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The role of paradigms in morphology

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What is morphology?

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An inflectional paradigm (Czech ‘cat’):

	singular	*plural*
nominative	kotʃka	kotʃkɪ
genitive	kotʃkɪ	kotʃɛk
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- An organizational tool for linguists
- **A theoretical claim that speakers of a language don’t just look at individual forms, but consider relations between forms sharing a base**

Course overview

- Types of morphological theories
- Arguments for paradigms
- Theoretical uses of paradigms
- Quantitative approaches to paradigms

Outline

A taxonomy of morphological theories

Hockett (1954) places theories of morphology into three categories:

- Item and Process (IP)
- Item and Arrangement (IA)
- Word and Paradigm (WP)

Item and Process

- Inflected forms are based on a *stem* (item)
- Morphosyntactic features are expressed through a series of realizational *rules* (process)

Examples:

- A-Morphous Morphology (Anderson, 1992)
- Paradigm Function Morphology (Stump, 2001)

Though as we'll see, these "have paradigms" (as the name of the latter suggests)

Affixation as a process

In many cases, inflected words seem to be divided into segmental morphemes. This process is affixation/concatenation.

Example: Georgian nominal inflection (Anderson, 1992, pp. 138–40)

	singular	*plural*
nominative	t^{h}eoria	t^{h}eoriebi
instrumental	t^{h}eoriit^{h}	t^{h}eoriebit^{h}

Nominal stems acquire features through the following rules (which must be ordered):

(1) [+N, +Pl]
/X(a)/ → /Xeb/

(2) [+N, +Nom]
/X/=/Y[−Syll]/ → /Xi/

(3) [+N, +Instr]
/X/ → /Xit/

Non-affixational processes

Sometimes things are not so simple: the process involves changing or removing things.

Example: German umlaut, a vowel alternation which shows up in many different places in the morphonology (Anderson, 1982; Janda, 1987; Wiese, 1996)

	past	*past subjunctive*
'have'	hatə	hɛtə
'bring'	braxtə	brɛçtə
'know'	vʊstə	vʏstə
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This fronting (and schwa addition, if applicable) can be represented schematically:

(4) [+Past, +Subjunctive]

/X V Y (ə)/

1 2 3 4 →

1 2 3 ə

[–Back]

Item and Process: considerations

- Affixation is just one of a number of processes of morphological realization (though a particularly common one)
- Words are not segmented into morphemes
- Instead, the entire word acquires morphosyntactic features through rules
- Questions: what do these processes look like and how do rules interact (e.g. order)?

Item and Arrangement

- Inflected forms are made up of smaller *pieces* representing morphosyntactic features (items)
- These are placed in a particular *order* (arrangement)

Examples:

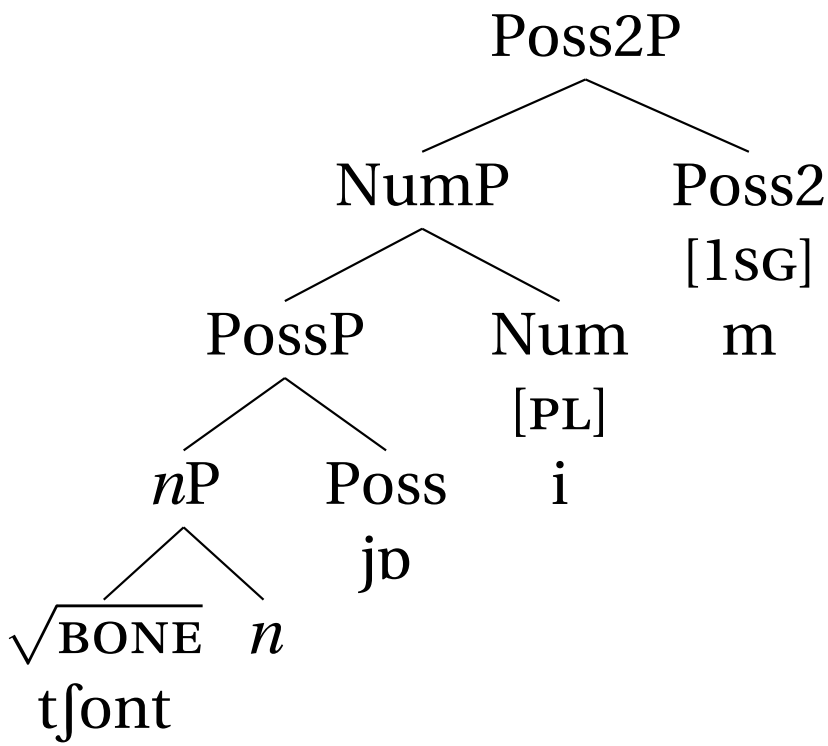
- Distributed Morphology (Halle & Marantz, 1993)
- Nanosyntax (Caha, 2009)

The syntactic nature of morphology

In many Item and Arrangement theories, both the items and the arrangement are *syntactic* (the syntax builds both words and sentences)

Example: Hungarian possessive nouns (cf. Dékány, 2015, p. 1129)

(5) ‘my bone’



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(10) Poss2 $\leftrightarrow$ m

Non-concatenative morphology

- As we've seen, not all inflected words can be neatly broken down into distinct pieces
- Item and Arrangement theories have multiple strategies for dealing with these cases, which we'll cover in more detail later
- Oversimplified example: German umlaut (vowel fronting) can be modelled as concatenation of a [–back] feature

Item and Arrangement: considerations

- Affixation is the basic form of morphological realization
- Words are segmented into morphemes (though these may be abstract)
- Questions: what are the pieces of words, how are they arranged, and what are the apparent deviations from one-to-one mappings between morphosyntactic features and exponents?

Word and Paradigm

- Inflected forms (words) are units in larger structures (paradigms)
- Differences in meaning are expressed through *contrasts* between paradigm cells
- Cells of a paradigm are linked by *implicational relations*

Examples:

- "classical" Greco-Latin grammatical analysis
- "Word and Paradigm Morphology" (Blevins, 2016)

Principal parts and analogy

Latin verbs are traditionally described with four *principal parts* (cf. Blevins, 2016, p. 86):

	present		*perfect*	
	indic. active	*infinitive*	*indic. active*	*pass. part.*
'love'	amoː	amaːre	amaːwiː	amaːtum
'advise'	moneoː	moneːre	monuiː	monitum
'cover'	tegoː	tegere	teːxiː	teːktum
'take'	kapioː	kapere	keːpiː	kaptum
'hear'	awdioː	awdiːre	awdiːwiː	awditum

- None of these is always predictable from the other three
- *Exemplary paradigms* can be used to infer forms by *analogy*

imperfect	amoː	: amaːbam	= oːroː	: oːraːbam
fut. active part.	amaːtum	: amaːtuːrum	= oːraːtum	: oːraːtuːrum

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Information theory

Contemporary work (e.g. Ackerman & Malouf, 2013; Ackerman et al., 2009) evaluates paradigms quantitatively using concepts from information theory

- Paradigms with lots of uncertainty (e.g. many possible frequent forms for a given paradigm cell) have a high *entropy*
- When knowing one cell allows speakers to predict another cell with relative certainty, they have a low *conditional entropy*
- Ackerman and Malouf (2013) propose that even very complex morphological systems have relatively low conditional entropy (allowing speakers to generate forms even with incomplete paradigms)

This work relies heavily on corpus data, experiments, and computational models.

Word and Paradigm: considerations

- Words are not composed of smaller units
- Words are units in larger structures
- Blevins (2016): There is nothing inherently special about words or paradigms (should instead be called “item and pattern”), but they are useful and empirically salient units
- Questions: how can we characterize patterns of contrast between paradigm cells, how do speakers infer unknown forms from known forms?

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- In *realizational* theories, abstract morphosyntactic features associated with a root condition phonological exponence (Late Insertion)
- In *incremental* theories, phonological exponence is what adds morphosyntactic features to a root

Outline

Against pieces and decomposition

Proponents of Word and Paradigm models argue that other theories are *empirically inadequate* or *theoretically problematic*

- Criticism of decomposition into pieces (Item and Arrangement vs. Item and Process + Word and Paradigm)
- Criticism of all sub-word structure (Item and Arrangement + Item and Process vs. Word and Paradigm)

We'll go through some of the common arguments and responses to them.

Non-concatenative morphology

Distinct units of meaning often do not correspond neatly with segments

Example: Germanic vowel alternations

- German: zɪts / zaːs / zɛːsə
- English: sɪt / sæt

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Item and Arrangement theories have three strategies for dealing with these cases:

- concede
- avoid
- double down

Concession

In Distributed Morphology, *readjustment rules* (Chomsky & Halle, 1968) can change the phonological output that has been realized.

Embick and Halle (2005) use a combination of Vocabulary Items and readjustment rules for the English past tense:

present	*past*
flow	flowd
hɪt	hɪt
fijl	fɛlt
sɪŋ	sæŋ

(11) T[past] ↔ d

(12) T[past] ↔ Ø / {$\sqrt{\text{HIT}}$, $\sqrt{\text{SING}}$, …}___

(13) T[past] ↔ t / {$\sqrt{\text{LEAVE}}$, $\sqrt{\text{BEND}}$, …}___

(14) ij → ɛ / {$\sqrt{\text{FEEL}}$, $\sqrt{\text{LEAD}}$, …}___

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Readjustment rules are *processes* in an *item*-based theory.

Avoidance

Stems in Hiaki alternate between “bound” and “free” forms, which are related by one of several phonological processes:

	free	*bound*	alternation class
‘pound’	poːna	pon	truncation
‘heal’	joːɾe	joɾeʔe	echo vowel
‘close one’s eyes’	kepe	kup	irregular

Instead of using readjustment rules like Harley and Tubino Blanco (2013), Haugen (2016) argues that the stems are *suppletive* (formally unrelated):

(16) $\sqrt{\text{POUND}} \leftrightarrow$ poːna / ___Asp

(17) $\sqrt{\text{POUND}} \leftrightarrow$ pon

Under this analysis, the phonological similarity is due to historical developments, but Hiaki speakers do not encode them in their grammar.

Doubling down

If you're committed to piece-based morphology, you need a more sophisticated phonology to expand the definition of a piece.

Example: German plurals, including umlaut (Trommer, 2021)

	singular	*plural*
'seam'	naːt	nɛːtə
'time'	zaːt	zaːtən
'rate'	ʀaːtə	ʀaːtən

The plurals are made up of the following pieces:

stem	PL	F.PL
nAːt	ⓒ•	ⓝ
zaːt	ⓒ•	ⓝ
ʀaːtə	ⓒ•	ⓝ

- A: low vowel unspecified for backness
- ⓒ: floating coronal feature
- •: empty segment
- ⓝ: floating nasal feature

Extended exponence

Even when a word can be broken into pieces, their relationship to morphosyntactic features can be complex (many-to-many).

Example: Vogul (Mansi) possessives (Harris, 2017, p. 185)

POSS			POSS			POSS		
SG	1 DU	xaːpmen	PL	1 DU	xaːpanamen	PL	1 SG	xaːpanum
DU	1 DU	xaːpagmen	PL	2 DU	xaːpanen	PL	1 DU	xaːpanamen
PL	1 DU	xaːpanamen	PL	3 DU	xaːpanen	PL	1 PL	xaːpanuw

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DU	1	DU	xaːpagmen	PL	2	DU	xaːpanen	PL	1	DU	xaːpanamen
PL	1	DU	xaːpanamen	PL	3	DU	xaːpanen	PL	1	PL	xaːpanuw

Extended exponence

Even when a word can be broken into pieces, their relationship to morphosyntactic features can be complex (many-to-many).

Example: Vogul (Mansi) possessives (Harris, 2017, p. 185)

POSS			POSS			POSS		
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PL	2 DU	xaːpanen
PL	3 DU	xaːpanen

	POSS	
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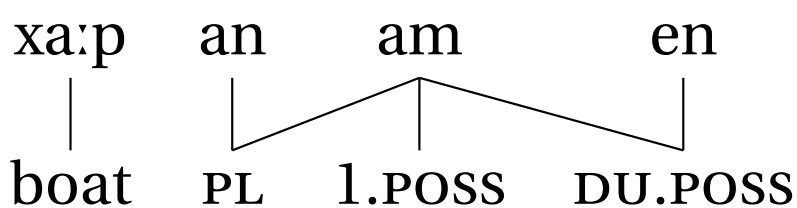
PL	1 DU	xaːpanamen
PL	1 PL	xaːpanuw



Primary exponence

For (realizational) piece-based models, such cases can be handled by saying that each piece expones one *primary* (set of) features.

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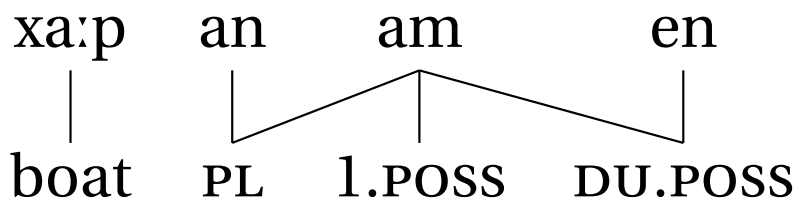

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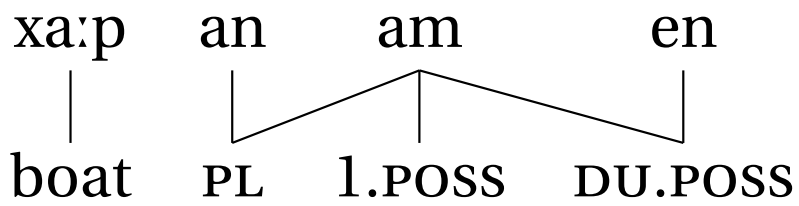

Contextually determined rule of realization:

(18) $\sqrt{\text{BOAT}}$ ↔ xaːp

(19) PL ↔ an

(20) 1.POSS ↔ am / [PL, DU.POSS]

(21) DU.POSS ↔ en

Primary exponence: objections

This strategy has in turn been met with theoretical and conceptual objections:

- Often no principled way (for the linguist or the child) to decide which features are primary and which are secondary
- Piece-based morphology was proposed as a *hypothesis* of neat correlation between units of form and units of meaning – if this is false, why hold on to the pieces?

Morphomes

Shared *form* does not always correspond to shared *meaning*–Aronoff (1994) calls pieces of morphology with no consistent meaning *morphomes*.

Example: English past participles (Aronoff, 1994, pp. 23–5)

- Two main uses: passive (*I have been eaten*) and perfect (*I have eaten*)
- The participle can be formed in various regular and irregular ways, but the passive and perfect are *always* identical
- The two uses don't share any morphosyntactic features

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Example: Spanish PYTA (*perfecto/pretérito y tiempos afines*) morpheme (Myler, 2026) – [kerér] 'want' (3PL)

	present	*imperfect*	*preterite*	*future*
indicative	kjéren	kerían	kisjéron	kerán
subjunctive	kjéran	kisjéran		kisjéren

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	present	*imperfect*	*preterite*	*future*
indicative	kjéɾen	keɾían	kisjéron	kerán
subjunctive	kjéɾan	kisjéran		kisjéɾen

Post-syntax

Morphomes are easier to handle in piece-based theories that have a layer between syntax and realization – *post-syntactic* operations that add or delete morphosyntactic features.

Inserting *parasitic features* in the right contexts – Trommer (2016, p. 75) for English participles

(22) [ ] → [+P] / [___ –fin +pass]

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Deleting certain features in the wrong contexts – Myler (2026, pp. 6–7) for Spanish PYTA

	pres	*impf*	*pret*	*fut*
indic	keɾ	keɾ	kis	keɾ
subj	keɾ	kis		kis

(24) $\sqrt{\text{WANT}} \leftrightarrow$ kis / ___ … [–pres, +fin]

(25) $\sqrt{\text{WANT}} \leftrightarrow$ keɾ

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(25) $\sqrt{\text{WANT}} \leftrightarrow$ keɾ

(26) –pres → Ø / [___ +past, –perf, –sbjv]

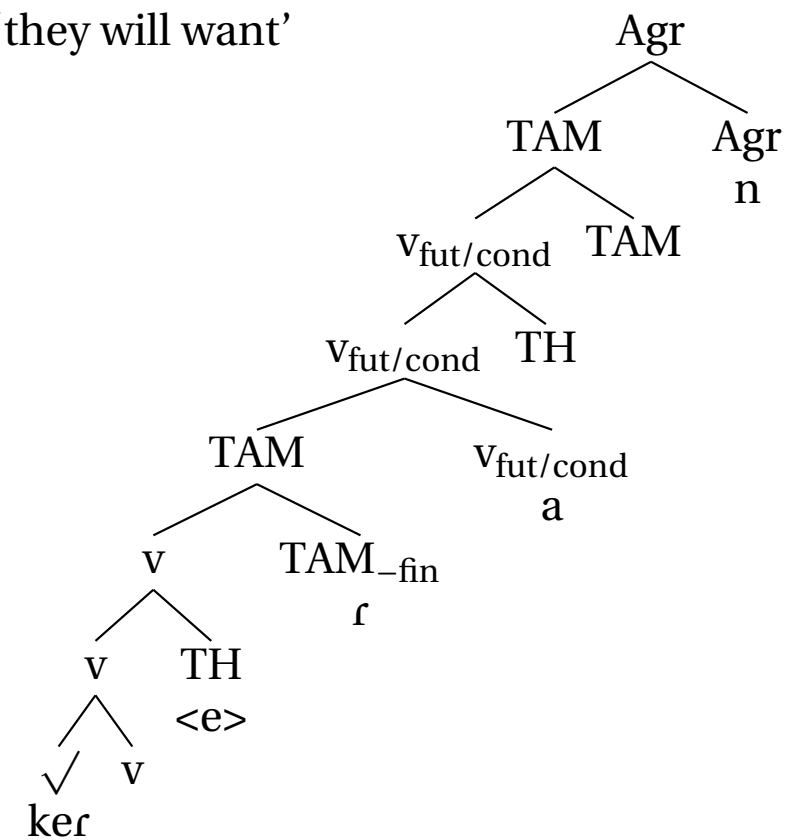
Syntax

Another possibility: they do share morphosyntactic structure after all (denial of morphomicity).

Myler (2026): the Spanish indicative future is built on the infinitive (cf. Harris, 1969, pp. 87–98)

	‘want’	‘request’
infinitive	kerér	peðír
conditional	kerían	peðirían
fut indic	kerán	peðirán

(27) ‘they will want’



Gestalt exponence

A related problem: inflected forms can often be analyzed into "recurrent partials", but only the word as a whole can be identified with a stable meaning.

Example: Estonian singular case forms (Blevins, 2016, pp. 74–6)

	'rooster'	'lock'	'trestle'	'stocking'
nominative	kːukː	lukː	pːukː	sukː
genitive	kːukːe	lukːu	pːukːi	sukːɑ
partitive	kːukːe	lukːu	pːukːi	sukːɑ

- Case is determined by a combination of stem weight and presence of (arbitrary) theme vowel
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- Case is determined by a combination of stem weight and presence of (arbitrary) theme vowel
- Neither of these pieces has any consistent meaning, only their combination
- The plural only makes things worse

The first seam

Many of the arguments in favor of paradigms in morphology are actually arguments against a strict Item and Arrangement model

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"Within the general typology provided by Hockett (1954), which continues to be referred to in the literature, this is an 'Item and Process' model of word structure, though, especially in its treatment of inflection, it could also be called a 'Word and Paradigm' view. The principal opposition is to 'Item and Arrangement' models; and since the dominant, classical picture of word structure based on the structuralist morphemes is firmly of this sort, it is this distinction that is most important to pursue." (Anderson, 1992, p. 72)

Segmentation

Different parts of the morphological system can provide evidence for different segmentations

Example: Estonian genitive plural of ‘workbook’ [ɤpːikːutːe]
(Blevins et al., 2016, p. 286)

	‘beak’		‘workbook’		‘seminar’	
	sing	*plur*	*sing*	*plur*	*sing*	*plur*
nom	nokː	nokːat	ɤpːikː	ɤpːikːut	seminar	seminarit
gen	nokːa	nokːate	ɤpːikːu	ɤpːikːutːe	seminari	seminarite
part	nokːa	nokːasit	ɤpːikːutː	ɤpːikːuit	seminari	seminarisit

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- GEN.PL = PART.SG + suffix

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- GEN.PL = PART.SG + suffix
- GEN.PL = stem + theme vowel + suffix
- Item-based: must choose one analysis
- Paradigm-based: can have both generalizations

Assembly instructions

Decomposing inflected forms into stems leads to a loss of information that must then be restored with “assembly instructions” like class diacritics

Example: Czech feminine inflectional classes

	‘woman’	‘rose’	‘song’	‘bone’
nominative	ʒɛna	ruːʒɛ	piːsɛɲ	kost
genitive	ʒɛnɪ	ruːʒɛ	piːsɲɛ	koscɪ
dative	ʒɛɲɛ	ruːʒɪ	piːsɲɪ	koscɪ
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vocative	ʒɛno	ruːʒɛ	piːsɛɲ	kost
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	/ʒɛn$_{[F1]}$/	/ruːʒ$_{[F2]}$/	/piːsɲ$_{[F3]}$/	/kost$_{[F4]}$/

Economy

Analysis that derive individual forms are often evaluated on more or less objective measures like:

- Economy (shorter description length)
- Connecting multiple aspects of the data
- Elegance

These analyses neglect an important aspect of economy: uncertainty/predictability

- Morphological systems can be very *complicated* (large paradigms, complicated derivations, fusion, etc.)
- …While still being highly *predictable* (knowing a small number of a word's forms is enough to infer all the others)
- Note that this economy is a property of morphological *systems* more than *analyses*

The second seam

These criticisms apply to all theories that focus on deriving individual forms, even those that aren't fully piece-based

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"In particular, the class of stem-based realizational models [...] are conventionally contrasted with morphemic models, even realizational ones, like Distributed Morphology. On the present account, however, both of these models, one dispensing with morphemes and the other embracing them, however different they may be in many respects, are alike in their contrast with the word-based assumptions relevant for analyzing morphology as a complex discriminative system." (Blevins et al., 2016, p. 296)

Outline

Syncretism

An important topic for morphological theory is *syncretism*: when two paradigm cells (morphosyntactic feature sets) share a realization

Example: standard English pronouns

	1SG	1PL	2SG	2PL	3SG.M	3SG.F	3SG.N	3PL
nominative	aj	wij	juw	juw	hij	ʃij	ɪt	ðej
accusative	mij	əs	juw	juw	hɪm	hɻ̩	ɪt	ðɛm
genitive	maj	awɹ	jʊɹ	jʊɹ	hɪz	hɻ̩	ɪts	ðɛɹ

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Here we see several syncretisms:

- nominative–accusative
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- singular–plural in second person

The last is a *metasyncretism*: number is never distinguished in the second person throughout the language

Underspecification and feature structure

At first glance, syncretism seems inherently relational (paradigmatic), but it's common to analyze it without comparison between forms

- Syncretic forms share some *morphosyntactic feature*
- Rules of realization are *underspecified* and can have *default* behavior

Which syncretisms can be (easily) captured depends on *feature structure*

	[2]	[3, +fem]
[+nom, −poss]	juw	ʃij
[−nom, −poss]	juw	hɻ̩
[−nom, +poss]	jʊɹ	hɻ̩

(28) [2, +poss] ↔ jʊɹ

(29) [2, −poss] ↔ juw

(30) [3, +fem, +nom] ↔ ʃij

(31) [3, +fem, −nom] ↔ hɻ̩

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(28) [2, +poss] ↔ jʊɹ

(29) [2, −poss] ↔ juw

(30) [3, +fem, +nom] ↔ ʃij

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Metasyncretism

Metasyncretism: syncretism across exponents (especially in multiple contexts) – not a property of individual rules of exponence like [juw]

Example: standard English second-person verbal agreement

	singular	*plural*
first	wəz	wɹ̩
second	wɹ̩	wɹ̩
third	wəz	wɹ̩

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second	wɹ̩	wɹ̩
third	wəz	wɹ̩

This is often handled by general rules that delete, add, or change features

(32) [±pl] → Ø / [___, 2]

(33) [+past, 2, −pl] ↔ wəz

(34) [+past, 2] ↔ wɹ̩

Most versions of Distributed Morphology only allow Impoverishment (feature deletion)

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(32) [2, –pl] → [2, +pl]

(33) [+past, 2, –pl] ↔ wəz

(34) [+past, 2, +pl] ↔ wɹ̩

Other theories allow arbitrary feature mappings (cf. Kramer, 2016)

Complex feature structure

Contemporary approaches can get quite complex in their feature structure

Example: Upper Sorbian dual ('woman') (Baerman, 2007, pp. 543–4)

	SG	DU	PL
NOM	ʒona	ʒonʲe	ʒoniɬ
ACC	ʒonu	ʒonʲe	ʒoniɬ
GEN	ʒoniɬ	ʒonow	ʒonow
LOC	ʒonʲe	ʒonomaj	ʒonax
DAT	ʒonʲe	ʒonomaj	ʒonam
INS	ʒonu	ʒonomaj	ʒonamʲi

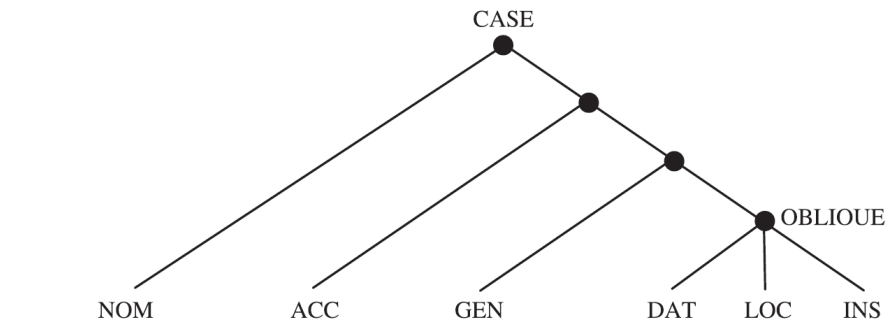

Fig. 1. A possible model of case in Sorbian.

Baerman (2007):

- Language- (and number-) specific
- Default CASE preempted by more specific forms

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NOM	ʒona	ʒonʲe	ʒoniɬ
ACC	ʒonu	ʒonʲe	ʒoniɬ
GEN	ʒoniɬ	ʒonow	ʒonow
LOC	ʒonʲe	ʒonomaj	ʒonax
DAT	ʒonʲe	ʒonomaj	ʒonam
INS	ʒonu	ʒonomaj	ʒonamʲi

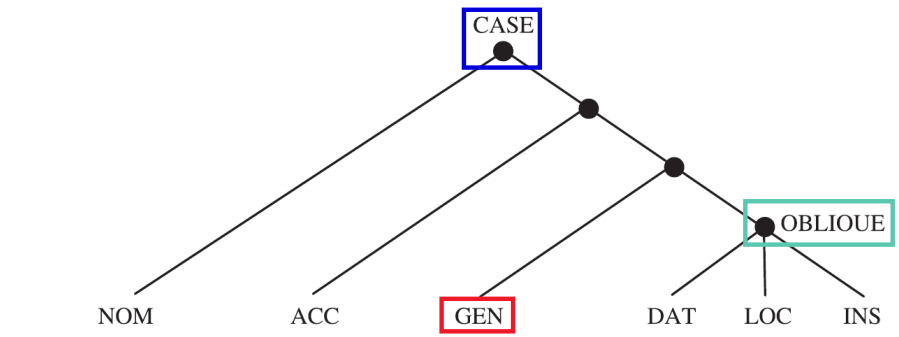

Fig. 1. A possible model of case in Sorbian.

Baerman (2007):

- Language- (and number-) specific
- Default CASE preempted by more specific forms

Complex feature structure

Contemporary approaches can get quite complex in their feature structure

Example: Upper Sorbian dual ('woman') (Baerman, 2007, pp. 543–4)

	SG	DU	PL
NOM	ʒona	ʒonʲe	ʒoniɨ
ACC	ʒonu	ʒonʲe	ʒoniɨ
GEN	ʒoniɨ	ʒonow	ʒonow
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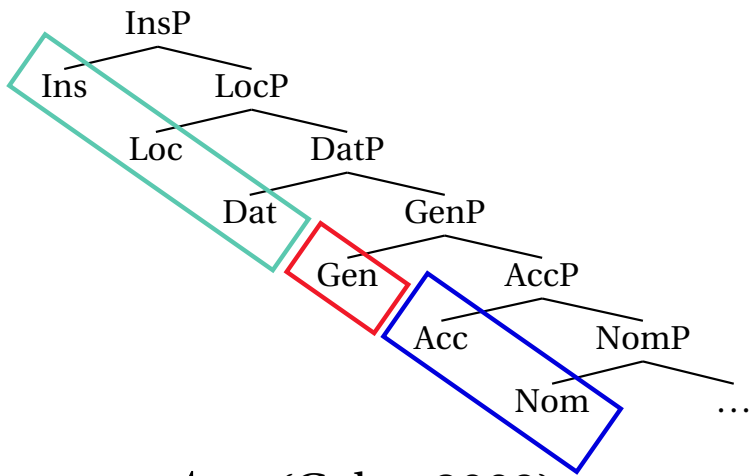

Nanosyntax (Caha, 2009):

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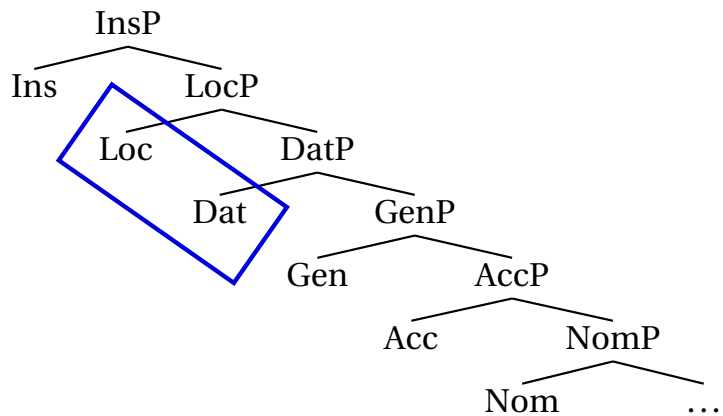

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Featural incoherence

Some metasyncretisms are hard to describe in terms of morphosyntactic feature, even complex, abstract ones (morphomic patterns).

Example: Dhaasanac verb stem alternations across forms and tense/aspect (Baerman et al., 2005, p. 106)

	SG	PL			*A*	*B*
1INCL	–	A	‘fall down’	*perfect*	lɛːðɪ	lɛːtɪ
1	A	B	‘die’	*perfect*	kʊfɪ	kʊjːɪ
2	B	B	‘migrate’	*imperfect*	guːrma	guːranːa
3F	B	A	‘cough’	*perfect*	ʔuːfʊmɪ	ʔuːfɛnɪ
3M	A	A	‘kill’	*perfect*	jɛs	cɛs

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Network Morphology: Forms are determined through evaluation of equations arranged in an inheritance hierarchy

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VERB:
  <index>==_A
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  <index 3rd sgf>==_B
  <index 1st_excl pl>==_B
  <mor pos prf>=="<form prf <index>>"
  . . .
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3F	B	A
3M	A	A

Network Morphology: Forms are determined through evaluation of equations arranged in an inheritance hierarchy

```
FORMS:
  <form prf>=="<stem initial>""<form c grade>"-i
  . . .
CORONALS:
  <form c grade _A>==<form _A"<stemfinal>">
  <form c grade _B>==<form _B"<stemfinal>">
  . . .
Léet:<mor pos prf 2nd sg>==<form prf _B>
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Léet:<mor pos prf 2nd sg>==l_e_e_t-i
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3M	A	A

Network Morphology: Forms are determined through evaluation of equations arranged in an inheritance hierarchy

- Form, features, and paradigmatic placement all distinct
- Assembly instructions distributed
- "Has paradigms"?

```
Léet:<mor pos prf 2nd sg>==l_e_e_t-i
```

Directional syncretism

Sometimes syncretism clearly goes in one direction

Example: Slovenian dual genitive/locative ('person') (Baerman et al., 2005, p. 176)

	singular	*dual*	*plural*
nominative	tʃlɔ́vɛk	tʃlɔvéka	ljudjé
accusative	tʃlɔvéka	tʃlɔvéka	ljudí
genitive	tʃlɔvéka	ljudí	ljudí
locative	tʃlɔvéku	ljudéx	ljudéx
dative	tʃlɔvéku	tʃlɔvékoma	ljudém
instrumental	tʃlɔvékom	tʃlɔvékoma	ljudmí

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Rules of referral realize one paradigm cell by referencing another

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NOUN:
  <mor du gen>=="<mor pl gen>"
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Summary

- Syncretism and (especially) metasyncretism are an important part of relations between paradigm cells
- All theories need a way to have two paradigm cells share a form that isn't dependent on particular exponents
- "Paradigmatic" theories can easily handle all sorts of cases by establishing dependencies and hierarchical relations between cells
- "Non-paradigmatic" theories must achieve the attested patterns without cross-reference
- Impoverishment (in Distributed Morphology) is a hypothesis that all metasyncretisms can be expressed through *feature removal* (Bobaljik, 2002)
- This is too strong, empirically – additional mechanisms (or much cleverness) are needed (Kramer, 2016; Trommer, 2016)

Outline

Output–output correspondence

- Theoretical phonologists have long noted that words seem to exert influences on one another
- Optimality Theory and friends: candidate forms for a given underlying form are evaluated by constraints
- Some have included constraints enforcing *output–output correspondence* a.k.a. *paradigm uniformity*
- This is not a course on Optimality Theory – analyses will not be technical

Transderivational correspondence

Benua (1997): Some forms (especially truncated ones) are derived through an intermediate form to which they are compared

Example: Underapplication of epenthesis in Tiberian Hebrew jussives (Benua, 1997, pp. 98–120)

	1SG.POSS	*base*	Constraints, in order of priority:
‘book’	sifʀ̥i:	se:fɛʀ̥	
	IMPF	JUSS	
‘take captive’	jiʃbɛ:	jiʃb	
‘be simple’	jiftɛ:	jift	
‘be exiled’	jiʁlɛ:	jiʁɛl	
‘build’	jivnɛ:	jivɛn	

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Constraints, in order of priority:

3. No coda clusters

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Constraints, in order of priority:

2. No differences between imperfective and jussive
3. No coda clusters

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Constraints, in order of priority:

1. No rising-sonority coda clusters
2. No differences between imperfective and jussive
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To derive the jussive, you must first derive the imperfective, then truncate it

Inflectional bases

Some phonologists have argued that members of an inflectional paradigm are influenced by a single privileged *base* (e.g. Albright, 2002)

Example: Underapplication of s-dissimilation in Swabian German verbs (Hall & Scott, 2007)

		Standard	Swabian
‘country’		ʃtaːt	ʃtaːt
‘window’		fɛnstɐ	fɛnʃtɐ
‘mail’		pɔst	poʃt
‘greet’	1SG	gʁyːsə	griəs
	3SG	gʁyːst	griəst
	3PL	gʁyːsət	griəsət

- /s/ and /ʃ/ neutralize to [ʃ] word-initially in Standard German, everywhere in Swabian
- No neutralization before verbal suffix /t/
- Unsuffixed 1SG form serves as inflectional base
- Base identity outranks *st

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Optimal Paradigms

Others argue that all paradigm members are evaluated simultaneously and can all influence one another

Example: Arabic verbal templates (McCarthy, 2005)

nouns	*verbs*
fVʕl-u	faʃal-a
fVʕVl-u	(ta)faʃːal-a
fVːʕVl-u	(ta)faːʕal-a
fVʕVːl-u	ʔafʕal-a
fVːʕVːl-u	nfaʃal-a
	ftaʃal-a
	fʕal(a)l-a
	stafʕal-a

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- No superheavy syllables (*faʃaːl-tu)

  \+ paradigm uniformity

  (*⟨faʃaːl-a, faʃal-tu⟩)

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	fʕal(a)l-a
	stafʕal-a

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  (*⟨faʃaːl-a, faʃal-tu⟩)

  ⇒ /-VːC -VCC/ templates realized as [-VC]

Bobaljik (2008): These templates could surface faithfully in *derived* forms unless those are subject to identity with some base

Lexical conservatism

The form of a derivative can sometimes be affected by a *different* derivative

Example: Stress shift in English *-able* words (Steriade, 1999)

	base	*-able*	*related*
‘remedy’	ɹɛ́məɹi	ɹəmíɹiəbl̩	ɹəmíɹiəl
‘parody’	pǽɹəɹi	pǽɹəɹiəbl̩	–
‘demonstrate’	dɛ́mənstɹèjt	dəmɔ́nstɹəbl̩	dəmɔ́nstɹəɹɪv
‘penetrate’	pɛ́nətɹèjt	pɛ́nətɹəbl̩	–
‘reciprocate’	ɹəsípɹəkèjt	ɹəsìpɹəkəbl̩	ɹɛ̀sɪpɹɔ́sɪɹi

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- Stress shifts in *-able* if there’s a related word with stress shift

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- Stress shifts in *-able* if there’s a related word with stress shift
- …Unless the related word also has a consonant alternation

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Example: Stress shift in English *-able* words (Steriade, 1999)

	base	*-able*	*related*
‘remedy’	ɹɛ́məɹi	ɹəmíɾiəbl̩	ɹəmíɾiəl
‘parody’	pǽɹəɹi	pǽɹəɹiəbl̩	–
‘demonstrate’	dɛ́mənstɹèjt	dəmɔ́nstɹəbl̩	dəmɔ́nstɹəɾɪv
‘penetrate’	pɛ́nətɹèjt	pɛ́nətɹəbl̩	–
‘reciprocate’	ɹəsípɹəkèjt	ɹəsìpɹəkəbl̩	ɹɛ̀sɪpɹɔ́sɪɾi

- Stress shifts in *-able* if there’s a related word with stress shift
- …Unless the related word also has a consonant alternation

Summary

- "Pure" generative morphologists are typically committed to derivations proceeding one word at a time
- Generative phonologists are often more comfortable with allowing surface forms to influence one another
- Proposals for "directions of influence" include:
  - bases to forms derived from them (Benua, 1997; Bobaljik, 2008)
  - one privileged cell in an inflectional paradigm to others (Albright, 2002; Benua, 1997; Hall & Scott, 2007)
  - all cells in an inflectional paradigm to one another (McCarthy, 2005)
  - derived forms (remote bases) to other forms derived from the same base (Steriade, 1999)
- In particular, there has been much disagreement whether inflectional paradigms have a base or not

Outline

Paradigm structure

One line of active research studies implicational relationships between paradigm cells (“the Paradigm Cell Filling Problem”)

- What inferences are licensed between cells? (descriptive, corpus)
- What inferences do speakers make between cells? (behavioral)
- How do speakers store relations between cells? (psycholinguistic)

Principal parts

Finkel and Stump (2007): morphological systems can vary in the structure of *principal parts* that imply the whole paradigm (see also Stump & Finkel, 2013)

Table 1.13. *Plat for the principal-part analysis of Ngiti verbs*

Conjugation	Infinitive	Imperative singular	Imperative plural	Perfective present	Perfective recent past	Perfective intermediate past	Perfective remote past	Perfective narrative past	Imperfective near future	Imperfective distant future	Imperfective past continuous	Imperfective past habitual	Imperfective past conditional	Subjunctive	Nominalized stem1	Nominalized stem2	Example (infinitive form)
v1a	αL	αL	αL	αL	αL	αL	αL	αL	αL	αL	αL	αH	αL	αL	αL	αL	*idzì-ta* 'to push'
v1b	βL	βL	βL	βL	βL	βL	βL	βL	βH	βH	βL	βH	βL	βH	βL	βL	*obhì-ta* 'to cultivate'
v2a.tr	αM	αM	αM	αL	αL	αL	αL	αM	αM	αM	αM	αH	αL	αM	αM	αL	*ada-ta* 'to cross'
v2a.itr	αM	αM	αM	αL	αL	αL	αL	αM	αM	αM	αM	αH	αL	αM	αM	αM	*upo-ta* 'to climb'
v2b.tr	βM	βM	βM	βL	βL	βL	βL	βL	βM	βM	βL	βH	βL	βM	βM	βL	*ɔdɔ-ta* 'to guard'
v2b.itr	βM	βM	βM	βL	βL	βL	βL	βL	βM	βM	βL	βH	βL	βM	βM	βM	*ɔdzi-ta* 'to cry'
v3.tr	αM	αLM	αM	αM	αM	αM	αM	αM	αM	αM	αM	αH	αL	αM	αLM	αM	*ʉdhɔ-ta* 'to pour'
v3.itr	αM	αLM	αM	αM	αM	αM	αM	αL	αL	αL	αL	αH	αL	αL	αM	αM	*ʉdhɔ-ta* 'to sleep'
v4.tr	αH	αLM	αLM	αLM	αLM	αLM	αLM	αH	αH	αH	αH	αH	αL	αH	αLM	αM	*andí-tá* 'to write'
v4.itr	αH	αLM	αLM	αLM	αLM	αLM	αLM	αH	αH	αH	αH	αH	αL	αH	αLM	αLM	*akpé-tá* 'to whistle'

Source: Kutsch Lojenga 1994: 217ff.
Notes: L = low tone, M = mid tone, H = high tone; α = stem-initial /a/, |I| or |U|; β = stem-initial |O|. According to the principles of Ngiti vowel harmony, the archisegment |I| is realized as /i/ or /ɨ/; |U|, as /u/ or /ʉ/; and |O|, as /o/ or /ɔ/. See Kutsch Lojenga (1994: 62ff) for a discussion of these principles.

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v1a	αL	αL	αL	αL	αL	αL	αL	αL	αL	αL	αL	αH	αL	αL	αL	αL	*idzì-ta* 'to push'
v1b	βL	βL	βL	βL	βL	βL	βL	βL	βH	βH	βL	βH	βL	βH	βL	βL	*obhì-ta* 'to cultivate'
v2a.tr	αM	αM	αM	αL	αL	αL	αL	αM	αM	αM	αM	αH	αL	αM	αM	αL	*ada-ta* 'to cross'
v2a.itr	αM	αM	αM	αL	αL	αL	αL	αM	αM	αM	αM	αH	αL	αM	αM	αM	*upo-ta* 'to climb'
v2b.tr	βM	βM	βM	βL	βL	βL	βL	βL	βM	βM	βL	βH	βL	βM	βM	βL	*ɔdɔ-ta* 'to guard'
v2b.itr	βM	βM	βM	βL	βL	βL	βL	βL	βM	βM	βL	βH	βL	βM	βM	βM	*ɔdzi-ta* 'to cry'
v3.tr	αM	αLM	αM	αM	αM	αM	αM	αM	αM	αM	αM	αH	αL	αM	αLM	αM	*ʉdhɔ-ta* 'to pour'
v3.itr	αM	αLM	αM	αM	αM	αM	αM	αL	αL	αL	αL	αH	αL	αL	αM	αM	*ʉdhɔ-ta* 'to sleep'
v4.tr	αH	αLM	αLM	αLM	αLM	αLM	αLM	αH	αH	αH	αH	αH	αL	αH	αLM	αM	*andí-tá* 'to write'
v4.itr	αH	αLM	αLM	αLM	αLM	αLM	αLM	αH	αH	αH	αH	αH	αL	αH	αLM	αLM	*akpé-tá* 'to whistle'

Source: Kutsch Lojenga 1994: 217ff.
Notes: L = low tone, M = mid tone, H = high tone; α = stem-initial /a/, |I| or |U|; β = stem-initial |O|. According to the principles of Ngiti vowel harmony, the archisegment |I| is realized as /i/ or /ɨ/; |U|, as /u/ or /ʉ/; and |O|, as /o/ or /ɔ/. See Kutsch Lojenga (1994: 62ff) for a discussion of these principles.

- A *static* system requires three principal parts

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v1a	αL	αL	αL	αL	αL	αL	αL	αL	αL	αL	αL	αH	αL	αL	αL	αL	*idzì-ta* 'to push'
v1b	βL	βL	βL	βL	βL	βL	βL	βL	βH	βH	βL	βH	βL	βH	βL	βL	*obhì-ta* 'to cultivate'
v2a.tr	αM	αM	αM	αL	αL	αL	αL	αM	αM	αM	αM	αH	αL	αM	αM	αL	*ada-ta* 'to cross'
v2a.itr	αM	αM	αM	αL	αL	αL	αL	αM	αM	αM	αM	αH	αL	αM	αM	αM	*upo-ta* 'to climb'
v2b.tr	βM	βM	βM	βL	βL	βL	βL	βL	βM	βM	βL	βH	βL	βM	βM	βL	*ɔdɔ-ta* 'to guard'
v2b.itr	βM	βM	βM	βL	βL	βL	βL	βL	βM	βM	βL	βH	βL	βM	βM	βM	*ɔdzi-ta* 'to cry'
v3.tr	αM	αLM	αM	αM	αM	αM	αM	αM	αM	αM	αM	αH	αL	αM	αLM	αM	*ʉdhɔ-ta* 'to pour'
v3.itr	αM	αLM	αM	αM	αM	αM	αM	αL	αL	αL	αL	αH	αL	αL	αM	αM	*ʉdhɔ-ta* 'to sleep'
v4.tr	αH	αLM	αLM	αLM	αLM	αLM	αLM	αH	αH	αH	αH	αH	αL	αH	αLM	αM	*andí-tá* 'to write'
v4.itr	αH	αLM	αLM	αLM	αLM	αLM	αLM	αH	αH	αH	αH	αH	αL	αH	αLM	αLM	*akpé-tá* 'to whistle'

Source: Kutsch Lojenga 1994: 217ff.
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- A *static* system requires three principal parts
- A *dynamic* system only requires two

Principal parts

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v1a	αL	αL	αL	αL	αL	αL	αL	αL	αL	αL	αL	αH	αL	αL	αL	αL	*idzì-ta* 'to push'
v1b	βL	βL	βL	βL	βL	βL	βL	βL	βH	βH	βL	βH	βL	βH	βL	βL	*obhì-ta* 'to cultivate'
v2a.tr	αM	αM	αM	αL	αL	αL	αL	αM	αM	αM	αM	αH	αL	αM	αM	αL	*ada-ta* 'to cross'
v2a.itr	αM	αM	αM	αL	αL	αL	αL	αM	αM	αM	αM	αH	αL	αM	αM	αM	*upo-ta* 'to climb'
v2b.tr	βM	βM	βM	βL	βL	βL	βL	βL	βM	βM	βL	βH	βL	βM	βM	βL	*ɔdɔ-ta* 'to guard'
v2b.itr	βM	βM	βM	βL	βL	βL	βL	βL	βM	βM	βL	βH	βL	βM	βM	βM	*ɔdzi-ta* 'to cry'
v3.tr	αM	αLM	αM	αM	αM	αM	αM	αM	αM	αM	αM	αH	αL	αM	αLM	αM	*ʉdhɔ-ta* 'to pour'
v3.itr	αM	αLM	αM	αM	αM	αM	αM	αL	αL	αL	αL	αH	αL	αL	αM	αM	*ʉdhɔ-ta* 'to sleep'
v4.tr	αH	αLM	αLM	αLM	αLM	αLM	αLM	αH	αH	αH	αH	αH	αL	αH	αLM	αM	*andí-tá* 'to write'
v4.itr	αH	αLM	αLM	αLM	αLM	αLM	αLM	αH	αH	αH	αH	αH	αL	αH	αLM	αLM	*akpé-tá* 'to whistle'

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- A *static* system requires three principal parts
- A *dynamic* system only requires two
- Most forms can be predicted by one principal part, but some require two (v3.itr nominal 1)

Entropy

Ackerman and Malouf (2013) introduce a more flexible notion of paradigmatic informativity: *entropy* (borrowed from information theory)

The *entropy H* of a paradigm cell *X* represents the uncertainty in its realization, depending on the probabilities of its realizations x_i:

$$H(X) = -\sum_i P(x_i)\log_2 P(x_i)$$

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Ngiti imperative singular:

v1a	vab	v2a.tr	v2a.itr	v2b.tr	v2b.itr	v3.tr	v3.itr	v4.tr	v4.itr
αL	βL	αM	αM	βM	βM	αLM	αLM	αLM	αLM

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	αL	βL	αM	βM	αLM
frequency	1	1	2	2	4

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	αL	βL	αM	βM	αLM
frequency	1	1	2	2	4
$P(x_i)$	.1	.1	.2	.2	.4

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frequency	1	1	2	2	4
$P(x_i)$	.1	.1	.2	.2	.4
$\log_2 P(x_i)$	−3.32	−3.32	−2.32	−2.32	−1.32

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Ngiti imperative singular:

	αL	βL	αM	βM	αLM
frequency	1	1	2	2	4
$P(x_i)$	.1	.1	.2	.2	.4
$\log_2 P(x_i)$	−3.32	−3.32	−2.32	−2.32	−1.32
$P(x_i)\log_2 P(x_i)$	−.33	−.33	−.46	−.46	−.53

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The *entropy H* of a paradigm cell *X* represents the uncertainty in its realization, depending on the probabilities of its realizations x_i:

$$H(X) = -\sum_i P(x_i)\log_2 P(x_i) = 2.12$$

Ngiti imperative singular:

	αL	βL	αM	βM	αLM
frequency	1	1	2	2	4
$P(x_i)$	.1	.1	.2	.2	.4
$\log_2 P(x_i)$	−3.32	−3.32	−2.32	−2.32	−1.32
$P(x_i)\log_2 P(x_i)$	−.33	−.33	−.46	−.46	−.53

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Ngiti imperative singular:

	αL	βL	αM	βM	αLM
frequency	2	2	2	2	2
$P(x_i)$	.2	.2	.2	.2	.2
$\log_2 P(x_i)$	−2.32	−2.32	−2.32	−2.32	−2.32
$P(x_i)\log_2 P(x_i)$	−.46	−.46	−.46	−.46	−.46

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The *entropy H* of a paradigm cell *X* represents the uncertainty in its realization, depending on the probabilities of its realizations x_i:

$$H(X) = -\sum_i P(x_i)\log_2 P(x_i) = 0.32$$

Ngiti imperative singular:

	αL	βL	αM	βM	αLM
frequency	1	1	1	1	96
$P(x_i)$	.01	.01	.01	.01	.96
$\log_2 P(x_i)$	−6.64	−6.64	−6.64	−6.64	−0.06
$P(x_i)\log_2 P(x_i)$	−.06	−.06	−.06	−.06	−.06

Conditional entropy

We can assess paradigm structure using *conditional entropy*

The *conditional entropy* $H(Y|X)$ represents the uncertainty in the realization of paradigm cell Y given that the realization of cell X, depending on the probabilities of their realizations x_i and y_j:

$$H(Y|X) = -\sum_i \sum_j P(x_i, y_j) \log_2 P(y_j|x_i)$$

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	v1a	vab	v2a.tr	v2a.itr	v2b.tr	v2b.itr	v3.tr	v3.itr	v4.tr	v4.itr
IMP.SG	αL	βL	αM	αM	βM	βM	αLM	αLM	αLM	αLM
SUBJ	αL	βH	αM	αM	βM	βM	αM	αL	αH	αH

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IMP.SG (X)	αL	βL	αM	βM	αLM	αLM	αLM
SUBJ (Y)	αL	βH	αM	βM	αM	αL	αH
frequency	1	1	2	2	1	1	2

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SUBJ (Y)	αL	βH	αM	βM	αM	αL	αH
frequency	1	1	2	2	1	1	2
$P(x_i, y_j)$	.1	.1	.2	.2	.1	.1	.2

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IMP.SG (X)	αL	βL	αM	βM	αLM	αLM	αLM
SUBJ (Y)	αL	βH	αM	βM	αM	αL	αH
frequency	1	1	2	2	1	1	2
$P(x_i, y_j)$	.1	.1	.2	.2	.1	.1	.2
$P(y_j\|x_i)$	1	1	1	1	.25	.25	.5

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IMP.SG (X)	αL	βL	αM	βM	αLM	αLM	αLM
SUBJ (Y)	αL	βH	αM	βM	αM	αL	αH
frequency	1	1	2	2	1	1	2
$P(x_i, y_j)$	.1	.1	.2	.2	.1	.1	.2
$P(y_j\|x_i)$	1	1	1	1	.25	.25	.5
$\log_2 P(y_j\|x_i)$	0	0	0	0	−2	−2	−1

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The *conditional entropy* $H(Y|X)$ represents the uncertainty in the realization of paradigm cell Y given that the realization of cell X, depending on the probabilities of their realizations x_i and y_j:

$$H(Y|X) = -\sum_i \sum_j P(x_i, y_j) \log_2 P(y_j|x_i) = .6$$

IMP.SG (X)	αL	βL	αM	βM	αLM	αLM	αLM
SUBJ (Y)	αL	βH	αM	βM	αM	αL	αH
frequency	1	1	2	2	1	1	2
$P(x_i, y_j)$	.1	.1	.2	.2	.1	.1	.2
$P(y_j\|x_i)$	1	1	1	1	.25	.25	.5
$\log_2 P(y_j\|x_i)$	0	0	0	0	−2	−2	−1
$P(x_i, y_j) \log_2 P(y_j\|x_i)$	0	0	0	0	−.2	−.2	−.2

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The *conditional entropy* $H(X|Y)$ represents the uncertainty in the realization of paradigm cell X given that the realization of cell Y, depending on the probabilities of their realizations x_i and y_j:

$$H(X|Y) = -\sum_i \sum_j P(y_j, x_i) \log_2 P(x_i|y_j) = .48$$

IMP.SG (X)	αL	βL	αM	βM	αLM	αLM	αLM
SUBJ (Y)	αL	βH	αM	βM	αM	αL	αH
frequency	1	1	2	2	1	1	2
$P(y_j, x_i)$	.1	.1	.2	.2	.1	.1	.2
$P(x_i\|y_j)$	.5	1	.67	1	.33	.5	1
$\log_2 P(x_i\|y_j)$	−1	0	−.58	0	−1.58	−1	0
$P(y_j, x_i)\log_2 P(x_i\|y_j)$	−.1	0	−.12	0	−.16	−.1	0

Low conditional entropy

- The lower a paradigm's overall conditional entropy, the easier it is to infer unknown cells from known ones
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Real Ngiti: $H(\text{SUBJ}|\text{IMP.SG}) = .6$, $H(\text{IMP.SG}|\text{SUBJ}) = .48$

	v1a	vab	v2a.tr	v2a.itr	v2b.tr	v2b.itr	v3.tr	v3.itr	v4.tr	v4.itr
IMP.SG	α_L	β_L	α_M	α_M	β_M	β_M	α_{LM}	α_{LM}	α_{LM}	α_{LM}
SUBJ	α_L	β_H	α_M	α_M	β_M	β_M	α_M	α_L	α_H	α_H

Fake Ngiti: $H(\text{SUBJ}|\text{IMP.SG}) = 1.2$, $H(\text{IMP.SG}|\text{SUBJ}) = 1.07$

	v1a	vab	v2a.tr	v2a.itr	v2b.tr	v2b.itr	v3.tr	v3.itr	v4.tr	v4.itr
IMP.SG	α_L	β_L	α_M	α_M	β_M	β_M	α_{LM}	α_{LM}	α_{LM}	α_{LM}
SUBJ	α_L	α_M	α_H	α_M	α_L	β_M	α_M	α_H	β_H	β_M

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SUBJ	α_L	β_H	α_M	α_M	β_M	β_M	α_M	α_L	α_H	α_H

Fake Ngiti: $H(\text{SUBJ}|\text{IMP.SG}) = 1$, $H(\text{IMP.SG}|\text{SUBJ}) = .88$

	v1a	vab	v2a.tr	v2a.itr	v2b.tr	v2b.itr	v3.tr	v3.itr	v4.tr	v4.itr
IMP.SG	α_L	β_L	α_M	α_M	β_M	β_M	α_{LM}	α_{LM}	α_{LM}	α_{LM}
SUBJ	α_L	β_M	α_M	α_H	β_H	β_M	α_M	α_L	α_M	α_H

Behavioral evidence

The next step: show that speakers use the available evidence to infer new paradigm cells (see also: my course next week)

- Seyfarth et al. (2014): Speakers learn inferences between paradigm cells in a simple artifical language experiment
- Tabachnick (2023): Speakers prefer nonce words that conform to predictions across paradigm cells
- Copot and Bonami (2023): Speakers give higher acceptability ratings to nonce words that conform to predictions across paradigm cells

Seyfarth et al. (2014)

Participants learned an artificial language with words divided into two number marking classes:

singular	*dual*	*plural*
table-yez	table-cav	table-lem
chair-taf	chair-guk	chair-lem

- Only one plural – easy
- Plural gives no info about others
- Singular and dual predict one another

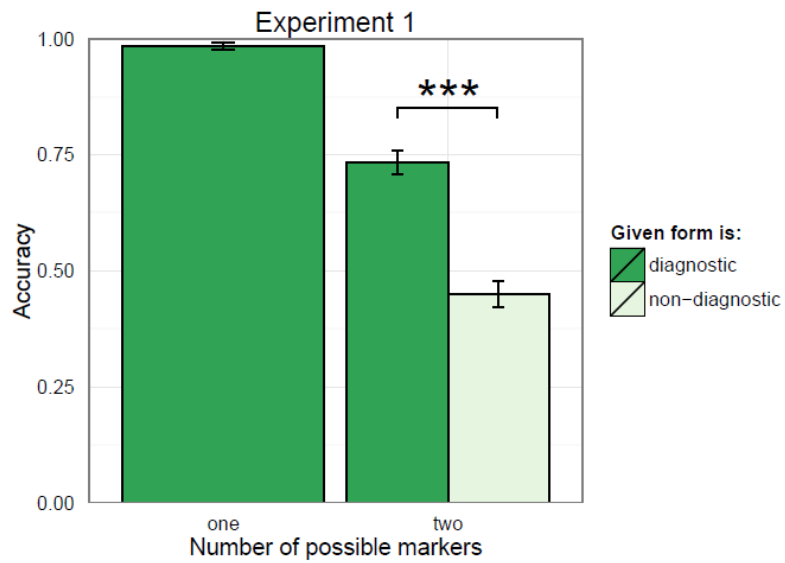
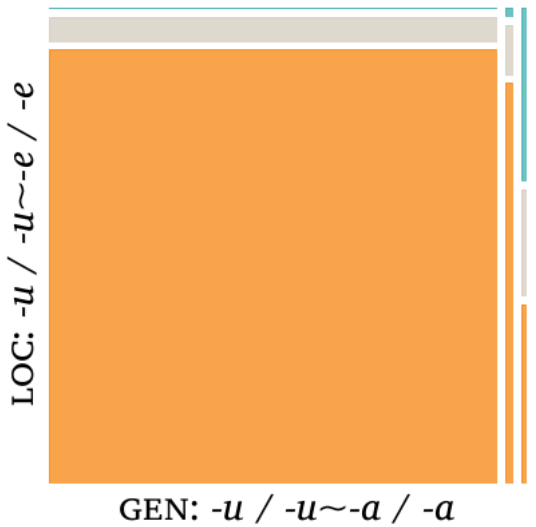


Figure 1: Mean accuracies at guessing the correct target form after being presented with a diagnostic or non-diagnostic given form in each testing trial.

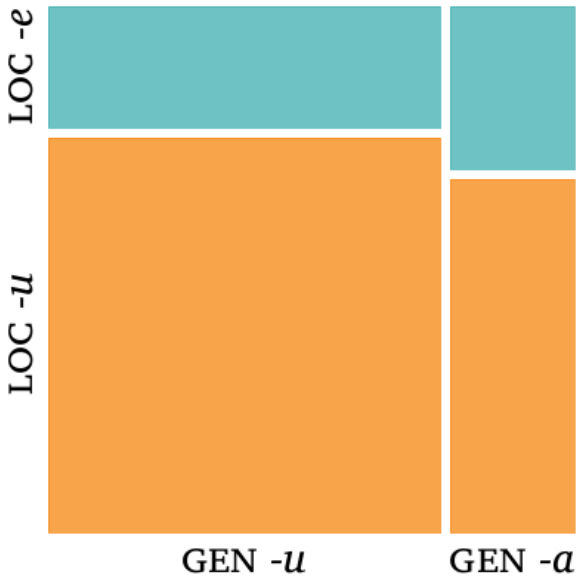
Tabachnick (2023)

Czech has a strong correlation between two uncommon case suffixes, which participants show sensitivity to in a forced-choice nonce word study:

	‘problem’	‘match’	‘evening’	‘church’	*nonce word*
genitive	problɛːmu	zaːpasu	vɛtʃɛra	kostɛla	tobalu/a
locative	problɛːmu	zaːpasɛ	vɛtʃɛru	kostɛlɛ	tobalu/ɛ



Distribution of GEN and LOC endings for nouns in Křen et al. (2022)



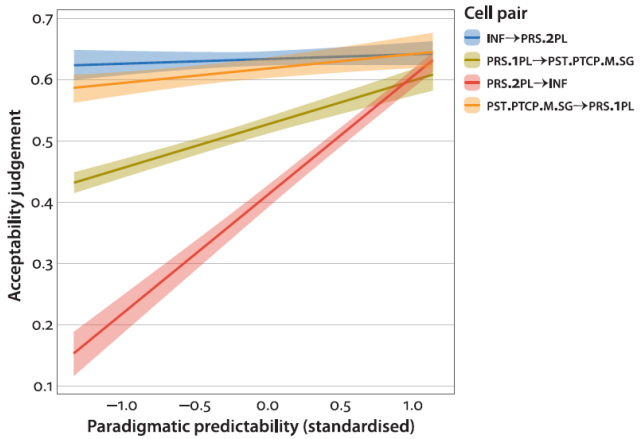
Distribution of presented GEN and selected LOC for trials in nonce word experiment

Copot and Bonami (2023)

French verbs have different rates of predictability across paradigm cells, which influences acceptability judgements of nonce words

Condition	Attested example			Sample pseudoword pair		
	Lexeme	Predictor	Target	Predictor	Target	Score
INF ↓ IPFV.2PL	VENIR 'come'	vəniʁ	vənje	pɥistəniʁ	pɥistənje	0.96
	AMORTIR 'damp'	amɔʁtiʁ	amɔʁtisje	saʁniʁ	saʁnisje	0.90
	ENSEVELIR 'bury'	ɑ̃səvəliʁ	ɑ̃səvəlisje	ʃeləniʁ	ʃeləsisje	0.70
	SORTIR 'exit'	sɔʁtiʁ	sɔʁtje	dekɑ̃fiʁ	dekɑ̃ffje	0.09
IPFV.2PL ↓ INF	TAPIR 'hide'	tapisje	tapiʁ	plasisje	plasiʁ	0.96
	TAPISSER 'paper'	tapisje	tapise	nɔlvisje	nɔlvise	0.69
	unattested			klɑ̃sisje	klɑ̃se	0.00
PST.PTCP ↓ PRS.1PL	BLÊMIR 'go pale'	blemi	blemisɔ̃	vemi	vemisɔ̃	0.73
	DORMIR 'sleep'	dɔʁmi	dɔʁmɔ̃	plomi	plomɔ̃	0.05
PRS.1PL ↓ PST.PTCP	LAVER 'wash'	lavɔ̃	lave	lanɔ̃	lane	0.97
	VENIR 'come'	vənɔ̃	vəny	ɛgzisənɔ̃	ɛgzisəny	0.34
	BATTRE 'beat'	batɔ̃	baty	ɛspatɔ̃	ɛspaty	0.01
	SUIVRE 'follow'	sɥivɔ̃	sɥivi	kʁiʒɔ̃	kʁiʒi	0.004

Table 1: Examples of prediction difficulty in the four conditions, illustrated with real lexemes and sample pseudoword pairs from the materials. MGL scores for the pseudoword pairs are provided.



(C)

Figure 5. Conditional effect plots based on the model in Table 3

Lexical decision

To probe language processing, psycholinguists often use the *lexical decision* task: deciding whether a string is a valid word

- Determining whether something is a word requires accessing and processing it
- The harder a word is to access and process, the longer it takes to make a lexical decision

One well-established effect is *frequency*: the more frequent a word or its lemma, the easier it is to process

- High frequency = high probability, low informativity
- From this perspective, we can consider conditional measures of probability/informativity as well: stem ↔ exponent ↔ inflection class (Milin, Kuperman, et al., 2009)

Milin, Filipović Đurđević, and Moscoso del Prado Martín (2009): An inflected form is processed faster if the distribution of forms in its paradigm closely matches the distribution of forms in the paradigms of its inflection class

Relative entropy

Main class of Serbian feminine nouns ('mountain') (Milin, Filipović Đurđević, & Moscoso del Prado Martín, 2009):

	SG	PL	w_e	$P(w_e)$	$P(e)$	$\log_2 \frac{P(w_e)}{P(e)}$
NOM	*planina*	*planine*	*planina*	.31	.26	.24
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NOTE: Paradigm cells that share an exponent are not necessarily phonologically or orthographically identical

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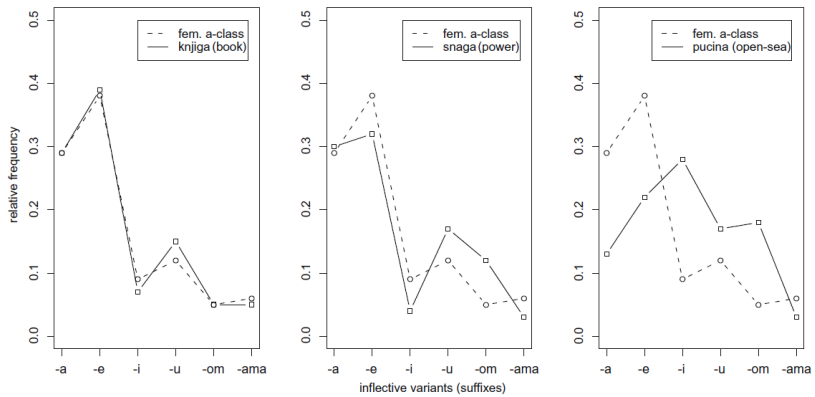
Milin et al. (2009)

Words vary in their relative entropy:



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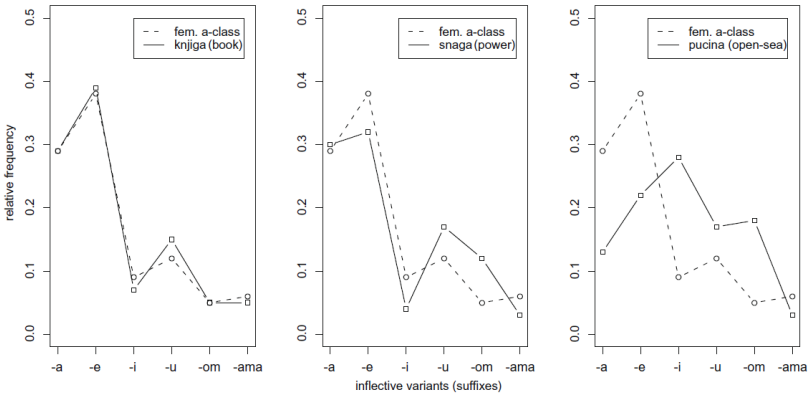

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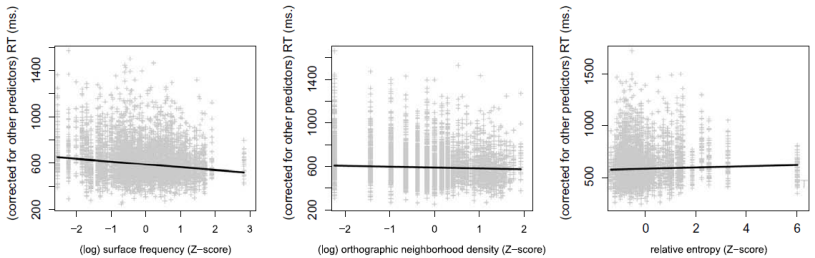

Fig. 3. Summary of the effects of (log) surface frequency, (log) orthographic neighborhood size, and relative entropy. In order to illustrate the independent contributions of each of the three predictors, the points plotted correspond to the individual reaction times of each subject and each item after considering the effects of all predictors (random and fixed-effects) except for the one being plotted. In addition, to enable direct comparison between the slopes, all predictors have be standardized to *z*-scores.

- More frequent words and lemmas had quicker responses
- Words with more similar-looking words had slower responses
- Words with larger relative entropy had slower responses

Milin et al. (2009)

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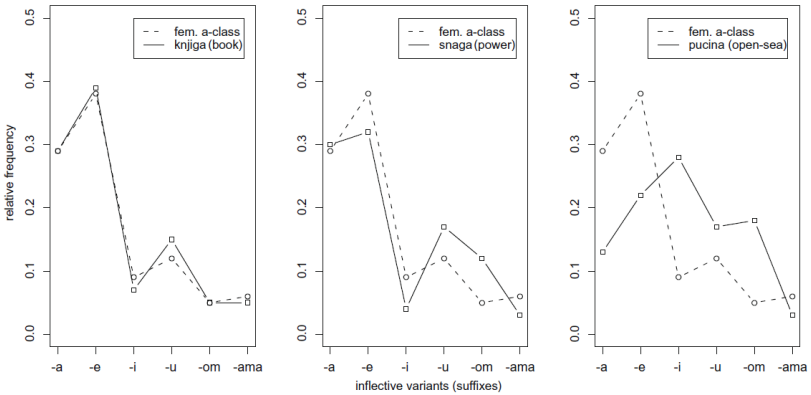

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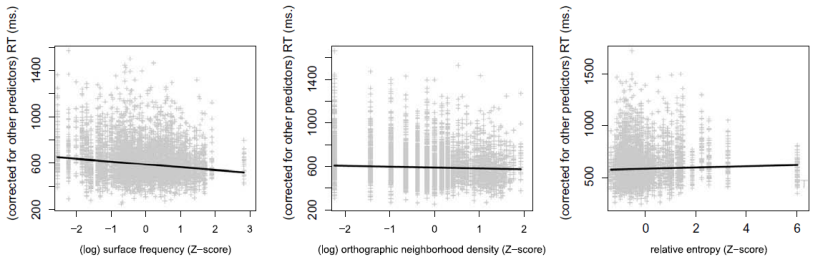

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Lexical access involves *some* consideration of informativity involving knowledge of the distribution of forms for a particular word and across the inflectional system as a whole

Summary

- Recent work has found evidence for paradigmatic relations in morphological organization and human behavior and processing
- Linguists are just starting to test particular hypotheses about what sort of relations humans store and use
- Such results are outside the purview of most contemporary generative approaches to morphology, though not necessarily incompatible with them

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