

The Morphopragmatics of Number

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The Alphabet of Universal Grammar

Horn Patterns and Conventions

Horn Patterns

Horn Patterns

Less marked expressions express less marked meaning;
more marked expressions express more marked meaning.

E.g. *kill* vs. *cause to die* (manner implicature)

This is a very robust pattern that can be found across languages and in various areas of natural language.

Goal: Want to account for Horn patterns found in **linguistic conventions** about uses/interpretations of morphological features.

(Horn 1989; see also Zipf 1936, 1949, Jakobson 1939, Greenberg 1966, Piantadosi, Tily & Gibson 2011, Mahowald, Dautriche, Gibson & Piantadosi 2018).

Game Theory and Convention

Van Rooij (2004a,b) attempts to account for the emergence of Horn patterns in natural language using Game Theory.

More marked forms have more cost to produce/understand, and conventions that arise over time tend to converge to ones that obey Horn patterns.

Consider a simple (Lewisian) **signalling game**:

- ▶ Sender s and Receiver r
- ▶ Sender sends a message to express some meaning
- ▶ Receiver receives the message and guesses its meaning
- ▶ Sender chooses one of two forms f_1 and f_2 *without semantics* to express one of two things m_1 and m_2 .

Signalling Game: Strategies

Sender strategies:

S_1		S_2		S_3		S_4	
m_1	$\mapsto f_1$	m_1	$\mapsto f_2$	m_1	$\mapsto f_1$	m_1	$\mapsto f_2$
m_2	$\mapsto f_2$	m_2	$\mapsto f_1$	m_2	$\mapsto f_1$	m_2	$\mapsto f_2$

Receiver strategies:

R_1		R_2		R_3		R_4	
f_1	$\mapsto m_1$	f_1	$\mapsto m_2$	f_1	$\mapsto m_1$	f_1	$\mapsto m_2$
f_2	$\mapsto m_2$	f_2	$\mapsto m_1$	f_2	$\mapsto m_1$	f_2	$\mapsto m_2$

(The strategies can be made probabilistic)

Signalling Game: Equilibria

Sender and Receiver try to choose an optimal strategy, e.g.

$\langle S, R \rangle$ will be good (is a **Nash equilibrium**) if:

- ▶ $\langle S, R \rangle$ is better than $\langle S', R \rangle$ for each $S' \neq S$
- ▶ $\langle S, R \rangle$ is better than $\langle S, R' \rangle$ for each $R' \neq R$

There are other ways of determining optimal strategies.

Sender and Receiver know the rules of the game and compare their payoffs.

Signalling Game: Utilities

If Sender wants to mean m and uses S and Receiver uses R :

If $R(S(m)) = m$, the communication is successful.

$$U(m, S(m), R(S(m))) = \begin{cases} 1 - \text{cost}(S(m)) & \text{if } R(S(m)) = m \\ 0 & \text{otherwise} \end{cases}$$

This represents the utility of $\langle S, R \rangle$ for Sender, $U_S = U$.

The utility for Receiver is expected utility based on Receiver's beliefs about Sender $P(S_m = m' | S(m) = S(m'))$

$$U_R(m, S, R) = \sum_{m' \in S_m} P(m' | S_m) \times U(m', S(m'), R(S(m')))$$

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Evolutionary Game Theory

A signalling game models behavior of a rational speaker-hearer pair, but conventionalization does not necessarily involve decision making by rational agents.

Van Rooy (2004a,b) proposes to account for linguistic conventions by **Evolutionary Game Theory**.

- ▶ Each user u of a language $L = \langle S, R \rangle$ is sometimes a speaker and sometimes a hearer.
- ▶ The payoff of communication between users of L and L' (p is the probability of one being Sender):

$$U(L, L') = p \times \sum_m U_S(m, S(m), R'(S(m))) \\ + (1 - p) \times \sum_m U_R(m, S'(m), R(S'(m)))$$

Evolutionary Game Theory (cont.)

- ▶ The expected utility of language L can be computed in terms of the probability distribution P of the languages. ($P(L')$ is the proportion of speakers of L')

$$EU(L) = \sum_{L'} P(L') \times U(L, L')$$

- ▶ After each conversation, each user updates their probability distribution P using the Bayes rule based on the outcome.

The idea is to define a notion of stability of languages to explain Horn conventions:

We want: A language that uses a Horn pattern will be more evolutionarily stable than a language that does not.

- ▶ A morphologically marked form is costly.
- ▶ A semantically marked form is costly and/or rare.

Towards Concrete Linguistic Applications

To apply this model to more concrete phenomena, two things need to be made clear:

What is the space of possible expressions in natural language (what forms are available?)

- ▶ **Morphological markedness:**
How do we determine markedness of forms?
- ▶ **Semantic markedness:**
How do we determine markedness of (possible) meanings?

Morphological Markedness

Diagnostics for morphological markedness:

- ▶ More marked forms are longer.
- ▶ More marked forms exhibit more syncretism
- ▶ More marked forms tend to be lost over time
- ▶ More marked forms are rarer crosslinguistically
- ▶ If a more marked form exists in a language, then a less marked form does too

Markeness in morphosyntactic features in natural language:

- ▶ **Number:** [singular] is less marked than [plural] in English
- ▶ **Person:** [3rd] is least marked in English
- ▶ **Gender:** [masculine] is least marked in French
- ▶ **Tense:** [present] is less marked in English

Semantic Markedness

One diagnostic that is often used is entailment: More general meaning is less marked, e.g. *Étudiants* ('students', masc.) vs. *étudiantes* ('students', fem) in French

Two others that are relevant:

- ▶ **Conceptual precedence:** Past and Future are defined in terms of Present, so more marked.
- ▶ **Prototypicality/Frequency:** The meaning of *kill* is more prototypical/frequent than *cause to die*, so less marked.

Other potential diagnostics:

- ▶ **Acquisition:** Less marked meaning is easier to acquire than more marked meaning
- ▶ **Cognitive bias:** Cognitively more prominent meaning is less marked

Semantic Markedness

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Markedness in the Number Domain

I would like to consider morphological vs. semantic markedness in the **nominal number** domain.

There seem to be different notions of semantic markedness at play, as well as other potential factors.

1. Singular vs. Plural in English: Does the morphological and semantic markedness hierarchies align?
2. Dual in Slovenian: Does a number system with three values exhibit a Horn pattern?
3. Pair Nouns and Horn patterns in the number domain

Unmarked Plurals

Singular vs. Plural

Many (though not all) languages morphologically distinguish singular and plural nouns.

Semanticists often assume:

- ▶ **Singular** nouns characterize singular entities
- ▶ **Plural** nouns characterize both singular and plural entities, so **number neutral**.

- (1) a. $\llbracket \text{book} \rrbracket = \{ x \mid x \text{ is a book} \}$
b. $\llbracket \text{books} \rrbracket = \{ x \mid x \text{ is a book or a plural entity consisting of books} \}$

(Sauerland 2003, 2007, Spector 2007)

Unmarked Plurals (cont.)

Evidence for the number neutral analysis of plural nouns:

▶ Negative contexts:

- (2) a. I didn't buy **books** last year.
b. If you buy **books** here, you can get a discount.
c. I was here before **other people** arrived.

▶ Quantificational contexts:

- (3) a. Every student gave **presentations**.
⇒ At least some students gave multiple presentations.
b. Every student submitted their **essays** on time.
⇒ At least some students have multiple essays.

Plurality Inference

In other cases, plural nouns are interpreted as plural (**plurality inference**).

(4) Students are waiting in the court yard.

Theories of the plurality inference:

- ▶ Scalar implicature theory (Spector 2007, Zweig 2009, Sudo 2019)
- ▶ Ambiguity theory (Farkas & De Swart 2010, Grimm 2013)
- ▶ Homogeneity theory (Križ 2017)
- ▶ Anti-presupposition theory (Sauerland 2003, 2008)

Anti-Horn Pattern

Notice that under this view, we have:

$$[[N_{sg}]] \subseteq [[N_{pl}]]$$

But this looks like an **anti-Horn pattern**.

- ▶ N_{sg} is morphologically unmarked in English.
- ▶ But it expresses the less general, more marked meaning!

Cf. $[[N_{fem}]] \subseteq [[N_{masc}]]$

Bale, Gagnon & Khanjian (2011) attempt to defend the above view but don't seem to give an explanation.

Farkas & De Swart (2010) propose an alternative analysis to resolve this tension, but I think their alternative is not very satisfactory.

Today: I claim that the standard view does not necessarily give rise to a conceptual dilemma, because it in fact is a Horn-compatible pattern in terms of semantic unmarkedness with respect to **conceptual precedence**.

Bale, Ganon & Khanjian (2011)

Bale, Ganon & Khanjian (2011) attempt to defend the anti-Horn pattern by claiming that the plural morphology is interpreted as an **augmenting function**:

For any set S of entities:

* S is the closure of S under sum-formation \oplus .

If I understand them correctly, the idea is that there are cases where the marked form adds meaning to the simpler form, leading to a seemingly anti-Horn pattern.

Cf. the marked form (feminine) is a subset of the unmarked form. The extra morphology is interpreted as subtraction/intersection.

But the issue is not really about the plural form only. Part of the question is why don't we have the following pattern (in English):

- ▶ **The unmarked form is number neutral.**
- ▶ The more marked form is strictly singular or strictly plural.
- ▶ The additional morphology (-s) is interpreted as an intersective function.

Farkas & De Swart (2010)

Farkas & De Swart (2010) propose an alternative analysis, which they claim is conceptually more desirable.

They start with two semantic assumptions:

- ▶ The unmarked form is number neutral.
- ▶ The marked form is ambiguous between the plural and number neutral meaning. (Which meaning is chosen is governed by a certain pragmatic principle)

Then they claim that the unmarked form ends up meaning singular as a result of optimization.

The key is that the marked form can mean strictly plural by assumption.

Farkas & De Swart (2010) (cont.)

But this account is unsatisfactory in several respects:

- ▶ We have to start with certain semantic assumptions, in particular that **the plural can express plural meaning**. Ideally we want to start with no semantic assumptions.
- ▶ The plural is ambiguous, which is conceptually unwelcome.
- ▶ The ambiguous plural is potentially problematic for the plurality inference in non-monotonic contexts.

(5) Exactly one boy is holding balloons.

⇒ One boy has multiple balloons

⇒ Other boys have no balloons

(The scalar implicature theory of plurality inferences can account for this; see Sudo 2019)

Individuation and Markedness

Instead I claim that the unmarked form N is semantically less marked with respect to **conceptual precedence**.

- ▶ A singular count noun encodes information about **individuation** (i.e. what counts as one)
(Borer 2003, Grimm 2012, Rothstein 2010, 2017, Landman 2011, Sutton & Filip 2016, 2017, Erbach 2019, etc.)
- ▶ The plural version of the same noun is true of any sum of such entities, so is defined in terms of the singular.

With respect to the entailment relation, this is an anti-Horn pattern, $[[N_{sg}]] \subseteq [[N_{pl}]]$, but not with respect to conceptual precedence.

Cf. Tense: Present is less marked than Past or Future.

How to Count Walls

Nouns like *wall*, *line*, *fence*, *twig* have multiple ways of counting, but each use of *a wall* or *walls* presupposes a particular way of counting (Rothstein 2010, 2017, Sutton & Filip 2016).

- ▶ Want to signal that you have a particular way of counting in mind in a particular context c .
- ▶ Define the set SG-WALL_c of singular walls in c , e.g. I want the sum consisting of the walls of my office $w_1 \oplus w_2 \oplus w_3 \oplus w_4$ to count as one wall.
- ▶ The set of all singular and sum walls in c will be $\text{WALL}_c = * \text{SG-WALL}_c$.
- ▶ Note that SG-WALL_c cannot be defined in terms of the number-neutral concept WALL (cf. $\oplus \text{WALL}_c$).

SG-WALL_c is semantically less unmarked than $* \text{WALL}_c$, so *wall* expressing is Horn-compatible.

Conceptual Precedence and Unmarkedness

In other words, $WALL_c$ encodes two pieces of information:

1. What counts as one; and
2. How to form sums of walls

$SG-WALL_c$ is less marked, because it only encodes **1.**, so semantically less marked.

Consequently, the unmarked form expresses $SG-WALL_c$ and the marked form expresses $WALL_c$.

(And in c you are not interested in expressing non-individuated walls)

More generally, an unmarked count noun ('singular') expresses only **1.** and its marked counterpart ('plural') expresses both.

Note that we did not pre-assign meaning to the two forms!

Nouns with No Contrast

All I am claiming here is that N_{SG} vs. N_{PL} in English is Horn-compatible.

Nothing to say about why neither form expresses strictly plural, $PL-WALL_c = WALL_c - SG-WALL_c$.

But it's crucial that two forms are available. A mass noun has only one form and is underspecified with respect to individuation.

- ▶ A 'mass noun' only has unmarked form. It might describe countable objects (e.g. *luggage*) or uncountable objects (e.g. *blood*).
- ▶ The meaning of *luggage* is compatible with counting (Barner & Snedeker 2005, Bale & Barner 2009, Deal 2017) but does not morphosyntactically encode it.

Similarly for pluralia tantum (e.g. *scissors*)?

Interim Summary

With respect to **conceptual precedence**, N_{SG} vs. N_{PL} in English is a Horn-pattern (though not with respect to **entailment**).

- ▶ Defining individuation (what counts as one) conceptually precedes individuation+sum formation/augmentation.
- ▶ The unmarked form ('singular') expresses the unmarked meaning ('plural').

SG is strictly singular, PL is number neutral.

The plurality inference is to be accounted for by some other way (e.g. scalar implicature).

Slovenian Dual

Slovenian Dual: Basics

Slovenian makes a three-way number distinction:

singular, **dual**, plural

'Town' (neuter)

	SG	DU	PL
NOM, ACC	mesto	mesti i	mesta
DAT	mestu	mest oma	mestom
INSTR	mestom	mest oma	mesti
GEN	mesta	mest	mest

Pronouns

NOM	SG	DU	PL	ACC	SG	DU	PL
1	ja	midva	mi	1	mene	naju	nas
2	ti	vidva	vi	2	tebe	vaju	vas
3	on	onadva	oni	3	njega	njiju	njih

Slovenian Dual: Basics (cont.)

Determiners, adjectives, and verbs show dual agreement.

- (6) **Ta** **dva** **stola**
these.DU.M.NOM two.DU.M.NOM chair.DU.M.NOM
sta **polomljena**
be.3.DU.PRES broken.DU.M.NOM
'These two chairs are broken.' (Derganic 2003: 168)

Unmodified dual nouns tend to receive specific/definite interpretations (Jakopin 1966; see also Dvořák & Sauerland 2006, Marušič & Žaucer 2017).

- (7) **Otroka** **hodita** **še v šolo.**
children.DU.M.NOM go.3.DU.PERS still to school
'The two children still go to school.' (Derganic 2003: 168)

Dva, Oba + DU

Modifiers like **dva** 'two' and **oba** 'both' require dual nouns

(Derganic 2003, Dvořák & Sauerland 2006, Marušič & Žaucer 2017).

- (8) **Dva** **otroka** hodita še v
two.DU.M.NOM child.DU.M.NOM go.3.DU.PRES still to
šolo.
school

'Two children still go to school.'

(Derganic 2003: 168)

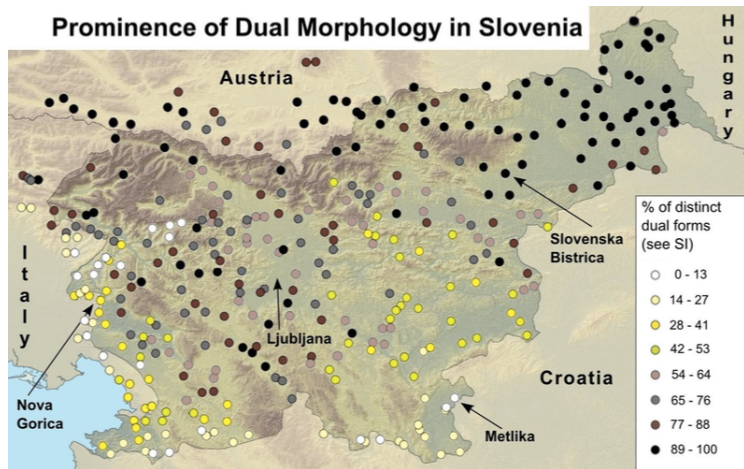
- (9) **Obe nogi** me bolita.
both foot.DU me hurt.3.DU.PRES

'Both my feet hurt'

(Derganic 2003: 172)

Note: Dialectal Variation

There is considerable dialectal variation (Marušič, Žaucer, Plesničar, Rzboršek, Sullivan & Barner 2016; see also Jakop 2008).



Dvořák & Sauerland's (2006) on Slovenian Dual

Dvořák & Sauerland's (2006) proposes an analysis, building on Sauerland's theory of number (Sauerland 2003, Sauerland, Anderssen & Yatsushiro 2005, Sauerland 2008).

They claim that the Slovenian dual is semantically less marked than the singular and more marked than the plural with respect to entailment (see also Sauerland 2008):

$$\llbracket N_{sg} \rrbracket \subseteq \llbracket N_{dl} \rrbracket \subseteq \llbracket N_{pl} \rrbracket$$

- ▶ Recall that the number neutrality of $\llbracket N_{dl} \rrbracket$ is not immediately clear due to the plurality inference.
- ▶ Dvořák & Sauerland propose that $\llbracket N_{dl} \rrbracket$ contains both singular entities and sums of pairs of entities.

Quantificational Test

Recall that we concluded that plural nouns are number neutral in English by looking at (10).

- (10) Every student submitted their **essays** on time.
⇒ At least some students have multiple essays.

Crucially, this does not require every student to have multiple essays.

(Other diagnostics are not very useful for dual nouns in Slovenian, because they tend to be specific/definite)

Sauerland's (2008) Data

Sauerland (2008) raises (11) as support for Dvořák & Sauerland's (2006) analysis.

(11) Context: *Every student brought one or two books.*

Vsak študent je prinesel s seboj { a. **svoj-o knjig-o** (SG)
b. **svoj-i knjig-i** (DL)
c. **svoj-e knjig-e** (PL)

every student be brought with self self's book(s)
'Every student brought his book(s)'

He reports that PL is not possible, while SG and DL are acceptable. (noting that the former is problematic for Dvořák & Sauerland).

Sauerland's (2008) Data

Marušič, Žaucer, Nevins & Sudo (in prep) asked 30 native speakers to judge Sauerland's example.

- ▶ SG: 48% acceptance
- ▶ DL: **0% acceptance**
- ▶ PL: 62% acceptance

This suggests that [DL] does *not* mean 'one or two', contrary to Dvořák & Sauerland, but either 'exactly two' or 'at least two'.

Additional remarks:

- ▶ The acceptability of SG is unexpected under any account.
- ▶ The acceptability of PL is also unexpected for Dvořák & Sauerland.

Experiment: Items

Context: *Every student brought one or two books.*

Vsak študent je prinesel s seboj	a.	svoj-o knjig-o	(SG)
	b.	svoj-i knjig-i	(DL)
	c.	svoj-i dv-e knjig-i	(NUM)
	d.	svoj-e knjig-e	(PL)

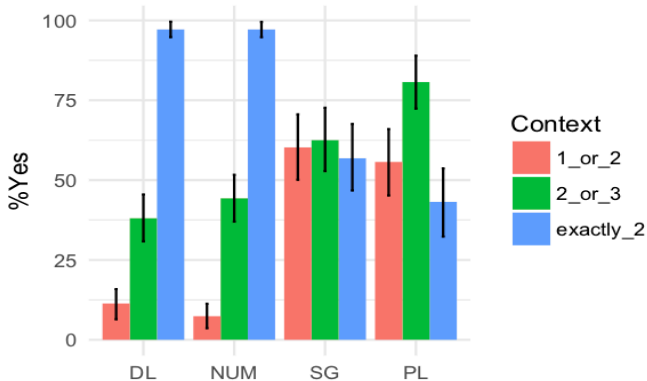
every student be brought with self self's book(s)

'Every student brought his book(s)'

We also tested 24 such sentences in three contexts
(Latin-squared):

- ▶ [1 or 2]: Some have exactly 1, the others have exactly 2.
- ▶ [2 or 3]: Some have exactly 2, the others have exactly 3.
- ▶ [exactly 2]: Everyone has exactly 2.

Experiment: Results ($n: 43$)



- ▶ DL is clearly bad in [1 or 2], contra Dvořák & Sauerland.
- ▶ DL is worse than PL in [2 or 3] but is comparable to NUM and is not entirely out.
- ▶ PL is not good in [exactly 2], suggesting competition with DL.
- ▶ PL in [1 or 2] and SG are unexpected.

Discussion

Our results suggest that DL does *not* mean ‘one or more’ (contra Dvořák & Sauerland).

Overall, ‘(his) N_{DL} ’ in Slovenian is interpreted similarly to ‘(his) two N_{DL} ’.

The semantics of numerals is complicated:

- ▶ Numerals tend to have ‘exact’ interpretations, more robustly than scalar implicatures.
- ▶ They can sometimes have ‘at least’ readings.

Let us suppose that numerals and DL have ‘exact’/strict interpretations.

Question: Is this a Horn-compatible pattern?

Horn Patterns with Three Forms

DL is morphologically more marked than PL (Nevins 2011):

- ▶ When a language has DL, it also has PL (Greenberg 1963).
- ▶ DL is rarer than PL (Corbett 2000).
- ▶ DL is the first one to be lost (Corbett 2000).
- ▶ DL is acquired later than PL (Ravid & Hayek 2003).
- ▶ DL exhibits more syncretism (Greenberg 1966, Nevins 2011).

Then, DL should express more marked meaning than PL, e.g.

- ▶ SG: Individuation (strictly singular)
- ▶ PL: Individuation + augmentation (+ plurality inference)
- ▶ **DL: Individuation + minimal augmentation (strictly dual)**

Pair Nouns

Pair Nouns

One peculiar thing about Slovenian DL is that PL is normally used for entities that naturally come in pairs (**pair nouns**)

(Derganic 2003, Dvořák & Sauerland 2006, Sauerland 2008, Marušič & Žaucer 2017).

<i>roke</i>	'hands'	<i>noge</i>	'feet'	<i>oči</i>	'eyes'
<i>čevlji</i>	'shoes'	<i>rokavice</i>	'gloves'	<i>starši</i>	'parents'

- (12) a. **Noge** me bolijo.
foot.PL me hurt.3.PL.PRES
'My feet hurt.'
- b. ***Nogi** me bolita.
foot.DU me hurt.3.DU.PRES

Dual Pair Nouns

It's not the case that the dual forms of pair nouns can never be used (Derganic 2003, Dvořák & Sauerland 2006, Sauerland 2008, Marušič & Žaucer 2017).

- ▶ They must be used when preceded by *dva* or *oba*.

(13) **Obe nogi** me bolita.
both foot.DU me hurt.3.DU.PRES

'Both my feet hurt'

(Derganic 2003: 172)

- ▶ One can describe two of the four hands, legs, etc. of some creature with a dual noun.

Dual Pair Nouns (cont.)

Dual pair nouns are also used to describe two things that do not form a pair.



Context 1



Context 2

(14a) is ok in Context 1, # in Context 2.

(14b) is ok in Context 2, # in Context 1.

(14) Njeni **čevlj-i** so
her shoes-PL are
zelen-i.
green-PL
“Her shoes_{PL} are green.”

(15) Njena **čevlj-a** sta
her shoes-DL are
zelen-a.
green-DL
“Her shoes_{DL} are green.”

Prototypicality/Frequency

This suggests that DL of pair nouns in Slovenian expresses unprototypical/infrequent meaning, while their PL expresses prototypical/frequent meaning, whenever both DL and PL are possible.

If PL is not possible (e.g. due to grammatical constraints imposed by *dva, oba*), these prototypicality/frequency effects disappear.

This suggests a Horn pattern: If two forms, DL and PL, are both usable, use the more marked form (DL) to express the more marked meaning, i.e. unprototypical/infrequent meaning.

- ▶ SG: Individuation (strictly singular)
- ▶ PL: Individuation + augmentation (+ plurality inference)
- ▶ DL: Individuation + minimal augmentation (strictly dual)

Hungarian Pair Nouns

Hungarian is a SG-PL language like English, but exhibits prototypicality/frequency effects with pair nouns.



Context 1



Context 2

(16a) is ok in Context 1, # in Context 2.

(16b) is ok in Context 2, # in Context 1.

(16) A **cipő** zöld.
the shoes-SG green
"The shoe_{SG} is green."

(17) A **cipő-k** zöld-ek.
the shoes-PL green-PL
"The shoe_{PL} are green."

English vs. Hungarian

PL is morphologically more marked in Hungarian, and should be used to express more marked meaning.

For pair nouns, two shoes from the same pair is less marked/less frequent than two shoes from different pairs.

There are two semantic markedness hierarchies at play here:

- ▶ Individuation \pm Sum/Augmentation
- ▶ Prototypicality/Frequency

Question: Why is English not Hungarian?

Possible answer: There's also pressure to keep uniform semantics. And what gets conventionalized is due to various other factors (e.g. Hungarian non-definite unmarked nouns are often used to express number neutral meaning)

But SG-PL syncretism in English, e.g. *sheep, fish, deer*, etc.

Complications in Hungarian

- ▶ Only inanimate pair nouns show this behavior in Hungarian.

(18) A **szülő** kint vár.
the parent outside wait
'The parent is waiting outside.'
not 'The parents are waiting outside.'

Cf. Slovenian:

(19) Pokličí svoj-e **starš-e**.
call.imp self's-PL parent-PL.ACC
'Call your (two) parents.'

- ▶ Things that naturally come in groups of size more than 2 do not trigger this.

(20) A **ujj-ad** hosszú.
the finger-SG-2sg long.SG
'Your finger is long.'
not 'Your fingers are long.'

Singulative

Singulative/Collective number is highly relevant here (Grimm 2012, Stolz 2001).

Singulative in Welsh (Grimm 2012)

	Singular	Plural	
Singular-Plural:	cadair	cadair- iau	'chair'
Collective-Unit:	cacyn- en	cacwn	'hornet'

Stolz (2001): Nouns that show collective/unit alternations naturally come in groups:

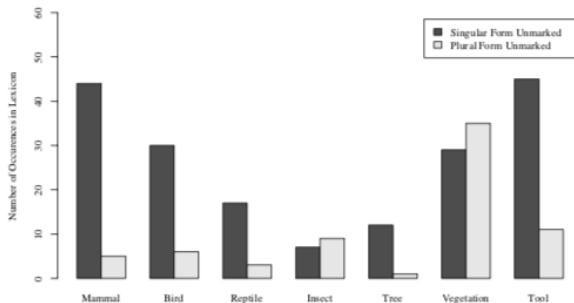
cacwn 'hornets'; picwn 'bees', chwain 'flea'; dincod 'seeds';
ceirch 'oats'; chwynn 'weeds'; cnau 'nuts'; tywod 'sand';
marwor 'embers'; llwch 'dust' (Grimm 2012)

Inverse Number

Another related phenomenon is **inverse number** in Kiowa, Dagaare, etc. (Corbett 2000, Harbour 2007, 2010, Grimm 2012, 2017).

E.g. Dagaare (from Grimm 2017):

Singular	Plural	
bíé	bíí-rí	'child'
bì-rí	bìè	'seed'



Summary and Further Prospects

Underlying idea: Horn patterns are evolutionarily optimal and tend to get conventionalized.

The process of conventionalization does not necessarily require conscious decision making by rational speakers.

We hope to account for this in Evolutionary Game Theory.

Tentative analysis in the number domain:

- ▶ SG: Individuation (strictly singular)
- ▶ PL: Individuation + augmentation (+ plurality inference)
- ▶ DL: Individuation + minimal augmentation (strictly dual)

+ prototypicality/frequency effects with pair nouns, singulatives, inverse number