# Vowel harmony in Finnish word games

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## 1. INTRODUCTION

There is a growing body of research in the phonological literature that seeks to bring external evidence derived from word games, secret languages, speech disguises, and the like (called *ludlings* by Laycock (1969, 1972)) to bear on the various non-linear theoretical frameworks that have emerged in the recent past; McCarthy (1979, 1982), Yip (1982), Mohanan (1982), Davis (1985), Vago (1985b), Clements (1986), McCarthy and Prince (1986), Bagemihl (1987a, 1987b), Lefkowitz (1987), and Lefkowitz and Weinberger (1987) is a partial but representative list. In line with this research program, the present contribution has a twofold purpose: (a) to provide a formal account of the patterning of vowel harmony in three Finnish word games, and (b) to draw conclusions for underspecification theory. The data are drawn primarily from a series of studies by Campbell (1980, 1981, 1986), and, when noted, from Seppänen (1982).

General familiarity with the basic tenets of underspecification theory is assumed; see in particular the seminal works of Kiparsky (1982b, 1985), Archangeli (1984), Pulleyblank (1986), and Archangeli and Pulleyblank (1986). Two further assumptions will be made: (a) as claimed by the framework of lexical phonology (cf. Kiparsky 1982a, 1982b, 1985; Mohanan 1982, 1986; Pulleyblank 1986, among many others), phonological rules may apply in the lexical component and/or the postlexical component of grammar; (b) as suggested by Mohanan (1982) and Bagemihl (1987b), language games are played in a separate component, here identified as the game component, mediating between the lexical and postlexical components, to which both rules of the natural language and rules specific to word games may belong. Thus, phonological rules will be assigned to one or more of the following, sequentially ordered, components: lexical, game, postlexical.[1]

Section 2 lays the groundwork with a brief overview of the underspecification analysis of Finnish vowel harmony assumed for the body of the paper. Section 3 describes the first word game and develops the major rules relating to vowel harmony suggested for the game component of

Finnish. Section 4 is concerned with the second word game and consequences for the analysis of transparent, or neutral, vowels. Section 5 provides an account of disharmonic words in the third word game. Finally, section 6 summarizes the most salient results.

## 2. FINNISH VOWEL HARMONY AND UNDERSPECIFICATION THEORY

As is well-known, the Finnish vowel harmony system is root-controlled, based on the feature [back].[2] With respect to vowel harmony, the Finnish vowel qualities are classified as follows, using standard Finnish orthography:

(1)

| | | High | Mid | Low |
|---|---|---|---|---|
| a. | Front harmonic: | y | ö | ä |
| b. | Back harmonic: | u | o | a |
| c. | Transparent (neutral): | i | e | |

In general, the vowels of a root may belong to either set (1a) or set (1b); transparent vowels may occur with either set. Typically, harmonic vowels in suffixes alternate, based on the harmonic category of the root: back harmonic roots take back harmonic suffixes, front harmonic roots and those containing only transparent vowels take front vowel suffixes.[3] The transparency of /i/ and /e/ is established by the fact that a preceding back vowel determines back harmony for a following harmonic vowel. Some examples from Steriade (1987b) are provided in (2).

(2)

| | | | 'In' |
|---|---|---|---|
| a. | talo | 'house' | talossa |
| | mykä | 'mute' | mykässä |
| b. | lume | 'snow' | lumessa |
| | Pariisi | 'Paris' | Pariisissa |

The harmonic alternation of the vowel of the inessive case suffix is evident in (2a); the examples of (2b) reveal the patterning of the two transparent vowels.

Loanwords may violate the usual cooccurrence restrictions imposed by vowel harmony: they may contain both front and back harmonic vowels. Steriade (1987b) mentions the following examples of disharmony:

(3)

| | | | | | |
|---|---|---|---|---|---|
| a. | martyyri | 'martyr' | b. | syntaksi | 'syntax' |
| | jonglööri | 'juggler' | | tyranni | 'tyrant' |
| | analyysi | 'analysis' | | följetongi | 'feuilleton' |

The suffix harmony of disharmonic roots is determined by the last harmonic vowel of the root. Accordingly, disharmonic roots like those in (3a) take front harmonic suffixes, those in (3b) back harmonic ones.[4]

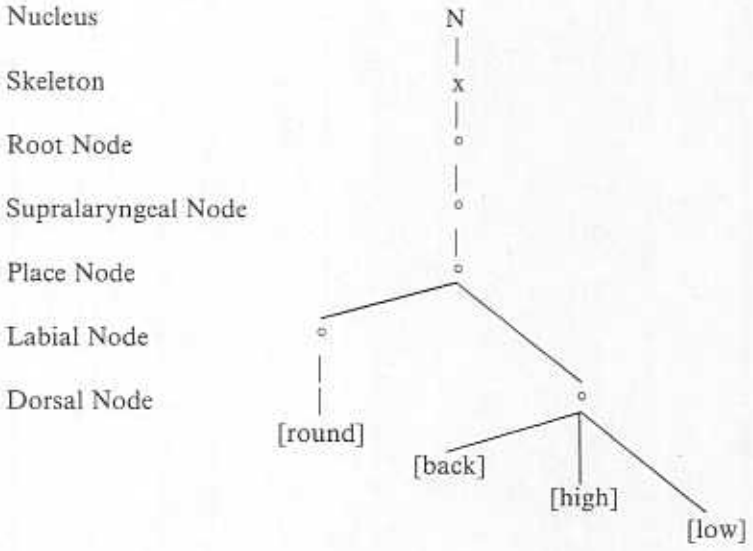
The word games that will be examined impact directly on the three aspects of the Finnish vowel harmony system whose essential and relevant facts have just been exposed: regular harmony, transparent vowels, and disharmony. The underspecification analyses assumed for these topics are discussed next.

### *2.1. Regular Harmony*

Under the strong interpretation of underspecification that is adhered to in most current works (cf. the references cited in section 1), only one value of a distinctive feature is specified underlyingly.[5] With respect to the harmonic feature [back] in Finnish, some analyses argue for [+back] to be the lexical feature (e.g. Kiparsky 1981), others opt for [–back] (e.g. Goldsmith 1985). The present study follows the position that [+back] is specified and spreads lexically and that [–back] is filled in by default; the opposite position appears to be tenable as well, with necessary modifications, to be sure. Ramifications for the lexical value of the feature [back] in Finnish will not be explored here; ultimately, the choice will rest on language internal evidence.

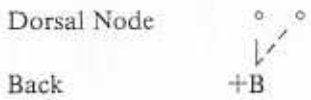
One of the fundamental axioms of underspecification theory is that distinctive features and their class nodes are arrayed on autonomous tiers within a universally defined segment architecture. For some specific proposals on the geometry of phonological features, see Clements (1985), Sagey (1986), Archangeli (1987), Archangeli and Pulleyblank (1986, 1987a, 1987b), and Steriade (1987a) among several others. As regards the Finnish vowel system, it is uncontroversially distinguished by the features [back], [high], [low], and [round]. The hierarchical organization of these features is assumed to be as in (4).

(4)



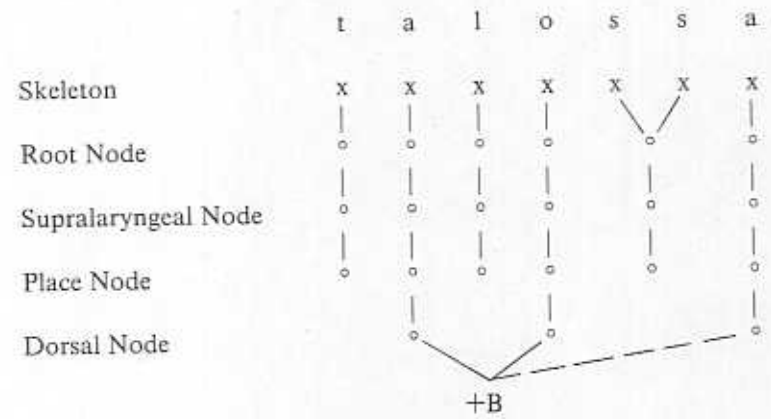

For the argument, given in the next section, concerning the representation of transparent vowels to hold, it is crucial to accept the position that the feature [round] does not dock onto the same class node tier with the other three features. Given the (incomplete) segmental structure in (4), the vowel harmony rule of Finnish is formalized in the following terms:

(5) Back Harmony (BH)




Back Harmony spreads the feature [+back] to a following dorsal node. Since harmonic vowels are targets of the spreading process, they must be represented on the dorsal node tier. On the assumption that class nodes cannot be terminal tiers in the feature hierarchy, harmonic vowels will be characterized by at least one of the features that is dominated by the dorsal node, namely [back], [high], or [low]; see section 2.4. The operation of Back Harmony on the suffix cycle is observed in the sample derivation given in (6).

(6)

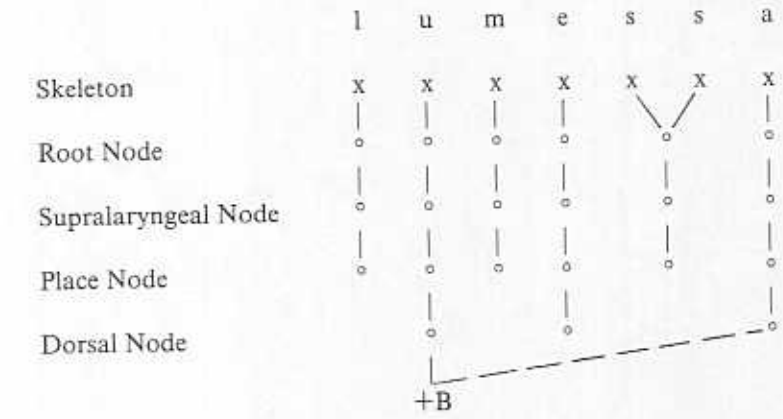



Note that the dorsal node tier is irrelevant for consonants. Tiers not in the path connecting the skeleton and the [back] tier are omitted from consideration.

*2.2. Transparent Vowels*

Underspecification theory explains transparent behavior in geometric terms; see in particular Archangeli and Pulleyblank (1986) and Vago (1988, in preparation). Since transparent vowels (and consonants in general) are neither triggers nor targets of the Back Harmony rule, they will lack representation on the dorsal node tier. This analysis is forced by the Locality Condition, a constraint of underspecification theory proposed by Archangeli and Pulleyblank (1986, 1987a), according to which the trigger and target nodes must be adjacent to each other on the tier where spreading takes place. To see this, consider the application of Back Harmony shown in (7), where the transparent vowel /e/ is represented on the dorsal node tier:

(7)

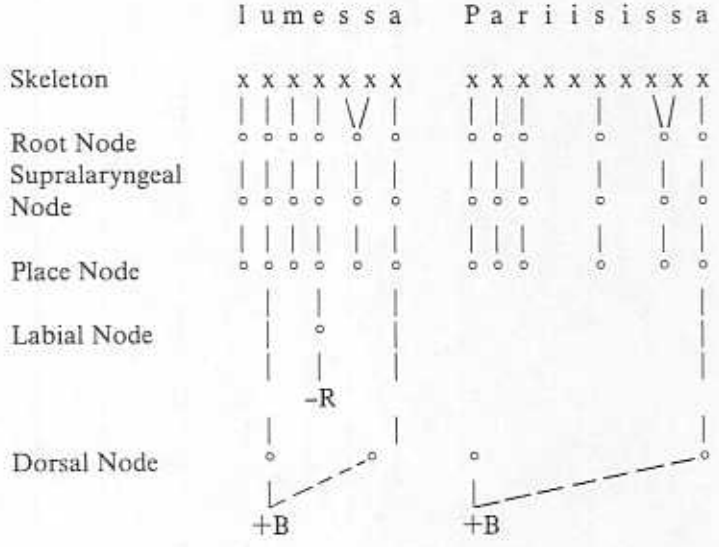


Since the trigger and target nodes are not adjacent on the dorsal node tier, where spreading takes place, the above representation is rendered illicit by the Locality Condition.[6]

If the Finnish transparent vowels have no dorsal nodes, i.e. are not specified for the features [back], [high], and [low], then two possible analyses are left open: (a) they are specified only for the feature [round], which is the only distinctive feature of the Finnish vowel system that does not anchor onto the dorsal node tier; (b) they are completely underspecified for the set of features relevant for vowels and thus have no representation below the skeleton. Since Finnish has two transparent vowels, both possibilities are utilized: one is analyzed in terms of [–round] and no other feature, while the other is specified for no feature at all. This author is aware of no language internal arguments that would force a particular choice. However, on the view that extreme underspecification is the preferred analysis of transparency, and taking into account the fact that in [back] harmony systems /i/ is the quintessential transparent vowel (see for instance Anderson 1980), considering /i/ to be the unspecifed vowel would seem to make sense.

As a consequence of the geometrically construed analysis of transparency, the spreading of [+back] onto the dorsal node tier will operate on adjacent trigger and target nodes. E.g:

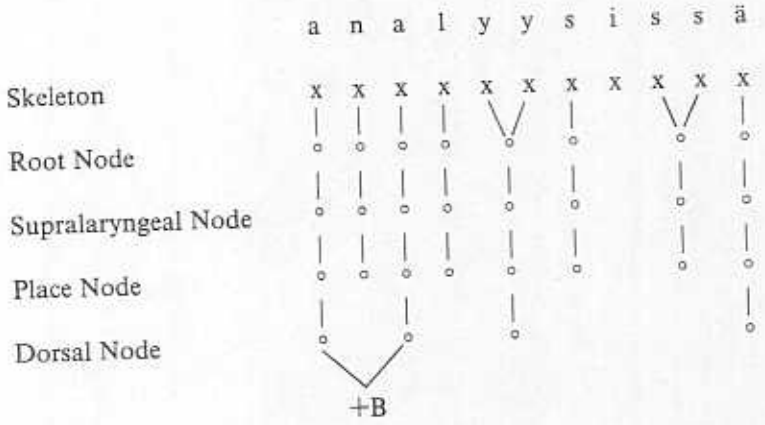
(8)



### *2.3. Disharmony*

In the case of disharmonic roots, back vowels are lexically linked to [+back]; front vowels, as before, are not specified for backness. E.g:

(9)




The Strict Cycle Condition (Kiparsky 1982a) prevents the spreading of the lexically associated [+back] feature root internally to the front vowel /yy/. The Locality Condition in turn prevents spreading to the suffix vowel, since on the dorsal node tier /yy/ intervenes between the trigger back root vowel and the target suffix vowel.[7] Rather, front harmonic /yy/ and /ä/, as well as transparent /i/, become [–back] by default.

The analysis of disharmonic roots whose final harmonic vowel is [+back], as in /syntaksi/, is unproblematical. The [+back] feature of the opaque back vowel does not link to the front root vowel, for either of two reasons: (a) strict cyclicity, as discussed above; (b) Back Harmony does not spread leftward. The Strict Cycle Condition is inoperative on suffix cycles, so [+back] can spread to suffix vowels: cf. for example the inessive inflection /syntaksissa/.

### *2.4. Summary*

We are now in position to set up the underspecified vowel system of Finnish:

(10)

| | i | e | ü | ö | ä | u | o | a |
|---|---|---|---|---|---|---|---|---|
| [back] | | | | | | + | + | + |
| [round] | | – | | | | | | |
| [high] | | | – | – | | | – | – |
| [low] | | | – | – | | – | – | |

The lexical values [+back] and [–round] force [–high] and [–low] to be lexical as well: either lexical values [+high], [+low] would yield nondistinct representations in the vowel system.[8] The features [round], [high], and [low] are specified minimally, allowing for a maximally underspecified vowel system. No vowel is analyzed solely in terms of [+back]; this allows for the possibility to capture root harmony by means of a floating morpheme-sized [+back] feature. This feature becomes associated with the vowels /ü ö ä/ first by a universal linking convention ("one-to-one, left-to-right"; cf. Pulleyblank 1986) and then by the Back Harmony rule given above in (5).[9]

The feature values missing in (10) are supplied by the following default rules:[10]

(11) Default Rules

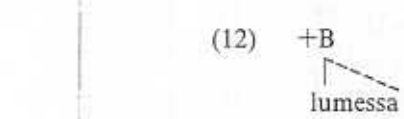
| | | | |
|---|---|---|---|
| a. | [–round] | → | [–low] |
| b. | [–round] | → | [–high] |
| c. | [–low] | → | [+round] |
| d. | [–high] | → | [+low] |
| e. | [ ] | → | [–low] |
| f. | [ ] | → | [+high] |
| g. | [ ] | → | [–round] |
| h. | [ ] | → | [–back] |

Rules (11a,b) are applicable only to the vowel /e/, since at the stage when they apply only /e/ is specified as [–round]. Default rules supply predictable feature values, and as such cannot change an already specified value. This characteristic is evident in the fact that rules (11c,d) do not apply to the vowel /e/; i.e., (11c) does not change the lexical value [–round] and (11d) does not affect the [–low] value that was assigned to /e/ by rule (11a). Rules (11e-h) fill in the remaining predictable feature values.

Default rules are subject to strong constraints, such as prohibiting extrinsic ordering within components and disallowing ternary feature values; see Pulleyblank (1986) for an excellent synthesis of these issues. For immediate purposes we need not be concerned with the specific ordering and component assignments of the default rules in (11), except, of course, for the [–back] default rule (11h). In the next section it will be suggested that rule (11h) applies as early as the game component.[11]

In summary, this section highlighted the assumed analyses of those aspects of the Finnish vowel harmony system for which the word games to be described in the next three sections have direct relevance. To facilitate the exposition of Finnish forms in derivations, segmental structure will be compressed into two tiers only: the [back] tier, represented with the autosegment B, and all other tiers combined, represented with phonemic symbols. E.g:

(12) +B




The above representation indicates the application of the Back Harmony rule. In interpreting such abbreviations, care should be taken to bear in mind the suppressed feature geometry and segmental underspecifications, especially as regards the transparent vowels.

### 3. /tä/ GAME

To play the first game, the consonant /t/ and a low vowel are inserted after the initial syllable of a word. In the case of regular (harmonic) roots, the low vowel is back /a/ if the initial syllable contains a back vowel, front /ä/ otherwise. E.g:

| | | | |
|---|---|---|---|
| (13) | kala | 'fish' | katala |
| | kevät | 'spring' | ketävät |
| | kädessä | 'in hand' | kätädessä |

To account for these facts, the following rule is assigned to the game component of Finnish:[12]

(14) /tä/ Game Rule
Insert /tä/ after the initial syllable of a word.

In effect, the vowel /ä/ derived by rule (14) is unspecified for the feature [back]. To account for the fact that /ä/ undergoes harmony in back harmonic contexts (cf. /katala/), we simply extend the domain of the Back Harmony rule to include not only the lexical phonology but the game component as well. Otherwise, [–back] is assigned to /ä/ by default rule (11h). Of course, other default rules are applicable as well, but we will not be concerned with these.

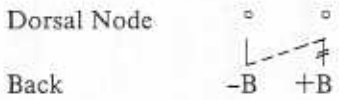
A further consequence of the /tä/ game is that the /tä/ variant induces front harmony in a following back vowel. This is observed in the case of disharmonic loan words whose initial front vowel is followed by a back vowel. E.g:

| | | | | |
|---|---|---|---|---|
| (15) | dösa | 'bus' | → | dötäsä |
| | fyssa | 'physics class' | → | fytässä |

The facts of disharmonic loans that contain a back vowel followed by a front vowel will be discussed in section 5.

The harmonic adjustment of back vowels observed in (15) is derived in two steps. First, the [-back] default rule is active in the game component. And second, the insertion of [-back] default values is followed by a feature-changing Front Harmony rule:

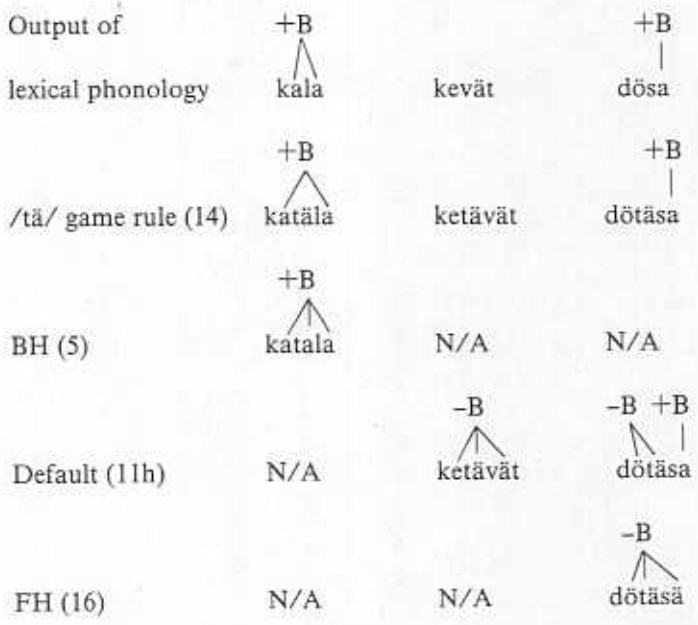
(16) Front Harmony (FH)




If the Redundancy Rule Ordering Constraint of underspecification theory is accepted (cf. Archangeli 1984; Pulleyblank 1986; Archangeli and Pulleyblank 1986), then default rule (11h) is automatically ordered before Front Harmony: the default rule derives the [-back] feature to which Front Harmony refers.

The sample derivations in (17) illustrate the organization of the game component as developed so far:

(17)




It may be noted that Back Harmony is exclusively left to right directional: cf. */dotasa/. Also, whenever appropriate, representations will reflect the effect of the Obligatory Contour Principle (OCP); [13] cf. for example the output of default rule (11h).

That back vowels following the inserted /tä/ undergo reharmony is also evident in the partitive singular inflections of the roots /meri/ 'sea' and /veri/ 'blood'. These roots are predictably front harmonic, except in the partitive singular, where they take the back harmonic variant of the regularly alternating partitive suffix: /merta/, /verta/. In the /tä/ game, these irregularities are removed: /mertätä/, /vertätä/. The explanation of these cases parallels that of /dötäsä/ in (17) above.

4. PIG GERMAN

Another Finnish word game is played according to the following rule:

(18) Pig German Game Rule
Interchange the onset (if any) and nucleus of the initial syllable in each succeeding pair of words.

Campbell gives no specific name to this game; Seppänen refers to it as *Siansaksa* 'Pig German'. Some examples are listed in (19).

(19) a. Saksalaisia hätyytettiin 'the Germans were attacked'
→ häksäläisiä satuutettiin
b. tykkään urheilusta 'I like sports'
→ ukkaan tyrheilystä

It is readily observed that following the interchange, harmonic vowels in non-initial syllables assimilate in backness to the transposed harmonic vowel in the initial syllable. This consequence follows automatically if the Pig German Game Rule precedes the set of rules which spread or specify values for the feaure [back] in the game component; the sequencing of these rules has already been established in the preceding section.

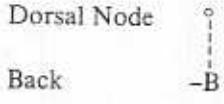
Rule (11h) supplies the default [–back] value to the front harmonic vowels /y ö ä/ as well as to the transparent vowels /i e/. Ordering this rule before Front Harmony makes the prediction that a transposed /i/ or /e/ will induce the fronting of a back vowel in a succeeding syllable, just as a transposed front harmonic vowel does. Apparently, this claim is correct for some dialects, but not others. In Seppänen's description of Pig German, reharmony does in fact obtain: e.g. /leipä taikina/ 'bread dough' becomes /taipa leikinä/. However, Campbell's discussion of the facts indicates that displaced transparent vowels fail to condition reharmony. Cf. the following examples:

(20) a. otsansa hiessä 'in the sweat of his brow' →
hitsansa oessa
b. pitää kalasta 'likes fish' → kataa pilasta

Since in the dialect described by Campbell front harmonic and transparent vowels pattern differently with respect to reharmony, their default specifications should not be derived simultaneously. In particular, front harmonic vowels become linked to [–back] *before* the rule of Front Harmony and thus induce reharmony, but transparent vowels receive their [–back] default values *after* Front Harmony and therefore block reharmony. This analysis, if correct, lends support to Steriade's (1987b) suggestion to distinguish between two kinds of predictable feature values: distinctive vs. redundant. In the present instance, [–back] is distinctive for the front harmonic vowels, redundant for the transparent vowels.

In terms of a formal account, harmonic front vowels undergo the following rule:

(21) Distinctive Default (DD)




The above default rule associates [–back] with a dorsal node which is not linked to the [back] tier. Since it introduces a feature which serves as input to Front Harmony, it is intrinsically ordered before Front Harmony by the Redundancy Rule Ordering Constraint. At the stage when rule (21) applies, only /y ö ä/ have dorsal nodes which are not associated on the [back] tier: /u o a/ are tied to [+back], and ex hypothesi, the transparent vowels /i/ and /e/ have no representation on the dorsal node tier. Following the application of Front Harmony, rule (11h) applies and supplies the [–back] default value of the transparent vowels. In the context of the present discussion, it might serve well to rename this rule:

(22) Redundant Default (RD)
[ ] → –B

Note that if Redundant Default and Front Harmony were assigned to the same component, the Redundancy Rule Ordering Constraint would force Redundant Default to precede Front Harmony. To account for the behavior of transparent vowels in Campbell's dialect, we assign Front Harmony to the game component and Redundant Default to the postlexical component;[14] in Seppänen's dialect, both reside in the game component. (23) summarizes the component assignments of the rules in the two dialects under consideration.

The default rules for the features [high], [low], and [round] are excluded from the list in (23). It should also be noted that in Seppänen's dialect, Distinctive Default precedes Redundant Default by the Elsewhere Condition (Kiparsky 1973a, 1982).[15]

(23)

| Component | Campbell's dialect | Seppänen's dialect |
|---|---|---|
| Lexical | BH (5) | BH (5) |
| Game | Game rules (14; 18)<br>BH (5)<br>DD (21)<br>FH (16) | Game rules (14; 18)<br>BH (5)<br>DD (21)<br>RD (22)<br>FH (16) |
| Postlexical | RD (22) | |

(24) below contains two pertinent derivations in Campbell's dialect of the Pig German word game; derivations in the less interesting variant described by Seppänen should be obvious.

(24)

| | | | | |
|---|---|---|---|---|
| Output of lexical component | tykkään | urheilusta (+B) | pitää | kalasta (+B) |
| Game rule (14) | ukkään (+B) | tyrheilusta (+B) | katää (+B) | pilasta (+B) |
| BH (5) | ukkaan (+B) | tyrheilusta (+B) | kataa (+B) | pilasta (+B) |
| DD (21) | ukkaan (+B) | tyrheilusta (−B +B) | N/A | |
| FH (16) | ukkaan (+B) | tyrheilystä (−B) | N/A | |
| RD (22); OCP | ukkaan (+B) | tyrheilystä (−B) | kataa (+B) | pilasta (−B +B) |

5. /kontti/ GAME

Another Finnish word game impacting on vowel harmony is called *kontti kieli* or *kontin kieli* 'knapsack language':

(25) /kontti/ Game Rule
Place /kontti/ 'knapsack' after a word.

Rule (25) is followed in turn by the Pig German game rule stated above in (18): the onset and nucleus of the initial syllable of /kontti/ and the preceding word are interchanged. The preposed back vowel of /kontti/ then triggers the application of Back Harmony. For instance, the sentence /Hän asuu Helsingissä/ 'he lives in Helsinki' becomes /Hän kontti kon häntti asuu kontti kosuu antti Helsingissä kontti kolsingissa hentti/.

The facts of the /kontti/ game parallel those of Pig German and will therefore receive similar treatment. Some expressions demonstrating the application of Back Harmony and the transparency of /i/ and /e/ are listed in (26).

| (26) | | | | | |
|---|---|---|---|---|---|
| | käy | 'he visits' | kontti | → | kou käntti |
| | mitä | 'what' | kontti | → | kota mintti |
| | nähnyt | 'seen' | kontti | → | kohnut näntti |
| | sikiö | 'embryo' | kontti | → | kokio sintti |
| | pysähtyä | 'to stop' | kontti | → | kosahtua pyntti |
| | menetelmä | 'system' | kontti | → | konetelma mentti |

The source materials on the /kontti/ game include information on the patterning of disharmonic words, with interesting results: the exceptional nature of disharmony with respect to the basic restrictions imposed by vowel harmony is preserved. That is, the non-initial front harmonic vowel of a disharmonic word does not harmonize to the preposed back harmonic vowel of /kontti/, as one might be led to expect on the basis of the patterning of harmonic roots. Cf. the examples in (27).

| (27) | | | | | | |
|---|---|---|---|---|---|---|
| | manööveri | 'manoeuvre' | kontti | → | konööveri | mantti |
| | jonglööri | 'juggler' | kontti | → | konglööri | jontti |
| | klorofylli | 'chlorophyl' | kontti | → | korofylli | kontti |
| | hydrosfääri | 'hydrosphere' | kontti | → | kodrosfääri | hyntti |

The salient fact to be noted concerning disharmonic roots with an initial back vowel is that their root internal exceptionality survives through the game component. Although this fact is not evidenced in the Pig German game, where the sources include no relevant information, we may safely

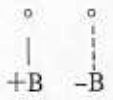
assume this to be the case in view of the fact that in other essential details, such as the patterning of diphthongs and long vowels, the /kontti/ game and the Pig German game have the same phonological consequences.[16]

As discussed in section 2, the back vowels of disharmonic roots are prelinked to [+back]; the Strict Cycle Condition blocks the application of the Back Harmony rule root internally. The facts in (27) clearly show that disharmonic roots do not undergo Back Harmony in the game component either. This fact is further evidenced in the /tä/ game. It will be recalled from section 3 that in this game a disharmonic root of the sort /dösa/ undergoes the rule of Front Harmony and becomes /dötäsä/. However, a back vowel in the initial syllable of a disharmonic root does not induce spreading on the [back] tier. Thus, for instance, /jonglööri/ 'juggler' becomes /jongtälööri/; note that [+back] does not spread to the inserted /tä/ either.

In terms of a formal account, we can prevent the spreading of [+back] from the initial syllable of a disharmonic root by supposing that the following front harmonic vowel is linked to [–back] *prior* to the application of Back Harmony; recall that this rule targets harmonic vowels which are *not* specified for the feature [back]. It is possible to achieve this in the game component via the following rule:

(28) Disharmony

Dorsal Node




Disharmony states that an unassociated (on the [back] tier) harmonic vowel which follows a back vowel becomes front. Following the lexical application of Back Harmony, a back vowel will be succeeded by a dorsal node that is not associated with [+back] only in the case of disharmonic roots; transparent vowels, it will be remembered, have no representation on the dorsal node tier.

As regards the ordering of Disharmony, the following relations are noteworthy: it bleeds Back Harmony; it precedes the /kontti/ and Pig German game rules, since [+back] spreads in the case of harmonic roots; it follows the /tä/ game rule – this explains the frontness of /tä/ in cases like /jongtälööri/;[17] it precedes the Distinctive Default rule (21) within the game component by the Elsewhere Condition.

The derivations in (29) should suffice to exemplify the account of disharmonic roots advocated here. They will also serve to illustrate the final list of rules proposed, as required for the three word games considered.

(29) *GAME COMPONENT*

| | | |
|---|---|---|
| Output of lexical component | +B \| jonglööri | +B \| jonglööri |
| /tä/ game (14) | +B \| jongtälööri | — |
| Disharmony (28) | +B –B \| \| jongtälööri | +B –B \| ↗ jonglööri |
| /kontti/ game (25) | -- | +B –B +B \| ↗ \| jonglööri kontti |
| Pig German game (18) | — | +B –B +B \| ↗ \| konglööri jontti |
| BH (5) | N/A | N/A |
| DD (21); OCP | +B –B \| ↖ jongtälööri | N/A |
| FH (16) | N/A | N/A |

*POSTLEXICAL COMPONENT*

| | | | |
|---|---|---|---|
| RD (22); OCP | +B –B \| ↖ jongtälööri | +B –B \| ↗ konglööri | +B –B \| \| jontti |

It will be noted that in the current analysis there are three sources for the feature [–back]: Disharmony, Distinctive Default, and Redundant Default. Each rule is active in the derivation of /jongtälööri/ above.

Finally, it should be clear that the entire game component is optional for the grammar of Finnish. Of its contents, only the Back Harmony and Distinctive Default rules belong to the natural language; the former is relegated to the lexical component, the latter to the postlexical (or phonetic)

component, to precede the Redundant Default rule. Presumably, the /tä/ game on the one hand and the /kontti/ and Pig German games on the other are mutually exclusive. Further, playing the /kontti/ game entails playing the Pig German game; it makes no difference whether this fact is expressed in the form of incorporating the Pig German game rule into the /kontti/ game rule, or by means of rule ordering, as practised here.[18]

## 6. CONCLUSION

This paper was concerned with an underspecification analysis of the patterning of vowel harmony in three Finnish word games. The facts were described within an independent game component presumed for the grammar of Finnish. This component was found to contain special rules added to a set of natural language rules. Transparency presented the most interesting cases for rule interaction. The relevant facts strongly suggest that transparent vowels and harmonic vowels receive their default specifications separately.

## NOTES

1. Pulleyblank (1986) suggests that the postlexical component serves as input to a separate phonetic component. The distinction between the postlexical and phonetic components will, for the most part, be ignored here.
2. For detailed accounts of the facts of Finnish vowel harmony, including discussion of problems posed for pre-autosegmental, linear phonological theory, see especially Kiparsky (1973b), Anderson (1975, 1980), Ringen (1975, 1980), and Campbell (1980, 1981), among others.
3. However, certain derivational suffixes have back vowels following roots containing only neutral vowels; see for instance Rardin (1969).
4. In prestigious speech styles disharmonic roots of the sort in (3a) can take back harmonic suffixes. In these situations the front vowels /y/ and /ö/, and perhaps /ä/ as well, seem to behave as if they were transparent; see Campbell (1980, 1981) and Kiparsky (1981). The treatment of such cases is not straightforward and will not be considered here. For some suggestions, in widely different autosegmental models, see Kiparsky (1981), Halle and Vergnaud (1981), Vago (1984), and Steriade (1987b).
5. A notable exception is Steriade (1987b), who allows for the possibility of specifying both values lexically.
6. One might suppose that transparent vowels are in fact targets of harmonic spreading and undergo late neutralization. However, this "abstract" analysis of transparency is not available universally. For discussion, see Vago (1985a, in preparation).
7. The above analysis of disharmony follows that proposed by Kiparsky (1981), with one exception: Kiparsky accounts for the failure of spreading to suffixes in cases like

/analyysissä/ by an opacity filter. Steriade (1987b), on the other hand, fills in the [-back] value of front harmonic vowels *before* spreading [+back] to suffixes; spreading is feature-changing in cases like /syntaksissa/. Invoking the Locality Condition would seem to accord a more principled explanation here.

8. Specifically, under the assumption that [+back] and [-round] are lexical values, and keeping in mind that /i/ and /e/ are unspecified for [high] and [low], postulating [+high] and/or [+low] lexically has the following consequences: [+high], [-low] leaves /i/ and /ä/ nondistinct; [+high], [+low] leaves /i/ and /ö/ nondistinct; and [-high], [+low] leaves /i/ and /ü/ nondistinct.

9. Detailed arguments in favor of considering harmonic features to be the property of morphemes (= floating features) can be found in such works as Archangeli and Pulleyblank (1987b) and Vago (1988, in preparation).

10. The term "default" is used here in a generic sense as a cover for Archangeli's (1984) default/complement distinction.

11. Default rules have one further characteristic that is worth attention: they automatically trigger node generation (cf. Sagey 1986). Thus for instance, rules (11e–h) supply the default values of the unspecified vowel /i/ as well, even though /i/ lacks the class nodes which dominate the output features.

12. The rules of the word games discussed in this paper are stated informally.

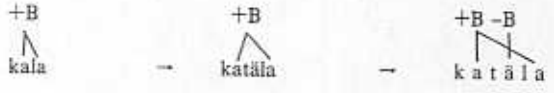
13. This well-known constraint was originally proposed by Leben (1973). For recent discussion, see McCarthy (1986) and Odden (1986).

14. We might follow the position advocated by Halle and Mohanan (1985) that, unless evidence exists to the contrary, default/redundancy rules (as well as phonological rules) are assigned to the last component of grammar. Accordingly, in the absence of contradictory evidence, the Redundant Default rule (22) would apply in the phonetic rather than postlexical component of Campbell's dialect.

15. An alternative view would be that Seppänen's dialect lacks Distinctive Default, Campbell's dialect Redundant Default. In the latter case, Distinctive Default would reapply automatically in the postlexical component, once a dorsal node is generated for transparent vowels via the application of the default rules in (11). See Pulleyblank (1986) and Archangeli and Pulleyblank (1986, 1987b) for motivating the claim that default rules reapply whenever their structural description is met subsequent to their initial application.

16. See Vago (1985b) for a formal treatment of diphthongs and long vowels in the /kontti/ word game.

17. In the case of back harmonic roots like /kala/, the structural description of Disharmony is met subsequent to the insertion of /tä/. However, the prohibition against crossing association lines appears to be sufficient to prevent the application of Disharmony:




Rather, correct /katala/ is obtained as a result of Back Harmony.

Alternatively, a constraint is built into Disharmony to the effect that the [+back] feature is not linked to the right.

18. The analysis of disharmonic roots developed above makes a number of predictions which cannot be tested, due to incomplete data in the source descriptions. For instance, it is expected that /tä/ would show up following a monosyllabic root with a back harmonic vowel: here Disharmony is applicable to /tä/. Similarly, in the /kontti/ and Pig German games the front harmonic vowel of a disharmonic root having the vowel sequence /{i, e}...{y, ö, ä}...{u, o, a}/ is expected to harmonize to a preposed back harmonic vowel in the initial

syllable: here Disharmony is inapplicable. Should these predictions turn out not to be correct, some form of exception devices, such as extraprosodicity or root-sized exception features, might need to be resorted to.

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