Sonority

An introduction

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In a nutshell

What is sonority?

- Various articulatory and acoustic correlates of sonority have been identified (at least 98 different correlates, according to Parker 2002).
- Aperture and intensity are probably the most salient features (Bloomfield 1914, Jespersen 1922, Laver 1994).
- According to Ladefoged (1982: 245), "the sonority of a sound is its loudness relative to that of other sounds with the same length, stress, and pitch" (loudness being the perceptual counterpart of acoustic intensity and amplitude).

In a nutshell

What is sonority?

- By way of consequence, a syllabe is a *wave of energy* (intensity/amplitude), according to Sievers (1893) and Pike (1943).
- Every syllable exhibits *one peak* of sonority, contained in the nucleus (Jesperson 1904).
- Between the leftmost member of a syllable and the peak, only sounds of higher sonority are allowed (Sievers 1881).

In a nutshell

What is sonority?

- Phonologists have been interested in the formal explanations that sonority allows us to derive, particularly with respect to sound combinations within syllables (phonotactics). Many phonologists deny that sonority has any physical reality.
- A good example of the mismatch between discrete, abstract phonological categories and non-discrete phonetic properties (the syllable is another typical example).

In a nutshell

What is sonority?

Sonority is a relative (non-binary) feature that "categorizes all speech sounds into a hierarchical scale"

(Parker 2011: 1160)

In a nutshell

What is sonority?

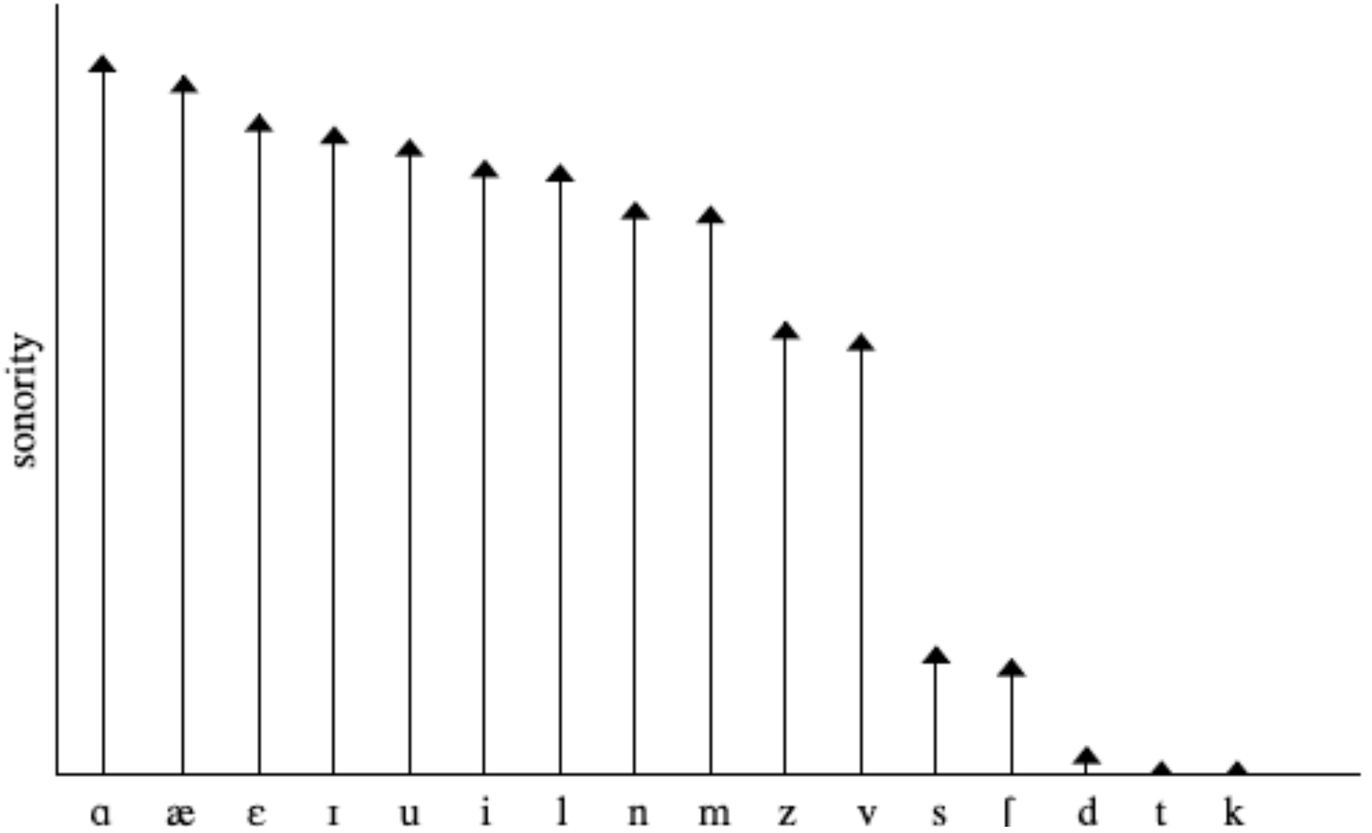
- The *Sonority hierarchy* or sonority scale is a ranking of segments along a scale on the basis of their sonority.
- Various versions of the scale exist, more or less refined depending on language-parametric settings, some versions dating back as far as the work by Sievers (1881) and Jespersen (1904).
- The best known version is proposed by Clements (1990):

Vowels > Approximants > Nasals > Obstruents

E. g., a, i, u, e, o > j, w, l, r > m,n, ŋ > f, s, t, d, k

In a nutshell

What is sonority?



The relative sonority of a number of the sounds of English (Ladefoged 1975)

In a nutshell

What is sonority?

- The most detailed version, designed for a more permissive syllabification algorithm, was proposed for Tashlhiyt Berber.
  - Dell & Elmedlaoui (1985: 109):

a > high vocoids > liquids > nasals > voiced fricatives > voiceless

fricatives > voiced stops > voiceless stops

  - Revised version (Dell & Elmedlaoui 2002 : 76) :

a > high vocoids > liquids > nasals > fricatives > stops

In a nutshell

Why it matters?

- Sonority accounts for the organization of segments within the syllable: more sonorous segments stand closer to the peak of the syllable than less sonorous segments.
- It defines the shape of the canonical syllable: Sonority rises at the beginning (onset) toward the nucleus (peak) and falls away from it (coda). => Sonority cycle (Clements 1990).
- It also defines licit clusters (which consonant combinations are allowed at onset and coda positions), especially in languages where only vowels (and as subset of consonants) occur in the nucleus => Sonority Sequencing Principle (Selkirk 1984, Clements 1990).

In a nutshell

Why it matters?

- In languages where consonants can be syllabic, sonority determines the hierarchy of consonants in their competition for the nucleus position (e.g., j,w > l,r > m,n > s, f > t, k).
  - A subset of sonorants can be syllabic in English (e.g. bott**l**e, botto**m**, butto**n**) and Czech (e.g. v**l**k 'wolf', k**r**k 'neck').
  - Any consonant can be syllabic in Tashlhiyt Berber (e.g. **b**.s**r**.t**n**t 'spread them (fem)', t**s.**s**k**.ʃ**f**.t**s**tt 'you faded it (fem)', **k**.k**t** 'go through').
- Sonority also determines where languages epenthesize vowels to repair sonority violations within consonant clusters (e.g. Spanish: structure *vs.* [e]structura, Farsi: teran 'train' vs. estop 'stop').

3.8. – 7.8.

11:00 - 14:30 hod **Při změně přílohy účtujeme**
Jídla mohou obsahovat alergeny . **Bližší informace**

Pondělí : 3.8.
Polévka: Žampionová
1. Čevabčiči s hořčicí a cibulí,vařené brambory
2. Pečené kuřecí stehno s dušenou rýží a okurkem
3. Zeleninový salát s filovaným kuřecím masem,sázeným v
   s bylinkovým dipem a rozpečeným toastem
4. Kuřecí špíz se sušenými švestkami a anglickou slaninou,
5. Pečený pstruh na kmíně a bylinkách s vařenými brambo

Úterý : 4.8.
Polévka:Frankfurtská s uzeninou
1.Zeleninové lečo s klobáskou,chléb
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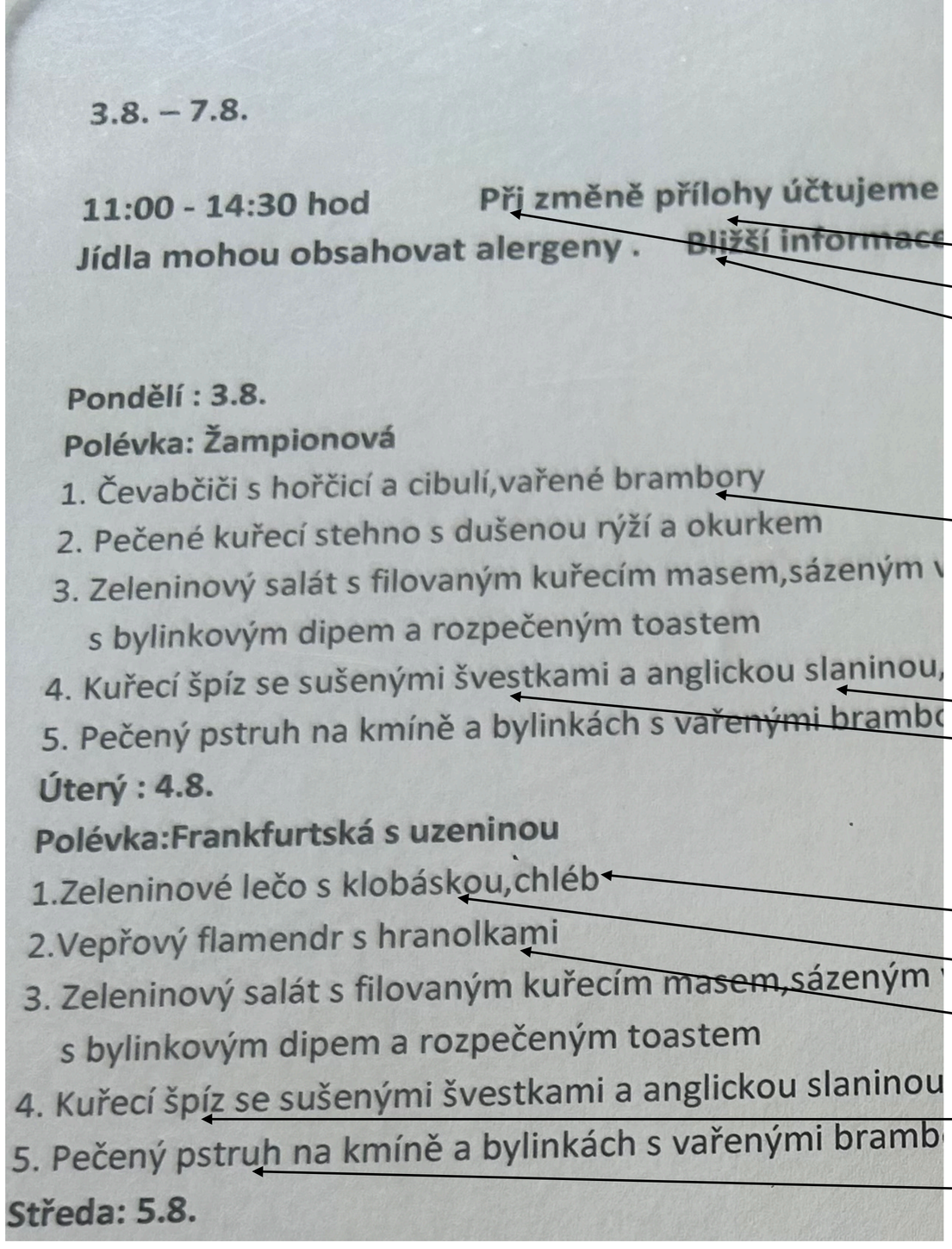
Středa: 5.8.



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Středa: 5.8.

attachements

during, when

more

potato

bacon

plums

bread

bread

French fries

skewer

trout

In a nutshell

Why it matters?

- Czech

trvat	to last
hřmět	to thunder
trstina	reed (plant)
rtut'	quick silver
lžíce	spoon

In a nutshell

Why it matters?

- Sonority also determines where languages epenthesize vowels to repair sonority violations within consonant clusters (e.g. Spanish: structure *vs.* [e]structura).

a. « train » > teran

« plan » > pelɑn

« drawer » > derɑver

« Blazer » > belejzer

b. « free » > firi

« Floyd » > folojd

« Sri Lanka » > serilɑnkɑ ; sirilɑnkɑ

« Schröder » > ʃeruder ; ʃuruder

c. « stop » > ʔestop

« Stuttgart » > ʔeʃtutkɑrt

« smoking » > ʔesmoking

« slide » > ʔeslɑjd

« Schneider » > ʔeʃnɑjder

« Schmeichel » > ʔeʃmɑjkel

In a nutshell

Any alternatives?

- **Strength**, as an inverse restatement of sonority (Hooper 1976: 206), refers to inherent properties of segments, typically consonants, which determine their behaviour in certain phonological processes (lenition).

Voiceless stop > *Voiceless continuant / Voiced stop* > *Voiced continuant* > *Nasals* > *Liquids* > *Glides*

- **Complexity**, in Element Theory and related theories, refers to the number of elements a segment contains: The more the segment contains Elements, the more complex it is (Harris 1990, 1994, Harris & Lindsey 1995, Scheer 1996, Backley 2011).
- Obstruents are more complex than sonorants.
- **OCP** on features (Enguehard

Outline

1. Sonority: a tentative definition
2. Sonority within the syllable
    - Sonority Hierarchy
    - Sonority Sequencing Principle
    - Sonority Distance
    - Sonority Dispersion
3. Case studies
    - English-like languages
    - Czech (and related languages)
    - Tashlhiyt Berber
4. Complex onsets
    - Experimental evidence (phonetics and perception)
    - Sonority vs. place
5. Sonority vs. complexity
6. Sonority beyond the syllable

Sonority

A tentative definition

"What, then, is sonority? Roughly speaking, it is a ranking on a scale that reflects the degree of openness of the vocal apparatus during production, or the relative amount of energy produced during the sound or perhaps it is a ranking that is motived by, but distinct from, these notions." (Goldsmith, 1990 : 110-111).

Sonority

A tentative definition

- Phoneticians have tried to identify the articulatory and acoustic properties that best characterize sonority.
- Ladefoged's C*ourse in Phonetics* (1975 and subsequent editions) has a whole chapter on syllables and suprasegmental features, wherein he states that "the sonority of a sound can be estimated from measurements of the acoustic intensity of a group of sounds" (6th edition, p. 245).
- Acoustic intensity (amount of energy) of a sound reflects its loudness.
- The greater the sound intensity, the higher its sonority.
- Articulatory feature: degree of openness of segments, or lack of (i.e. stricture).

Sonority

A tentative definition

- Sonority is a phonological a feature of segments, though not equivalent to other features such as coronality or labiality (≠ SPE major class [±son], see Scheer 2019)
- It is a relative (non binary) feature that "categorizes all speech sounds into a hierarchical scale" (Parker 2011: 1160)
- Some sounds are inherently more sonorous (more vowel-like) than others.
- **Voicing** and **sonority** may overlap but are not interchangeable.
- Voicing contributes to sonority: A voiced consonant is more sonorous than its voiceless counterpart, unless some language's phonotactic constraints indicate otherwise: e.g. /z/ is more sonorous than /s/, but in some languages /s/ can be syllabic, /z/ cannot.

Sonority

A tentative definition

- **Voicing** is a binary feature that some segments have or do not have: a consonant is either [+voice] or [-voice].
- It is distinctive only in obstruents (a natural class that includes stops, fricatives and affricates).
- Languages contrast voiced / voiceless obstruents; there are hardly any languages that contrast voiced sonorants with voiceless counterparts (but see Welsh that contrasts a subset of voiced/voiceless sonorants: e.g. voiced /l/ and voiceless /ɬ/ may appear in any position (Bell et al. 2021))

Sonority

A tentative definition

- Final devoicing shows that the feature is binary (not gradient). It triggers obstruents (sonorants remain unaffected). Examples in German:

tag [taːk] 'day' / tage [taːgə] 'days'

hand [hant] 'hand' / hände [handə] 'hands'

ganz [gans] 'goose' / ganze [ganzə] 'geese'

lob [loːp] 'praise' / lobe [loːbə] 'praises'

Sonority

A tentative definition

- **Sonorants** or resonants (vowels, glides, liquids, nasals) are those segments characterized by a relatively open vocal tract, with continuous airflow.
- They display spontaneous voicing (hence no contrastive voicing feature), and high sonority (sit at the higher end of sonority hierarchy).
- They can be syllabic in some languages (e.g. English /l, m, n/, Czech /l, r/).
- In languages with complex onsets (e.g., English, French), they appear as the second member of the cluster, close to the nucleus.
- In feature theories, [sonorant] functions as a major class feature: E.g., in SPE (1968: 303), vowels, glides, liquids and nasals are [+sonorant].

Sonority

within the syllable

- **Sonority** is a feature of segments that reflects their behaviour in phonological processes rather than any physical (phonetic) property, though not equivalent to features such as coronality or labiality.
- It is a relative feature that "categorizes all speech sounds into a hierarchical scale" (Parker 2011: 1160)
- Some sounds are inherently more sonorous (more vowel-like) than others.
- Sonority determines the arrangement of segments within the syllable (more sonorous segments stand closer to the nucleus than less sonorous segments), and inside the constituants (complex onsets must display a rising sonority profile).

Sonority

within the syllable

- **gaps in English complex onsets**
- **sr, ʃr, *kn, *km, *tl vs. sm, sn, *sʒ**

- **why some clusters are illicit?**

	p	b	t	d	k	ɡ	ʧ	ʤ	f	v	θ	ð	s	z	ʃ	ʒ	h	m	n	ŋ	l	r	j	w
p																								
b																								
t																								
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	p	b	t	d	k	ɡ	ʧ	ʤ	f	v	θ	ð	s	z	ʃ	ʒ	h	m	n	ŋ	l	r	j	w
p	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	+	+	+	
b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	
t	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	+	+
d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+
k	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(+)	-	+	+	-	+
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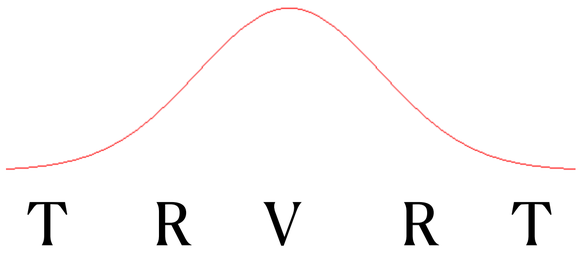
Sonority

within the syllable

- The preferred syllable type (canonical) has a specific sonority profile that rises sharply at the beginning (onset) toward the nucleus and then falls gradually toward the end (coda).
- This refers to a cycle of sonority (Clements 1990) or a curve of sonority (Sievers 1883, Jespersen 1904):



(Scheer 2015: 50)

Sonority

hierarchy

- The **sonority hierarchy** is a ranking of segments (natural classes) along a scale on the basis of their sonority.
- Segments are no more [±vocalic] or [±syllabic], as SPE used to claim (p. 354).
- The ranking of segments determines their position within the syllable and, more crucially, their ability to occupy the nucleus position.
- Vowels are the most likely segments to occupy the nucleus position (the vast majority of languages allow only vowels to do so), voiceless stops are the least likely.
- The sonority hierarchy defines the "degree of eligibility" for the nucleus position (Carr 1993: 198).

Sonority

hierarchy

- Clements' 1990 version: **Vowels** > **Approximants** > **Nasals** > **Obstruents**

E. g., a, i, u, e, o > j, w, l, r > m,n, ŋ > f, s, t, d, k

- Languages that need syllabic segments other than vowels first select from the approximants class, which comes second in the hierarchical order (e.g. English, Czech, Slovak, Serbo-Croatian, Sanskrit, etc.).
- Some languages may have syllabic nasals (e.g. English *button* [ˈbʌtn̩], German *geben* [ˈgeːbən] ~ [ˈgeːbn̩] 'to give', Czech *sedm* 'seven', Japanese moraic /n/ in coda, Mandarin, etc.).

Sonority

hierarchy

- Selkirk (1984) proposed assigning a sonority index to sound classes:
- Vowels (6) > Glides (5) > Liquids (4) > Nasals (3) > Fricatives, affricates (2) > Stops (1)
- Clements (1990) used a slightly different index and argued that certain distinctive features can be used to capture the sonority hierarchy.

	[syll]	[voc]	[approx]	[son]	
Vowels	+	+	+	+	4
Glides	-	+	+	+	3
Liquids	-	-	+	+	2
Nasals	-	-	-	+	1
Obstruents	-	-	-	-	0

The sounds marked "+" for the 4 features are the most sonorous.
The sounds marked "–" for the 4 features are the least sonorous.

Sonority

hierarchy

- German (Hall 1992, Wiese 1996)

- What do you notice in these examples ?

blessing	ze:gən ~ ze:gn
breath	a:təm ~ a:tm
sail	ze:gəl ~ ze:gl
heaven	hɪməl ~ hɪml

Sonority

hierarchy

- German (Hall 1992, Wiese 1996)

blessing	ze:gn̩	ze:gn-ən
breath	a:tm̩	a:tm-ən
sail	ze:gl̩	ze:gl-ɐ(r)
heaven	hɪml̩	hɪml-iʃ

Sonority

hierarchy

- Czech (Scheer 2008, Ziková 2007, Ziková et al. 2025)

trvat	to last
hřmět	to thunder
trstina	reed (plant)
klnout	to curse
bobr	beaver
vítr	wind
mysl	sense

Sonority

hierarchy

- Czech (Ziková et al. 2025)

verse 1: 8 V-peaks	verse 2: 7 V-peaks + 1 syllabic L-peak
bude **fio̯rki:** **ka**lix **pi:ci**	(**slzi**)$_{\sigma\sigma}$ **na**d **mal**va**zi:** **mi:ci**
will bitter cup drink	tears over beer have
‘he will drink a bitter cup ||	crying tears over the beer’ [Lom]

verse 1: 8 V-peaks	verse 2: 8 V-peaks + 1 non-syllabic L-peak
k **je**ho **ro**vu **pi̯**ša **bi**la	**a**bi s **pla:t͡**ʃ**e**m (**slzi**)$_{\sigma}$ **pro**lila
to his grave came was	in.order.to with cry tears spilt
‘she came to his grave ||	so she would cry tears’ [HradMagd]

Sonority

hierarchy

- Slovak (Blaho 2004: 23)
- Word-initial stress
- syllabic consonants receive stress

non-syllabic				syllabic			
pravý	[pravi:]	‘right’	**rp*	*prst*	[p̩rst]	‘finger’	**rp*
tri	[tri]	‘three’	**rt*	*trh*	[t̩rh]	‘market’	**rt*
krava	[krava]	‘cow’	**rk*	*krv*	[k̩rv]	‘blood’	**rk*
hra	[hra]	‘game’	**rh*	*hrsť*	[h̩rsc]	‘fist’	**rh*
člen	[t͡ʃlen]	‘member’	**lč*	*čln*	[t͡ʃl̩n]	‘boat’	**lč*
tlač	[tlat͡ʃ]	‘press’	**lt*	*tlstý*	[tl̩sti:]	‘fat’	**lt*
plač	[plat͡ʃ]	‘cry’	**lp*	*plný*	[pl̩ni:]	‘full’	**ln*
kľúč	[kʌu:t͡ʃ]	‘key’	**lk*	*kĺb*	[kl̩:p]	‘joint’	**ĺk*
mreža	[mreʒa]	‘grate’	**rm*	*mrkva*	[m̩rkva]	‘carrot’	**rm*
mlieko	[mli͡eko]	‘milk’	**lm*	*mlčiť*	[ml̩t͡ʃic]	‘be silent’	**lm*
vrana	[vrana]	‘crow’	**rv*	*vŕba*	[vr̩:ba]	‘willow’	**ŕv*
vlasy	[vlasi]	‘hair’	**lv*	*vlk*	[vl̩k]	‘wolf’	**lv*

Sonority

hierarchy

- Verlan, French

a.	ʃope	peʃo	get
	mezɔ̃		home
	bizar		strange
b.	fam	məf(a)	thing
	mɛk		guy
	bɛt		idiot

Sonority

hierarchy

- Serbian word game "Šatrovački" (Rizzolo 2005, fn 5)

a.	cvet	təcve	flower
	vic	cəvi	joke
	grad	dəgra	city
b.	stvar	rstva	thing
	smor	rsmo	boredom (slang)

Sonority

hierarchy

- Slovak Polish cognates (Blaho 2004)

Slovak		Polish		gloss
vlk	/vlk/	*wilk*	/vilk/	‘wolf’
krv	/krf/	*krew*	/kref/	‘blood’
krst	/krst/	*chrzest*	/xʃest/	‘baptism’
dlh	/dlh/	*dlug*	/dluk/	‘debt’

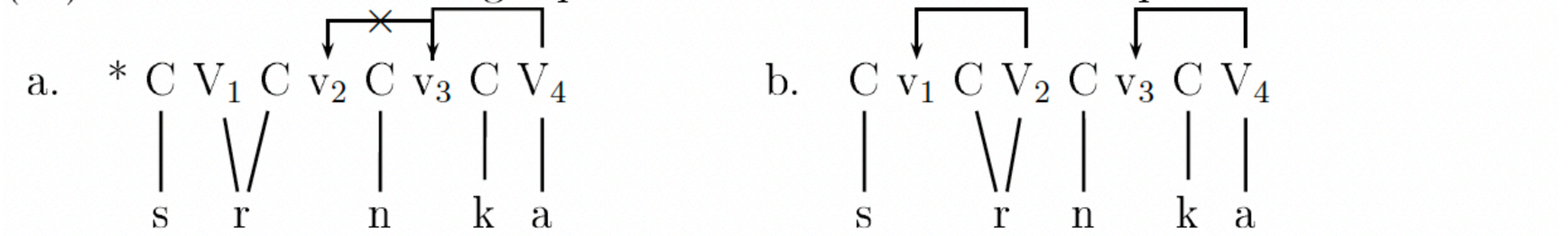
- Slovak allows words without vowels provided that they contain a syllabic consonant.
- In Polish, vowelless words are ill-formed.

Sonority

hierarchy

- Syllabic behave as vowels but are still consonants:
- They branch into a V position (left or right-branching depending on languages and/or analyses).
- Blaho (2004: 25) argues for a right-branching representation: C V
  |/

(22) *The left-branching representation makes incorrect predictions in Slovak*



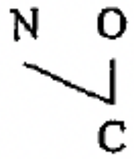
Sonority

hierarchy

- Scheer (2004, 2009)

representation of syllabic and trapped consonants in Scheer (2004:§240, 2008)

a. left-branching: syllabic



Czech *tṛvat* 'to last'

b. right-branching: trapped

Polish *trwać* 'to last'

Arguments:

- Syllabic consonants (Czech) and trapped consonants (Polish) behave differently, therefore they must have different representations.

- Syllabic consonants block prefix vocalization (e.g. roz-tṛhat 'to tear up' / roze-ptat 'to start to ask')

- Trapped consonants trigger prefix vocalization (e.g. roze-d**r**gać 'to become vibrating', roze-b**r**nąć 'to flounder (pf)).

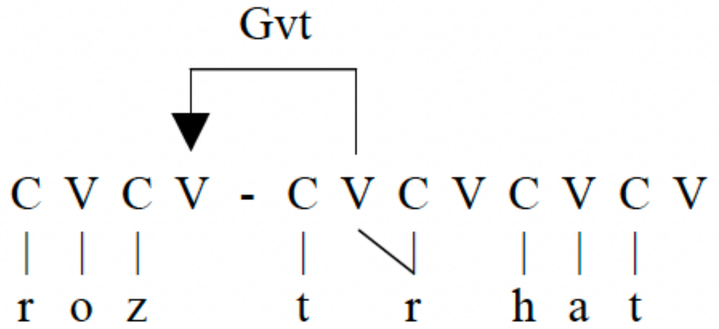
Sonority

hierarchy

Scheer (2004, 2008, 2009)

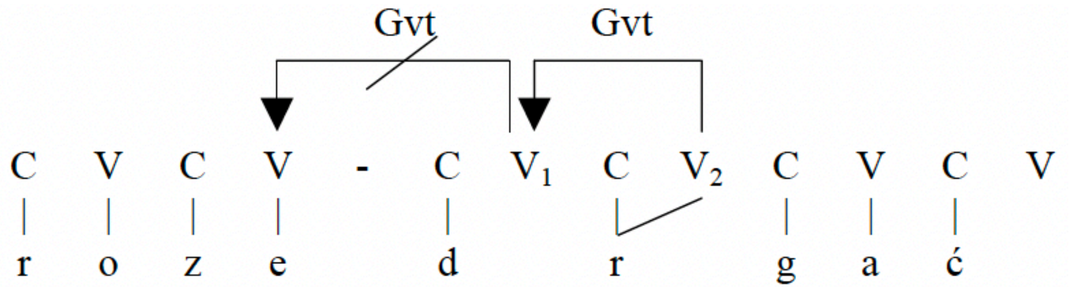
- Syllabic consonants (left-branching) govern the prefixal nucleus, preventing its vocalization.
- Trapped consonants (right-branching) do not govern the prefixal nucleus, allowing vocalization.

Syllabic



Czech rozø-trhat "to tear up"

trapped



roze-drgać "to set vibrating"

Sonority

hierarchy

Scheer (2004, 2008, 2009)

- trapped consonants are transparent to voicing assimilation (e.g. /kadr/ > [katr], /kadr-a/> [kadra] 'staff')
- syllabic consonants are not (/bobr/ > [bobr], *[bopr] (no devoicing) 'beaver').

Sonority

hierarchy

- Sonority hierarchy in Czech and Slovak:

Vowels > **Glides** > **Liquids** > **Nasals** > **Obstruents**

Sonority

hierarchy

Vowels are always syllabic, consonants may or may not be syllabic

Sonority

hierarchy

- Jespersen's (1904: 188) version, taken from Clements (1990), includes many more levels:
    1. (a) voiceless stops, (b) voiceless fricatives
    2. voiced stops
    3. voiced fricatives
    4. (a) voiced nasals, (b) voiced laterals
    5. voiced r-sounds
    6. voiced high vowels
    7. voiced mid vowels
    8. voiced low vowels

Sonority

hierarchy

- Very few languages display syllabic obstruents (Tashlhiyt [kṣ] 'to graze', [g̩] 'to be', [ḳk] 'to pass'; Bella Colla, a Salish language, [ṣt’] 'to be dry', [ḳ’] 'to be short' (Bagemihl 1991)).
- Such languages require a more refined version of the hierarchy, where obstruents are broken down into fricatives and stops, with or without voicing.
- Dell & Elmedlaoui (1985: 109) hierarchy for Tashlhiyt:

a > high vocoids > liquids > nasals > voiced fricatives > voiceless

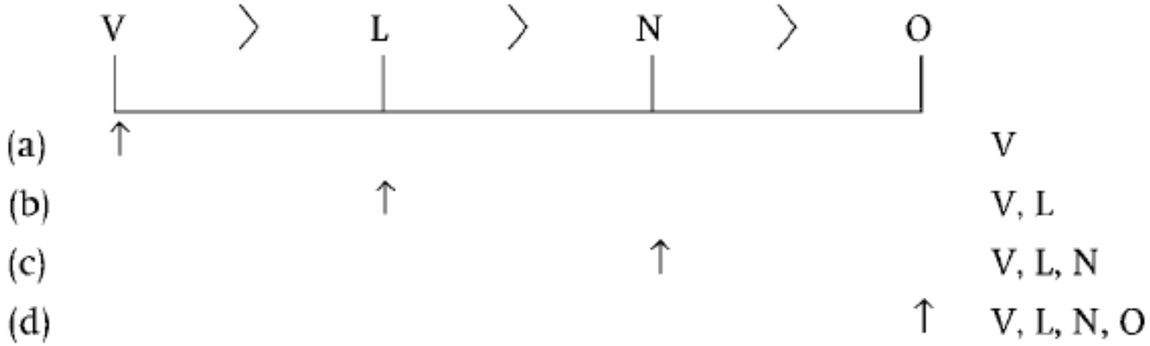
fricatives > voiced stops > voiceless stops

Sonority

hierarchy

- Zec (2007: 179)

Hierarchy of syllable peaks



A four-point peak hierarchy defines four sonority thresholds:

- In (a) only vowels are above the sonority threshold
- In (b) vowels and liquids
- In (c) vowels, liquids and nasals
- in (d), all segments are above the sonority threshold

Any of these thresholds may define the set of syllabic segments in a language:

(a) *Bulgarian, French* (only vowels can occupy the nucleus)
(b) *Slovak, Czech* (vowels and liquids)
(c) *English* (vowels, liquids and nasals)
(d) *Tashlhiyt* (any consonant)

Sonority

hierarchy

- If a segment with a relatively low sonority value can serve as a syllabic nucleus in a language, then any segment of greater sonority can also serve as a syllabic nucleus
- Syllabification algorithms rely entirely on the sonority hierarchy to break utterances into syllables, built around vowels only in some languages, and around consonants when vowels are missing in other languages.
- Core syllables (onset+nucleus) are built first, then the remaining unsyllabified segments are attached to the syllables edges, maximazing onsets (cf. Clement's 1990: 299 *Core Syllabification Principle*, Kahn 1976, Selkirk 1982, Clements & Keyser 1983, among others).

Sonority

hierarchy

- The **Core Syllabification Principle** (p. 299):

  a. Associate each [+syllabic] segment to a syllable node.

  b. Given P (an unsyllabified segment) preceding Q (a syllabified segment), adjoin P to the syllable containing Q iff P has a lower sonority rank than Q (iterative).

  c. Given Q (a syllabified segment) followed by R (an unsyllabified segment), adjoin R to the syllable containing Q iff R has a lower sonority rank than Q (iterative).

Sonority

hierarchy

- The **Maximal Onset Principle**, which follows directly from the Core Syllabification Principle, states that intervocalic segments are attached to the onset of the following syllable rather than the coda of the preceding one, as long the resulting cluster in the onset displays a rising sonority profile (Clements 1990: 300, Selkirk 1982, Steriade 1982: 72).
- For example, French *pa.**tr**ie* 'homeland' vs. *pa**r.t**ie* 'part', *a**s.tr**al* 'astral'; English *me.**tr**ic* vs. *pa**r.t**y*.
- Languages with no complex onsets uniformly split intervocalic clusters into coda+onset: e.g. Moroccan Arabic *mak.la* 'food' vs. *mal.qa* 'he didn't find'; Tashlhiyt *ir.zˁa* 'he broke' vs. *izˁ.ra* 'he saw', *Botrus*.

Sonority

hierarchy

- Sonority hierarchy in Tashlhiyt (from Dell & Elmedlaoui 1985):
  - For any sequence YZ, assign the syllabic peak to the most sonorous segment.
  - Example 1: j**u**.s**i** 'he carried ' / t**r**.g**l** 'she locked'
  - Example 2: **i**rˤ.zˤ**m**.t**n** 'he opened them'
  - Example 3: t**a**.m**a**.d**u**.n**t** 'illness' (avoid hiatus => /n/ cannot be syllabic though more sonorous than /t/).

Sonority

hierarchy

- Core syllables in Tashlhiyt (from Dell & Elmedlaoui 1985):
  - Associate a core syllable with any sequence (Y)Z, where Y can be any segment and Z is more sonorous.
  - Syllabic segments are selected in the order specified by the sonority hierarchy, starting from /a/, the most sonorous segment in the scale.
  - CS(a): associate a core syllable with any sequence (Y)Z where Z is an a.
  - CS(HV): associate a core syllable with any sequence (Y)Z where Z is a HV.
  - CS(L): associate a core syllable with any sequence (Y)Z where Z is a liquid.

And so on...

Sonority

hierarchy

YOUR TURN!

Sonority

hierarchy

- /tazrwalt/ 'city name'
- /tzdm/ 'she gathered some wood'
- /zdmʁ/ 'I gathered some wood'
- /nzdm/ 'we gathered some wood'
- /sngibiltnt/ 'make them (fm) face each other'
- /trkm/ 'it (fm) is cold'
- /isngaratn/ 'he divided them'
- /tsslkmt/ 'you accompanied (somebody)'
- /tkkstn/ 'she removed them'

Sonority

hierarchy

- Czech Sonority hierarchy (Ziková et al. 2023: 393): Vowels > Sonorants > Obstruents
- Only vowels and liquids can occur as syllable nuclei (Scheer 2003, Ziková et al. 2023, among others).

/brno/

/smrk/ 'spruce'

/prst/ 'finger'

/trvat/ 'to last'

/vlk/ 'wolf'

/vitr/ 'wind'

/sprchl/ 'to take a shower'

Sonority

Sequencing Principle

- The Sonority Sequencing Principle (SSP) or Sonority Sequencing Generalization (SSG) defines the sonority shape or profile of the syllable (Hooper 1976, Selkirk 1984, Clements 1990, Blevins 1995, among many others).
- It states that a well-formed syllable must have a sonority profile that rises from the onset to the nucleus (typically CV or OSV), and falls from the nucleus to the coda.
- In other words, every syllable must have one syllable peak (usually a vowel). The adjacent consonant clusters, if any, must exhibit a uniform sonority profile, constantly rising toward the nucleus (Parker 2002: 8).
- It is a universal tendency that relies entirely on a sonority hierarchy and helps understanding syllabification patterns, phonotactic constraints and repair strategies (deletion, epenthesis, metathesis, etc.) in various languages.

Sonority

Sequencing Principle

- SSP accounts for many languages syllable types and consonant clusters allowed at the edges (onset and coda).
- It predicts that in English-like languages, words may begin with an obstruent + a sonorant (e.g **pl**ate, **tr**ain, **fl**y), but not the other way around (*lp, *rt, *lf, etc.).
- Languages can vary with respect to the degree to which they adhere to the SSP:
  - English, French and the like may have postvocalic (coda) falling or rising sonority clusters (e.g. da**rk**, pa**rk** vs. un**cl**e, a**ppl**e, a**x**).
  - English-like languages have words starting with s+(O)S (e.g. structure, stop, spot) whose onsets violate the SSP (/s/ is more sonorous than /t/ or /p/).

Sonority

Sequencing Principle

- In English, words may not begin with /tl/, /vl/, /vr/, /sr/ or /zr/ though perfectly fine in terms of sonority profile (rising from /t/ to /l/). The reason for */tl/ lies elsewhere (OCP-Place).
- Sonority plateaus are disallowed (no *kt or *lr within the onset, but found in the coda position: Eng. *fact*, *act, girl*; Fr. *hymne*, *pacte*, *perle*, *merle*).
- #sC and #sCC are very common in English-like languages that many phonologists have linked to *extrasyllabicity* (Clements & Keyser 1983 for English, Shane 1968 and Rialland 1994 for French). Some others link sibilants to a syllable coda, whose nucleus is empty (Kaye 1992).

Sonority

Sequencing Principle

- Czech has greater flexibility regarding the nature of word-initial consonant clusters (SSP does not apply as strictly as it does in English):

trvat	to last
hřmět	to thunder
trstina	reed (plant)
rtut'	quick silver
lžíce	spoon

Sonority

Sequencing Principle

- Moroccan Arabic

a. OS		b. SO		c. OO	
ʃra	'he bought'	rʃa	'he corrupted'	ktab	'book'
sni	'sign'	nsa	'he forgot'	kdub	'lies'
mrˁa	'woman'	rˁma	'he throw'	ʃkun	'who's there?'
bləʕ	'swallow'	lbən	'milk'	xbarˁ	'news'
gləs	'sit down'	lga	'he found'	dkərˁ	'male'

Sonority

Sequencing Principle

- Tashlhiyt is even more permissive

a. OS		b. SO		c. OO	
kru	‘rent’	rku	‘be dirty’	kti	‘remember’
bri	‘scratch’	rbu	‘carry on the back’	bsi	‘melt’
gnu	‘sew’	ngi	‘overflow’	sti	‘pick out’
dlu	‘cover’	ldi	‘pull’	zdʕarn	‘they are able’

Sonority

Distance

Minimum Sonority Distance is a tendency for languages to impose a minimal sonority distance between C1 and C2 in a syllable-initial consonant cluster.

(Steriade 1982, Selkirk 1984, Clements 1990)

Sonority

Dispersion

Sonority dispersion principle (Clements 1990, 1992): maximize the onset-to-nucleus sonority slope

Tashlhiyt

words without vowels

- One major feature of Tashlhiyt Berber is its extensive use of consonant clusters, which may result in utterances without any vocalic segment:

  E.g. *tsslkmttnt* ‘you made them (fem.) arrive’

  nlkmd 'we arrived'

  tssχsrttnt 'you turned them (fem.) into a wreck'

  tʃʃkfftstt 'you faded it (fem.)'

- Based on this characteristic, Dell & Elmedlaoui (1985, 1988, 2002) argued that in Tashlhiyt any segment, even a voiceless obstruent, can be syllabic (see also Boukous 1987, Bensoukas 2001, Ridouane 2008, and Lahrouchi 2018).

Tashlhiyt

words without vowels

- The so-called “transitional vocoids”, which appear in certain consonant clusters (e.g. nkər ‘wake up, stand up’, lkəm ‘arrive’), have no syllabic status according to Dell & Elmedlaoui.
- On the contrary, Coleman (1996, 2001) argues that they are epenthetic, filling syllabic nuclei that would otherwise remain empty.
- All other Berber varieties (Tamazight, Tarifit, Kabyle, etc.) resort to schwa epenthesis to break up illicit clusters.

Tashlhiyt

Sonority-based syllabification

- Sonority scale for Tashlhiyt (Dell & Elmedlaoui 1985: 109):
- Voiceless stops > voiced stops > voiceless fricatives > voiced fricatives > nasals > liquids > high vocoids > a

- Dell & Elmedlaoui's (1985) syllabic algorithm
- Core syllabification (CS):
  - 1. CS(a): Associate a core syllable with any sequence (Y)Z where Z is a.
  - 2. CS(HV): Associate a core syllable with any sequence (Y)Z where Z is a HV.
  - 3. CS(L): Associate a core syllable with any sequence (Y)Z where Z is a liquid.
  - 4. CS(N): Associate a core syllable with any sequence (Y)Z where Z is a nasal.
- and so on...

Tashlhiyt

Sonority-based syllabification

- All syllables must have an onset (except domain-initially).
- CS operates iteratively from left to right until all possible core syllables are built.
- Tashlhiyt has no branching onsets (rising sonority clusters and their mirror image).
- Non-syllabified consonants are attached to the coda position (prepausal annexation).
- A geminate cannot branch into an onset + a nucleus.
- e.g. /tizrwalin/ « inhabitants of Tazrwalt »

1.tIzr**Ua**lIn

2.**tI**zr**Ual**In

3.**tIzrUall**n

4.**(tI)(zr)(Ua)(lIn)**

Tashlhiyt

Sonority-based syllabification

Dell & Elmedlaoui's (2002) syllabic model

- Two principles:
    1. The *licit consonantal nuclei thesis*, which states that any segment even a voiceless obstruent can act as a syllabic nucleus.
    2. The *sonority-driven syllabification thesis*, which holds that in the competition for the status of syllabic nucleus, more sonorous segments are favored over less sonorous segments.
- *Sonority scale* (D&E 2002: 76), decreasing sonority:

    a > high vocoids > liquids >nasals > fricatives > stops

Tashlhiyt

Sonority-based syllabification

Six constraints:

1. Any rime contains at most three consonants. If so, the last consonants form a geminate (Dell and Elmeldaoui 2002:98).
2. The coda position cannot be more sonorous than the nucleus (Dell and Elmedlaoui 2002:102).
3. Every syllable has an onset, except domain-initially where the onset may be empty (Dell and Elmedlaoui 2002:92).
4. Any sequence with a sonority peak must contain a nucleus (Dell and Elmedlaoui 2002:100).
5. A geminate cannot branch into an onset followed by a nucleus (Dell and Elmedlaoui 2002:102).
6. Any rime contains at most three consonants. If so, the last consonants form a geminate

Tashlhiyt

Sonority-based syllabification

- Tashlhiyt Berber complex consonants clusters, as a typological unique characteristic, has served as a testing ground for several theories.
- de Lacy (2007:23): “[OT's] success at dealing with markedness hierarchies in the now famous case of Imdlawn Tashlhiyt Berber syllabification is probably part of the reason that OT's influence spread so quickly”.
- Prince & Smolensky (1993, §2) used Tashlhiyt syllabification algorithm as a crucial argument to introduce two key notions: "optimality" and "constraint domination".
- Two constraints:

1. The Onset Constraint (Ons): Syllables must have onsets (except phrase initially)
2. The Nuclear Harmony Constraint (Hnuc): A higher sonority nucleus is more harmonic than one of lower sonority.

Tashlhiyt

Sonority-based syllabification

- Ons >> Hnuc

Parallel Analysis of Complete Syllabification of /txznt/

Candidates	ONS	HNUC	
☞ .t**X**.z**N**t.		n	x
.**T**x.z**N**t.		n	t !
.t**X**z.n**T**.		x !	t
.tx**Z**.**N**t.	* !	n	z
.**T**.**X**.**Z**.**N**.**T**.	* ! ***	n z x t t	

Tashlhiyt

Argument 1: The Imperfective

In Tashlhiyt, three processes are involved in the formation of the imperfective:

1. the gemination of a consonant in the base
2. the prefixation of the augment *tt-*
3. the insertion of a vowel in the base

Tashlhiyt

Argument 1: The Imperfective

- Vowel insertion may operate jointly with prefixation or with gemination to form the imperfective.
- Vowel insertion and gemination cooccur mainly in biconsonantal verbs (e.g. *gn* > *ggan* 'sleep', *ls* > *lssa* 'wear', ʁr > aqqra 'read').
- Gemination never combines with the augment tt-, except for a few monoconsonantal verbs (e.g. *g* > *ttgga* 'be', *ʃʃ* > *ʃtta* 'eat', kk > ttkka 'go through').

Table with examples here

Tashlhiyt

Argument 1: The Imperfective

- As an imperfectizing mechanism in Tashlhiyt Berber, gemination involves verbs with no more than three consonants and no full vowels, except in the final position.
- All Berber varieties systematically geminate the medial consonant, except for Tashlhiyt Berber where the geminated consonant can be initial or medial.

Table with examples here

Tashlhiyt

Argument 1: The Imperfective

- D&E's (1988) analysis relies on the idea that prior syllabification is necessary for the explanation of this variation in TB.
- The segment which is geminated in the imperfective is that segment which is syllabified as an onset in the basic stem.

Table with examples here

Tashlhiyt

Argument 1: The Imperfective

- The segment which is geminated in the imperfective is that segment which is syllabified as an onset in the basic stem.

- Can you identify where the syllabic segment is?

	base	**impf**	
a.	frn	ffrn	sort
	krz	kkrz	plow
	ħlb	ħħlb	eat (liquid)'
b.	lkm	lkkm	arrive
	rgl	rggl	close
	knu	knnu	lean'
c.	mun	tt-muna	accompany
	gawr	tt-gawar	sit down

Tashlhiyt

Argument 1: The Imperfective

- Without the information provided by the syllabification algorithm it would be impossible to identify the geminating segment in the imperfective.
- The difference between verbs geminating the initial consonant and those geminating the medial consonant lies in that the consonant syllabified in the onset appears either in the initial or in the medial position of the verb base.
- The key to understanding why verbs containing a vowel in non-final position fail to geminate in the imperfective relies, according to Jebbour (1999), on the constraint that requires that the output to gemination contains exactly two light syllables.

Tashlhiyt

Argument 1: The Imperfective

- Jebbour (1999)
- LL imposed on the output of impf gemination (Jebbour's analysis)

CC̣C is light / CVC is heavy.

		Verb	Gemination	σ structure	Template
a.	frs	ffrs	ffrs	C̣.OC̣C	LL
	fsr	fssr	fssr	OC̣.OC̣	LL
	gru	grru	grru	OC̣.OV	LL
b.	mun	*mmun	m.mun	C̣.OVC	*LH
	amr	*ammr	am.mr	VC.OC̣	*HL
	aru	*arru	ar.ru	VC.OV	*HL

Tashlhiyt

Argument 2: The verse

- Rays Albnsir (1970's)

	L	H	L	L	L	H	L	L	L	L	H
a.	r	zmʁ	di	wu	li	nus	lû	da	ʁu	ʒd	dig
b.	m	qar	tn	tk	si	ʁar	di	sn	tnt	tl	ʒab
c.	ha	nur	gi	ʁn	ki	nam	sa	ʁu	la	ks	sab
d.	i	ʃat	nu	ks	sa	bis	da	ʁi	ra	way	yâd
e.	i	ʁat	sl	la	ni	waʃ	tu	ks	ʁi	di	bidd
f.	mn	waħ	du	st	ti	nat	tu	kan	nt	mʒ	ʒad