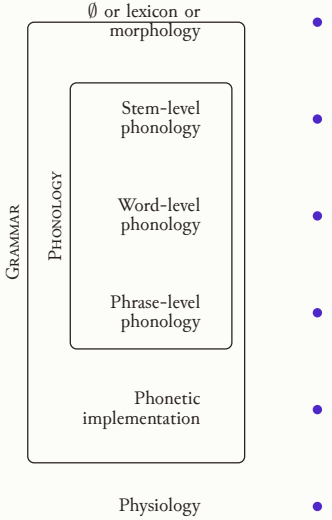
Sound change, phonological theory, and *inference*

Deepthi Gopal, Tromsø/Uppsala

§ 1

The life cycle, again

The life cycle of phonological processes



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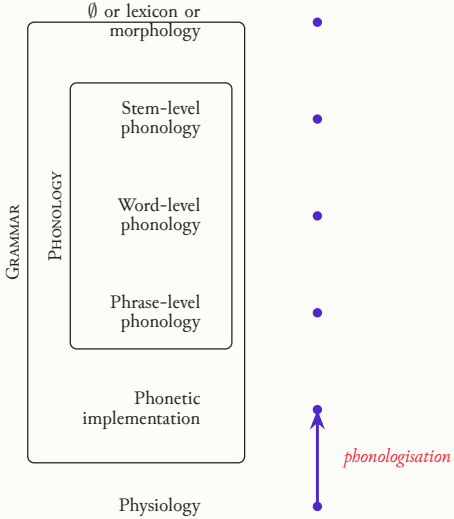

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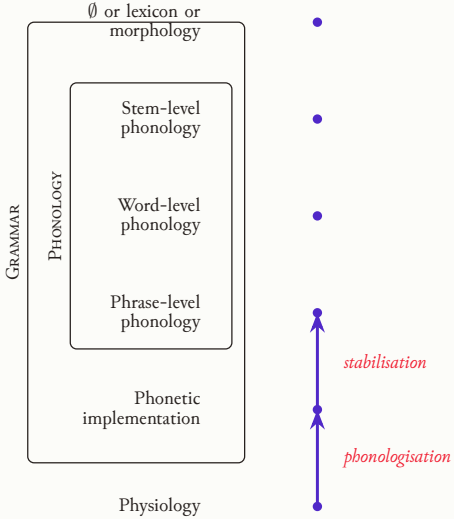

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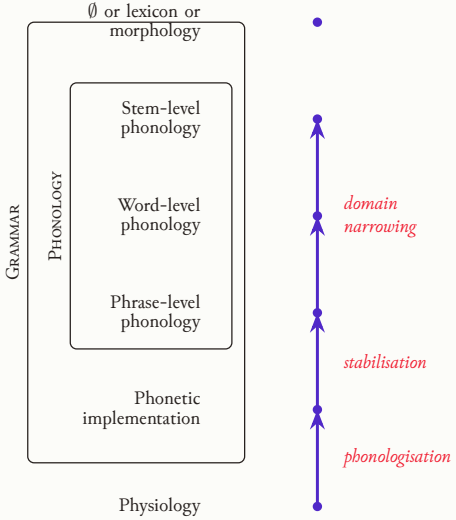

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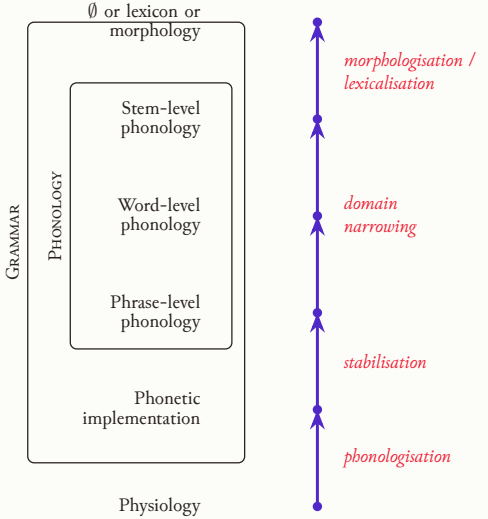

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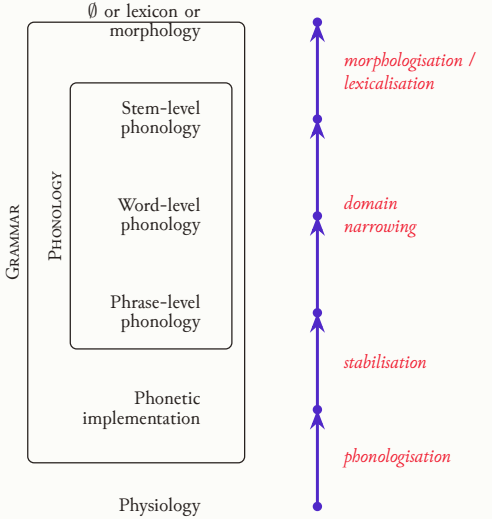

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We also discussed *Norwegian retroflexion*, and whether its distribution might be due to *diffusion*.

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- *Does all surface change eventually give rise to phonological change, given sufficient time?*
- When we see related varieties sharing a piece of phonology, how do we know whether to attribute this to *inheritance, contact, parallel innovation, or even chance*?

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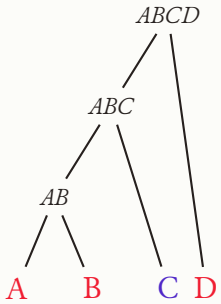

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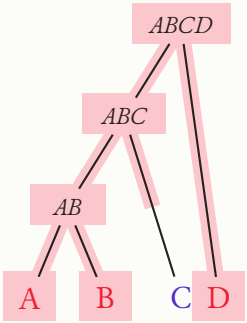

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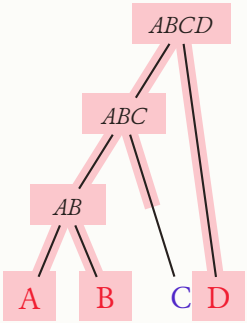

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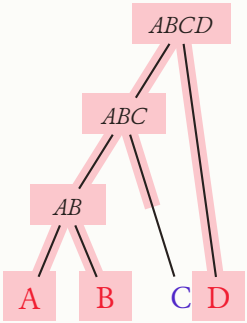

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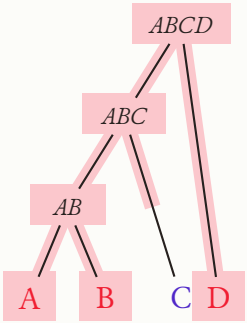

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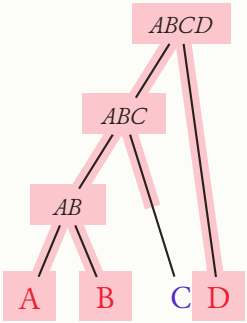

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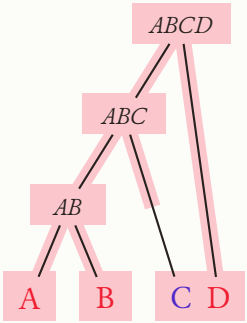

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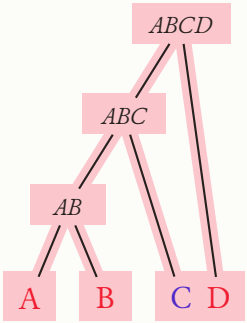

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- C may have all the ingredients for the change, but never instantiate it.

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  - In this case, there are multiple independent *events* corresponding to multiple innovations, but the innovations are still causally linked.

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- Famously, Sapir (1921): *'Language moves down time in a current of its own making. It has a drift.'* Actually, Sapir really worries about the idea that we need to be sensitive to how a worked-out theory of variation might give rise to drift.

> '[...] are we not imputing to this history a certain mystical quality? Are we not giving language a power to change of its own accord over and above the involuntary tendency of individuals to vary the norm?'

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- Arguably, the more 'unusual' the development, the easier it is to tell these cases apart from one another. **What other evidence do we have?**

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- But what are we doing when we make this kind of claim? Are we right to do it? (Spoiler, boring: I think we probably are, but I think we could stand to spell things out more often and more explicitly.) In fact (Iosad, 2025), the logical chain from precursors to 'drift' parallel development probably works for unrelated languages that happen to share structural and/or phonetic properties, too.

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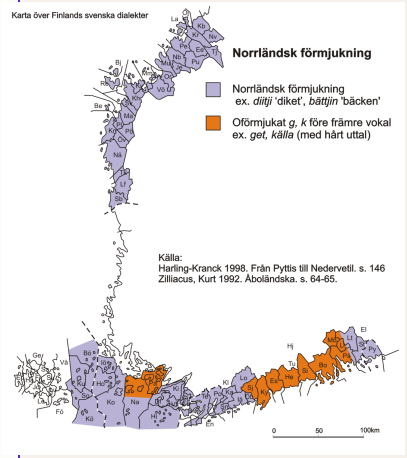
Swedish palatalisations: one rule, or many?



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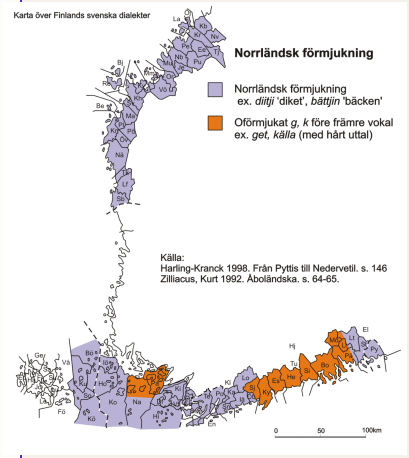

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- But in many varieties of Northern Sweden and Finland, this applies in further environments and seems to remain phonological: *mycket* [mytʃe] 'much', C.Sw. [mykʲe(t)], but also *språket* /sproːkːt/ [sproːtʃe] C.Sw. [sproːkʲɛt] *skogen* /skuːgːn/ [skuːjin] C.Sw. [skuːgɛn].

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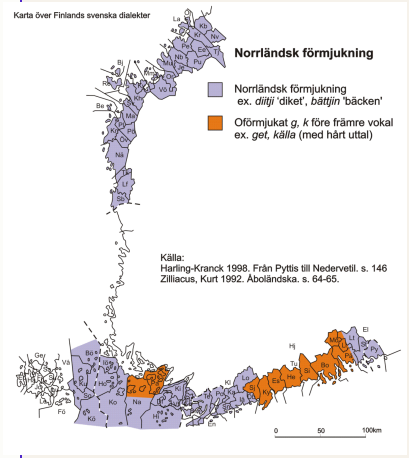

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- But we also find varieties in which none of this took place.

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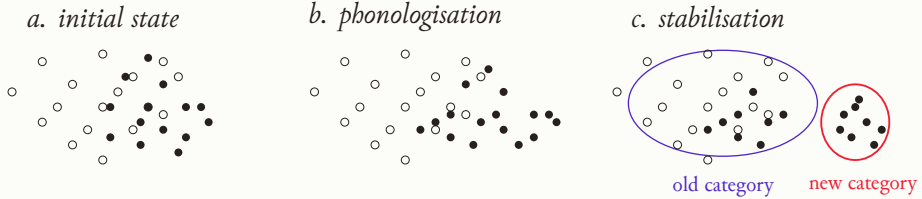

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Lowering in sonorant-closed syllables.

/erdem/	[æɾ.dæm]	'virtue'	/erdem-i/	[æɾ.de.mi]	'virtue-ACC'
/hejkel/	[hej.kæl]	'statue'	/hejkel-im/	[hej.ke.lim]	'statue-1SG.POSS'
/biber/	[bi.bæɾ]	'pepper'	/biber-in/	[bi.be.ɾin]	'pepper-GEN'
/gør-mek/	[gœɾ.mek]	'see-INF'	/gør-i-yor-im/	[gø.ɾy.yor.um]	'see-PROG-1SG
/gøl/	[gœl]	'lake'	/gøl-i/	[gø.ly]	'lake-ACC'
/gøm-mek/	[gœm.mek]	'bury-INF'	/gøm-eɾ/	[gø.mæɾ]	'bury-3SG.P'

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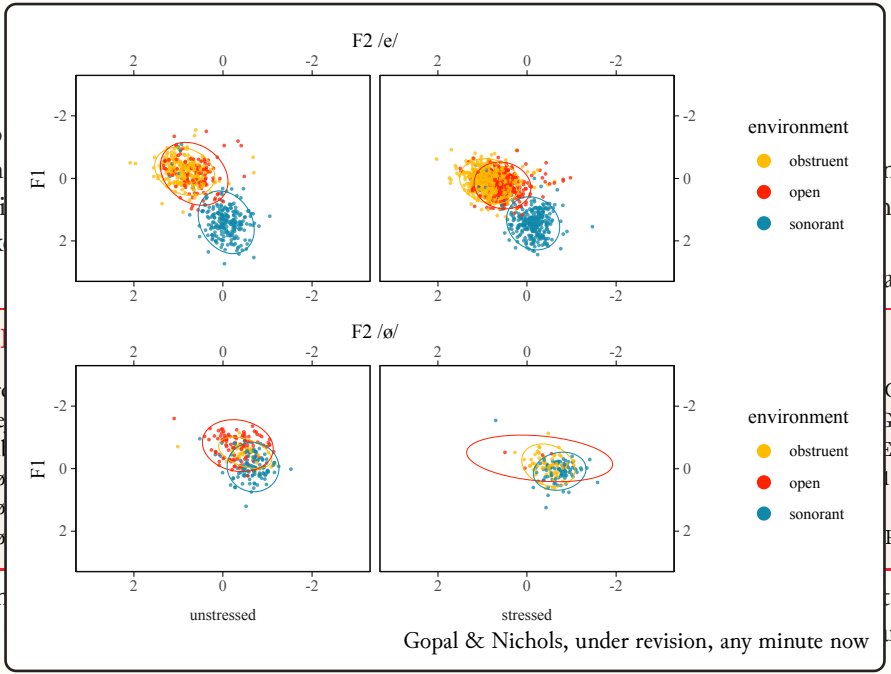
One reason to think that these are **two related rules** rather than *one single rule* is that one of them looks more recently stabilised; and a phonetic rule seems to have stuck around.

Change,

- So
- In



Gopal & Nichols, under revision, any minute now

Rule generalisation

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  - Are there phonetic reasons that this might be the case, i.e. that /rd/ might 'promote' retroflexion more than /rt/ does? But even if there are, why should it be the case that CSw and ENo don't 'follow' phonetics quite as closely as FSw?

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  - Actually, this is exactly what the existence of rule generalisation predicts!

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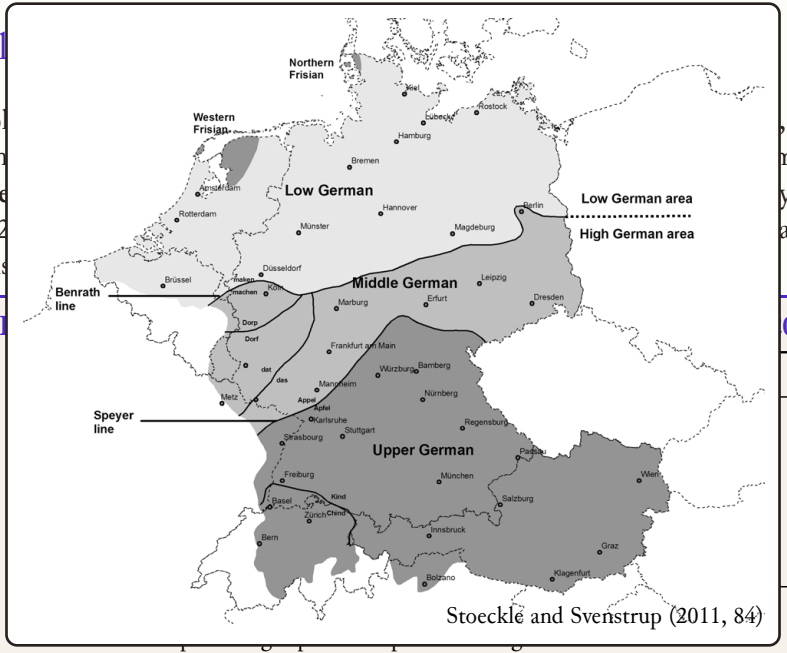
Old High German consonant shift (Davis 2008, 212; Bermúdez-Otero 2015, 393).

	ˈV̆__V	ˈV̆__]$_\omega$	ˈV̄__	ˈVC[+son]__	ˈVC__V	[$_\omega$__V
stage 1	✓					
stage 2	✓	✓				
stage 3	✓	✓	✓			
stage 4	✓	✓	✓	✓		
stage 5	✓	✓	✓	✓	✓	
stage 6	✓	✓	✓	✓	✓	✓
	opfan ‘open’	*gripf* ‘grasp’	*slāpfan* ‘sleep’	*dorpf* ‘village’	*scepphen* ‘create’	*pflëgan* ‘care for’

Rule general

- Multipl , but at
  differen mon.
- **Rule ge** y, 2018;
  Iosad, 2 ation. This
  gives ris

Old I 015, 393).



Stoeckle and Svenstrup (2011, 84)

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> **Bermúdez-Otero (2015, 394)**
>
> "This connection between rule generalization and geographical space arises because sound change originates in a focal area (Hock 1991: 440), from which it propagates outwards in line with Schmidt's (1872) wave theory. A change is therefore active for the longest time in its focal area, and so it is there that, by rule generalization, it eventually reaches its most general form. In the outermost areas, in contrast, the change may never progress beyond its initial, most narrowly defined environment."

Rule generalisation and *spatial* processes

- So here we have quite an explicit claim as to the empirical signature that all this leaves, *via diffusion*; that is, the relationship between sound change and physical space can only hold if we assume that an innovation propagates outward from a point of origin.

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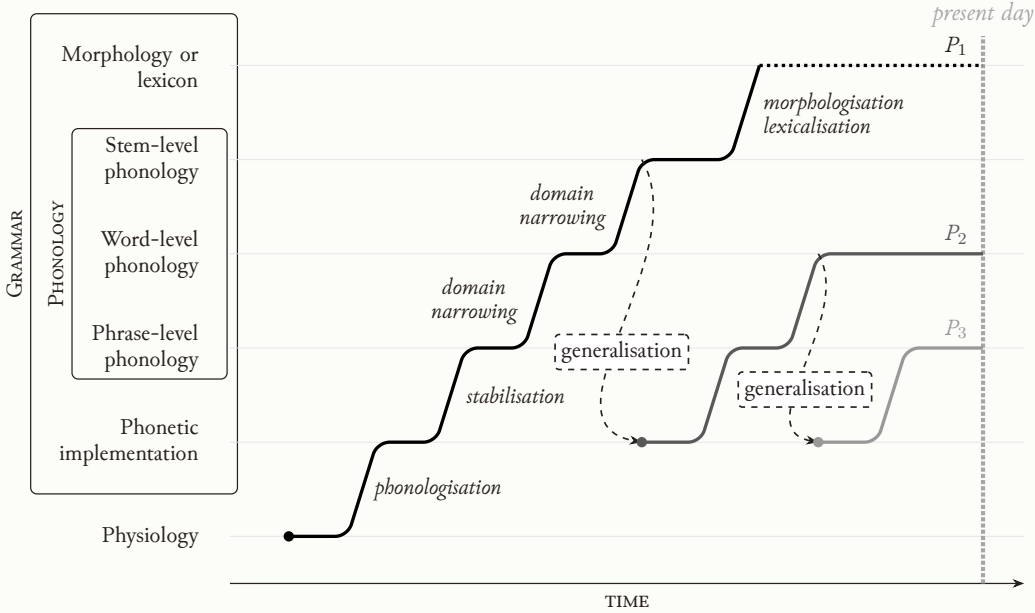
- So there is a further interaction, between the pathway of *generalisation* which serves to distance the phonology from the phonetics (i.e. innovate further rules which are less and less like the original conditioning), and the pathway given by the *life cycle*.


present day
Morphology or lexicon
Grammar
Phonology
Stem-level phonology
Word-level phonology
Phrase-level phonology
Phonetic implementation
Physiology
P_1
P_2
P_3
morphologisation
lexicalisation
domain narrowing
domain narrowing
generalisation
generalisation
stabilisation
phonologisation
TIME

Rule generalisation and *the life cycle*

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- This interacts with *umlaut*, which applies at the *word level*: that is, it receives the stem-level's output as input, and so can't see what goes on below it. That gives us a nice lens into it!

Rule generalisation and *the life cycle*

Swiss German *o*-lowering (Kiparsky, 1965; Robinson, 1976; Bermúdez-Otero, 2015).

	‘thorn’ /torn/	‘thorns’ /torn/[-bk]	‘floor’ /bodə/	‘floors’ /bodə/[-bk]
Stage I				
SL	—	—	—	—
WL umlaut	—	tørn	—	bødə
Surface	torn	tørn	bodə	bødə

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Surface	torn	tørn	bodə	bødə
Stage II				
SL	—	—	—	—
WL umlaut	—	tørn	—	bødə
pre-*r* lowering	tɔrn	—	—	—
Surface	tɔrn	tørn	bodə	bødə

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WL umlaut	—	tœrn	—	bødə
Surface	tɔrn	tœrn	bodə	bødə
Stage IV (Schaffhausen)				
SL pre-*r* lowering	tɔrn	tɔrn	—	—
WL umlaut	—	tœrn	—	bødə
general lowering (vacuous)	—	—	bɔdə	—
Surface	tɔrn	tœrn	bɔdə	bødə

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WL umlaut	—	tœrn	—	bødə
general lowering	—	—	bɔdə	—
(vacuous)				
Surface	tɔrn	tœrn	bɔdə	bødə
Stage V (Kesswil)				
SL general lowering[1]	tɔrn	tɔrn	bɔdə	bɔdə
WL umlaut	—	tœrn	—	bœdə
Surface	tɔrn	tœrn	bɔdə	bœdə

Rule generalisation and the life cycle *and* spatial processes

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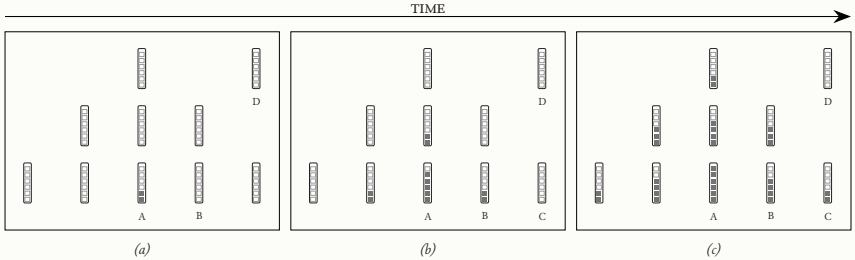

Figure: The spatial projection of rule generalisation along a single dimension. A rule P is innovated at the focal point A, and generalises to successively more environments, creating rules P^{x}, P^{xy}, P^{xyz}.

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Rule generalisation and the life cycle *and* spatial processes

- Following this intuition, if variant phonological alternations arose through successive waves of rule generalisation, their spatial distribution should reflect its progress.
- So we're back to a very traditional insight indeed!

§ 2

The most detailed case study I can possibly produce, which has taken years off my life

The phenomenon

- A set of morphophonological alternations widespread among the central and northern Turkic languages, in which **suffix-initial sonorants /-l -n -m/ are realised as stops** if preceded by a sufficiently low-sonority (?) consonantal coda.

Kazakh		**Bashkir**		**Western Yugur**		**Shor**	
alma-nɨ	‘apple-ACC’	bɑqsɑ-nɨ	‘garden-ACC’	kɨsɨ-nɨ	‘people-ACC’	qaja-nɨ	‘cliff-ACC’
taw-dɨ	‘mountain-ACC’	taw-ðɨ	‘mountain-ACC’			toj-dɨ	‘wedding-ACC’
kijar-dɨ	‘cucumber-ACC’	jər-ðɨ	‘place-ACC’	selir-nɨ	‘2PL-ACC’	pester-di	‘*Erythronium*-ACC’
køl-di	‘lake-ACC’	kyl-dɨ	‘lake-ACC’			abɨl-dɨ	‘hoe-ACC’
kelin-di	‘bride-ACC’	urman-dɨ	‘forest-ACC’	semen-nɨ	‘food-ACC’	qa:**n-n**ɨ	‘khan-ACC’
qɨz-dɨ	‘girl-ACC’	kolxoz-do	‘kolkhoz-ACC’	mɨz-tɨ	‘1PL-ACC’	—	
qus-tɨ	‘bird-ACC’	qoʃ-to *	‘bird-ACC’	jɨʁaş-tɨ	‘wood-ACC’	aɣaʃ-tɨ	‘tree-ACC’
kitap-tɨ	‘book-ACC’	kitap-tɨ	‘book-ACC’	aʰt-tɨ	‘horse-ACC’	pɨt͡ʃaq-tɨ	‘knife-ACC’

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taw-lar	‘mountain-PL’	taw-ðar	‘mountain-PL’			qoj-lar	‘sheep-PL’
kijar-lar	‘cucumber-PL’	jər-ðar	‘place-PL’	kʰir-lir	‘garbage-PL’	t͡ʃer-ler	‘land-PL’
køl-der	‘lake-PL’	kyl-dær	‘lake-PL’	mal-lir	‘livestock’	køl-ler	‘lake-PL’
adam-dar	‘man-PL’	kəjəm-dær	‘garment-PL’	jim-nir	‘medicine-PL’	ʃorta n-n ar	‘pike (*Esox*)-PL’
qɨz-dar	‘girl-PL’	qəð-ðar *	‘girl-PL’	qɨz.tar	‘girl-PL’	—	
						qas-tar	‘goose-PL’
kitap-tar	‘book-PL’	kitap-tar	‘book-PL’	ɨʰt-tir	‘meat-PL’	pɨt͡ʃaq-tar	‘knife-PL’

The phenomenon

- A set of morphophonological alternations widespread among the central and northern Turkic languages, in which **suffix-initial sonorants /-l -n -m/ are realised as stops** if preceded by a sufficiently low-sonority (?) consonantal coda.

Kazakh		**Bashkir**		**Western Yugur**		**Shor**	
alma-ma	‘apple-Q’	baqsa-mɨ*	‘garden-Q’	tanɨ-mas	‘know-NEG’	sarna-ba	‘sing-NEG’
kijar-ma	‘cucumber-Q’	al-ɨr-mɨn	‘take-POT-1SG’	par-ma	‘go-NEG’	kør-be	‘look-NEG’
køl-me	‘lake-Q’	al-mam	‘take-NEG-1SG’	pil-mis	‘know-NEG’	qal-ba	‘remain-NEG’
kelin-be	‘bride-Q’	kurðeŋ-me	‘see-Q’			qo**n.m**a	‘stay-NEG’
qɨz-ba	‘girl-Q’	qɨð-mɨ*	‘girl-Q’				
qus-pa	‘bird-Q’	qoʃ-mo*	‘bird-Q’	aʰʂ-ma	‘open-NEG’		
kitap-pa	‘book-Q’	kitap-mɨ*	‘book-Q’	tuʰt-pa	‘do-NEG’	t͡ʃat-pa	‘lie-NEG’

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    - How many times has this alternation been innovated in these languages?
    - How can we try to find out?

The Turkic languages

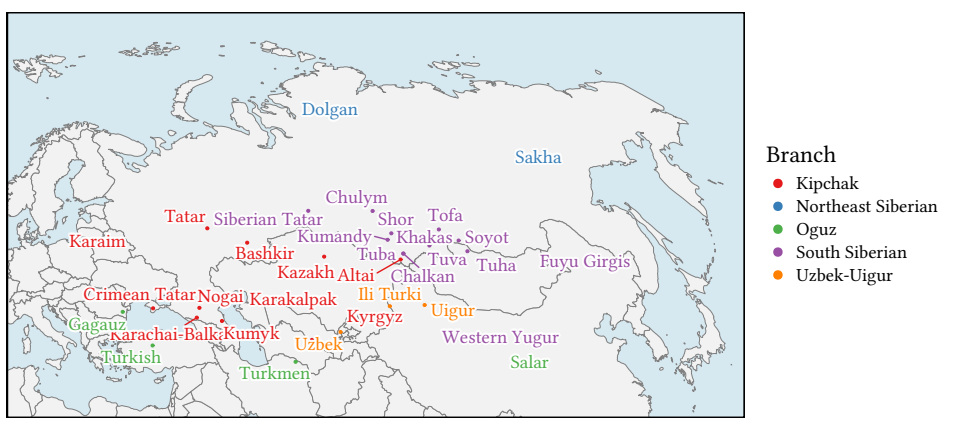

Figure: Some Turkic languages, by classification (see e.g. Johanson 1998).

The survey

- Clear evidence for the pattern in at least **21 languages**:

  (Standard or Southern) Altai (Dyrenkova, 1940; Kotvič, 1962; Schönig, 1998; Nevskaja et al., 2017), 3 varieties of **Northern Altai** (**Chalkan**, **Kumandy**, **Tuba**) (Baskakov, 1985, 1972, 1966), **Bashkir** (Dmitriev, 1948; Poppe, 1964), **Chulym** (Li et al., 2008; Schönig, 1998), **Dolgan** (Stapert, 2013; Däbritz, 2022), **Fu-Yü Girgis** (Hu and Imart, 1987), **Ili Turki** (Zhào and Hahn, 1989; Hahn, 1991), **Karakalpak** (Menges, 1947; Zhu, 2018), **Kazakh** (Davis, 1998; Gouskova, 2004; Mukhamedova, 2015), **Khakas** (Baskakov, 1975; Anderson, 1998), **Kyrgyz** (Herbert and Poppe, 1963; Imart, 1981; Landmann, 2011), **Nogai** (Baskakov, 1973; Csató and Karakoç, 1998; Karakoç, 2013), **Sakha** (Kharitonov, 1947; Krueger, 1962), **Shor** (Schönig, 1998; Chispyakov, 1992), **Soyot** (Rassadin, 2010), **Tofa** (Anderson and Harrison, 2008; Rassadin, 1971, 2014), **Tuha** (Ragagnin, 2011), **(Dzungar) Tuva** (Mawkanuli, 2004; Anderson and Harrison, 1999; Harrison, 2000), **Western (Yellow) Yugur** (Tenishev, 1976; Roos, 2000)

- No pattern in, at minimum:

  Crimean Tatar (Kavitskaya, 2010), **Gagauz** (Özkan, 1996), **Karachai-Balkar** (Seegmiller, 1996), **Karaim**, **Kumyk** (Doniyorova and Qahramonil, 2004), **Salar** (Dwyer, 2007; Tenišev, 1976), **(Kazan) Tatar** (Poppe, 1968), **Turkish** (Lewis, 1967; Göksel and Kerslake, 2005), **Turkmen** (Clark, 1998), **Uzbek** (Sjoberg, 1963), **Uigur** (Hahn and Ibrahim, 1991)

The survey

- Few of these languages show *exactly* the same pattern as any other.

Language	Preceding segment								
	vowel	glide	r	l	n	m	vcd fric	vclss fric	stop
Ili Turki	l	l	l	l	l	l	—	l	l
	n	d	d	d	d	d	—	t	t
	m	ʔ	ʔ	ʔ	b	b	—	p	p
(S.) Altai	l	l	l	d	d	d	—	t	t
	n	d	d	d	d	d	—	t	t
	b	*b*	*b*	*b*	*b*	*b*	—	*b*	*b*
Bashkir	l	ð	ð	d	d	d	d	t	t
	n	ð	ð	d	d	d	d	t	t
	m	m	m	m	m	m	m	m	m
Karakalpak	l	l	l	l	n	n	l	l	l
	n	d	d	d	d	d	d	t	t
	m	m	m	m	b	b	b	p	p

Grey : obstruentised. *Darker grey* : reanalysed. —: trigger absent underlyingly. ʔ: no example found.

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	vowel	glide	r	l	n	m	vcd fric	vclss fric	stop
Kazakh	l	l	l	d	d	d	d	t	t
	n	d	d	d	d	d	d	t	t
	m	m	m	m	b	b	b	p	p
Kyrgyz	l	l	d	d	d	d	d	t	t
	n	d	d	d	d	d	d	t	t
Nogai	l	l	l	l	n	n	l	l	l
	d	*d*	*d*	*d*	*d*	*d*	*d*	*d*	*d*
	m	m	m	m	m	m	b	p	p

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N. Altai	l	l	l	l	**n**	**m**	—	t	t
Chalkan (Kuu)	n	d	d	d	**n**	**m**	—	t	t
	b	*b*	*b*	*b*	*b*	*b*	—	*b*	*b*
N. Altai	l	l	l	l	**n**	**m**	—	t	t
Kumandy	n	d	d	d	**n**	**m**	—	t	t
	b	*b*	*b*	*b*	*b*	*b*	—	*b*	*b*
N. Altai	l	l	l	d	**n**	**m**	—	t	t
Tuba	n	d	d	d	**n**	**m**	—	t	t
	b	*b*	*b*	*b*	*b*	*b*	—	*b*	*b*
Chulym	l	l	l	d	**n**	**n**	d	t	t
	n	n	n	d	**n**	**n**	d	t	t
	b	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*

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Fuyu Girgis	l	l	l	d	d	d	—	t	t
	n	ʔ	d	ʔ	**n**	ʔ	—	t	t
	m	m	ʔ	ʔ	m	m	—	p	p
Khakas	l	l	l	l	n	n	l	t	t
	n	n	n	n	n	n	n	t	t
	b	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*
Shor	l	l	l	l	n	n	l	t	t
	n	d	d	d	**n**	**n**	d	t	t
	b	*b*	*b*	*b*	***m***	***m***	*b*	*b*	*b*
Soyot	l	l	l	l	n	n	l	t	t
	n	n	n	ʔ	n	n	ʔ	t	t
	b	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*

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Tofa	l	l	l	l	n	n	l	t	t
	n	n	n	n	n	n	n	t	t
	b	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*
Tuha	l	l	l	l	n	l	l	t	t
	n	n	n	l	n	n	?	t	t
	b	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*
Tuva	l	l	l	d	**n**	**n**	d	t	t
	n	n	n	d	**n**	**n**	d	t	t
	m	m	m	b	**m**	**m**	p	p	p
W. Yugur	l	l	l	l	**n**	**n**	t	t	t
	n	n	n	n	n	n	t	t	t
	m	m	m	m	m	m	m	m	p

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Dolgan	l		t	t	**l**	**n**	**n**	—	t	t
	n		t	t	**l**	**n**	**n**	—	t	t
	b		*b*	*b*	*b*	*b*	*b*	—	*b*	*b*
Sakha	l		d	d	**l**	**n**	**n**	—	t	t
	n		t	t	**l**	**n**	**n**	—	t	t
	b		*b*	*b*	*b*	*b*	*b*	—	*b*	*b*

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- The net inventory of sonorant onsets is *maximally* {m, n, l}.
  - /r/ and often also /j, w/ are in the inventories, but basically never appear in post-consonantal onsets (or any onsets at all, for /r/).

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- Suffixes that share the same onset generally do the same thing (i.e. analysis as one suppletion is impossible / undesirable).

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- In all 3 Northern Altai varieties, Chulym, Dolgan, Khakas, Sakha, Shor, and Tuva, further **assimilations** counterfeed these alternations (**marked** in the examples earlier). These assimilations target *all onset stops of any kind*.

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Dolgan (Däbritz, 2022).

taba-lar ‘reindeer-PL’
har-tar ‘rough-legged buzzard-PL’
ti**l.l**er ‘language-PL’
eti**ŋ.n**er ‘thunder-PL’
tiːs-ter ‘tooth-PL’
ot.tor ‘grass-PL’

/buol-tI-m/ → buo**l.l**um ‘be-PST-1SG’
/tyrgen-tIk/ → tyrge**n.n**ik ‘quick-ADVZ’
/aːn-gA/ → aː**ŋ.ŋ**a ‘door-DAT/LOC’

The survey

- So I can summarise and visualise:

Type of repair	Segment		
	l	n	m
Synchronically absent, diachronically obstruentised	0	1	13 (2 9 2)
Obstruentised after any [+consonantal]	3 (1 2)	10 (1 5 4)	0
Obstruentised only after some segments	15 (3 12)	8 (2 6)	7 (4 3)
Never obstruentised	3 (1 1 1)	0	2
Absent	0	2	0

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And in fact

Non-alternating obstruentised /-b/ < *-m is only found in 'obstruentising languages', never elsewhere in the family.

The survey

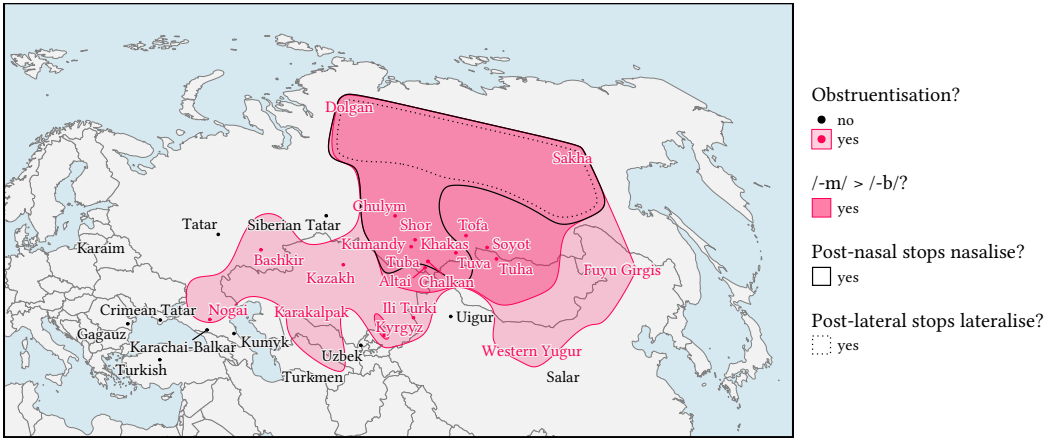

Figure: Map with obstruentising patterns marked present or **absent**.

Root-internal evidence

Synchronic activity away from the morphological boundary?

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Synchronic activity away from the morphological boundary?
Where C.C[son] clusters are created by resyllabification, obstruentisation *may* occur.

Source	CC	Kazakh	Kyrgyz	Bashkir	Tatar
‘in-laws’		qa.jɨn	qa.jɨn		qa.jən
‘neck’		mo.jun	mo.jun	mu.jən	mu.jən
‘nose’		mʊ.rʊn	mu.run	mo.ron	bo.ron
‘stomach/belly’		qa.rɨn	qa.rɨn	qa.rən	qɒ.rən
‘place’		o.rʊn	o.run	u.rən	u.rən
‘in-laws-POSS.3SG’	j.n	qaj.nɨ	qaj.nɨ		qa.jə.nə
‘neck-POSS.3SG’	j.n	moj.nu	moj.nu	mu.jə.nə	mu.jə.nə
‘nose-POSS.3SG’	r.n	mur.nu	mur.du	mo.ro.no	bo.ro.nə
‘stomach/belly-POSS.3SG’	r.n	qar.nɨ	qar.dɨ	qa.rə.nə	qɒ.rə.nə
‘place-POSS.3SG’	r.n	or.nʊ	or.du	u.rə.nə	u.rə.nə

Root-internal evidence

Synchronic activity away from the morphological boundary?

Dolgan and **Sakha** lack synchronic /-n/ in affixes, but vowel-zero alternations of this type cause alternations in root-internal onset /n/. (Examples are from Dolgan.)

Gloss	IMP.2SG	CC	PTCP.PRS	PTCP.PST
‘flow’	uhun	s.n	ust-ar	ustu-but
‘ride’	meŋehin	s.n	meŋest-er	meŋesti-bit
‘break (intr.)’	tohun	s.n	tost-or	tostu-but
‘put in’	ugun	k.n	ukt-ar	uktu-but
‘miss’	agɨn	k.n	akt-ar	aktɨ-bɨt
‘climb’	ɨtɨn	t.n	ɨtt-ar	ɨttɨ-bɨt
‘catch’	tutun	t.n	tutt-ar	tuttu-but
‘watch’	køryl	r.l	kø **ll** -ør	kø **ll** y-byt
‘take away’	ilin	l.n	i **ll** -er	i **ll** i-bit
‘worry’	kɨhalɨn	l.n	kɨha **ll** -ar	kɨha **ll** ɨ-bɨt
‘come back’	tønyn	n.n	tø **nn** -ør	tø **nn** y-byt

Root-internal evidence

***Past* activity away from the morphological boundary?**

Turkic lacks onset sonorants (stay tuned), so the inventory of non-borrowed roots with C.C[son] sequences is extremely limited (often synchronically-unproductive affixations etc.).

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Gloss	CC	Kazakh	Kyrgyz	Karakalpak	Bashkir	Tatar
‘swallow, swift’	r.l	qar.lɨ.ʁɑʃ	qar.dɨ.ʁɑʃ	qar.lɨ.ʁɑʃ	qar.lu.ʁas	qɒr.lə.ʁɑɕ
‘lion’	s.l	ɑ.rɨs.tan	ars.tan	ɑ.rɨs.lan	ɑ.rɨθ.lan	ɒ.rəs.lan
‘fingernail’	r.n (*r.ŋ)	tɨr.naq	tɨr.maq	tɨr.naq	tɨr.nɑq	tər.nɑq
‘son-in-law/sister’s husband’ (variously)	z.n	ʒez.de	d͡ʒez.de	ʒez.de	jɪð.næ	ʑiz.næ
‘twenty’	r.m	ʒɨ.jɨr.ma	d͡ʒɨ.jɨr.ma	ʒɨ.ʁɨr.ma	æ.gær.mæ	e.ger.me
‘sixty’	lt.m	ɑl.pɨs	ɑl.tɨ.mɨʃ	ɑl.pɨs	ɑlt.mɨʃ	ɑlt.məʃ
‘seventy’	t.m	ʒet.pis	d͡ʒe.ti.miʃ	ʒet.pis	jɪt.mɨʃ	ʑit.meʃ
‘hoe’	t.m	ket.pen	ket.men	ket.pen	kæt.mæn	kit.mæn

Root-internal evidence

***Past* activity away from the morphological boundary?**

Turkic lacks onset sonorants (stay tuned), so the inventory of non-borrowed roots with C.C[son] sequences is extremely limited (often synchronically-unproductive affixations etc.).

Gloss	CC	Khakas	Tuva	Shor	Sakha
'lion'	s.l	—	ar.zɨ.laŋ	—	—
'son-in-law/sister's husband' (variously)	z.n	t͡ʃis.te	t͡ʃes.te	t͡ʃes.te	?
'twenty'	r.m	t͡ʃibirge	t͡ʃeːr.bi	t͡ʃe.gir.be	syːr.be
'hoe'	t.m	—	xet.pe	?	?

Of 227 early loans from Mongolic into Sakha listed by Pakendorf and Novgorodov (2009), exactly 3 contain C.C[son]: [χa rb aː] 'to sweep' < *xarma* 'rake up, gather together', [ma ŋn aj] 'in.the.beginning' < *maŋlay*, [su gul aːn] 'meeting house' < *čuɣlaɣan* 'meeting, assembly'.

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Source	CC	Kazakh	Kyrgyz	Karakalpak	Bashkir	Tatar
P. (< Ar.) *bārak-allāh* 'bravo!'	l.l	bɑ.re.kel.di	bɑ.rɑ.kel.de	bæ.re.kel.le	?	?
P. (< Ar.) *'illat* 'disease'	l.l	in.det	il.det	—	—	—
P. (< Ar.) 'mullah'	l.l	mol.da	mol.do	mol.lɑ	mol.lɑ	mul.lɑ
P. *čelle* > 'July'	l.l	ʃil.de	tʃil.de	—	—	—
Ar. *dallāl* 'broker'	l.l	del.dal	—	—	—	—
P. (< Ar.) *minnat* 'obligation'	n.n	min.det	mil.det	min.net 'gratitude'	?	?
Ar. *sunna* 'tradition' > 'circumcision'	n.n	sʏn.det	sʏn.nøt	sun.net	sʏn.net	søn.næt
P. (< Ar.) *qīm(m)at* 'expensive'	m.m	qɨm.bat	qɨm.bat	qɨm.bat	qɪm.mæt ~ qɪj.bat	qəjm.mæt
P. *āsmān* 'sky'	s.m	ɑs.pɑn	ɑs.mɑn	ɑs.pɑn	—	—
P. *došman* 'enemy'	ʃ.m	dʊʃ.pɑn	[d/t]uʃ.mɑn	duʃ.pɑn	doʃ.mɑn	doʃ.mɑn
P. *dānišmand* 'wise person'	ʃ.m	dɑ.nɨʃ.pɑn	dɑː.nɨʃ.mɑn	dɑ.nɨʃ.pɑn	—	—

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Source	CC	Kazakh	Kyrgyz	Karakalpak	Bashkir	Tatar
P. (< Ar.) *mamlakat* 'state'	m.l	mem.le.ket	mæm.le.ket	?	?	?
P. (< Ar.) *imlā* 'orthography'	m.l	jem.le	?	imla	?	?
Ar. *maṣlaḥa* 'good affair'	s.l	mæs.ləj.χat 'council'				
Ar. *ʔislām* 'Islam'	s.l	is.lɑm	is.lɑm	is.lɑm	ɪs.lam	is.lɑm
P. (< Ar.) *janna(t)* 'paradise'	n.n	ʒæn.næt	dʒɑn.nɑt	ʒɑn.net	jæn.næt	ʑæn.næt
P. (< Ar.) *rasmi* 'official, formal'	s.m	res.məj	ras.miː	ras.mi	ræs.mi	ræs.mi
P. (< Ar.) *raḥmat* 'mercy' > 'thanks'	h.m	raχ.met	ɨ.rak.mat	raχ.met	ɾæχ.mæt	ræχ.mæt
P. *šâh mât* 'chess'	h.m	ʃɑχ.mɑt	ʃɑχ.mɑt	ʃɑχ.mɑt	ʃɑχ.mɑt	ʃɒχ.mɒt

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- No other textual attestation for Siberian. One single Kipchak example in a letter written in 1769 by the Kazakh sultan Abulfeyz to the military governor of Yili (Noda and Onuma, 2010; Äbdiläšimulï, 2014): *ẖatïmdu* [xatɨmdu], presumably 'letter-POSS.1S-ACC'

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- For Kipchak, no obstruentisation of any kind is found in the late 13th /early 14th century (Middle Turkic period) *Codex Cumanicus*, a document compiled by Italian and German missionaries and written in the Latin alphabet.
- But bounds of this kind cannot rule out the existence of the *phonetic precursors to the phonologised pattern*, about which we know very little at this date.

Related cases: Chuvash

- In **Chuvash**, the only sonorant-initial suffixes are *r*-initial (locative /-rA/ and ablative /-rAn/, cognate to /-dA/ and /-dAn/ elsewhere). Suffix-initial /r/ obstruentises if and only if preceded by any coronal sonorant (Poppe, 1964).

kino uj	‘movie’ ‘field’	kino.ra uj.ra	kino.ran uj.ran
ir	‘morning’	ir.te	ir.ten
kil	‘home’	kil.te	kil.ten
xusan	‘Kazan’	xusan.ta	xusan.ten
ylem	‘future’	ylem.re	ylem.ren
ʃɨv	‘water’	ʃɨv.ra	ʃɨv.ran

- **coronality**, not sonority, is the relevant property. This is **structurally distinguishable** from the Kipchak/Siberian patterns as an independent innovation.

Related cases: Azerbaijani

- In **Azerbaijani**, the plural /-lAr/ obstruentises, but **only** after coronal obstruents (based on elicitation).

alma	‘apple’	alma.lar	‘apple-PL’
tʃitʃæx	‘flower’	tʃitʃæx.lær	‘flower-PL’
gɨz	‘girl’	gɨz.dar	‘girl-PL’
sœz	‘word’	sœz.dær	‘word-PL’
aʁat͡ʃ	‘tree’	aʁat͡ʃ.tar	‘tree-PL’
quʃ	‘bird’	quʃ.tar	‘bird-PL’

- Again, the conditioning property is **coronality**, not sonority: non-coronal obstruents do nothing. Again **structurally distinguishable** from the core pattern.

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Possible **phonetic precursors** to the phonologised alternation?

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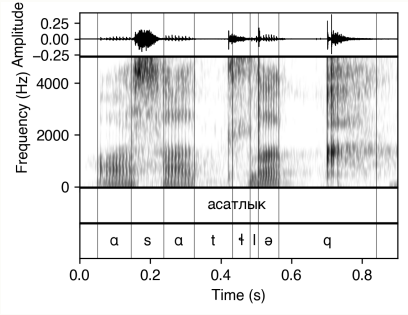
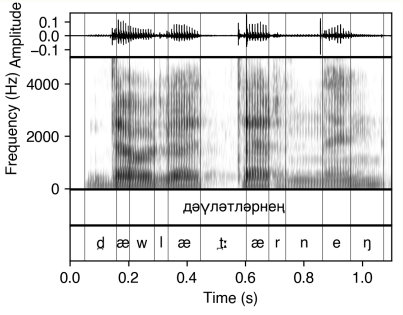


/ɑsɑt-lEq/ [ɒ.sɒ̪ˑˈɬəq] ‘peaceful-NMLZ’



/dæwlæt-lAr-nEŋ/ [d̪æw.læ.t̪ː.ær.ˈneŋ]
‘state-PL-GEN’

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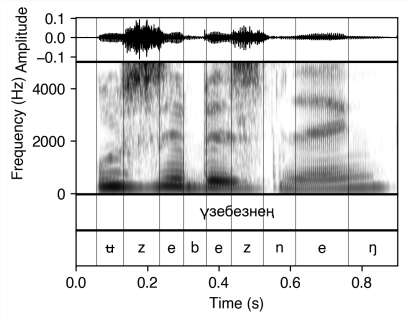
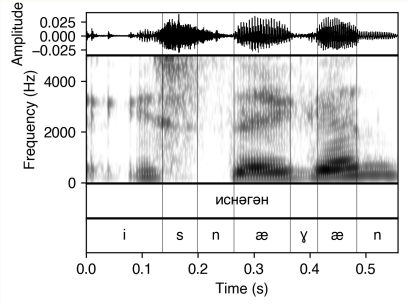


/ʉz-ebez-neŋ/ [ʉ.ze.bez.neŋ] ‘self-1PL.POSS-GEN’



/isnæ-gæn/ [is.tæ.ˈgæn] ‘yawn-PST.PTCP’

Possible **phonetic precursors** to the phonologised alternation?

Rule generalisation in two dimensions

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- If both occur simultaneously, how should the resulting state space translate into the spatial domain?

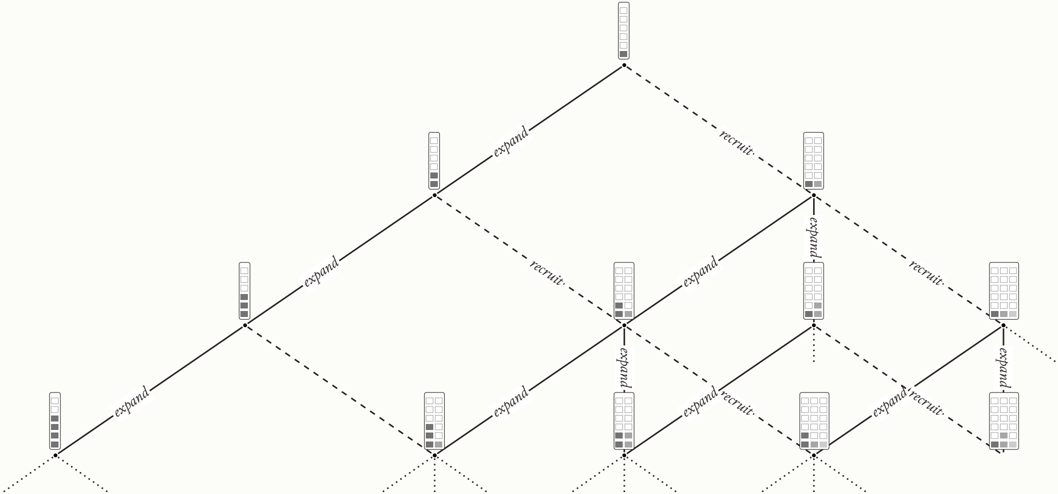

Figure: A process undergoing generalisation along two dimensions: expansion in environment (solid) and recruitment of new undergoers (dashed).

Rule generalisation in two dimensions

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- *Either* both generalisations proceed outward from A at roughly the same rate: the core is innovative along both dimensions, and the periphery is conservative.

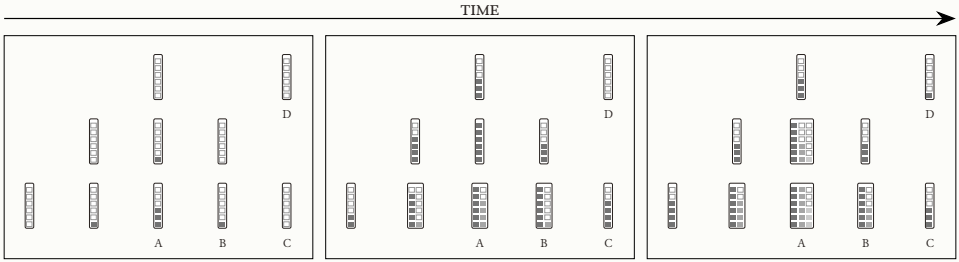

Figure: P_1 generalises horizontally to P_2 and P_3 and vertically to P_1^a $P_1^{xy\cdots}$.

Rule generalisation in two dimensions

- Two ways for this to go.
- *Or* generalisation along one dimension outruns. In the focal area, $\{P^{x}_{\alpha}, P^{xy}_{\alpha}, P^{xyz\cdots}_{\alpha}\}$ are innovated; subsequently, P^{x}_{β} is innovated by generalisation; but if $\{P^{xyz}_{\alpha}$ 'complete' the life cycle via lexicalisation, then when $P^{xyz\cdots}_{\beta}\}$ diffuse, they arrive without accompanying P_{α}.

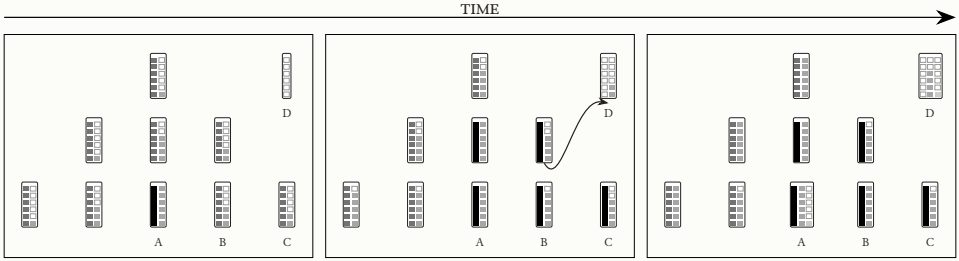

Figure: P_1 generalises horizontally to P_2 and P_3 and vertically to P^{a}_{1} $P^{xy\cdots}_{1}$.

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- In the second scenario, the environment of P_α, which is likely the original, phonetically-motivated environment of the innovation, is no longer involved in alternation at the core (A); but it has *never* been involved in alternation in the periphery (D); and yet the alternations at A and D truly share a historical source.

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- The implicational ordering between processes also thus reverses between A and D: due to the sequence of generalisations, $P_\alpha > P_\beta > P_\gamma$ in age and stratal affiliation at A; but at D, both $P_\beta > P_{(\beta)\gamma} > P_{\alpha(\beta)}$ and $P_\beta > P_{\alpha(\beta)} > P_{(\alpha\beta)\gamma}$ are possible via subsequent generalisations.

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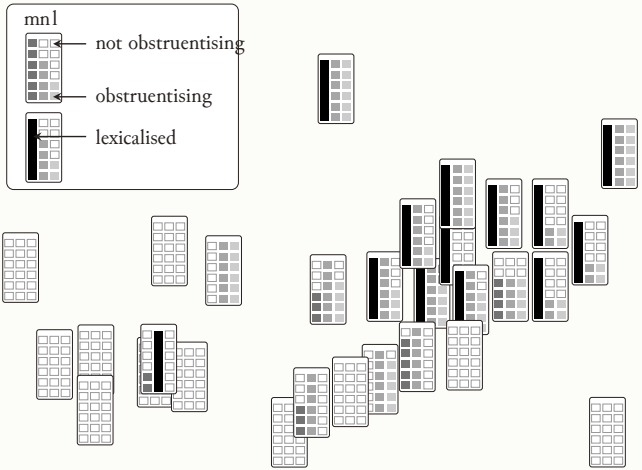
- If the oldest rule has already lexicalised in the core by the time diffusion reaches the periphery, then the peripheral languages should lack a productive alternation in the original target altogether: that is, we predict a gap at the periphery precisely where the most advanced rule once was at the core.

Rule generalisation in two dimensions

- In fact, the real-world distribution essentially recapitulates the hypothetical figure.



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  - **Non-alternating /-b/ < */-m/**: only found where synchronic obstruentisation also holds, and only in core Siberian; also classic rule loss, via lexicalisation.

The life-cycle argument

- Several converging lines of evidence suggest that the obstruentisations **were once active in a wider domain**, and remain so in a few of the languages:
  - **Root-internal evidence**: obstruentisation applies or has applied to C.C[son] sequences created by resyllabification (Kyrgyz, Dolgan) and is fossilised in native roots (Kazakh, Siberian); consistent with, in the former case, an active rule, and in the latter case, the lexicalisation of the output of an earlier one.
  - **Loanword evidence**: older Persian-Arabic borrowings into Kipchak show obstruentisation; newer Russian borrowings never do; classic rule loss!.
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- **Big point.** Now that I've got a hammer, everything looks like a nail; generalisations of this kind do seem to be everywhere in historical phonology, and it's very tempting to say that they have been severely underappreciated. The more sequences of events of this kind we can uncover, the more we will understand about the mechanisms behind them!

References I

Gregory D. S. Anderson. *Khakas*. Lincom Europa, München, 1998.

Gregory D. S. Anderson and K. David Harrison. *Tyvan*. Lincom Europa, München, 1999.

Gregory D. S. Anderson and K. David Harrison. Tofa language change and terminal generation speakers. In K. David Harrison, David S. Rood, and Arienne M. Dwyer, editors, *Lessons from Documented Endangered Languages*, volume 78 of *Typological Studies in Language*. John Benjamins, Amsterdam, 2008.

Anonymous. *Grammatika altajskago jazyka, sostavlennaja členami Altajskoj missii*. Tipografija Kazanskago Universiteta, Kazan′, 1869.

N. A. Baskakov. *Dialekt černevyx tatar (Tuba-Kiži): Grammatičeskij očerk i slovar'*. Nauka, Moskva, 1966.

N. A. Baskakov. *Dialekt kumandincev (Kumandy-Kiži): Grammatičeskij očerk, teksty, perevody i slovar'*. Nauka, Moskva, 1972.

References II

N. A. Baskakov, editor. *Grammatika nogajskogo jazyka. Čast' 1: Fonetika i morfologija*. Karačaevo-Čerkesskoe otdelenie Stavropol'skogo knižnogo izdatel'stva, Čerkessk, 1973. Karačaevo-Čerkesskij naučno-issledovatel'skij institut ėkonomiki, istorii, jazyka i literatury.

N. A. Baskakov. *Dialekt lebedinskix tatar-čalkancev (Kuu-Kiži): Grammatičeskij očerk, teksty, perevody, slovar'*. Severnye dialekty altajskogo (ojrotskogo) jazyka. Nauka, Moskva, 1985.

Nikolaj A. Baskakov. *Grammatika xakasskogo jazyka*. Nauka, Moskva, 1975.

Ricardo Bermúdez-Otero. Amphichronic Explanation and the Life Cycle of Phonological Processes. In Patrick Honeybone and Joseph C. Salmons, editors, *The Oxford Handbook of Historical Phonology*, pages 374–399. Oxford University Press, Oxford, 2015.

Leonard Bloomfield. *Language*. Holt, New York, 1933.

Hendrik Boeschoten. The structure of Turkic. In Johanson and Csató (1998), pages 1–15.

References III

Otto Böhtlingk. *Über die Sprache der Jakuten: Grammatik, Text und Wörterbuch*. Buchdruckerei der Kaiserlichen Akademie der Wissenschaften, St. Petersburg, 1851.

E. F. Chispyakov. *Uchebnik shorskogo yazyka: Posobiye dlya prepodavateley i studentov*. Kemerovskoye knizhnoye izdatel'stvo, Kemerovo, 1992.

Larry Clark. *Turkmen reference grammar*, volume 34 of *Turcologica*. Harrassowitz, 1998.

Éva Ágnes Csató and Birsel Karakoç. Noghay. In Johanson and Csató (1998), pages 333–343.

Garry W. Davis. Toward a progression theory of the Old High German consonant shift. *Journal of Germanic Linguistics*, 20(3):197–241, 2008.

Stuart Davis. Syllable Contact in Optimality Theory. *Journal of Korean Linguistics*, 23(2): 181–211, 1998.

Nikolai K. Dmitriev. *Grammatika bashkirskogo jazyka*. Izd-vo Akademii nauk SSSR, Moskva, 1948.

References IV

Saodat Doniyorova and Toshtemirov Qahramonil. *Parlons Koumyk*. L'Harmattan, Paris, 2004. ISBN 2-7475-6447-9.

Arienne M Dwyer. *Salar*, volume 37 of *Turcologica*. Harrassowitz, 2007.

Nadežda Petrovna Dyrenkova. *Grammatika ojrotskogo jâzyka*. Izddatel'stvo Akademii Nauk SSSR, 1940.

Chris Lasse Däbritz. *A Grammar of Dolgan: A Northern Siberian Turkic Language of the Taimyr Peninsula*. Brill, Leiden, 2022. ISBN 978-90-04-51642-7. doi: 10.1163/9789004516427.

Marcel Erdal. *A grammar of Old Turkic*. Brill, Leiden, 2004.

Maria Gouskova. Relational hierarchies in Optimality Theory: The case of Syllable Contact. *Phonology*, 21:201–250, 2004.

References V

Aslı Göksel and Celia Kerslake. *Turkish: A Comprehensive Grammar*. Routledge, London, 2005.

Reinhard F. Hahn. An annotated sample of Ili Turki. *Acta Orientalia Academiae Scientiarum Hungaricae*, 45(1):31–53, 1991.

Reinhard F. Hahn and Ablahat Ibrahim. *Spoken Uyghur*. University of Washington Press, 1991.

K. David Harrison. *Topics in the phonology and morphology of Tuvan*. PhD thesis, Yale University, 2000.

R. J. Herbert and N. Poppe. *Kirghiz Manual*. Indiana University Press, Bloomington, 1963.

Hans Heinrich Hock. *Principles of Historical Linguistics*. Mouton De Gruyter, Berlin, 1991.

References VI

Zhen-hua Hu and Guy Imart. *Fu-yü Gïrgïs: A tentative description of the easternmost Turkic language*, volume 8 of *Papers on Inner Asia*. Indiana University Research Institute for Inner Asian Studies, Bloomington, Indiana, 1987.

José Ignacio Hualde. Sound change. *The Blackwell Companion to Phonology*, page 1–22, April 2011. doi: 10.1002/9781444335262.wbctp0093. URL `http://dx.doi.org/10.1002/9781444335262.wbctp0093`.

Larry M. Hyman. Phonologization. In Alphonse Juilland, editor, *Linguistic studies presented to Joseph H. Greenberg*, pages 407–418. Anna Libri, Saratoga, 1976.

Guy Imart. *Le Kirghiz (Turk d'Asie Centrale Soviétique): Description d'une langue de litterisation recente*. PhD thesis, Université de Provence, 1981.

Pavel Iosad. *Phonological Drift and Language Contact: The Northwest European Phonological Area*. Cambridge University Press, Cambridge, 2025.

References VII

Lars Johanson. The history of Turkic. In Johanson and Csató (1998), pages 81–125.

Lars Johanson and Éva Ágnes Csató, editors. *The Turkic Languages*. Routledge, London & New York, 1998.

Birsel Karakoç. Az konuşurlu bir Türk dili: Nogayca ve Nogaylar üzerine. *Tehlikedeki Diller Dergisi*, 2(2):273–301, 2013.

Darya Kavitskaya. *Crimean Tatar*. Lincom Europa, München, 2010.

Luka N. Kharitonov. *Sovremennyj jakutskij jazyk, I: Fonetika i morfologija*. Gosizdat JaASSR, Jakutsk, 1947.

Paul Kiparsky. *Phonological change*. PhD thesis, Massachusetts Institute of Technology, 1965.

V. Kotvič. *Issledovanie po altajskim jazykam*. Izdatel'stvo inostrannoj literatury, Moscow, 1962.

John Richard Krueger. *Yakut manual: area handbook, grammar, graded reader and glossary*, volume 21. Indiana University Press, Bloomington, 1962.

References VIII

Angelika Landmann. *Kirgisisch Kurzgrammatik*. Harrassowitz Verlag, Wiesbaden, 2011.

G. L. Lewis. *Turkish Grammar*. Oxford University Press, Oxford, 1967.

Yong-Sŏng Li, Ho-young Lee, Hyong-won Choi, Geon Sook Kim, Dong Eun Lee, and Mehmet Ölmez. *A study of the Middle Chulym dialect of the Chulym language*, volume 3 of *Altaic Languages Series*. Seoul National University Press, Seoul, 2008.

Talant Mawkanuli. *The phonology and morphology of Jungar Tuva*. PhD thesis, University of Michigan, 2004.

Karl Menges. *Qaraqalpaq Grammar, Part One: Phonology*. King's Crown Press, Morningside Heights, New York, 1947.

Raikhangul Mukhamedova. *Kazakh: A Comprehensive Grammar*. Routledge, 2015.

References IX

I. A. Nevskaja, N. D. Almadakova, A. N. Majzina, A. A. Ozonova, and A. È. Čumakaev. *Grammatika sovremennogo altajskogo jazyka. Morfologija*. NII altaistiki im. S.S. Surazakova, Gorno-Altajsk, 2017. ISBN 978-5-903693-34-4.

Jin Noda and Takahiro Onuma. *A collection of documents from the Kazakh Sultans to the Qing Dynasty*. The University of Tokyo, Tokyo, 2010.

Nevzat Özkan. *Gagavuz Türkçesi Grameri*, volume 657 of *Türk Dil Kurumu*. Atatürk Kültür, Dil ve Tarih Yüksek Kurumu, Ankara, 1996.

Brigitte Pakendorf. *Contact in the prehistory of the Sakha (Yakuts): Linguistic and genetic perspectives*, volume 170 of *LOT Dissertation Series*. LOT, Utrecht, 2007.

Brigitte Pakendorf and Innokentij Novgorodov. Sakha. In Martin Haspelmath and Uri Tadmor, editors, *World Loanword Database*. Max Planck Institute for Evolutionary Anthropology, Leipzig, 2009. URL `https://wold.clld.org/vocabulary/19`.

References X

Nicholas Poppe. *Tatar manual: descriptive grammar and texts with a Tatar-English glossary*, volume 25 of *Uralic and Altaic Series*. Indiana University and Mouton & Co., Bloomington and The Hague, second, revised edition, 1968.

Nikolaï Nikolaevich Poppe. *Bashkir manual: descriptive grammar and texts with a Bashkir-English glossary*. Indiana University Press, Bloomington, 1964.

Wilhelm Radloff. *Die alttürkischen Inschriften der Mongolei*. Buchdruckerei der Kaiserlichen Akademie der Wissenschaften, St. Petersburg, 1895.

Wilhelm Radloff. *Grammatische Skizze der alttürkischen Inschriften*. Buchdruckerei der Kaiserlichen Akademie der Wissenschaften, St. Petersburg, 1897.

Elisabetta Ragagnin. *Dukhan, a Turkic variety of Northern Mongolia: Description and analysis*, volume 54. Harrassowitz, Wiesbaden, 2011.

References XI

Michael Ramsammy. The phonology-phonetics interface in constraint-based grammar: gradience, variability, and phonological change. In S.J. Hannahs and Anna R. K. Bosch, editors, *The Routledge handbook of phonological theory*. Routledge, Abingdon, 2018.

Valentin Ivanovich Rassadin. *Fonetika i leksika tofalarskogo jazyka*. Burjatskoe knižnoe izdatel'stvo, Ulan-Udė, 1971. In Russian. [Phonetics and Lexicon of the Tofalar Language].

Valentin Ivanovich Rassadin. *Soyotica*. University of Szeged, Szeged, 2010. ISBN 978-963-306-027-8.

Valentin Ivanovich Rassadin. *Sovremennyj tofalarskij jazyk i ego mesto v sisteme tjurkskix jazykov*. Izdatel'stvo Kalmyckogo universiteta, Elista, 2014. ISBN 978-5-91458-132-6. In Russian. [The Modern Tofalar Language and Its Place in the System of Turkic Languages].

Orrin Warner Robinson. A "scattered" rule in Swiss German. *Language*, 52(1):148–62, 1976.

References XII

Marti Roos. *The Western Yugur (Yellow Uygur) Language: Grammar, Texts, Vocabulary*. PhD thesis, Leiden University, 2000.

Edward Sapir. *Language*. Harcourt, Brace, 1921.

Johannes Schmidt. *Die Verwandtschaftsverhältnisse der indogermanischen Sprachen*. Hermann Böhlau, Weimar, 1872.

Claus Schönig. South Siberian Turkic. In Johanson and Csató (1998), pages 403–417.

Hugo Schuchardt. *Über die Lautgesetze: gegen die Junggrammatiker*. Oppenheim. In English (1972), in T. Vennemann and T. H. Wilbur (eds.), Schuchardt, the neogrammarians, and the transformational theory of phonological change: four essays. Frankfurt: Athenäum, 41-72, Berlin, 1885.

Steve Seegmiller. *Karachay*, volume 109. Lincom Europa, München, 1996.

References XIII

Andrée F Sjoberg. *Uzbek structural grammar*, volume 18. Indiana University Press, Bloomington, Indiana, 1963.

Eugénie Stapert. *Contact-induced change in Dolgan: an investigation into the role of linguistic data for the reconstruction of a people's (pre)history*. PhD thesis, Leiden University, Utrecht, 2013.

Sverre Stausland Johnsen. A diachronic account of phonological unnaturalness. *Phonology*, 29 (3):505–531, 2012.

Philipp Stoeckle and Christoph Hare Svenstrup. Language variation and (de-) standardisation processes in germany. In *Standard languages and language standards in a changing Europe*, pages 83–90. Novus, Oslo, 2011.

Èdhem Rahimovič Tenišev. *Stroj salarskogo jâzyka*. Nauka, Moscow, 1976.

Èdgem R. Tenishev. *Stroj saryg-jugurskogo jazyka*. Nauka, Moskva, 1976.

References XIV

Theo Vennemann. Rule inversion. *Lingua*, 29:209–242, 1972. ISSN 0024-3841. doi: 10.1016/0024-3841(72)90025-3. URL http://dx.doi.org/10.1016/0024-3841(72)90025-3.

Hanzhi Zhu. Sonorant restrictions in Kyrgyz. In William G. Bennett, Lindsay Hracs, and Dennis Ryan Storoshenko, editors, *Proceedings of the 35th West Coast Conference on Formal Linguistics*, pages 468–478, Somerville, MA, 2018. Cascadilla Proceedings Project.

Xiāngrú Zhào and Reinhard F. Hahn. The Ili Turk people and their language. *Central Asiatic Journal*, 33(3/4):260–289, 1989.

Düysenäli Äbdiläšimulï. *Eskï Qazaq žazba tili [The Old Kazakh written language]*. The Ethnic Publishing House, Beijing, 2014.