Class 8
Assimilation 3

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Bukusu

Consonant alternations in Bukusu

- The following data comes from Bukusu (Kenya, Bantu).

Imperative	3pl pres.	1sg pres.	Gloss
ʧa	βaʧa	ɲʤa	'go'
ʧexa	βaʧexa	ɲʤexa	'laugh'
ʧuʧuːŋga	βaʧuʧuːŋga	ɲʤuʧuːŋga	'sieve'
talaːnda	βatalaːnda	ndalaːnda	'go around'
teːxa	βateːxa	ndeːxa	'cook'
tiːra	βatiːra	ndiːra	'get ahold of'
piːma	βapiːma	mbiːma	'weigh'
pakala	βapakala	mbakala	'writhe in pain'
ketulula	βaketulula	ŋgetulula	'pour out'
kona	βakona	ŋgona	'pass the night'
kula	βakula	ŋgula	'buy'
kwa	βakwa	ŋgwa	'fall'

Bukusu

Consonant alternations in Bukusu

⋆ **What is the morpheme that expresses 3pl pres.?**

Imperative	3pl pres.	1sg pres.	Gloss
ʧa	βaʧa	ɲɟa	'go'
ʧexa	βaʧexa	ɲɟexa	'laugh'
ʧuʧuːŋga	βaʧuʧuːŋga	ɲɟuʧuːŋga	'sieve'
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Bukusu

Consonant alternations in Bukusu

⋆ **What is the morpheme that expresses 3pl pres.? /βa-/**

Imperative	3pl pres.	1sg pres.	Gloss
ʧa	βa-ʧa	ɲɟa	'go'
ʧexa	βa-ʧexa	ɲɟexa	'laugh'
ʧuʧuːŋga	βa-ʧuʧuːŋga	ɲɟuʧuːŋga	'sieve'
talaːnda	βa-talaːnda	ndalaːnda	'go around'
teːxa	βa-teːxa	ndeːxa	'cook'
tiːra	βa-tiːra	ndiːra	'get ahold of'
piːma	βa-piːma	mbiːma	'weigh'
pakala	βa-pakala	mbakala	'writhe in pain'
ketulula	βa-ketulula	ŋgetulula	'pour out'
kona	βa-kona	ŋgona	'pass the night'
kula	βa-kula	ŋgula	'buy'
kwa	βa-kwa	ŋgwa	'fall'

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Consonant alternations in Bukusu

⋆ **Do we observe any alternations when we add this morpheme?**

Imperative	3pl pres.	1sg pres.	Gloss
ʧa	βa-ʧa	ɲɟa	'go'
ʧexa	βa-ʧexa	ɲɟexa	'laugh'
ʧuʧuːŋga	βa-ʧuʧuːŋga	ɲɟuʧuːŋga	'sieve'
talaːnda	βa-talaːnda	ndalaːnda	'go around'
teːxa	βa-teːxa	ndeːxa	'cook'
tiːra	βa-tiːra	ndiːra	'get ahold of'
piːma	βa-piːma	mbiːma	'weigh'
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kona	βa-kona	ŋgona	'pass the night'
kula	βa-kula	ŋgula	'buy'
kwa	βa-kwa	ŋgwa	'fall'

Bukusu

Consonant alternations in Bukusu

⋆ **Do we observe any alternations when we add this morpheme? No.**

Imperative	3pl pres.	1sg pres.	Gloss
ʧa	βa-ʧa	ɲʤa	'go'
ʧexa	βa-ʧexa	ɲʤexa	'laugh'
ʧuʧuːŋga	βa-ʧuʧuːŋga	ɲʤuʧuːŋga	'sieve'
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teːxa	βa-teːxa	ndeːxa	'cook'
tiːra	βa-tiːra	ndiːra	'get ahold of'
piːma	βa-piːma	mbiːma	'weigh'
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kwa	βa-kwa	ŋgwa	'fall'

Bukusu

Bukusu 1sg pres.

- Let's focus on the 1sg pres. **What's going on?**

Imperative	1sg pres.
ʧa	ɲʤa
ʧexa	ɲʤexa
ʧuʧuːŋga	ɲʤuʧuːŋga
talaːnda	ndalaːnda
teːxa	ndeːxa
tiːra	ndiːra
piːma	mbiːma
pakala	mbakala
ketulula	ŋgetulula
kona	ŋgona
kula	ŋgula
kwa	ŋgwa

Bukusu

Bukusu 1sg pres.

- Let's focus on the 1sg pres. **What's going on?**

Imperative	1sg pres.
ʧa	ɲ-ʤa
ʧexa	ɲ-ʤexa
ʧuʧuːŋga	ɲ-ʤuʧuːŋga
talaːnda	n-dalaːnda
teːxa	n-deːxa
tiːra	n-diːra
piːma	m-biːma
pakala	m-bakala
ketulula	ŋ-getulula
kona	ŋ-gona
kula	ŋ-gula
kwa	ŋ-gwa

- The initial segments of the roots become **voiced**.
- A **nasal** consonant is added before the root. These appear to be prefixes.

⋆ **How do we explain the voicing?**

Bukusu

Post-nasal voicing

- Let's focus on the 1sg pres. **What's going on?**

Imperative	1sg pres.
ʧa	ɲ-ʤa
ʧexa	ɲ-ʤexa
ʧuʧuːŋga	ɲ-ʤuʧuːŋga
talaːnda	n-dalaːnda
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kula	ŋ-gula
kwa	ŋ-gwa

- Voiceless obstruents become voiced after a nasal.

(1) /−voice,−son/ → [+voice] / [+nasal]_

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Post-nasal voicing

- Let's focus on the 1sg pres. **What's going on?**

Imperative	1sg pres.
ʧa	ɲ-ʤa
ʧexa	ɲ-ʤexa
ʧuʧuːŋga	ɲ-ʤuʧuːŋga
talaːnda	n-dalaːnda
teːxa	n-deːxa
tiːra	n-diːra
piːma	m-biːma
pakala	m-bakala
ketulula	ŋ-getulula
kona	ŋ-gona
kula	ŋ-gula
kwa	ŋ-gwa

- Voiceless obstruents become voiced after a nasal.

(1) /−voice,−son/ → [+voice] / [+nasal]_

⋆ **Is this a general rule of the language?**

Bukusu

Post-nasal voicing

- Let's focus on the 1sg pres. **What's going on?**

Imperative	1sg pres.
ʧa	ɲ-ʤa
ʧexa	ɲ-ʤexa
ʧuʧuːŋga	ɲ-ʤuʧuːŋga
talaːnda	n-dalaːnda
teːxa	n-deːxa
tiːra	n-diːra
piːma	m-biːma
pakala	m-bakala
ketulula	ŋ-getulula
kona	ŋ-gona
kula	ŋ-gula
kwa	ŋ-gwa

- Voiceless obstruents become voiced after a nasal.

(1) /−voice,−son/ → [+voice] / [+nasal]_

⋆ **Is this a general rule of the language?**

- Yes. Whenever we see an obstruent after a nasal, it's always voiced.

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Voicing in obstruents

- Let's focus on the 1sg pres. **What's going on?**

Imperative	1sg pres.
ʧa	**ɲ-ʤ**a
ʧexa	**ɲ-ʤ**exa
ʧuʧuːŋga	**ɲ-ʤ**uʧuːŋga
talaːnda	**n-d**alaːnda
teːxa	**n-d**eːxa
tiːra	**n-d**iːra
piːma	**m-b**iːma
pakala	**m-b**akala
ketulula	**ŋ-g**etulula
kona	**ŋ-g**ona
kula	**ŋ-g**ula
kwa	**ŋ-g**wa

⋆ **Is voicing in obstruents contrastive in the language?** (That is, can you predict whether an obstruent will be voiced or voiceless depending on its position?)

Bukusu

Voicing in obstruents

- Let's focus on the 1sg pres. **What's going on?**

Imperative	1sg pres.
ʧa	**ɲ-ʤ**a
ʧex**k**a	**ɲ-ʤ**ex**k**a
ʧu**ʧ**u:**ŋg**a	**ɲ-ʤ**u**ʧ**u:**ŋg**a
tala:**nd**a	**n-d**ala:**nd**a
te:**x**a	**n-d**e:**x**a
ti:ra	**n-d**i:ra
pi:ma	**m-b**i:ma
pa**k**ala	**m-b**a**k**ala
ke**t**ulula	**ŋ-g**e**t**ulula
kona	**ŋ-g**ona
kula	**ŋ-g**ula
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tala:**nd**a	**n-d**ala:**nd**a
te:**x**a	**n-d**e:**x**a
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ke**t**ulula	**ŋ-g**e**t**ulula
kona	**ŋ-g**ona
kula	**ŋ-g**ula
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⋆ **Is voicing in obstruents contrastive in the language?** (That is, can you predict whether an obstruent will be voiced or voiceless depending on its position?)

- Voicing in obstruents is **not contrastive**. (It **is predictable**.)

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Voicing in obstruents

- Let's focus on the 1sg pres. **What's going on?**

Imperative	1sg pres.
tʃa	**ɲ-dʒ**a
tʃex**x**a	**ɲ-dʒ**ex**x**a
tʃuʧu:**ŋg**a	**ɲ-dʒ**uʧu:**ŋg**a
tala:**nd**a	**n-d**ala:**nd**a
te:**x**a	**n-d**e:**x**a
ti:ra	**n-d**i:ra
pi:ma	**m-b**i:ma
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- Voicing in obstruents is **not contrastive**. (It **is predictable**.)

⋆ **What kind of distribution are the voiced and voiceless obstruents in?**

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Voicing in obstruents

- Let's focus on the 1sg pres. **What's going on?**

Imperative	1sg pres.
ʧa	**ɲ-ʤ**a
ʧe**x**a	**ɲ-ʤ**e**x**a
ʧu**ʧ**u:**ŋg**a	**ɲ-ʤ**u**ʧ**u:**ŋg**a
tala:**nd**a	**n-d**ala:**nd**a
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⋆ **Is voicing in obstruents contrastive in the language?** (That is, can you predict whether an obstruent will be voiced or voiceless depending on its position?)

- Voicing in obstruents is **not contrastive**. (It **is predictable**.)

⋆ **What kind of distribution are the voiced and voiceless obstruents in?**

- Complementary.

Bukusu

Voicing in obstruents

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tʃa	**ɲ-dʒ**a
tʃe**x**a	**ɲ-dʒ**e**x**a
tʃu**tʃ**u:**ŋg**a	**ɲ-dʒ**u**tʃ**u:**ŋg**a
tala:**nd**a	**n-d**ala:**nd**a
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- Our voicing rule already told us this:

(1) /−voice,−son/ → [+voice] / [+nasal]_

↪ The only place in the language we ever get a voiced obstruent is after a nasal.

Bukusu

Voicing in obstruents

- Let's focus on the 1sg pres. **What's going on?**

Imperative	1sg pres.
ʧa	**ɲ-ʤ**a
ʧex**k**a	**ɲ-ʤ**ex**k**a
ʧu**ʧ**u:**ŋg**a	**ɲ-ʤ**u**ʧ**u:**ŋg**a
tala:**nd**a	**n-d**ala:**nd**a
te:**x**a	**n-d**e:**x**a
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pa**k**ala	**m-b**a**k**ala
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- Our voicing rule already told us this:

(1) $/-\text{voice},-\text{son}/ \rightarrow [+\text{voice}] \;/\; [+\text{nasal}]\_$

↪ The only place in the language we ever get a voiced obstruent is after a nasal.

⋆ **So, which obstruents are phonemes in the language?**

Bukusu

Voicing in obstruents

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ʧa	**ɲ-ʤ**a
ʧex**k**a	**ɲ-ʤ**ex**k**a
ʧu**ʧ**u:**ŋg**a	**ɲ-ʤ**u**ʧ**u:**ŋg**a
tala:**nd**a	**n-d**ala:**nd**a
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Bukusu

Voicing in obstruents

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ʧex**k**a	**ɲ-ʤ**ex**g**a
ʧu**ʧ**u:**ŋg**a	**ɲ-ʤ**u**ʧ**u:**ŋg**a
tala:**nd**a	**n-d**ala:**nd**a
te:**x**a	**n-d**e:**x**a
ti:ra	**n-d**i:ra
pi:ma	**m-b**i:ma
pa**k**ala	**m-b**a**k**ala
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- Our voicing rule already told us this:

(1) /−voice,−son/ → [+voice] / [+nasal]_

↪ The only place in the language we ever get a voiced obstruent is after a nasal.

⋆ **So, which obstruents are phonemes in the language?** /p,t,ʧ,k,x/

- Are any of these phonemes in complementary distribution?

Bukusu

Voicing in obstruents

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Imperative	1sg pres.
ʧa	**ɲ-ʤ**a
ʧe**x**a	**ɲ-ʤ**e**x**a
ʧu**ʧ**u:**ŋg**a	**ɲ-ʤ**u**ʧ**u:**ŋg**a
tala:**nd**a	**n-d**ala:**nd**a
te:**x**a	**n-d**e:**x**a
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- Our voicing rule already told us this:

(1) /−voice,−son/ → [+voice] / [+nasal]_

↪ The only place in the language we ever get a voiced obstruent is after a nasal.

⋆ **So, which obstruents are phonemes in the language?** /p,t,ʧ,k,x/

- Are any of these phonemes in complementary distribution?
- No. They all appear in the same environment. **Place** is contrastive for obstruents.

Bukusu

The nasals

- Now let's focus on the nasals.

Imperative	1sg pres.
ʧa	**ɲ-ʤ**a
ʧe**x**a	**ɲ-ʤ**e**x**a
ʧu**ʧ**u:**ŋg**a	**ɲ-ʤ**u**ʧ**u:**ŋg**a
tala:**nd**a	**n-d**ala:**nd**a
te:**x**a	**n-d**e:**x**a
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ke**t**ulula	**ŋ-g**e**t**ulula
kona	**ŋ-g**ona
kula	**ŋ-g**ula
kwa	**ŋ-g**wa

- It looks like we have four different nasal prefixes: [ɲ-], [n-], [m-], [ŋ-]

⋆ **Can we make any generalizations about their distribution?**

Bukusu

The nasals

- Now let's focus on the nasals.

Imperative	1sg pres.
ʧa	ɲ-ʤa
ʧexa	ɲ-ʤexa
ʧuʧuːŋga	ɲ-ʤuʧuːŋga
talaːnda	n-dalaːnda
teːxa	n-deːxa
tiːra	n-diːra
piːma	m-biːma
pakala	m-bakala
ketulula	ŋ-getulula
kona	ŋ-gona
kula	ŋ-gula
kwa	ŋ-gwa

- It looks like we have four different nasal prefixes: [ɲ-], [n-], [m-], [ŋ-]

⋆ **Can we make any generalizations about their distribution?**

- Palatal [ɲ-] appears before the palatal obstruent [ʤ] (← /ʧ/).
- Alveolar [n-] appears before the alveolar obstruent [d] (← /t/).
- Bilabial [m-] appears before the bilabial obstruent [b] (← /p/).
- Velar [ŋ-] appears before the velar obstruent [g] (← /k/).

Bukusu

The nasals

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Imperative	1sg pres.
ʧa	**ɲ-ʤ**a
ʧexa	**ɲ-ʤ**exa
ʧu**ʧ**u:**ŋg**a	**ɲ-ʤ**u**ʧ**u:**ŋg**a
tala:**nd**a	**n-d**ala:**nd**a
te:**x**a	**n-d**e:**x**a
ti:ra	**n-d**i:ra
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ke**t**ulula	**ŋ-g**e**t**ulula
kona	**ŋ-g**ona
kula	**ŋ-g**ula
kwa	**ŋ-g**wa

- It looks like we have four different nasal prefixes: [ɲ-], [n-], [m-], [ŋ-]

⋆ **Can we make any generalizations about their distribution?**

(2) /+nasal/ → [palatal] / _[palatal,−son]

(3) /+nasal/ → [alveolar] / _[alveolar,−son]

(4) /+nasal/ → [bilabial] / _[bilabial,−son]

(5) /+nasal/ → [velar] / _[velar,−son]

Bukusu

The nasals

- Now let's focus on the nasals.

Imperative	1sg pres.
tʃa	**ɲ-dʒ**a
tʃex**a**	**ɲ-dʒ**ex**a**
tʃu**tʃ**u:**ŋg**a	**ɲ-dʒ**u**tʃ**u:**ŋg**a
tala:**nd**a	**n-d**ala:**nd**a
te:**x**a	**n-d**e:**x**a
ti:ra	**n-d**i:ra
pi:ma	**m-b**i:ma
pa**k**ala	**m-b**a**k**ala
ke**t**ulula	**ŋ-g**e**t**ulula
kona	**ŋ-g**ona
kula	**ŋ-g**ula
kwa	**ŋ-g**wa

- It looks like we have four different nasal prefixes: [ɲ-], [n-], [m-], [ŋ-]

⋆ **Can we make any generalizations about their distribution?**

(2) /+nasal/ → [palatal] / _[palatal,−son]

(3) /+nasal/ → [alveolar] / _[alveolar,−son]

(4) /+nasal/ → [bilabial] / _[bilabial,−son]

(5) /+nasal/ → [velar] / _[velar,−son]

⋆ **What are we missing?**

Bukusu

Nasal place assimlation

- Now let's focus on the nasals.

Imperative	1sg pres.
ʧa	ɲ-ʤa
ʧexa	ɲ-ʤexa
ʧuʧuːŋga	ɲ-ʤuʧuːŋga
talaːnda	n-dalaːnda
teːxa	n-deːxa
tiːra	n-diːra
piːma	m-biːma
pakala	m-bakala
ketulula	ŋ-getulula
kona	ŋ-gona
kula	ŋ-gula
kwa	ŋ-gwa

(2) /+nasal/ → [palatal] / _[palatal,−son]

(3) /+nasal/ → [alveolar] / _[alveolar,−son]

(4) /+nasal/ → [bilabial] / _[bilabial,−son]

(5) /+nasal/ → [velar] / _[velar,−son]

- In each instance, the nasal is taking on the **place** of the following obstruent.

  → This is **nasal place assimlation**.

Bukusu

Nasal place assimlation

- Now let's focus on the nasals.

Imperative	1sg pres.
ʧa	ɲ-ʤa
ʧexa	ɲ-ʤexa
ʧuʧuːŋga	ɲ-ʤuʧuːŋga
talaːnda	n-dalaːnda
teːxa	n-deːxa
tiːra	n-diːra
piːma	m-biːma
pakala	m-bakala
ketulula	ŋ-getulula
kona	ŋ-gona
kula	ŋ-gula
kwa	ŋ-gwa

(2) /+nasal/ → [palatal] / _[palatal,−son]

(3) /+nasal/ → [alveolar] / _[alveolar,−son]

(4) /+nasal/ → [bilabial] / _[bilabial,−son]

(5) /+nasal/ → [velar] / _[velar,−son]

- In each instance, the nasal is taking on the **place** of the following obstruent.
  → This is **nasal place assimlation**.

⋆ **How can we implement this in rules?**

Bukusu

Alpha notation

- Now let's focus on the nasals.

Imperative	1sg pres.
ʧa	ɲ-ʤa
ʧexa	ɲ-ʤexa
ʧuʧuːŋga	ɲ-ʤuʧuːŋga
talaːnda	n-dalaːnda
teːxa	n-deːxa
tiːra	n-diːra
piːma	m-biːma
pakala	m-bakala
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(2) /+nasal/ → [palatal] / _[palatal,−son]

(3) /+nasal/ → [alveolar] / _[alveolar,−son]

(4) /+nasal/ → [bilabial] / _[bilabial,−son]

(5) /+nasal/ → [velar] / _[velar,−son]

- We can introduce a *variable* over different values of place: e.g. α

(6) /+nasal/ → [αPLACE] / _[αPLACE,−son]

∗ This means that the notion "PLACE" is something that we must be able to reference in our rules.

Feature geometry

The PLACE node

⋆ **What are the implications of using [αplace] in our analysis?**

Feature geometry

The PLACE node

⋆ **What are the implications of using [αplace] in our analysis?**

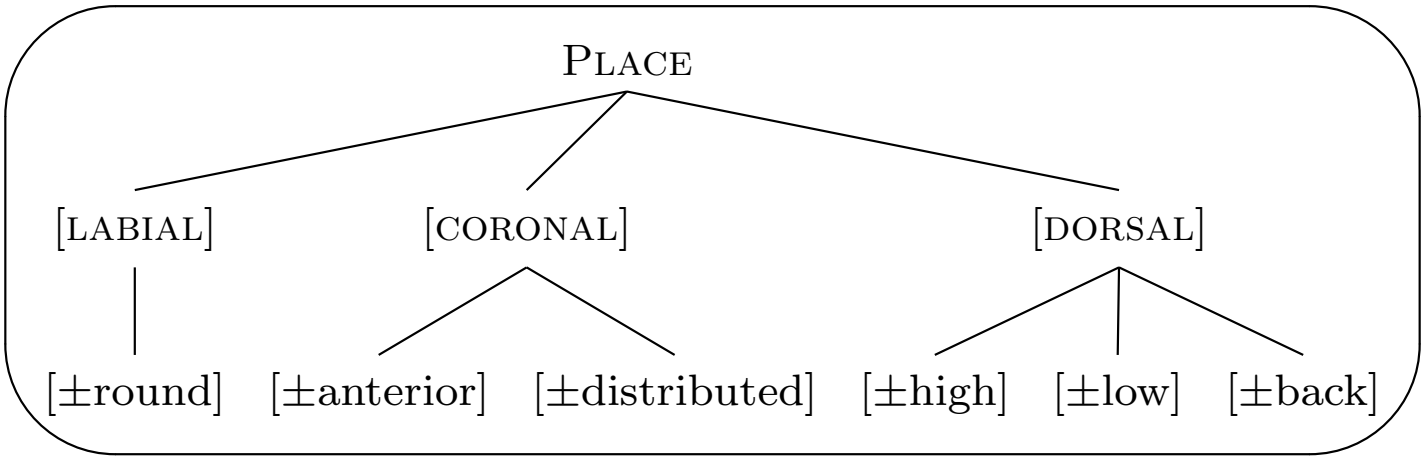
→ There must be a PLACE "node" that contains all of the different possible values of place of articulation.

- This typically gets implemented using **feature geometry**.

Feature geometry

Feature geometry

- There are many different theories/versions of feature geometry. A typical one is the following:

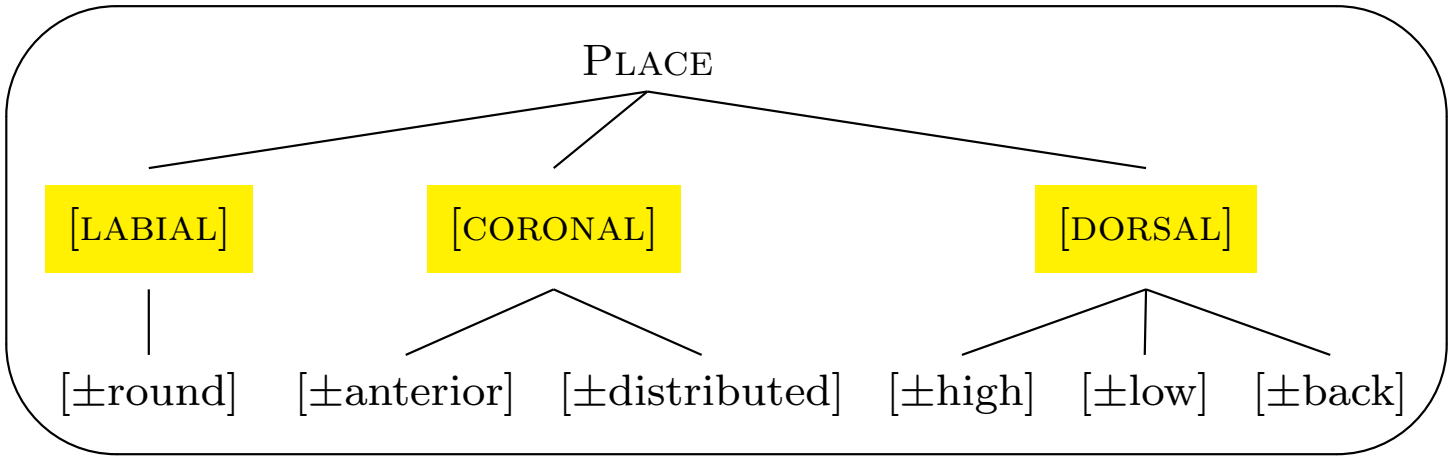


- All of the features that determine place of articulation are (directly or indirectly) dependent on a single PLACE node.

Feature geometry

Major place features

- There are many different theories/versions of feature geometry. A typical one is the following:

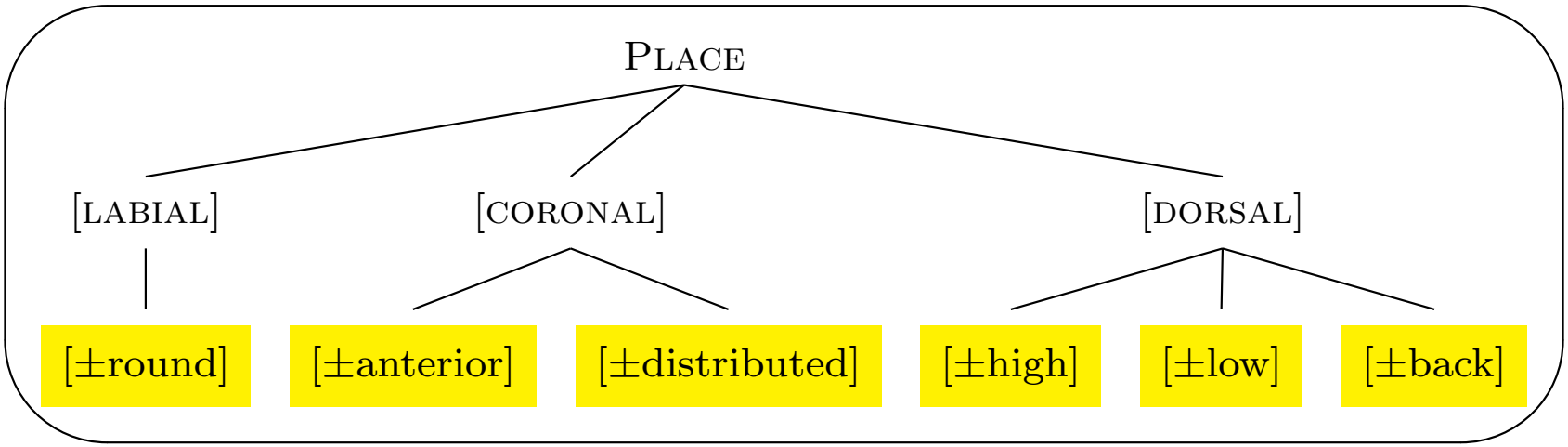


- The PLACE node *dominates* the major places: labial, coronal, dorsal.
  - These features are "privative". They don't have [+/−] values; they are either present or absent.
  - This is because we normally don't find natural classes defined by, e.g., "not coronal". (Though Kipsigis may give evidence against this view.)

Feature geometry

Minor place features

- There are many different theories/versions of feature geometry. A typical one is the following:

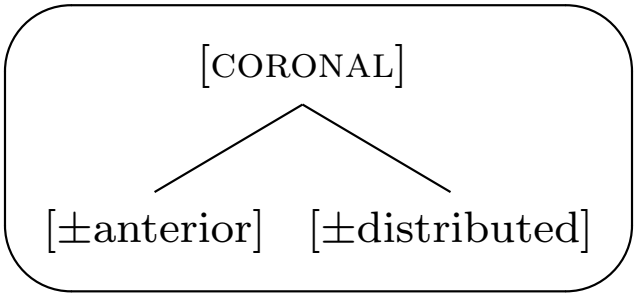


- These major places are nodes themselves.
  - They dominate additional features that subdivide the major places.
  - These features are all binary.
- These features are only specified for consonants that are specified for the major place they depend on.

Feature geometry

Coronal features

- Coronal consonants can be specified for two minor place features: [±anterior] and [±distributed].



- The 2×2 combinations of these features accounts for the four minor coronal places:

	[+**anterior**]	[−**anterior**]
[+**distributed**]	(inter)dental	postalveolar/palatal
[−**distributed**]	alveolar	retroflex

Feature geometry

Anterior

- [±anterior] refers to the position within the coronal region where the articulation is made:

	[+**anterior**]	[−**anterior**]
[+**distributed**]	(inter)dental	postalveolar/palatal
[−**distributed**]	alveolar	retroflex

Feature geometry

Anterior

- [±anterior] refers to the position within the coronal region where the articulation is made:
  - [+anterior] signifies articulations in the front part of that region (at or in front of the alveolar ridge).

	[+anterior]	**[−anterior]**
[+distributed]	(inter)dental	postalveolar/palatal
[−distributed]	alveolar	retroflex

Feature geometry

Anterior

- [±anterior] refers to the position within the coronal region where the articulation is made:
  - [+anterior] signifies articulations in the front part of that region (at or in front of the alveolar ridge).
  - [−anterior] signifies articulations in the rear part of that region (behind the alveolar ridge).

	[+**anterior**]	[−**anterior**]
[+**distributed**]	(inter)dental	postalveolar/palatal
[−**distributed**]	alveolar	retroflex

Feature geometry

Distributed

- [±distributed] refers to which part of the front of the tongue is used to make the articulation:

	[+**anterior**]	[−**anterior**]
[+**distributed**]	(inter)dental	postalveolar/palatal
[−**distributed**]	alveolar	retroflex

Feature geometry

Distributed

- [±distributed] refers to which part of the front of the tongue is used to make the articulation:
  - [+distributed] signifies articulations made with the tongue blade.

	[+**anterior**]	[−**anterior**]
[+**distributed**]	(inter)dental	postalveolar/palatal
[−**distributed**]	alveolar	retroflex

Feature geometry

Distributed

- [±distributed] refers to which part of the front of the tongue is used to make the articulation:
  - [+distributed] signifies articulations made with the tongue blade.
  - [−distributed] signifies articulations made with the tongue tip.

	[+**anterior**]	[−**anterior**]
[+**distributed**]	(inter)dental	postalveolar/palatal
[−**distributed**]	alveolar	retroflex

What's the UR in Bukusu?

Bukusu again

- Here's Bukusu again. We figured out the rule (6), but did we ever determine what the UR of the nasal prefix was?

Imperative	1sg pres.
ʧa	ɲ-ʤa
ʧexa	ɲ-ʤexa
ʧuʧuːŋga	ɲ-ʤuʧuːŋga
talaːnda	n-dalaːnda
teːxa	n-deːxa
tiːra	n-diːra
piːma	m-biːma
pakala	m-bakala
ketulula	ŋ-getulula
kona	ŋ-gona
kula	ŋ-gula
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(6) /+nasal/ → [αPLACE] / _[αPLACE,−son]

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ʧexa	ɲ-ʤexa
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tala:nda	n-dala:nda
te:xa	n-de:xa
ti:ra	n-di:ra
pi:ma	m-bi:ma
pakala	m-bakala
ketulula	ŋ-getulula
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kona	ŋ-gona
kula	ŋ-gula
kwa	ŋ-gwa

(6) /+nasal/ → [αPLACE] / _[αPLACE,−son]

- Our current data won't tell us.
- Our rule says that any nasal will take on the place of the following obstruent, so it doesn't matter what place we ascribe to the UR.

What's the UR in Bukusu?

Bukusu again

- Here's Bukusu again. We figured out the rule (6), but did we ever determine what the UR of the nasal prefix was? **Can we?**

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ketulula	ŋ-getulula
kona	ŋ-gona
kula	ŋ-gula
kwa	ŋ-gwa

(6) /+nasal/ → [αPLACE] / _[αPLACE,−son]

- Our current data won't tell us.
- Our rule says that any nasal will take on the place of the following obstruent, so it doesn't matter what place we ascribe to the UR.
- This situation sometimes gets represented as /N/, where N means a nasal that is **underspecified** for place.

→ Underspecification means that the relevant feature value is not present in the UR, but is always filled in by a phonological rule.

What's the UR in Bukusu?

Additional evidence?

⋆ **But is there other evidence that might tell us?**

What's the UR in Bukusu?

Additional evidence?

⋆ **But is there other evidence that might tell us?**

- Vowel-initial roots! Since they don't begin in an obstruent, they won't trigger nasal place assimlation, and we can see the UR unobstructed.

Imperative	1sg pres.	Gloss
i:xala	ni:xala	'sit'
a:sama	na:sama	'gape'
o:la	no:la	'arrive'
e:kesya	ne:kesja	'show'

What's the UR in Bukusu?

Additional evidence?

⋆ **But is there other evidence that might tell us?**

- Vowel-initial roots! Since they don't begin in an obstruent, they won't trigger nasal place assimlation, and we can see the UR unobstructed.

Imperative	1sg pres.	Gloss
iːxala	**n-**iːxala	'sit'
aːsama	**n-**aːsama	'gape'
oːla	**n-**oːla	'arrive'
eːkesya	**n-**eːkesja	'show'

- The prefix surfaces as **[n-]** here.
- Since there is no rule changing it's place in this context, the UR for this prefix must be **/n-/**.
- ⋆ But we don't need to update our rule, because it will still apply regardless of the underlying place.

∗ *I'm suppressing some details that add unnecessary complications. We may return to them later in the semester.*

Assimilation and feature geometry

Arabic definite article

- A well-known case of place assimilation is the definite article in Arabic. It has two different kinds of realizations. **What are they?**

Indef.	Def.	Gloss
hawa	ʔilhawa	'air'
baːred	ʔilbaːred	'cold'
ʔadham	ʔilʔadham	'black'
madine	ʔilmadine	'city'
ʕaːde	ʔilʕaːde	'custom'
ħaːra	ʔilħaːra	'quarter'
waħʃ	ʔilwaħʃ	'beast'
yaʔs	ʔilyaʔs	'despair'
kalb	ʔilkalb	'dog'
xadd	ʔilxadd	'cheek'
fayy	ʔilfayy	'shadow'
ɣada	ʔilɣada	'lunch'
life	ʔillife	'loofah'

Indef.	Def.	Gloss
taːlet	ʔittaːlet	'third'
taxt	ʔittaxt	'bed'
raʔbe	ʔirraʔbe	'neck'
nəde	ʔinnəde	'dew'
difaːʕ	ʔiddifaːʕ	'defense'
smike	ʔissmike	'thick'
ʃoːraba	ʔiʃʃoːraba	'soup'
ʒamil	ʔiʒʒamil	'pretty'
zaki	ʔizzaki	'bright'
tˤaːleb	ʔitˤtˤaːleb	'student'
zˤaːbet	ʔizˤzˤaːbet	'officer'
dˤahuːk	ʔidˤdˤahuːk	'jolly'
sˤaff	ʔisˤsˤaff	'row'

Assimilation and feature geometry

Arabic definite article: allomorphs

[ʔil-]		
Indef.	Def.	Gloss
hawa	**ʔil-**hawa	'air'
baːred	**ʔil-**baːred	'cold'
ʔadham	**ʔil-**ʔadham	'black'
madine	**ʔil-**madine	'city'
ʕaːde	**ʔil-**ʕaːde	'custom'
ħaːra	**ʔil-**ħaːra	'quarter'
waħʃ	**ʔil-**waħʃ	'beast'
yaʔs	**ʔil-**yaʔs	'despair'
kalb	**ʔil-**kalb	'dog'
xadd	**ʔil-**xadd	'cheek'
fayy	**ʔil-**fayy	'shadow'
ɣada	**ʔil-**ɣada	'lunch'
life	**ʔil-**life	'loofah'

[ʔiC$_\alpha$-] / _C$_\alpha$		
Indef.	Def.	Gloss
taːlet	**ʔit-**taːlet	'third'
taxt	**ʔit-**taxt	'bed'
raʔbe	**ʔir-**raʔbe	'neck'
nəde	**ʔin-**nəde	'dew'
difaːʕ	**ʔid-**difaːʕ	'defense'
smike	**ʔis-**smike	'thick'
ʃoːraba	**ʔiʃ-**ʃoːraba	'soup'
ʒamil	**ʔiʒ-**ʒamil	'pretty'
zaki	**ʔiz-**zaki	'bright'
tˤaːleb	**ʔitˤ-**tˤaːleb	'student'
zˤaːbet	**ʔizˤ-**zˤaːbet	'officer'
dˤahuːk	**ʔidˤ-**dˤahuːk	'jolly'
sˤaff	**ʔisˤ-**sˤaff	'row'

Assimilation and feature geometry

Arabic definite article: allomorphs

[ʔil-]		
Indef.	Def.	Gloss
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ʔadham	**ʔil-**ʔadham	'black'
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ʕaːde	**ʔil-**ʕaːde	'custom'
ħaːra	**ʔil-**ħaːra	'quarter'
waħʃ	**ʔil-**waħʃ	'beast'
yaʔs	**ʔil-**yaʔs	'despair'
kalb	**ʔil-**kalb	'dog'
xadd	**ʔil-**xadd	'cheek'
fayy	**ʔil-**fayy	'shadow'
ɣada	**ʔil-**ɣada	'lunch'
life	**ʔil-**life	'loofah'

[ʔiC$_\alpha$-] / _C$_\alpha$		
Indef.	Def.	Gloss
taːlet	**ʔit-**taːlet	'third'
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nəde	**ʔin-**nəde	'dew'
difaːʕ	**ʔid-**difaːʕ	'defense'
smike	**ʔis-**smike	'thick'
ʃoːraba	**ʔiʃ-**ʃoːraba	'soup'
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zˤaːbet	**ʔizˤ-**zˤaːbet	'officer'
dˤahuːk	**ʔidˤ-**dˤahuːk	'jolly'
sˤaff	**ʔisˤ-**sˤaff	'row'

⋆ **What conditions the distribution of the allomorphs?**

Assimilation and feature geometry

Arabic definite article: conditioning environment

[ʔil-] elsewhere		
Indef.	Def.	Gloss
hawa	**ʔil-**hawa	'air'
baːred	**ʔil-**baːred	'cold'
ʔadham	**ʔil-**ʔadham	'black'
madine	**ʔil-**madine	'city'
ʕaːde	**ʔil-**ʕaːde	'custom'
ħaːra	**ʔil-**ħaːra	'quarter'
waħʃ	**ʔil-**waħʃ	'beast'
yaʔs	**ʔil-**yaʔs	'despair'
kalb	**ʔil-**kalb	'dog'
xadd	**ʔil-**xadd	'cheek'
fayy	**ʔil-**fayy	'shadow'
ɣada	**ʔil-**ɣada	'lunch'
life	**ʔil-**life	'loofah'

[ʔiC$_\alpha$-] / _C$_\alpha$[coronal]		
Indef.	Def.	Gloss
taːlet	**ʔit-**taːlet	'third'
taxt	**ʔit-**taxt	'bed'
raʔbe	**ʔir-**raʔbe	'neck'
nəde	**ʔin-**nəde	'dew'
difaːʕ	**ʔid-**difaːʕ	'defense'
smike	**ʔis-**smike	'thick'
ʃoːraba	**ʔiʃ-**ʃoːraba	'soup'
ʒamil	**ʔiʒ-**ʒamil	'pretty'
zaki	**ʔiz-**zaki	'bright'
tˤaːleb	**ʔitˤ-**tˤaːleb	'student'
zˤaːbet	**ʔizˤ-**zˤaːbet	'officer'
dˤahuːk	**ʔidˤ-**dˤahuːk	'jolly'
sˤaff	**ʔisˤ-**sˤaff	'row'

- The UR must be /ʔil-/ because it is the elsewhere allomorph. (Also appears before vowel-initial roots!)

Assimilation and feature geometry

Arabic definite article: writing the rule

⋆ **What should our rule look like?**

[ʔiC$_\alpha$-] / _C$_\alpha$[coronal] vs. **[ʔil-] elsewhere**

Assimilation and feature geometry

Arabic definite article: writing the rule

⋆ **What should our rule look like?**

[ʔiC$_\alpha$-] / _C$_\alpha$[coronal] vs. **[ʔil-] elsewhere**

- /l/ completely assimilates to the following consonant if that consonant is coronal.

Assimilation and feature geometry

Arabic definite article: writing the rule

⋆ **What should our rule look like?**

[ʔiC$_\alpha$-] / _C$_\alpha$[coronal] vs. **[ʔil-] elsewhere**

- /l/ completely assimilates to the following consonant if that consonant is coronal.

(7) /COR,+son,+lat/ → [αson,βvoice,γant,...] / _ [COR,αson,βvoice,γant,...]

Assimilation and feature geometry

Arabic definite article: writing the rule

⋆ **What should our rule look like?**

[ʔiC$_\alpha$-] / _C$_\alpha$[coronal] vs. **[ʔil-] elsewhere**

- /l/ completely assimilates to the following consonant if that consonant is coronal.

(7) /COR,+son,+lat/ → [αson,βvoice,γant,...] / _ [COR,αson,βvoice,γant,...]

⋆ **What are we missing?**

Assimilation and feature geometry

Arabic definite article: writing the rule

⋆ **What should our rule look like?**

[ʔiC$_\alpha$-] / _C$_\alpha$[coronal] vs. **[ʔil-] elsewhere**

- /l/ completely assimilates to the following consonant if that consonant is coronal.

(7) /COR,+son,+lat/ → [αson,βvoice,γant,...] / _ [COR,αson,βvoice,γant,...]

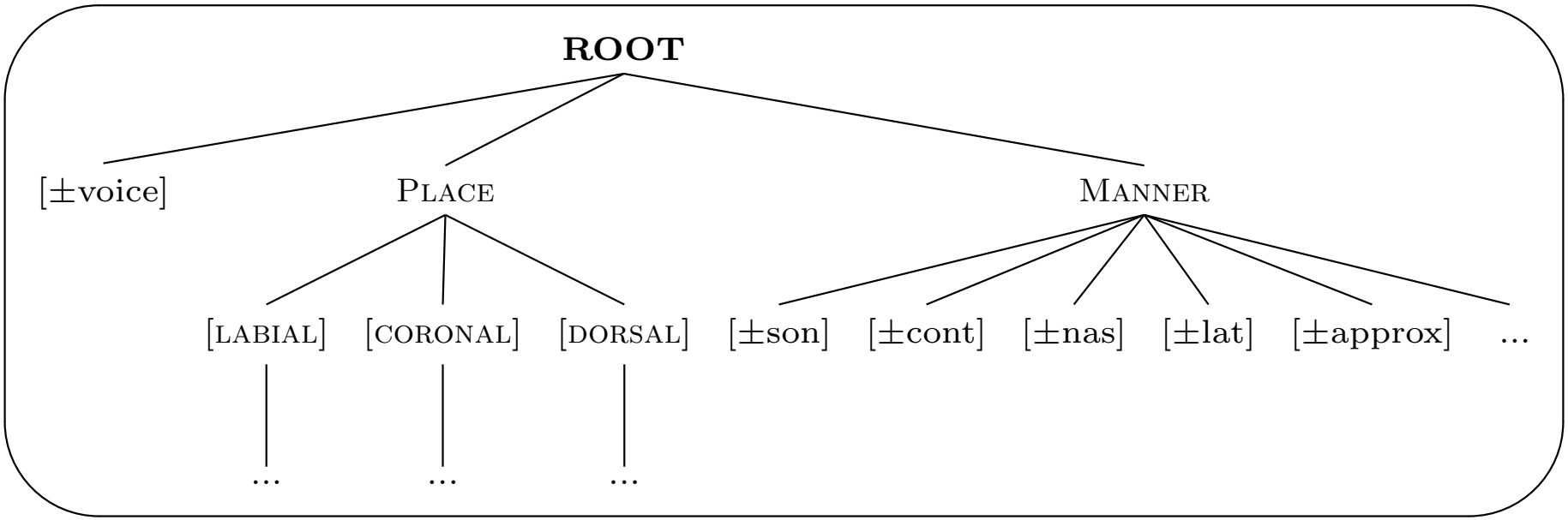
⋆ **What are we missing?**

→ We need a way to do **total assimilation**.

Assimilation and feature geometry

Expanding our feature geometry

ri We need to add a **root node**, that dominates *all the features*.



- This allows us to make reference to a node that contains the voicing features, the place features, and the manner features.

Assimilation and feature geometry

Expanding our feature geometry

- We could now re-write our rule to assimilate the root node:

(8) /COR,+son,+lat/ → [αROOT] / _ [COR,αROOT]

Assimilation and feature geometry

Expanding our feature geometry

- We could now re-write our rule to assimilate the root node:

(8) /COR,+son,+lat/ → [αROOT] / _ [COR,αROOT]

⋆ **Do you see any problem with this?**

Assimilation and feature geometry

Expanding our feature geometry

- We could now re-write our rule to assimilate the root node:

(8) /COR,+son,+lat/ → [αROOT] / _ [COR,αROOT]

⋆ **Do you see any problem with this?**

→ CORONAL is contained under the ROOT, so it is at least odd to have it co-exist with ROOT in a single rule.

Assimilation and feature geometry

Expanding our feature geometry

- We could now re-write our rule to assimilate the root node:

(8) /COR,+son,+lat/ → [αROOT] / _ [COR,αROOT]

⋆ **Do you see any problem with this?**

→ CORONAL is contained under the ROOT, so it is at least odd to have it co-exist with ROOT in a single rule.

⋆ **Can you imagine a solution?**