenser is an operator in the governing nucleus. The question that arises at this point is whether it is at all possible for switching to take place in the absence of an operator in the governing nucleus. At this point, we have no reason to assume that this is theoretically impossible. There might be a language where (U) is the head of an expression and harmonises (A) from a simplex expression (U). Whether a switching-licenser is universally required is a matter for further research.

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[18] The OAT texts we consulted are written in Arabic script which distinguishes between *i/ı* and *ü/u* but not between *i* and *ı* or *ü* and *u*. However, I-harmony is known to have existed in this period. This is based on orthographic evidence found in texts dating from the period 850 to 1200 written in other alphabets (e.g. Uighur, Brahmi and Manichean), which did distinguish between *u* and *ü*, *o* and *ö*, and *a* and *e* (von Gabain 1988).

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The Slavic [w > v] shift: a case for phonological strength

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This paper is a report on work in progress rather than a presentation of a complete analysis. We take up the old problem of the development of Common Slavonic (CSl) **w* in various present day languages of this group, to define the reasons as well as the results of the shift by considering the changes from the perspective of phonological representation. Briefly, in Slavonic languages we find different reflexes of the historical glide [w] which range from the original glide to the labial fricatives [v] and [f], and even to [x] in North Russian. Thus the main issues which we want to consider here comprise the cause or motivation for the shift and the synchronic representation of the respective reflexes; the latter is necessary to account for their phonological behaviour. First we present the facts concerning the development of the CSl glide **w* and offer some data for reference. Then the relevant aspects of the model of phonological representation used in Government Phonology (GP) are presented and the main theoretical problems are defined. This is followed by a proposal concerning the most crucial stages in the development.

1. The data

The division provided in (1), and the respective examples in (2) are based on the types of reflexes of the CSl **w* in a number of modern Slavonic languages, though the grouping corresponds to the actual phonological behaviour of these objects only partially.

(1) *Development from "glide" [w] to "obstruent" [v].*[1]

A	**B**	**C**	**D**	**E**	**(F)**
[w]	[w/v]	[w/v/f]	[v/f]	[v/f]	[v/f/x]
E.Ukr.	St.Ukr.	St.Slovak	St.Czech	St.Polish	N.Russ.
Up.Sorb.	S.Russ.		St.Russ.	N.Mor.Czech	
				Periph.Polish	
				W.Ukr.	

[1] One has to stress that we are not suggesting here that there was a linear development from CSl via Ukrainian to Polish, for example. Rather, the different languages reflect the respective stages in the development of CSl **w*.