Class 3 Assimilation 1

Sam Zukoff LING 301, Spring 2022, USC

January 19, 2022

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Lithuanian ●0000000		
Lithuanian _{Data}		

- In Lithuanian, there are various prefixes that appears on verbs that affect the meaning of the verb. One of them is shown below.
- ▷ It can have different surface forms. What are they?

at-eiti	'to arrive'	at-pra∫i : ti	'to ask'
at-imti	'to take away'	at-kurti	'to reestablish'
at-ne∫ti	'to bring'	ad-bekti	'to run up'
at-leisti	'to forgive'	ad-gauti	'to get back'
at-likti	'to complete'	ad-bukti	'to become blunt'
at-korpti	'to rise'	ad-gimti	'to be born again'

Lithuanian 0●000000		
Lithuanian Allomorphs		

• There are two **allomorphs** (surface forms) of the prefix: **[at-]** and **[ad-]**.

at-eiti	'to arrive'	<mark>at-</mark> pra∫i : ti	'to ask'
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 \triangleright What is the difference between [at-] and [ad-] in terms of features?

Image: A matrix

Lithuanian 00000000		
Lithuanian _{Voicing}		

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- The [t] in [at-] is voiceless. = [-voice]
- \circ The [d] in [ad-] is voiced. = [+voice]
- * Both are *alveolar stops*.

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\triangleright Can we use the feature [±voice] to explain the distribution?

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Lithuanian

Voicing

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T:+1		

Voicing

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- When there's a **voiceless** sound at the beginning of the root, we always get the **voiceless** allomorph **[at-]**.
 - \circ [p,t,k,s,f] are all voiceless sounds.

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T:+1		

Voicing

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• But when there's a **voiced** sound at the beginning of the root, we sometimes get the **voiceless** allomorph **[at-]** and sometimes get the **voiced** allomorph **[ad-]**.

 \circ [b,d,g,z,3,m,n,l,r] and all the vowels are **voiced** sounds.

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Voicing

\triangleright What else do we need?

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
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Obstruent vs. Sonorant

\triangleright What else do we need: obstruent vs. sonorant

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
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<mark>at-n</mark> e∫ti	'to bring'	ad-bekti	'to run up'
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at-ko:pti	'to rise'	ad-gimti	'to be born again'

- The **voiced** sounds where we get the **voiceless** allomorph are all **sonorants** (sounds with little/no constriction of airflow): [**m**,**n**,**l**,**r**] and **vowels**
- The **voiced** sounds where we get the **voiced** allomorph are all **obstruents** (sounds with total or near total constriction of airflow): [b,d,g,z,3]

Lithuanian 00000000		
Lithuanian Morphological Rule		

▷ What *morphological* rule can explain the distribution of the allomorphs?

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
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(1) a. The voiced allomorph [ad-] appears before voiced obstruents.

b. The voiceless allomorph **[at-]** appears everywhere else (before voiceless sounds, before sonorants)

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Phonological Rule

▷ Can we restate this as a *phonological* rule?

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
at-i mti	'to take away'	at-kurti	'to reestablish'
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(2) a.
$$/\mathbf{t}/ \rightarrow [\mathbf{d}] / _$$
voiced obstruent
b. $/\mathbf{t}/ \rightarrow [\mathbf{t}]$ elsewhere

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Phonological Rule

\triangleright How do we know that /t/ is the underlying form?

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
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(2) a. $/\mathbf{t} / \rightarrow [\mathbf{d}] / \text{_voiced obstruent}$ b. $/\mathbf{t} / \rightarrow [\mathbf{t}]$ elsewhere

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(2) a. $/\mathbf{t}/ \rightarrow [\mathbf{d}] / _$ voiced obstruent b. $/\mathbf{t}/ \rightarrow [\mathbf{t}]$ elsewhere

• [t] is the **elsewhere** allophone; it doesn't appear in a single, unified context.

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The IPA and Features •00000 Manner Features 0000000000 Lithuanian Analysis 00000

Features The IPA chart

CONSONANT	sau	MONK									T (revi	acu i				2015	IPA
	Ribbu	i Labi	dental	Dents	Alveola	tom	ilveolar	Retroflex	Pala	al	Velar	Uva	lar	Phary	ingeal	Gk	est.
Bashve	p b				t d			t d	с	Ŧ	kg	q	G		Ĺ	2	
Sacal	n	1	m		n			η		n	η	L.	N				-
Inill	в				r			-		-			R		_		
Tap or Flap		+	v		ſ		r					-				_	
Fricative	φβ	3 f	v	0 8	s z	IJ	3	S Z	ç	i	хү	χ	в	ħ	Ŷ	h	ĥ
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Approximant			υ		I			Æ		j	щ						
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- IPA stands for 'International Phonetic Alphabet' (not India Pale Ale, at least in this context)
- The IPA assigns a **unique symbol** (or symbol + diacritic(s)) to each sound that is a possible sound of human language.
- The chart is organized according to phonetic/phonological **features**
 - \approx articulatory properties of speech sounds.

The IPA and Features	
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The IPA chart: consonants

CONSONANTS (PULMONIC)

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	Bilabia	l La	abiodental	Den	ıtal	Alve	olar	Postalv	/eolar	Retr	oflex	Pal	atal	Ve	lar	Uv	ular	Phary	ngeal	Glo	ttal
Plosive	рb)				t	d			t	d	с	J	k	g	q	G			3	
Nasal	n	ı	ŋ				n				η		ր		ŋ		Ν				
Trill	Е						r										\mathbf{R}				
Tap or Flap			\mathbf{V}				ſ				r										
Fricative	φβ		f v	θ	ð	\mathbf{S}	\mathbf{Z}	ſ	3	ទុ	Z,	ç	j	x	y	χ	R	ħ	ſ	h	ĥ
Lateral fricative						ł	Է														
Approximant			υ				J				ł		j		щ						
Lateral approximant							1				l		λ		\mathbf{L}						

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

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The IPA and Features	
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Place of articulation

CONSONANT	S (PULM	ONIC)		PLA	CE O	F AF	RTIC	CU	LATI	ON	C	2018 IPA
	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retrofle	c Pala	tal	Velar	Uvular	Pharyngeal	Glottal
Plosive	рb			t d		td	c	J	k g	qG		?
Nasal	m	ŋ		n		η		ր	ŋ	Ν		
Trill	В			r						R		
Tap or Flap		v		ſ		r						
Fricative	φβ	f v	θð	s z	∫ <u>3</u>	şz	Ç	j	хү	Хк	ћ ና	h ƙ
Lateral fricative				łβ								
Approximant		υ		I		ન		j	щ			
Lateral approximant				1		l		λ	L			

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

- The location in the vocal tract where a constriction is made is called the place of articulation.
 - $\circ\,$ Constrictions at the front of the mouth (labial) are further left.
 - $\circ\,$ Constrictions at the back of the vocal tract (glottal) are further right.

The IPA and Features	
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Place of articulation

CONSONANT	rs (Pulm	ONIC)		PLA	CE O	F AR	TICU	LATI	ON	C	2018 IPA
	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	рb			t d		td	сэ	k g	qG		?
Nasal	m	ŋ		n		η	ր	ŋ	N		
Trill	В			r					R		
Tap or Flap		v		ſ		r					
Fricative	φβ	f v	θð	s z	∫ 3	şz	çj	хγ	Хк	ħΥ	h ƙ
Lateral fricative				łβ							
Approximant		υ		I		ન	j	щ			
Lateral approximant				1		l	λ	L			

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

• We can see how this looks using Real Time MRI imagining:

 \rightarrow https://sail.usc.edu/span/rtmri_ipa/db_2015.html

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Image: A math black

The IPA and Features	
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Manner of articulation

CONSONANTS (PULMONIC)

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	Bilabial	Labiodental	Dental Alv	veolar Postalveola	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b		t	d	t d	сյ	k g	qд		3
Nasal	m	ŋ		n	η	ŋ	ŋ	Ν		
Trill	в			r				R		
Tap or Flap		\mathbf{V}		ſ	r					
Fricative	φβ	f v	$\theta \delta s$	5 z ∫ 3	şz	çj	хү	Хк	ħΥ	h fi
Lateral fricative			ł	β						
Approximant		υ		I	ન	j	щ			
Lateral approximant				1	l	λ	L			

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

MANNER OF ARTICULATION

- The **type** of constriction that is made when producing a sound is called the **manner of articulation**.
 - Complete constriction (stops) at the top of the chart.
 - Virtually no constriction (approximants and vowels) at the bottom.

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Class 3: Assimilation 1

The IPA and Features	
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Manner of articulation

CONSONANTS (PULMONIC)

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	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retr	oflex	Pal	atal	Velar	Uvı	ılar	Phary	ngeal	Glo	ttal
Plosive	p b			t d		t	d	с	J	k g	q	G			2	
Nasal	m	ŋ		n			η		ր	ŋ		Ν				
Trill	В			r								R				
Tap or Flap		v		ſ			r									
Fricative	φβ	f v	θð	s z	∫ <u>3</u>	ទ្	Z,	ç	j	хγ	χ	R	ħ	ſ	h	ĥ
Lateral fricative				łβ												
Approximant		υ		r			મ		j	щ						
Lateral approximant				1			l		λ	L						

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MANNER OF ARTICULATION

- We can see how this looks too:
 - \rightarrow https://sail.usc.edu/span/rtmri_ipa/db_2015.html

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The IPA and Features	
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Voicing

CONSONANT	CS (P	ULM	ONIC)																	©	2018	B IPA
	Bila	ibial	Labio	dental	Dei	ıtal	Alv	eolar	Postal	veolar	Retr	oflex	Pal	atal	Ve	elar	Uvi	ılar	Phar	yngeal	Glottal	
Plosive	р	b				1	t	d			t	d	С	J	k	g	q	G			?	
Nasal		m		ŋ				n				η		ր		ŋ		Ν				
Trill		в						r										R				
Tap or Flap				\mathbf{V}				r				r										
Fricative	φ	β	f	v	θ	ð	\mathbf{s}	\mathbf{Z}	ſ	3	ទ្	z	ç	j	x	y	χ	R	ħ	ſ	h	ĥ
Lateral fricative							ł	ß														
Approximant				υ				ı				ર		j		щ						
Lateral approximant								1				l		λ		L						

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

• Within each place/manner combination, the sound on the left is voiceless.

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The IPA and Features	
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Voicing

CONSONANT	TS (PU	JLM	ONIC)																	C	2018	IPA
	Bila	bial	Labio	dental	Den	tal	Alve	eolar	Postal	veolar	Retro	oflex	Pala	ıtal	Ve	elar	Uvı	ılar	Phary	/ngeal	Glo	ottal
Plosive	р	b				1	t	d			t	d	С	Ŧ	k	g	q	G			2	
Nasal		m		ŋ				n				η		ր		ŋ		Ν				
Trill		в						r										R				
Tap or Flap				\mathbf{V}				ſ				r										
Fricative	Φ	β	f	v	θ	ð	\mathbf{s}	\mathbf{z}	∫	3	ទ្	Z,	ç	j	x	y	χ	R	ħ	ſ	\mathbf{h}	ĥ
Lateral fricative							ł	β														
Approximant				υ				I				J		j		щ						
Lateral approximant								1				l		λ		L						

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

- Within each place/manner combination, the sound on the left is voiceless.
- Within each place/manner combination, the sound on the right is **voiced**.

Image: A math black

The IPA and Features	
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Voicing

CONSONANT	TS (PU	JLM	ONIC)																	C	2018	IPA
	Bila	bial	Labio	dental	Den	tal	Alve	eolar	Postal	veolar	Retro	oflex	Pala	ıtal	Ve	elar	Uvı	ılar	Phary	/ngeal	Glo	ottal
Plosive	р	b					t	d			t	đ	С	Ŧ	k	g	q	G			2	
Nasal		m		ŋ				n				η		ր		ŋ		Ν				
Trill		в						r										R				
Tap or Flap				\mathbf{V}				ſ				r										
Fricative	φ	β	f	v	θ	ð	\mathbf{s}	\mathbf{z}	∫	3	ទ្	Z,	ç	j	x	y	χ	R	ħ	ſ	h	ĥ
Lateral fricative							ł	ţ														
Approximant				υ				I				ન		j		щ						
Lateral approximant								1				l		λ		L						

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

- We can sort of see the difference with the MRI images:
 - https://sail.usc.edu/span/rtmri_ipa/db_2015.html

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Image: A math black

The IPA and Features	
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Voicing

CONSONANT	TS (PU	JLM	ONIC)																	C	2018	IPA
	Bila	bial	Labio	dental	Den	tal	Alve	eolar	Postal	veolar	Retro	oflex	Pala	ıtal	Ve	elar	Uvı	ılar	Phary	/ngeal	Glo	ottal
Plosive	р	b					t	d			t	d	С	Ŧ	k	g	q	G			2	
Nasal		m		ŋ				n				η		ր		ŋ		Ν				
Trill		в						r										R				
Tap or Flap				\mathbf{V}				ſ				r										
Fricative	Φ	β	f	v	θ	ð	\mathbf{s}	\mathbf{z}	∫	3	ទ្	Z,	ç	j	x	y	χ	R	ħ	ſ	\mathbf{h}	ĥ
Lateral fricative							ł	β														
Approximant				υ				I				J		j		щ						
Lateral approximant								1				l		λ		L						

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

• Here's a slightly more in depth explanation:

o https://www.youtube.com/watch?v=edYLoMRgaFw

- And here's what that actually looks like with a laryngoscope:
 - \rightarrow https://www.youtube.com/watch?v=mJedwz_r2Pc

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Class 3: Assimilation 1

		Manner Features •000000000	
Features			
Lithuanian cons	sonants		

• Here are the consonants of Lithuanian. (Most of the consonants also have a palatalized version, omitted here.)

	Labial		Alv	eolar	Pal	atal	Velar	
Stops	р	b	t	d			k	g
Affricates			ts	dz	ťſ	ф		
Fricatives	f	V	\mathbf{S}	Ζ	ſ	3	х	y
Nasals		m		n				
Approximants				l,r		j		

• We're going to focus on the manner features.

	Manner Features 0●00000000	
Features		
Stops		

• **Stops** (aka plosives) are consonants that involve a complete closure in the oral cavity.

	Labial		Alv	eolar	Palatal		Velar	
Stops	р	b	t	d			k	g
Affricates			ts	dz	ťſ	ф		
Fricatives	f	v	\mathbf{S}	Z	ſ	3	х	y
Nasals		m		n				
Approximants				l,r		j		

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	Manner Features 00●0000000	
Features Stops and Nasals		

• **Nasals** technically also fall into this category, because they involve a complete closure in the oral cavity too.

	Labial		Alv	Alveolar		Palatal		lar
Stops	р	b	t	d			k	g
Affricates			ts	dz	ťſ	ф		
Fricatives	f	v	\mathbf{S}	Z	ſ	3	х	y
Nasals		m		n				
Approximants				l,r		j		

- But nasals (technically, *nasal stops*) involve lowering the **velum** to allow air to pass through the nose.
- Stops (technically, *oral stops*) leave the velum raised so no air escapes through the nose.

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	Manner Features 000000000	
Features Fricatives		

• Fricatives are consonants that involve an *incomplete closure*, i.e. a tight constriction that still allows air to pass through.

	Labial		Alv	eolar	Palatal		Velar	
Stops	р	b	t	d			k	g
Affricates			ts	dz	ťſ	ф		
Fricatives	f	v	\mathbf{S}	\mathbf{Z}	ſ	3	х	Ŋ
Nasals		m		n				
Approximants				l,r		j		

Image: A matrix

	Manner Features 0000●00000	
Features		
Affricates		

• Affricates are consonants that begin with a complete closure (stop portion) and end with an incomplete closure (fricative portion).

	Labial		Alv	eolar	Palatal		Velar	
Stops	р	b	t	d			k	g
Affricates			ts	dz	ţſ	ф		
Fricatives	f	V	\mathbf{S}	\mathbf{Z}	ſ	3	Х	y
Nasals		m		n				
Approximants				l,r		j		

- Affricates are "complex" sounds, and thus transcribed with digraph symbols.
- \star They are **not a sequence** of two sounds; they behave like other consonants.

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Features		
Approviments		

• Approximants, often divided up into liquids ([l,r]) and glides ([w,j]), are consonants with very little constriction.

	Labial		Alveolar		Palatal		Velar	
Stops	р	b	t	d			k	g
Affricates			ts	dz	ťſ	ф		
Fricatives	f	v	\mathbf{S}	Ζ	ſ	3	х	y
Nasals		m		n				
Approximants								

• Approximants share a lot of properties with vowels, especially that they allow for a high degree of airflow.

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		Manner Features 000000●000	
Features			
Manner Feature	s		

• It is frequently useful in phonological analysis to group these individual consonant manner of articulation categories into large feature classes.

	Labial		Alveolar		Palatal		Velar	
Stops	р	b	t	d			k	g
Affricates			ts	dz	ţſ	ф		
Fricatives	f	V	s	Z	ſ	3	х	X
Nasals		m		n				
Approximants				l,r		j		

▷ Does anybody remember any of these manner features?

Lithuanian The I	IPA and Features	Manner Features	Lithuanian Analysis
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Obstruent vs. Sonorant

	Labial		Alveolar		Palatal		Velar	
Stops	р	b	t	d			k	g
Affricates			ts	dz	ťſ	ф		
Fricatives	f	v	s	Z	ſ	3	х	y
Nasals		m		n				
Approximants				l,r		j		

Sonorants ([+sonorant]): sounds with a large amount of airflow

 → nasals, approximants, vowels
 (protoypically voiced)

Obstruents ([-sonorant]): sounds with a little to no airflow
 → stops, fricatives, affricates

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The IPA and Feature 000000 Manner Features

Lithuanian Analysis 00000

Features

Continuants

	Labial		Alveolar		Pal	atal	Ve	lar
Stops	р	b	t	d			k	g
Affricates			ts	dz	ţſ	ф		
Fricatives								X
Nasals		m		n				
Approximants				l,r		j		

- Continuants ([+continuant]): sounds with continuous oral airflow
 → fricatives, approximants, vowels (protoypically voiced)
- Non-continuants ([−continuant]): sounds without continuous oral airflow
 → stops, affricates, nasals

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Features

Approximants

	Labial		Alveolar		Palatal		Velar	
Stops	р	b	t	d			k	g
Affricates			ts	dz	ţſ	ф		
Fricatives	f	V	\mathbf{S}	\mathbf{Z}	ſ	3	х	y
Nasals		m		n				
Approximants				l,r		j		

- Approximants ([+approximant]): sounds with minimal constriction
 → approximants (liquids and glides), vowels
- Non-approximants ([−approximant]): sounds with non-minimal constriction
 → stops, affricates, fricatives, nasals

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Lithuanian Analysis

Rules revisited

• Let's go back to our analysis of Lithuanian:

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i:ti	'to ask'
at-imti	'to take away'	at-kurti	'to reestablish'
<mark>at-n</mark> e∫ti	'to bring'	ad-bekti	'to run up'
at-l eisti	'to forgive'	ad-gauti	'to get back'
at-likti	'to complete'	ad-bukti	'to become blunt'
at-ko:pti	'to rise'	ad-gimti	'to be born again'

- (1) a. The voiced allomorph [ad-] appears before voiced obstruents.
 - b. The voiceless allomorph **[at-]** appears everywhere else (before voiceless sounds, before sonorants)
- (2) a. $/\mathbf{t}/ \rightarrow [\mathbf{d}] / _$ voiced obstruent b. $/\mathbf{t}/ \rightarrow [\mathbf{t}]$ elsewhere

The IPA and Feature 000000 Manner Features 000000000 Lithuanian Analysis •0000

Lithuanian Analysis

Rules revisited

▷ How should we represent the rule in terms of features?

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
at-imti	'to take away'	at-kurti	'to reestablish'
<mark>at-n</mark> e∫ti	'to bring'	ad-bekti	'to run up'
at-l eisti	'to forgive'	ad-gauti	'to get back'
at-likti	'to complete'	ad-bukti	'to become blunt'
at-ko:pti	'to rise'	ad-gimti	'to be born again'

- (1) a. The voiced allomorph [ad-] appears before voiced obstruents.
 - b. The voiceless allomorph **[at-]** appears everywhere else (before voiceless sounds, before sonorants)
- (2) a. $/\mathbf{t}/ \rightarrow [\mathbf{d}] / _$ voiced obstruent b. $/\mathbf{t}/ \rightarrow [\mathbf{t}]$ elsewhere

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Lithuanian Analysis

Feature-based rules

▷ How should we represent the rule in terms of features?

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
at-imti	'to take away'	at-kurti	'to reestablish'
<mark>at-n</mark> e∫ti	'to bring'	ad-bekti	'to run up'
at-l eisti	'to forgive'	ad-gauti	'to get back'
at-likti	'to complete'	ad-bukti	'to become blunt'
at-ko:pti	'to rise'	ad-gimti	'to be born again'

(3) a. $/\mathbf{t} / \rightarrow [\mathbf{d}] / [+\text{voice},-\text{sonorant}]$ b. $/\mathbf{t} / \rightarrow [\mathbf{t}]$ elsewhere

- [+voice] eliminates the voiceless consonants from conditioning the change.
- [-sonorant] eliminates the voiced sonorants from conditioning the change.

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Lithuanian Analysis

Feature-based rules

▷ Can we go any further?

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i:ti	'to ask'
at-i mti	'to take away'	at-kurti	'to reestablish'
<mark>at-n</mark> e∫ti	'to bring'	ad-bekti	'to run up'
at-l eisti	'to forgive'	ad-gauti	'to get back'
at-likti	'to complete'	ad-bukti	'to become blunt'
at-ko:pti	'to rise'	ad-gimti	'to be born again'

(3) a. $/\mathbf{t} / \rightarrow [\mathbf{d}] / [+\text{voice},-\text{sonorant}]$ b. $/\mathbf{t} / \rightarrow [\mathbf{t}]$ elsewhere

- [+voice] eliminates the voiceless consonants from conditioning the change.
- [-sonorant] eliminates the voiced sonorants from conditioning the change.

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Lithuanian Analysis

Feature-based rules

• Identify the featural composition of the segments in the rule.

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
at-imti	'to take away'	at-kurti	'to reestablish'
<mark>at-n</mark> e∫ti	'to bring'	ad-bekti	'to run up'
at-l eisti	'to forgive'	ad-gauti	'to get back'
at-likti	'to complete'	ad-bukti	'to become blunt'
at-ko:pti	'to rise'	ad-gimti	'to be born again'

(3) a. $/\mathbf{t} / \rightarrow [\mathbf{d}] / [+\text{voice},-\text{sonorant}]$ b. $/\mathbf{t} / \rightarrow [\mathbf{t}]$ elsewhere

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Lithuanian Analysis

Feature-based rules

• We describe sounds with their (1) voice (2) place (3) manner.

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
at-imti	'to take away'	at-kurti	'to reestablish'
<mark>at-n</mark> e∫ti	'to bring'	ad-b ekti	'to run up'
at-l eisti	'to forgive'	ad-gauti	'to get back'
at-likti	'to complete'	ad-bukti	'to become blunt'
at-ko:pti	'to rise'	ad-gimti	'to be born again'

(3) a. $/\mathbf{t} / \rightarrow [\mathbf{d}] / [+\text{voice},-\text{sonorant}]$ b. $/\mathbf{t} / \rightarrow [\mathbf{t}]$ elsewhere

 $\bullet \ [t] = \textit{voiceless alveolar stop} = [-voice, +alveolar, -sonorant, -continuant]$

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The IPA and Feature 000000 Manner Features 000000000 Lithuanian Analysis 00000

Lithuanian Analysis

Feature-based rules

• We describe sounds with their (1) voice (2) place (3) manner.

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
at-i mti	'to take away'	at-kurti	'to reestablish'
<mark>at-n</mark> e∫ti	'to bring'	ad-b ekti	'to run up'
at-l eisti	'to forgive'	ad-gauti	'to get back'
at-likti	'to complete'	ad-bukti	'to become blunt'
at-ko:pti	'to rise'	ad-gimti	'to be born again'

(3) a. $/\mathbf{t} / \rightarrow [\mathbf{d}] / [+\text{voice},-\text{sonorant}]$ b. $/\mathbf{t} / \rightarrow [\mathbf{t}]$ elsewhere

• [t] = voiceless alveolar stop = [-voice,+alveolar,-sonorant,-continuant]

• [d] = voiced alveolar stop = [+voice,+alveolar,-sonorant,-continuant]

Lithuanian Analysis 000●0

Lithuanian Analysis

Feature-based rules

• Now let's put the features into the rule:

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
at-i mti	'to take away'	at-kurti	'to reestablish'
<mark>at-n</mark> e∫ti	'to bring'	ad-bekti	'to run up'
at-l eisti	'to forgive'	ad-gauti	'to get back'
at-l ikti	'to complete'	ad-bukti	'to become blunt'
at-ko:pti	'to rise'	ad-gimti	'to be born again'

(4) $/-\text{voi}, +\text{alv}, -\text{son}, -\text{cont}/ \rightarrow [+\text{voi}, +\text{alv}, -\text{son}, -\text{cont}] / [+\text{voi}, -\text{son}]$

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The IPA and Feature 000000 Manner Features 000000000 Lithuanian Analysis 000●0

Lithuanian Analysis

Feature-based rules

▷ What have we learned by using the features?

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
at-imti	'to take away'	at-kurti	'to reestablish'
<mark>at-n</mark> e∫ti	'to bring'	ad-bekti	'to run up'
at-l eisti	'to forgive'	ad-gauti	'to get back'
at-likti	'to complete'	ad-bukti	'to become blunt'
at-ko:pti	'to rise'	ad-gimti	'to be born again'

(4) $/-\text{voi}, +\text{alv}, -\text{son}, -\text{cont}/ \rightarrow [+\text{voi}, +\text{alv}, -\text{son}, -\text{cont}] / [+\text{voi}, -\text{son}]$

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Lithuanian Analysis

Feature-based rules

▷ What have we learned by using the features?

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i : ti	'to ask'
at-imti	'to take away'	at-kurti	'to reestablish'
<mark>at-n</mark> e∫ti	'to bring'	ad-bekti	'to run up'
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at-likti	'to complete'	ad-bukti	'to become blunt'
at-ko:pti	'to rise'	ad-gimti	'to be born again'

(4) $/-voi, +alv, -son, -cont/ \rightarrow [+voi, +alv, -son, -cont] / [+voi, -son]$

• When we identify the features of the segments involved in the rule, we can identify which features are changing: this is a rule that changes [±voice].

The IPA and Feature 000000 Manner Features 000000000 Lithuanian Analysis

Lithuanian Analysis

Voicing Assimilation

▷ What have we learned by using the features?

at-eiti	'to arrive'	<mark>at-p</mark> ra∫i:ti	'to ask'
at-imti	'to take away'	at-kurti	'to reestablish'
<mark>at-n</mark> e∫ti	'to bring'	ad-bekti	'to run up'
at-l eisti	'to forgive'	ad-gauti	'to get back'
at-likti	'to complete'	ad-bukti	'to become blunt'
at-ko:pti	'to rise'	ad-gimti	'to be born again'

 $(4) \quad /-\mathbf{voi}, +\mathbf{alv}, -\mathbf{son}, -\mathbf{cont}/ \rightarrow [+\mathbf{voi}, +\mathbf{alv}, -\mathbf{son}, -\mathbf{cont}] / _[+\mathbf{voi}, -\mathbf{son}]$

• The change in [±voice] matches the environment, making the sounds more similar: this is an <u>assimilation</u> rule.

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