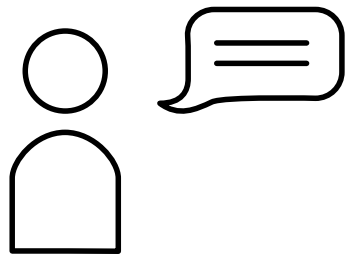
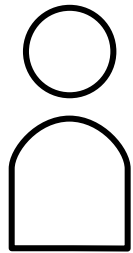
The other perspective on exponence

Sacha Beniamine & Mae Carroll

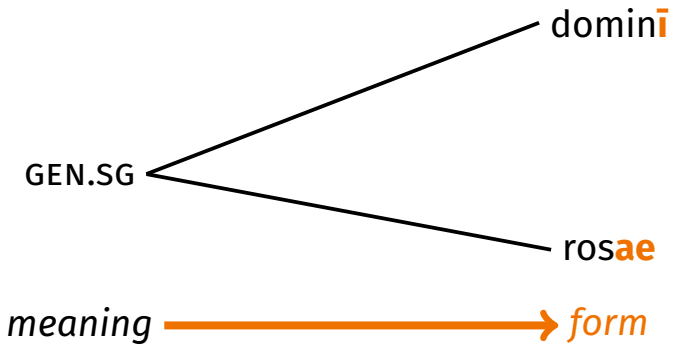
Two perspectives





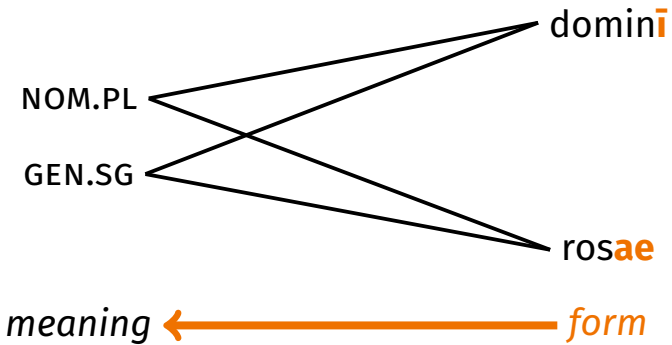
Is comprehension any different?

- Allomorphy is a problem for production



Is comprehension any different?

- Allomorphy is a problem for production
- Syncretism is a problem for discrimination



A comprehension question

Paradigm Cell Recognition Problem: What information in the shape of inflected wordforms can speakers draw on when guessing its morpho-syntactic properties?

	INF	PRS.3SG	PST	PRS.PTCP
JUMP	*ʤʌmp*	*ʤʌmps*	*ʤʌmpt*	*ʤʌmpɪŋ*

English Verb *jump*

ɪŋ: PRS.PTCP

Talk structure

1. **The segmentation problem**

2. **The meaning assignment problem**

3. **Characterising the typological space of exponence**

Segmentation

Segmenting forms

		sg	*du*	*pl*
1		*wəmdədə*	*nɛmdədanɛ*	*nɛmdədə*
2		*nəmdədə*	***yɛmdədanɛ***	*yɛmdədə*
3	f	*wəmdədə*	*yɛmdədanɛ*	*yɛmdədə*
	m	*yəmdədə*	*yɛmdədanɛ*	*yɛmdədə*

Present paradigm for the Yei verb ‘to sit’, (Carroll 2020)

/**y**-**ɛ**-mdəd- **anɛ**/

‘they.both sit‘; ‘we.both sit‘

The Segmentation problem

”the place to make a cut may be obvious or obscure, and the business of segmenting may be correspondingly easy or difficult according as the data permit of but one manner of interpretation or of several”

Lounsbury (1953)

The Segmentation problem

”In general, for any complex word in any language, there is (apparently) no way to establish a segmentation algorithmically”

Spencer (2012)

Segmentation principle

Definition:

Formatives are the longest contiguous sequences of sounds which recurr together in the paradigm.

Identifying changes and recurrences

Multiple alignments of inflectional paradigms

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Abstract

Most models of inflectional morphology rely at their core on the identification of recurrent and diverging material across inflected forms. Across theoretical frameworks, this can be expressed in terms of morpheme segmentation, rules, processes, patterns or analogies.

Finding these recurrences in large structured lexicons is an important step in empirical computational morphology, where analyses are induced bottom-up from inflected forms. This

PRS.IND.1SG	l	i	b	ɛ	ɾ	t	-	-	u	-
PRS.IND.2SG	l	i	b	ɛ	ɾ	t	ɐ	-	-	ʃ
PRS.IND.3SG	l	i	b	ɛ	ɾ	t	ɐ	-	-	-
PRS.IND.1PL	l	i	b	ɔ	ɾ	t	ɐ	m	u	ʃ
PRS.IND.2PL	l	i	b	ɔ	ɾ	t	a	-	i	ʃ
PRS.IND.3PL	l	i	b	ɛ	ɾ	t	ɐ̃	-	ũ	-
indexes	0	1	2	3	4	5	6	7	8	9

Table 1: Alignment for a sub-paradigm of the European Portuguese verb LIBERTAR, 'to free'

Applying the principle

PRS.1.SG	w	ə	m	d	ə	d	-	-	ə
PRS.1.DU	n	ɛ	m	d	ə	d	a	n	ɛ
PRS.1.PL	n	ɛ	m	d	ə	d	-	-	ə
PRS.2.SG	n	ə	m	d	ə	d	-	-	ə
PRS.2.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.2.PL	y	ɛ	m	d	ə	d	-	-	ə
PRS.3.F.SG	w	ə	m	d	ə	d	-	-	ə
PRS.3.F.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.3.F.PL	y	ɛ	m	d	ə	d	-	-	ə
PRS.3.M.SG	y	ə	m	d	ə	d	-	-	ə
PRS.3.M.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.3.M.PL	y	ɛ	m	d	ə	d	-	-	ə

Present paradigm for the Yei verb ‘to sit’, (Carroll 2020)

Applying the principle

PRS.1.SG	w	ə	**m**	**d**	**ə**	**d**	-	-	ə
PRS.1.DU	n	ɛ	**m**	**d**	**ə**	**d**	a	n	ɛ
PRS.1.PL	n	ɛ	**m**	**d**	**ə**	**d**	-	-	ə
PRS.2.SG	n	ə	**m**	**d**	**ə**	**d**	-	-	ə
PRS.2.DU	y	ɛ	**m**	**d**	**ə**	**d**	a	n	ɛ
PRS.2.PL	y	ɛ	**m**	**d**	**ə**	**d**	-	-	ə
PRS.3.F.SG	w	ə	**m**	**d**	**ə**	**d**	-	-	ə
PRS.3.F.DU	y	ɛ	**m**	**d**	**ə**	**d**	a	n	ɛ
PRS.3.F.PL	y	ɛ	**m**	**d**	**ə**	**d**	-	-	ə
PRS.3.M.SG	y	ə	**m**	**d**	**ə**	**d**	-	-	ə
PRS.3.M.DU	y	ɛ	**m**	**d**	**ə**	**d**	a	n	ɛ
PRS.3.M.PL	y	ɛ	**m**	**d**	**ə**	**d**	-	-	ə

/**-mdəd-**/
all cells

(Bonami & Beniamine, 2021)

Present paradigm for the Yei verb ‘to sit’, (Carroll 2020)

Applying the principle

PRS.1.SG	**w**	ə	m	d	ə	d	-	-	ə
PRS.1.DU	n	ɛ	m	d	ə	d	a	n	ɛ
PRS.1.PL	n	ɛ	m	d	ə	d	-	-	ə
PRS.2.SG	n	ə	m	d	ə	d	-	-	ə
PRS.2.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.2.PL	y	ɛ	m	d	ə	d	-	-	ə
PRS.3.F.SG	**w**	ə	m	d	ə	d	-	-	ə
PRS.3.F.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.3.F.PL	y	ɛ	m	d	ə	d	-	-	ə
PRS.3.M.SG	y	ə	m	d	ə	d	-	-	ə
PRS.3.M.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.3.M.PL	y	ɛ	m	d	ə	d	-	-	ə

/**w**-/
{1.SG, 3.F.SG}

Present paradigm for the Yei verb ‘to sit’, (Carroll 2020)

Applying the principle

PRS.1.SG	w	**ə**	m	d	ə	d	-	-	ə
PRS.1.DU	n	ɛ	m	d	ə	d	a	n	ɛ
PRS.1.PL	n	ɛ	m	d	ə	d	-	-	ə
PRS.2.SG	n	**ə**	m	d	ə	d	-	-	ə
PRS.2.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.2.PL	y	ɛ	m	d	ə	d	-	-	ə
PRS.3.F.SG	w	**ə**	m	d	ə	d	-	-	ə
PRS.3.F.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.3.F.PL	y	ɛ	m	d	ə	d	-	-	ə
PRS.3.M.SG	y	**ə**	m	d	ə	d	-	-	ə
PRS.3.M.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.3.M.PL	y	ɛ	m	d	ə	d	-	-	ə

/**-ə-**/
{1.SG, 2.SG,
3.F.SG, 3.M.SG}

Present paradigm for the Yei verb ‘to sit’, (Carroll 2020)

Applying the principle

PRS.1.SG	w	ə	m	d	ə	d	-	-	ə
PRS.1.DU	n	ɛ	m	d	ə	d	**a**	**n**	**ɛ**
PRS.1.PL	n	ɛ	m	d	ə	d	-	-	ə
PRS.2.SG	n	ə	m	d	ə	d	-	-	ə
PRS.2.DU	y	ɛ	m	d	ə	d	**a**	**n**	**ɛ**
PRS.2.PL	y	ɛ	m	d	ə	d	-	-	ə
PRS.3.F.SG	w	ə	m	d	ə	d	-	-	ə
PRS.3.F.DU	y	ɛ	m	d	ə	d	**a**	**n**	**ɛ**
PRS.3.F.PL	y	ɛ	m	d	ə	d	-	-	ə
PRS.3.M.SG	y	ə	m	d	ə	d	-	-	ə
PRS.3.M.DU	y	ɛ	m	d	ə	d	**a**	**n**	**ɛ**
PRS.3.M.PL	y	ɛ	m	d	ə	d	-	-	ə

/**-anɛ-**/
{1.DU, 2.DU,
3.F.DU, 3.M.DU}

Present paradigm for the Yei verb ‘to sit’, (Carroll 2020)

Applying the principle

PRS.1.SG	w	ə	m	d	ə	d	-	-	ə
PRS.1.DU	n	ɛ	m	d	ə	d	a	n	ɛ
PRS.1.PL	n	ɛ	m	d	ə	d	-	-	ə
PRS.2.SG	n	ə	m	d	ə	d	-	-	ə
PRS.2.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.2.PL	y	ɛ	m	d	ə	d	-	-	ə
PRS.3.F.SG	w	ə	m	d	ə	d	-	-	ə
PRS.3.F.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.3.F.PL	y	ɛ	m	d	ə	d	-	-	ə
PRS.3.M.SG	y	ə	m	d	ə	d	-	-	ə
PRS.3.M.DU	y	ɛ	m	d	ə	d	a	n	ɛ
PRS.3.M.PL	y	ɛ	m	d	ə	d	-	-	ə

Present paradigm for the Yei verb ‘to sit’, (Carroll 2020)

Meaning assignment

A set-theory of exponence

Morphology (2021) 32:1–24
https://doi.org/10.1007/s11525-021-09384-8

Verbose exponence: Integrating the typologies of multiple and distributed exponence

M. J. Carroll[1]

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Abstract
Multiple exponence is the multiple marking of the same feature or category within a single word. Distributed exponence is the occurrence of morphological structure such that providing a precise interpretation of a category can only be determined after considering more than one morphological formative. I propose the term verbose ex-

Meaning of a formative

		SG	DU	PL
1		-e		-e
2		-e		-e
3	F	-e		-e
	M	-e		-e

$$\text{dist}(/\textbf{-e}/) = \{\ \{1, \textsc{sg}\}, \{1, \textsc{pl}\}, \{2, \textsc{sg}\}, \{2, \textsc{pl}\},$$
$$\{3, \textsc{f}, \textsc{sg}\}, \{3, \textsc{m}, \textsc{sg}\}, \{3, \textsc{m}, \textsc{pl}\}\}$$

Meaning of a formative

		SG	DU	PL
1		-e		-e
2		-e		-e
3	F	-e		-e
	M	-e		-e

$$\text{dist}(/\text{-e}/) = \{\text{1.SG, 1.PL, 2.SG, 2.PL,}$$
$$\text{3.F.SG, 3.M.SG, 3.M.PL}\}$$

Meaning of a formative

All of the minimal, valid, informative ways to describe cells in the distribution.

		SG	DU	PL
1		**-e**		**-e**
2		**-e**		**-e**
3	F	**-e**		**-e**
	M	**-e**		**-e**

$$\exp(\text{/-e/}) = \{\text{SG, PL}\}$$

Meanings with imperfect distributions

		sg	*du*	*pl*
1				
2			***y-***	***y-***
3	f		***y-***	***y-***
	m	***y-***	***y-***	***y-***

dist(/**y-**/) = {2.DU, 2.PL, 3.F.DU, 3.F.PL, 3.M.SG, 3.M.DU, 3.M.PL}

exp(/**y-**/) = {2.DU, 2.PL, M, 3.DU, 3.PL}

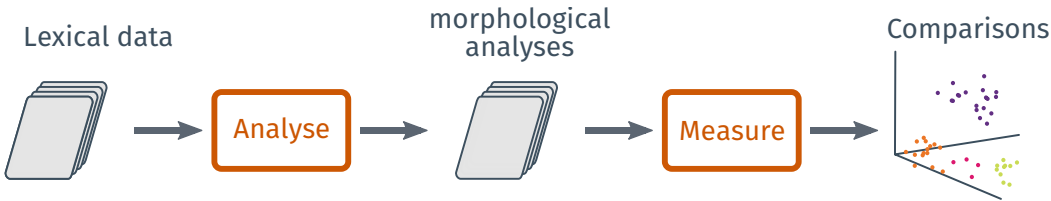
Yei present exponents (to sit)

		sg.	*du.*	*pl.*
1		*w-ə-mdəd-ə*	*n-ɛ-mdəd-ɑnɛ*	*n-ɛ-mdəd-ə*
2		*n-ə-mdəd-ə*	*y-ɛ-mdəd-ɑnɛ*	*y-ɛ-mdəd-ə*
3	f	*w-ə-mdəd-ə*	*y-ɛ-mdəd-ɑnɛ*	*y-ɛ-mdəd-ə*
	m	*y-ə-mdəd-ə*	*y-ɛ-mdəd-ɑnɛ*	*y-ɛ-mdəd-ə*

exp(/**w-**/) = {1.SG, 3.F.SG }
exp(/**-ə-**/) = {SG }
exp(/**n-**/) = {1.DU, 1.PL, 2.SG }
exp(/**-ɛ-**/) = {DU, PL }
exp(/**y-**/) = {2.DU, 2.PL, M, 3.DU, 3.PL}
exp(/**-anɛ**/) = {DU }
exp(/**-ə**/) = {SG, PL }

Sketch typology

Data-direct typology



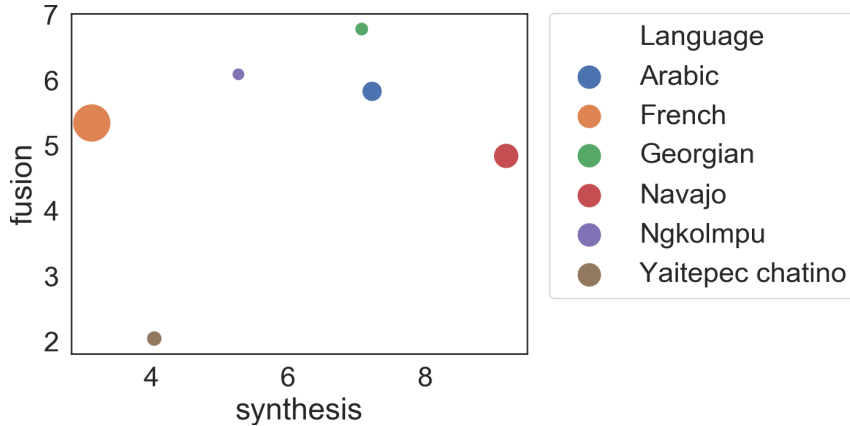
Large scale, **precise** and **multivariate** typology

- Start from general purpose datasets
- Conceive analytic pipelines from data to comparisons

Datasets in preparation

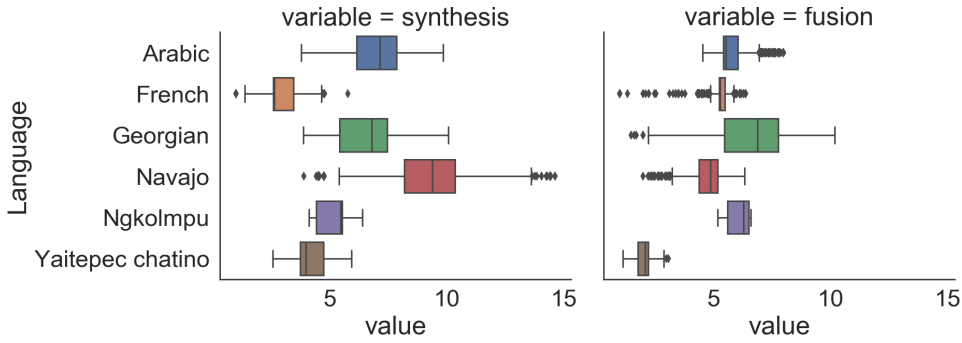
Family	Language	Source
Finnic	Estonian	Ekilex
Indo-European	French	Vlexique, (Bonami et al., 2014)
Kartvelian	Georgian	Unimorph
Na-Dene	Navajo	Beniamine et al., 2017
Oto-mangean	Yaitepec Chatino	Feist and Palancar, 2015
Pama-nyungan	Martuthunira	Dench, 1995
Yam	Ngkolmpu	M. Carroll
Semitic	Modern Standard Arabic	Unimorph

Typological indices



- **Synthesis**: average number of formatives per word
- **Fusion**: average number of values per formatives (see Greenberg, 1960)

Indices: system-internal variation



- **Synthesis**: average number of formatives per word
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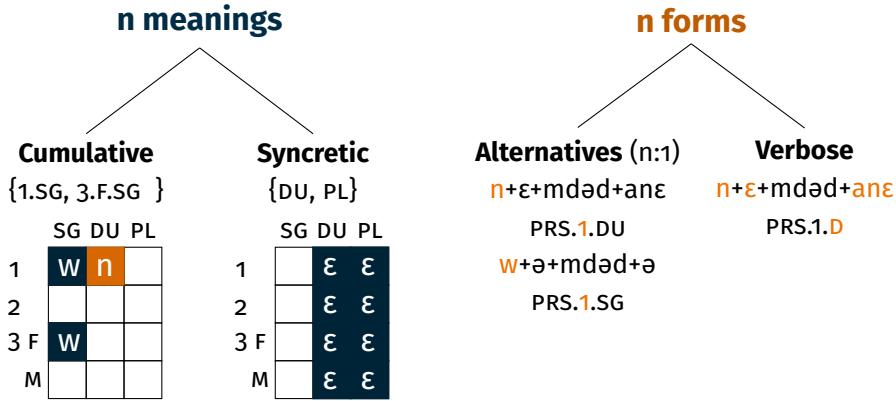
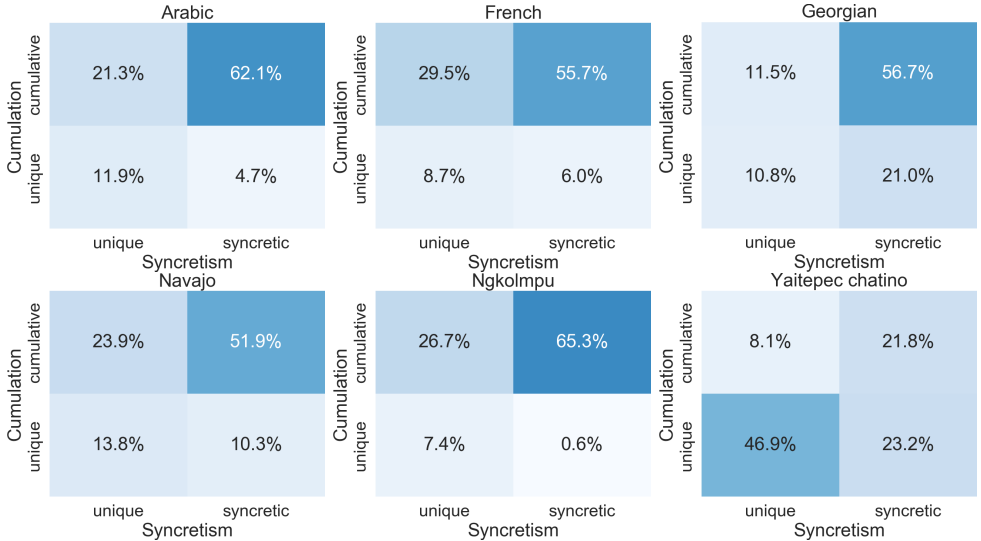
Sketch of the typological space

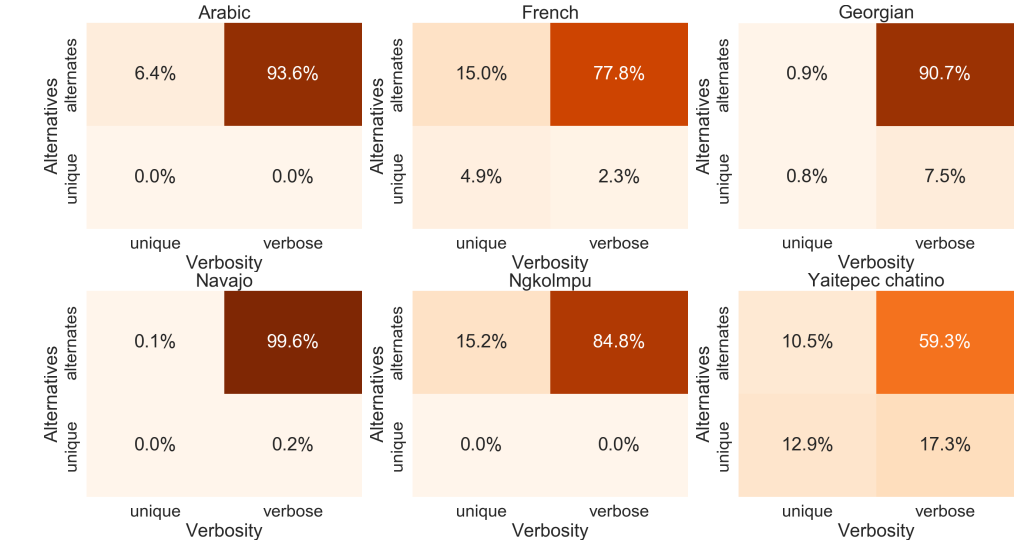
Canonical exponent: 1 meaning and 1 form. With $n > 1$:



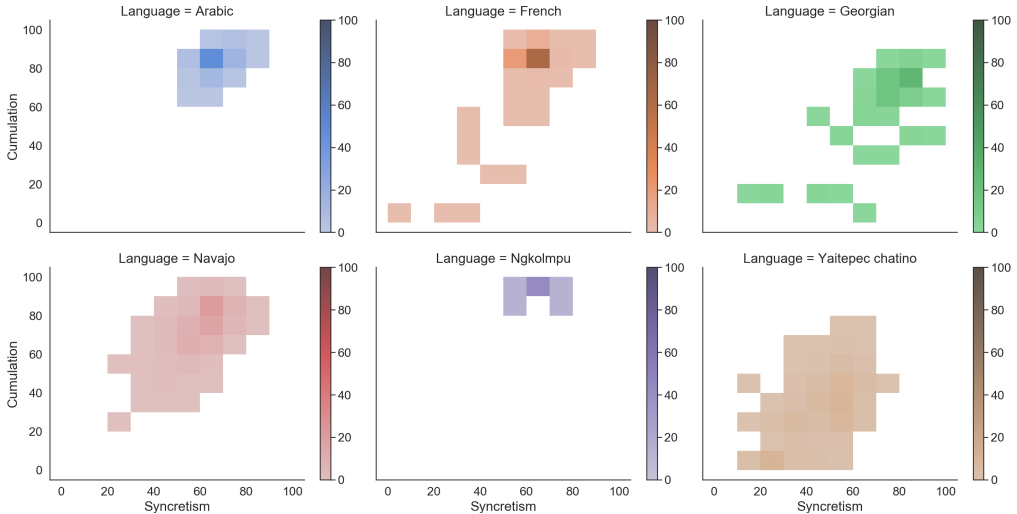
Meaning deviations



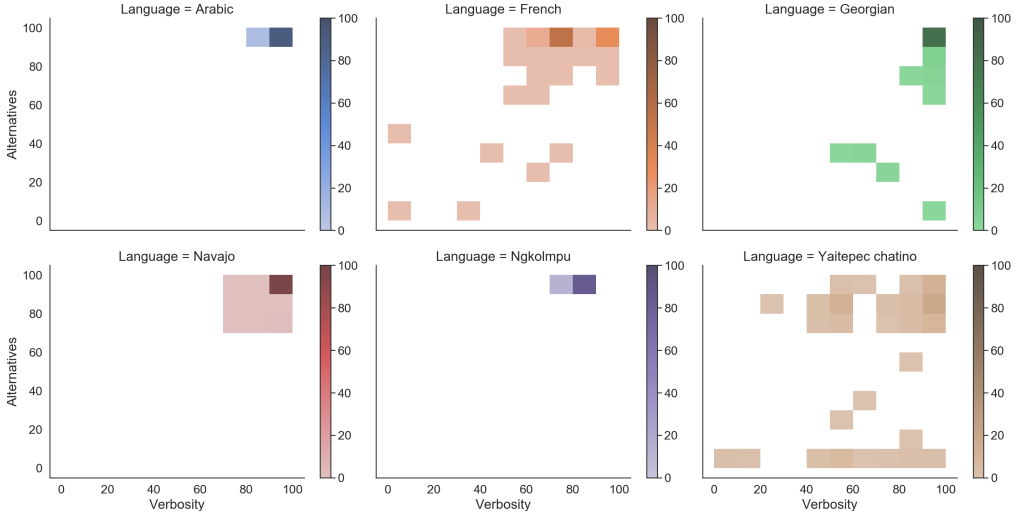
Form deviations



Meaning deviations, per lexeme



Form deviations, per lexeme



Conclusion

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- **The other perspective**:
  - Productive grammars prioritize economy
  - Discriminative grammars focuses on distinctiveness
  - Independent of a model of cognition
- **Exponence**:
  - Formal, implemented approach
  - Novel, fine-grained units of form
  - Set-theoretic definition of meaning
- Well suited to typology
  - Data-driven
  - No assumption of canonicity
  - Mesurements beyond impressionistic samples

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Thank you !