The life cycle of phonological patterns explains drift in sound change

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Key points and outline

- Drift occurs when shared innovations post-date the separation of proto-languages
- Joseph (2006, 2013): shared innovation is the narrowing of the range of inherited variation
- I agree! In fact, this is positively predicted by the life cycle of phonological processes (Bermúdez-Otero 2015)
- Parallel innovations could also be genuine phonetic parallels?
- Case study: Uralic consonant gradation
  - Typologically unusual: no easy recourse to typology
  - The life cycle accounts for the pattern *and* offers additional clues on its development

Drift, shared changes, and the life cycle

The basic problem

- Three mechanisms of innovation sharing
  - Vertical transfer: inheritance
  - Horizontal transfer: contact
  - Parallel changes after (?) separation
- Drift in linguistics (Sapir 1921)[1]

[1] Not the same as drift in genetics! But see Yanovich (2016)

Shared innovation after 'separation'

- Horizontal transmission
  - *Wellentheorie*, diffusion, linkages (François 2015)
  - Language and dialect contact
- Vertical transmission (Joseph 2013)
  - Languages inherit patterns of variation
  - Later change narrows the range of variation
  - Parallel innovations arise from the same pool of variation
- Round, Dockum & Ryder (2022): biologists know this as incomplete lineage sorting[2]

[2] See also Jacques & List (2019)

Why does the range of variation narrow?

- Because that's how sound change works!

- The life cycle of phonological processes (Kiparsky 1988, 1995, Bermúdez-Otero 2007, 2015, Ramsammy 2015, Sen 2016)

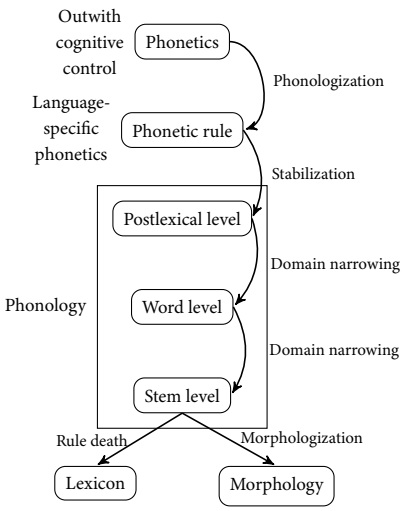

Figure 1: The life cycle of phonological processes

Sound change and phonological typology

- Historical phonologists are blessed/cursed[3] with a raft of substantively grounded explanations/rationalizations for sound change (Blevins 2004, Garrett & Johnson 2013)
- Independent development can be difficult to exclude when the change is 'natural'
- Less appealing explanation when it is not
- A classic case is morphological reduction via phonological reduction in unstressed syllables

[3] Delete as appropriate

Finnic and Sámi consonant gradation

Summary of case study

- A notable case of an unusual process in related languages that resists easy reconstruction to the common ancestor
- Amenable to a variationist account of drift informed by the life cycle
- This perspective also casts clearer light on some old controversies

Roadmap

- Key notions
  - Rhythmic vs. syllabic gradation
  - Quantitative vs. qualitative gradation
- Finnic vs. Sámi: lenition vs. fortition
- Finnic vs. Sámi: expansion vs. contraction

- 'Phonetic' vs. 'phonological' gradation and the life cycle

Key background: Proto-Uralic consonants

Manner	Labial	Coronal			Dorsal
Stop	p	t			k
Affricate				č	
Sibilant		s	ś	(š)	
Nasal	m	n	ń		ŋ
Lateral		l			
Rhotic		r			
Glide	w			j	
Unclear		δ	δ'		(x)

Table 1: Proto-Uralic consonants following Luobbal Sámmol Sámmol Ánte (2022), see also Janhunen (1981); Sammallahti (1988).

- Singleton/affricate distinction for **p t č k*, perhaps **m*

Consonant gradation

For some overviews, see Laanest (1982), Novak (2014) and Bakró-Nagy (2022)

- Consonants come in 'weak' (Č) and 'strong' (C̀) varieties
- Originally allophonic, now morphologized and/or levelled to various degrees
- Two kinds of gradation conditioning:[4]
  - 'Rhythmic' ('suffixal'): Č after every even-numbered vowel
  - 'Syllabic' ('radical'): in R-strong positions, Č before a closed syllable

[4] In the following, I refer to positions being R- or S- strong or weak, depending on the type of gradation at issue

The common denominator: foot structure?

- Assuming L → R syllabic trochees

	(CV́	C̀V)	(ČV̀	C̀V)
Rhythmic	—	Strong	Weak	Strong
Syllabic	—	Strong	—	(Strong)

	('CV́	ČVC)	(ČV̀C	ČVC)
Rhythmic	—	Strong	Weak	Strong
Syllabic	—	Weak	—	(Weak)

- Syllabic gradation beyond main stress is limited to some Finnic varieties

Rhythmic gradation: Finnic

- Finnic partitive *-tA*
  - **-ta̋A* > *-tA*
  - **-ťA* > *-A*

	R-strong		R-weak
Language	**mā* 'land'	**korkea* 'tall'	**kala* 'fish'
Finnish	*maata*	*korkeata*	*kalaa*
Estonian	*maad*	*kõrget*	*kala*
Ingrian	*māɒa*	(*korkijā*)	*kal·ā*

In the Ingrian partitive, rhythmic consonant gradation does not apply after odd-numbered vowels other than after heavy monosyllables (Laanest 1966: p. 106). See below for the half-length in *kal·ā*.

Rhythmic gradation: Sámi

- Northern Sámi inflection: 2PL.PRES **-bē-ta̋-dē(k)*
  - 'Even-syllable stems', R-weak: *borra-behttet* 'you (pl.) eat'
  - 'Odd-syllable stems', R-strong: *riegáde-hppet* 'you (pl.) are born'
- Northern Sámi derivation: causative **-ttA* < PUr **-ktA*
  - R-weak *borra-t* 'eat', *bora-hi-t* 'feed'[5]
  - R-strong *riegádi-t* 'be born', *riegáda-htti-t* 'give birth'
- Comparative **-mbō*
  - R-weak **-b(ō)*
  - R-strong **-bb(ō)*

	R-strong	R-weak
Language	**pɔ̄rēs* 'old'	**nōrę* 'young'
Northern Sámi	*boarráseabbo*	GEN.SG *nuorabu*
South Sámi	*båarasåbpoe*	*noerebe*

[5] The *h* in the R-weak grade is a later change: the expected weak grade of PSaa **tt* is *ht*, which is what we find e.g. in Nielsen (1979): *bǫrâtit*, *riegadât'tet*. Note the S-weak grade in *borahit*, caused by the following geminate (< **poře-tta-*), contrast *borrat* < **poŕę-dēk*

Syllabic gradation

- Similar but not identical behaviour in Sámi and Finnic
- Need to distinguish intervocalic consonants and consonants in clusters

The 'Q2 merger' in Finnic

- Singleton/geminate crossed with strong/weak creates a potential four-way contrast
- The usual pattern is for C̀ to merge with C̆C as a 'Q2 grade'

Estonian maintains a distinction between short and long geminates, but the origin may be secondary. We return later to Veps (and Livonian).

	**joke* 'river'		**loppu* 'end'	
	GEN	NOM	GEN	NOM
	**p̆ t̆ k̆*	**p̀ t̀ k̀*	**p̆p t̆t k̆k*	**p̀p t̀t k̀k*
Finnish	*joen*	*joki*	*lopun*	*loppu*
Votic	*jõgõõ*	*jõtši*	*lõpuu*	*lõppu*
Estonian	*jõe*	*jõgi*	*lõpu*	*lõpp*
Veps	*jogen*	*jogi*	*lopun*	*lop*

The 'Q2 merger' in Sámi

- Much the same picture in Sámi,[^9] with two important differences:
  - Not just stops, but also fricatives and sonorants participate in the alternation
  - The Q2 merger outcome is a short geminate/half-long consonant, not a short consonant
- Exceptions:
  - Special developments in Kola Sámi (Kildin and Ter), especially in stops
  - Southern varieties (southern Pite and all of Ume) lack gradation after short vowels due to consonant gemination in that context
  - No syllable gradation at all in South Sámi

Table 7: Syllable gradation in Sámi: stops

	**jokę* 'river'		**tikkē* 'louse'	
	GEN	NOM	GEN	NOM
	**p̆ t̆ k̆*	**p̀ t̀ k̀*	**p̆p t̆t k̆k*	**p̀p t̀t k̀k*
Skolt Sámi	*joogg*	(*jokk*)	*tee′k̆k̆*	*te′k̆k̆*
Inari Sámi	*juuvâ*	*juuhâ*	*tihe*	*tikke*
Northern Sámi	*joga*	*johka*	*dihki*	*dihkki*
South Sámi	*johken*	*johke*	*dihkien*	*dihkie*

Table 8: Syllable gradation in Sámi: continuants

	**kōlē* 'fish'		**kōssē* 'guest'	
	GEN	NOM	GEN	NOM
	**C̆*	**C̀*	**C̆C*	**C̀C*
Skolt Sámi	*kue′l*	*kue′ll*	*kue′ss*	*kue′s′s*
Northern Sámi	*guoli*	*guolli*	*guossi*	*guos′si*
South Sámi	*guelien*	*guelie*	*guessien*	*guessie*

- This is the source of *quantitative gradation* and the synchronic ternary contrast in Sámi
  - Č = Q1
  - Ċ = ČC = Q2
  - ĊC = Q3

Quantitative and qualitative gradation

- *Qualitative gradation* occurs generally when Q1 reflexes[6] are not qualitatively identical to Q2
- It is characteristic of Finnic[7] and eastern varieties of Sámi

[6] Usually of stops, but sometimes fricatives

[7] Except Veps and Livonian, which lack syllabic gradation

Language	Q1	Q2	Q3
Finnish	v d/r/l/j/h ∅/v/j	p t k	pp tt kk
Estonian	v ∅ ∅	b d g	p(p) t(t) k(k)
Votic	v ∅ g	p t k	pp tt kk
Ingrian	v ∅ ∅	ʙ ᴅ ɢ	pp tt kk
Skolt Sámi	v ð ɣɣ	ʰpˑ ʰtˑ ʰkˑ	ʰpː ʰtː ʰkː
Inari Sámi	v ð v	pʰ tʰ h	pːʰ tːʰ kːʰ
Northern Sámi	p/v ð k/ɣ/v/∅	hp ht hk	hːp hːt hːk
Lule Sámi	p t k	hp ht hk	hpː htː hkː
Pite Sámi	p t k	hp ht hk	hpː htː hkː

- South Sámi has unaspirated stops from unlengthened singletons vs. preaspirated stops from lengthened singletons and original geminates
  - *gïete* 'hand' < **kētę*
  - *johke* 'river' < **jokke* < **jokę*
  - *aahka* 'grandmother' < **ākkē*

Secondary lengthening

- Many languages undergo consonant lengthening before secondary long vowels[8]
- The details differ significantly in both outcome and conditioning

[8] Those arising from contraction after consonant deletion (e.g. due to R-gradation)

Estonian

- Singleton stops lengthen to geminates, resulting in Q3
- Singleton sonorants do *not* lengthen
- Geminate sonorants do lengthen to Q3[9]

[9] Geminate sonorants are mostly secondary, cf. **linna* 'town' < **litna*, cf. Votic *lidna*

Manner	Grade	Form		Outcome
Stop	Weak	**kät-ten* 'hand-GEN.PL'	**käťten*	*käte*^{Q2}

Manner	Grade	Form		Outcome
	Strong	**käte-hen* 'hand-ILL'	**kätːēn*	*kätte*^{Q3}
Sonorant	Weak	**lina-n* 'flax-GEN'	**liňa*	*lina*^{Q1}
	Strong	**lina-a* 'flax-PART'	**liǹā*	*lina*^{Q1}
Geminate sonorant	Weak	**linna-n* 'town-GEN'	**liňna*	*linna*^{Q2}
	Strong	**linna-a* 'town-PART'	**liǹnā*	*linna*^{Q3}

Elsewhere in Finnic

- Original singletons lengthen before a long vowel
  - Allophonic lengthening in Finnish
  - Distinctive half-length in Ingrian
  - Neutralized to long in Finnish dialects
- This affects most or all consonants

Finnish	Finnish dialects	Soikkola Ingrian	Gloss
kala	*kala*	*kala˙*	'fish-NOM'
kalaa	*kallaa*	*kal˙a*	'fish-PART'
sota	*sota*	*soɒa˙*	'war-NOM'
sotaa	*sottaa*	*sot˙a*	'war-PART'
kukka	*kukka*	*kukːə*	'flower-NOM'
kukkaa	*kukkaa*	*kukːa˙*	'flower-PART'

Sámi

- Original C̀ > C̀C before various long vowels[10]
- In Sámi, this means Q2 > Q3 for all segments

[10] Usually those of secondary origin

Manner	Grade	Form		Outcome
Stop	Weak	**pɔ̄tē-m* 'come-PRS.1SG'	**pɔ̄t̆ēm*	*boađán*^{Q1}
	Strong	**pɔ̄tē-tēk* 'come-INF'	**pɔ̄tːēt̄ēk*	*boahtit*^{Q2}
	Strengthened	**pɔ̄tē-jē* 'come-PRS.PTCP'	**pɔ̄tːtē-(j)ē*	*boahtti*^{Q3}
Sonorant	Weak	**sōlōj* 'island-NOM'	**sōl̆ōj*	*suolu*^{Q1}
	Strong	**sōlōj-in* 'island-GEN'	**sōlːlō(j)-in*	*sul'lo*^{Q3}

- For a three-way alternation in sonorants, cf. Northern Sámi *doalan*^{Q1} 'hold-PRS.1SG' ∼ *doallat*^{Q2} 'hold-INF' ∼ *doal'li*^{Q3} 'hold.PRS.PTCP'
- For a Finnic parallel to such Q1 ∼ Q3 alternations:

- Q1 **käten* 'hand-GEN' > Finnish *käden*, Estonian *käe*[11]
- Q3 **käte-hen* 'hand-ILL' > Finnish *käteen*, dialectal *kätteen*, Estonian *kätte*

[11] The form *käe* is Q3 for synchronic phonological reasons, but historically it is a **Č* grade

Consonant gradation in clusters

- Every cluster comes only in a $\check{C}_1C_2$ and $\grave{C}_1C_2$ version
- Big difference between Finnic and Sámi
  - Finnic: lenition of C_2 in weak grade with Q2 merger
  - Sámi: fortition of C_1 in strong grade with no Q2 merger

Finnic: lenition of C_2

	**jalka* 'foot'		**palkka* 'wage'	
	GEN	NOM	GEN	NOM
Finnish	*jalan*	*jalka*	*palkan*	*palkka*
Votic	*jalgaa*	*jalka*	*palkaa*	*palkka*
Estonian	*jala*	*jalg*	*palga*	*palk*

Sámi: fortition of C_1

- $\grave{C}_1C_2$
  - Increased duration of C_1
  - Excrescent vowel after sonorants in western languages
  - Relative lenition (shortening, voicing) of C_2
- $\check{C}_1C_2$
  - Relatively short duration of C_1
  - No excrescent vowel
  - Relative fortition (lengthening, voicelessness) of C_2

	**jōlkē* 'foot'		**pālkkē* 'wage'	
	GEN	NOM	GEN	NOM
Northern Sámi	*juolggi* [juolkːi]	*juolgi* [juolegi]	*bálkká* [paːl̥hkaː]	*bálká* [paːlahkaː]

The origin of gradation

A common ancestor?

- There is no exclusive common ancestor for Finnic and Sámi: a Finnic-Sámi-Mordvin linkage (T. Itkonen 1983, Helimski 2006, Aikio 2015, Zhivlov 2015)

- Relatively late date:
  - Not all languages have S-gradation
    - Livonian, Veps[12]
    - South Sámi
  - …although all have R-gradation, including South Sámi (Bergsland 1945)
  - Q2 merger not Common Sámi, absent in
    - Kola Sámi (T. I. Itkonen 1916)
    - Ume Sámi dialects (Bergsland 1973, Larsson 2012)
- Critically: differences in detail and fundamentally the nature of the process
- Lenition in Finnic, fortition in Sámi (Ravila 1951, Gordon 1997, Sammallahti 1998)

[12] Note that these are the most peripheral Finnic varieties, respectively west and east. Veps shows traces of gradation (e.g. Tunkelo 1938, Posti 1940, Turunen 1965), but these may be due to Karelian influence (see further Kettunen 1939, Laanest 1972).

Phonetics vs. phonology, and drift

- Long established idea that 'phonetic' gradation was in the proto-language but 'phonological' gradation developed separately in the daughter languages (Ravila 1960: p. 287, Leppik 1968, Korhonen 1981: pp. 237–238, Kallio 2007)
- This is *drift*

The life cycle of gradation

- R-gradation is older than S-gradation
  - It is found in all languages
  - It is a more drastic type of lenition ($*\check{t} > \emptyset$ in R-gradation, $t/\eth$ in S-gradation)[13]
- *Phonologization* of quantitative S-gradation: duration asymmetry in foot-medial onsets of closed syllables is innovated and spreads to parts of the Finnic-Sámi-Mordvin linkage
- Some (but not all) descendant languages experience *stabilization* to discrete phonological gradation patterns
- Similar outcomes in similar contexts, but inevitable differences in detail
- *Rule scattering*: the phonetic rule continues to exist after stabilization
  - The phonetic asymmetry is available to stabilize again later
  - Explains the pattern's 'pertinacity' (e.g. Dresher & Lahiri 2005, Kennard & Lahiri 2017)

[13] Cf. on this criterion Bermúdez-Otero (2015)

The development of gradation

Lenition vs. fortition

- Uncontroversially, secondary lengthening is fortition
- Clear motivation from *metrical compensation*: (ĹH) is an exceptionally bad trochee[14]
- Amply attested synchronically (Gordon 1997, Bye 2005, Kiparsky 2008)

[14] Interestingly, in Ingrian (Markus 2010, 2011, Kuznetsova 2012) secondary lengthening also occurs in the onset of a non-initial (LL) foot, which is more difficult to motivate directly by such compensation.

- The nature of S-gradation is more contested

The fortition theory

- Qualitative gradation looks like lenition
- Not controversial for Finnic: lenition/degemination,[15] including in clusters[16]
- This cannot be right for Sámi: fortition instead (Ravila 1960, Gordon 1997, Sammallahti 1998, Bye 2001)

[15] Recall that voiced continuants of the Č grade in Finnic cannot have come from the proto-language

[16] This includes secondary generalization of qualitative gradation like *s* > *z* gradation in Votic: *isä* 'father.NOM' ∼ *izä* 'father.GEN' (Markus & Rozhanskiĭ 2017: p. 382)

Expansion vs. contraction

- Finnic:
  - Stabilized S-gradation for stops
  - Some extension to other segments, usually secondary[17]
  - Secondary (pre-V̄) lengthening of most or all consonants
  - Phonetic onset shortening in closed syllables, applying to *all* consonants (Lehtonen 1970: p. 112)
- Sámi
  - Stabilized S-gradation for *all* consonants
  - Secondary lengthening(s) of *all* consonants

[17] Cf. Votic (Markus & Rozhanskiĭ 2017: p. 381) *issu-ma* 'sit-INF' ∼ *isu-n* 'sit-PRS.1SG' (Finnish *istua*, *istun*), *püssü* 'gun:NOM' ∼ *püsü* 'gun:GEN' (Finnish *pyssy*, *pyssyn*)

Alternative models

- Finnic-like restricted scope → expansion in Sámi
  - Historically tied to the Fennocentric view of S-gradation as lenition
- Sámi-like maximum scope → restriction in Finnic
- Gordon (1997):
  - S-gradation is originally fortition of all consonants, driven by metrical structure (I agree)
  - Modern Finnic lost phonological fortition, with only the phonetic tendencies remaining (I disagree)

A life cycle perspective

- Patterns develop from phonetics to phonology, not the other way around
- Scope expansion is fairly mundane *rule generalization* (Vennemann 1972, Bermúdez-Otero 2015, Ramsammy 2015)
- Scope restriction must be rejected, *pace* Gordon (1997)
- *Rule scattering*: the persistence of the phonetic gradation rule conditions repeated stabilization
  - C > C· before contracted vowels (Ingrian, Estonian dialects)
  - C > C: before contracted vowels (Finnish dialects, Sámi, Estonian)[18]
  - C > C: in some contexts before long vowels (some Sámi)

[18] Via the previous stage?

S-gradation, rule generalization, and rule scattering

Rule	Proto-language	Finnic	Sámi
Phonetic rule	✔	✔	?
Stabilized stop gradation		✔	✔
Stabilized continuant gradation			✔

The question of shortening in closed syllable onsets is understudied. There is little clear evidence in this respect from the Sámi languages.

✔ Present
⊙ Reconstructed
? Unclear

Secondary lengthening as pertinacious drift

Secondary lengthening	Fi	Ingr	Est	FiDial	Sámi
Phonetic rule	✔	⊙	⊙	⊙	?
C > Cˑ stops		✔	⊙	⊙	⊙
C > Cː stops			✔	✔	✔
C > Cˑ all		✔		⊙	⊙
C > Cː all				✔	✔
Strengthening					✔

- Lengthening before contracted vowels is a repeated process, conditioned by the constant presence of the phonetic rule
- The details differ, but stabilization reoccurs

Conclusions

- Parallel developments in related languages arise from a shared pool of variation as patterns proceed along the life cycle
- This approach extends to patterns that are otherwise unusual, unlike explanations from typology
- The life cycle framework casts some light on long-standing issues
  - Rule scattering explains repeated innovation (pertinacity) of lengthening
  - The life cycle offers a principled reason to reconstruct Finnic/Sámi phonological gradation as expanding rather than contracting in scope

Outstanding issues

- What is the precise relationship between rhythmic and syllabic gradation?
- What is the nature of the phonetic rule of S-gradation? Is Gordon (1997) right to view it as metrical compensation via foot-final lengthening?
- How old is Uralic gradation? What is the relationship of Finnic/Sámi gradation to Nganasan (Helimski 1996)?

Appendix

More typologically unusual drift

- Fall of the yers: the last Common Slavic sound change? (Trubetzkoy 1924)
  Or inherited 'tendencies'?
- Break-up of Common Slavic: mid to second third of first millennium CE
- Common Slavic **ъ ь* < Proto-Slavic **ŭ ĭ*
- Havlík's Law: yers are 'weak' word-finally and unless followed by a weak yer, 'strong' before a weak yer
  - **vъ lъbъ* > **vъ lьbъ* > Ru *v lob*
  - **vъ lъbu* > **vь lъbu* > Ru *vo lbu*
- Not exactly a common way of treating reduced vowels (Scheer 2011)
- Started in the south, eventually reached all of Slavic,[19] but not completed until the 13th century or even later in East Slavic
- Other possible examples
  - Germanic 'breaking' processes (Howell 1991)
  - North Germanic sonorant preocclusion (Sandøy 2003)

[19] Possibly not even all (Zales'kŷĭ 1986, Kasatkin 1996, Dombrowski 2013)

Why Sámi gradation must be fortition

- Qualitative gradation is not universal
- Limited qualitative lenition in clusters[20]
- Q2 merger: the strong grade is longer
- Clear evidence there was no **t* > **ð* change provided by original **ð*

[20] Even in varieties with qualitative gradation otherwise, cf. Inari Sámi *juelgi* 'foot:NOM' ~ *juelgi* 'foot:GEN'; to the contrary Skolt Sámi *jue'lğğ*, weak grade *jue'lj*

	**kota* 'house'		**paðɜ* 'dam'	
Language	Weak	Strong	Weak	Strong
Finnish	*kodan*	*kota*	*padon*	*pato*
SaaN	*goađi*	*goahti*	*buođu*	*buođđu*
SaaS	*gåetie*		*boere*	
Hungarian	*ház* 'house'		*fál* 'wall'	

Multiple secondary lengthenings

- Võro shows two separate secondary lengthenings (Iva 2010)
- C > C: before **VhV*
- C > C· before **VĭV*
- Confirmation that secondary lengthening proceeds in several stages

	Short		Half-long	Long
	Weak	Strong		
Segments	GEN	NOM	PART	ILL
Stops	∅ ∅ ∅	B D G	pˑ tˑ kˑ	pː tː kː
‘shame’	*häp̆i-n *häü*	*häp̀i *häbü*	*häpi-t̆a *häpü*	*häpi-hen *häppü*
Sonorants	m n l r		mˑ nˑ lˑ rˑ	mː nː lː rː
‘dog’	*peni-n *pini*^{Q1}	*peni *pini*^{Q1}	*peni-t̆a *pinni*^{Q2}	*peni-hen *`pinni*^{Q3}

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