Case Alternation in Lexicalized Grammar

Genitive of Negation in Lithuanian

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Introduction

- In Balto-Slavic languages, there is a genitive-accusative case alternation on the direct object that is triggered by presence of negation (Genitive of Negation)
- We present an implementation of the case alternation in two lexicalist grammars: HPSG and HTCLG
  - HPSG has a rich tradition of work on morpho-syntax
  - In CG empirical work on inflectionally rich languages is still scarce
  - No widely adopted theory of syntactic features has been developed within type-logical CG to date (Kubota 2021)

Short distance GN in Lithuanian

- direct objects are canonically accusative case-marked

(1) Vaiva pamatė Šarūn-ą / *Šarūn-o.
Vaiva.nom see.pst.3 Šarūn-acc Šarūn-gen

'Vaiva saw Šarūnas.'

- direct objects are genitive case-marked when verb is negated

(2) Vaiva ne-pamatė *Šarūn-ą / Šarūn-o.
Vaiva.nom neg-see.pst.3 Šarūn-acc Šarūn-gen

'Vaiva didn't see Šarūnas.'

Long distance GN: optionality of genitive case

- embedded objects can surface with genitive case marking

(3) Vaiva ne-nori pamatyti Šarūn-o / *Šarūn-ą.
Vaiva.nom neg-want.prs.3 see.inf Šarūn-gen Šarūn-acc

'Vaiva doesn't want to see Šarūnas.'

- genitive seems to be optional in some instances

(4) Tėvas ne-uždraudė vaik-ams žiūrėti š-į film-ą / ši-o film-o.
father-nom neg-forbid.pst child-dat watch.inf this-acc movie-acc this-gen movie-gen

'The father didn't forbid the children to watch this film.' (Arkadiev 2016, 13)

Long distance GN: multiple genitive arguments

(5) Tėvai ne-išmokė vaik-ų / *vaik-us
parent.nom neg-teach.pst3 children-gen children-acc
dažyti tvor-os / ?tvor-ą.
paint.inf fence-gen fence-acc
‘Parents did not teach their children to paint the fence.’
(Arkadiev 2016, 86)

Taking stock

- Case alternation:
  - Short GN: genitive is obligatory
  - Long distance GN: genitive can be optional / obligatory (Arkadiev 2016)
  - Long distance GN: multiple direct objects can be affected
- We propose two theories of the foregoing data in two different lexicalist grammars:
  - HPSG
  - Hybrid Type-Logical Categorial Grammar (HTLCG)

Genitive of Negation in HPSG

- We extend Przepiórkowski (2000)'s analysis of Genitive of Negation in Polish to Lithuanian
- Case division:
  - Structural cases: snom, **sacc**, **sgen**
  - Lexical cases: **lacc**, **lgen**, ldat, lins, lloc

Grammatical constraints and case assignment

Structural case is resolved to a particular morphological case by the following (simplified) set of constraints.

(6) $[\text{neg-}, \text{arg-st}[\boxed{1}_{nelist} \oplus <[\text{case } \textit{str}]> \oplus \boxed{2}_{list}]] \rightarrow$
$[\text{arg-st}[\boxed{1} \oplus <[\text{case } \textit{acc}]> \oplus \boxed{2}]]$

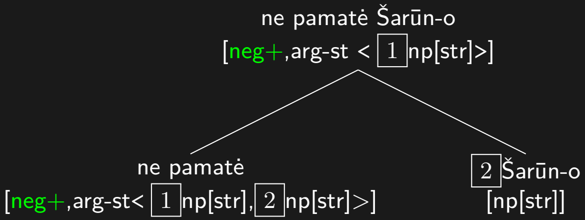
(7) $[\text{neg+}, \text{arg-st}[\boxed{1}_{nelist} \oplus <[\text{case } \textit{str}]> \oplus \boxed{2}_{list}]] \rightarrow$
$[\text{arg-st}[\boxed{1} \oplus <[\text{case } \textit{gen}]> \oplus \boxed{2}]]$

(6) ensures accusative when the NP is selected by something with the neg- property.

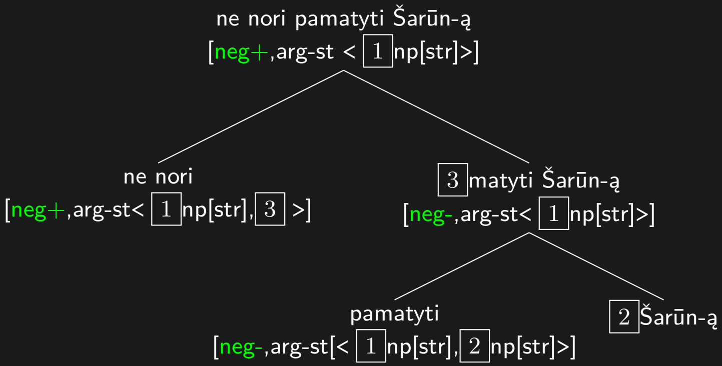
(7) ensures genitive when the NP is selected by something with the neg+ property.

Short distance GN: *Vaiva didn't see Šarūno[gen]*

- Genitive case marking in short distance GN is obligatory:

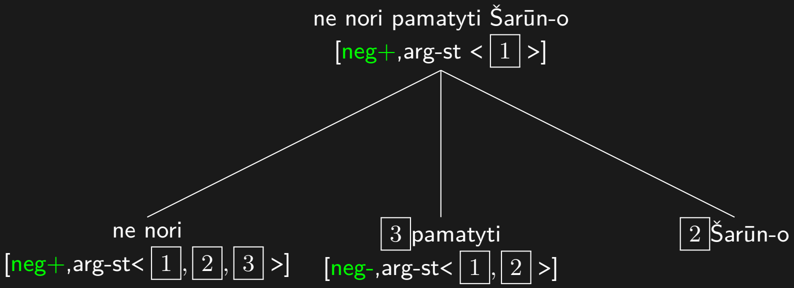


Long distance GN: *Vaiva doesn't want to see Šarūną[acc]*



Long distance GN: *Vaiva doesn't want to see Šarūno[gen]*

- **Assumption:** the embedded NP argument raises, *nenori* 'neg-want' selects the infinitive *pamatyti* 'to see', subsequently inheriting its list of complements, including the NP.
- **Assumption:** to avoid case clash, case is resolved in the 'highest' AGR-ST.



Hybrid Type Logical Categorial Grammar

- HTLCG (Kubota 2014*a*, Moot & Stevens-Guille 2019, 2020, Kubota & Levine 2020) is a lexical theory of grammar based on linear logic Girard (1987).
- HTLCG differs from standard Lambek Categorial Grammar (Moortgat 1997) in dividing syntax between the 'pheno' and 'tecto' components–roughly word order and argument structure
- A sentence is generated by the grammar if and only if there is a proof of the proposition S(entence) with the premises corresponding to the lexemes.

Lexical entries

Lexical entries consist of tuples consisting of pheno, tecto and the semantic term.

(8)
a. $saruno^s$; $NP(gen)$; $sarunas^e$
b. $vaiva^s$; $NP(nom)$; $vaiva^e$
c. $nori^s$; $(NP(nom)\backslash S)/(NP(nom)\backslash INF)$; $\lambda P^{e\to t} x^e.want(x, P(x))$
d. $pamatyti^s$; $(NP(nom)\backslash INF)/NP(acc)$; $\lambda x^e y^e.see(y, x)$
e. $pamate^s$; $(NP(nom)\backslash S)/NP(acc)$; $\lambda x^e y^e.see(y, x)$

Case is uniformly represented by an argument of N or NP which expones it.

Verbs sub-categorize for N(P)s of a particular type (=case).

Gentzen-Style ND Inference Rules for directed HTLCG

$$\frac{}{p^s : w \vdash M ; A}\text{Lex} \qquad \frac{}{x^\alpha : A \vdash x^\alpha : A}\text{Id}$$

$$\frac{\Gamma \vdash M^s ; B/A \qquad \Delta \vdash N^s ; A}{\Gamma, \Delta \vdash (M + N)^s : B}/E \qquad \frac{\Delta \vdash N^s : A \qquad \Gamma \vdash M^s : A\backslash B}{\Delta, \Gamma \vdash (M + N)^s : B}\backslash E$$

$$\frac{\Gamma, p^s : A \vdash (M + p)^s : B}{\Gamma \vdash M^s : B/A}/I \qquad \frac{p^s : A, \Gamma \vdash (M + p)^s : B}{\Gamma \vdash M^s : A\backslash B}\backslash I$$

Vaiva pamatė Šaruną ‘Vaiva saw Sarunas[acc]’

To get a sense of how the grammar works, here’s a syntactic proof of *Vaiva pamate Šaruną* followed by the corresponding semantic proof.

$$
\dfrac{\dfrac{}{\vdash vaiva^{e}\ ;\ NP(nom)}\text{Lex} \qquad \dfrac{\dfrac{}{\vdash pamate^{s}\ ;\ (NP(nom)\backslash S)/NP(acc)}\text{Lex} \qquad \dfrac{}{\vdash saruna^{s}\ ;\ NP(acc)}\text{Lex}}{\vdash pamate + saruna\ ;\ NP(nom)\backslash S}/E}{\vdash vaiva + pamate + saruna\ ;\ S}\backslash E
$$

Figure: Lithuanian transitive in HTLCG

$$
\dfrac{\dfrac{}{\vdash vaiva^{e}}\text{Lex} \qquad \dfrac{\dfrac{}{\vdash \lambda x^{e} y^{e}.see(y, x)}\text{Lex} \qquad \dfrac{}{\vdash saruna^{e}}\text{Lex}}{\vdash \lambda y^{e}.see(y, saruna)}app, \beta}{\vdash see(vaiva, saruna)}app, \beta
$$

Figure: Semantic term for Lithuanian Transitive in HTLCG.

Implementing Genitive of Negation

The lexeme scheme for negation, like for conjunction and disjunction, is polymorphic.

(9) $\lambda t^{(s\rightarrow)_n s} q^s \ldots q^s_n . ne + t(q \ldots q_n);$
$\forall x . T[x := f(x)] \upharpoonright T;$
$\lambda P^{e\rightarrow(e\rightarrow)_n t} z^e \ldots z^e_n x^e . \neg P(x, z \ldots z_n)$

T is a meta-variable in the style of (Steedman 2000) over:

- $\{$NP(nom)\S^{int}, (NP(nom)\S)↾E$\}$

E is a meta-variable over:

- $\{$NP(x), NP(x)↾NP(x)$_1$…↾NP(x)$_{n\geq1}\}$

The axiom defining f:

(10) $\forall x . (f(x) = x \leftrightarrow x \neq acc) \wedge (f(x) = gen \leftrightarrow x = acc)$

The axiom ensures the function f, which is implemented within the lexeme for negation, is the identity function on every case but accusative, for which it returns genitive.

Vaiva nori pamatyti Šaruną ‘Vaiva wants to see Sarunas’

Complex predicates are modelled in the spirit of Kubota (2014*b*)’s account of Japanese complex predicates in CG.

$$\frac{}{\vdash \mathit{vaiva}^{e}}\ \text{Lex} \qquad \frac{}{\vdash \mathit{nori}^{s}\ ;\ (NP(nom)\backslash S)/(NP(nom)\backslash INF)}\ \text{Lex}$$

$$\frac{}{\vdash \mathit{pamatyti}^{s}\ ;\ (NP(nom)\backslash INF)/NP(acc)}\ \text{Lex} \qquad \frac{}{\vdash \mathit{saruna}^{s}\ ;\ NP(acc)}\ \text{Lex}$$

$$\frac{\vdash \mathit{pamatyti}^{s}\ ;\ (NP(nom)\backslash INF)/NP(acc) \qquad \vdash \mathit{saruna}^{s}\ ;\ NP(acc)}{\vdash \mathit{pamatyti} + \mathit{saruna}\ ;\ NP(nom)\backslash inf}\ /E$$

$$\frac{\vdash \mathit{nori}^{s}\ ;\ (NP(nom)\backslash S)/(NP(nom)\backslash INF) \qquad \vdash \mathit{pamatyti} + \mathit{saruna}\ ;\ NP(nom)\backslash inf}{\vdash \mathit{nori} + \mathit{matyti} + \mathit{saruna}\ ;\ VP}\ /E$$

$$\frac{\vdash \mathit{vaiva}^{e} \qquad \vdash \mathit{nori} + \mathit{matyti} + \mathit{saruna}\ ;\ VP}{\vdash \mathit{vaiva} + \mathit{nori} + \mathit{matyti} + \mathit{saruna}\ ;\ S}\ \backslash E$$

$$\frac{}{\vdash \mathit{vaiva}}\ \text{Lex} \qquad \frac{}{\vdash \lambda P^{e\to t} x^{e}.\mathit{want}(x, P(x))}\ \text{Lex} \qquad \frac{}{\vdash \lambda x^{e} y^{e}.\mathit{see}(y, x)}\ \text{Lex} \qquad \frac{}{\vdash \mathit{sarunas}^{e}}\ \text{Lex}$$

$$\frac{\vdash \lambda x^{e} y^{e}.\mathit{see}(y, x) \qquad \vdash \mathit{sarunas}^{e}}{\vdash \lambda y^{e}.\mathit{see}(y, \mathit{sarunas})}\ \mathit{app}, \beta$$

$$\frac{\vdash \lambda P^{e\to t} x^{e}.\mathit{want}(x, P(x)) \qquad \vdash \lambda y^{e}.\mathit{see}(y, \mathit{sarunas})}{\vdash \lambda x^{e}.\mathit{want}(x, \mathit{see}(x, \mathit{sarunas}))}\ \mathit{app}, \beta$$

$$\frac{\vdash \mathit{vaiva} \qquad \vdash \lambda x^{e}.\mathit{want}(x, \mathit{see}(x, \mathit{sarunas}))}{\vdash \mathit{want}(\mathit{vaiva}, \mathit{see}(\mathit{vaiva}, \mathit{sarunas}))}\ \mathit{app}, \beta$$

Non-directional implication

HTLCG is obtained by adding the following connective and rules.

$$\frac{\Gamma \vdash M^{\alpha \to \beta} \ ; \ A \upharpoonright B \qquad \Delta \vdash N^{\alpha} \ ; \ B}{\Gamma, \Delta \vdash (MN)^{\beta} \ : \ A} \upharpoonright E$$

$$\frac{\Gamma, x^{\alpha} \ : \ A \vdash M^{\beta} \ : \ B}{\Gamma \vdash (\lambda x.M)^{\alpha \to \beta} \ : \ B \upharpoonright A} \upharpoonright I$$

Figure: ND for $\upharpoonright$.

We can add the rule for ∀E and the derived rule of universal modus ponens, too, but we leave these out for exposition.

Short GN: *Vaiva nepamate Šaruno[gen]*

$$\dfrac{\dfrac{}{\vdash vaiva^s \;;\; NP(nom)}\text{Lex} \qquad \dfrac{\dfrac{\dfrac{}{9}\text{Lex} \quad \dfrac{\dfrac{\dfrac{}{\vdash pamate^s \;;\; (NP(nom)\backslash S)/NP(acc)}\text{Lex} \quad \dfrac{}{y^s \;;\; NP(acc) \vdash y^s \;;\; NP(acc)}\text{ID}}{y^s \;;\; NP(acc) \vdash pamate + y \;;\; NP(nom)\backslash S}/E}{\vdash \lambda y^s.pamate + y \;;\; (NP(nom)\backslash S) \upharpoonright NP(acc)}\upharpoonright I}{\vdash \lambda t^s.ne + pamate + t \;;\; (NP(nom)\backslash S) \upharpoonright NP(gen)}\forall \upharpoonright E \qquad \dfrac{}{\vdash^s aruna^s \;;\; NP(gen)}\text{Lex}}{\vdash ne + pamate + saruna \;;\; NP(nom)\backslash S}\upharpoonright E}{\vdash vaiva + ne + pamate + saruna \;;\; S}\backslash E$$

Figure: Gen from *ne-pamate* in HTLCG

$$\dfrac{\dfrac{}{\vdash vaiva^{e}}\,\mathrm{Lex} \qquad \dfrac{\dfrac{\dfrac{}{\vdash \lambda P^{e\to e\to s} y^{e} x^{e}.\neg(P(x,y))}\,\mathrm{Lex} \qquad \dfrac{\dfrac{\dfrac{}{\vdash \lambda y^{e} x^{e}.see(x,y)}\,\mathrm{Lex} \qquad \dfrac{}{z^{e} \vdash z^{e}}\,\mathrm{ID}}{z^{e} \vdash \lambda x^{e}.see(x,z)S}\,app,\beta}{\vdash \lambda z^{e} x^{e}.see(x,z)}\,abs}{\vdash \lambda y^{e} x^{e}.\neg(see(x,y))}\,app,\beta \qquad \dfrac{}{\overset{s}{\vdash}\ aruna^{e}}\,\mathrm{Lex}}{\vdash \lambda x^{e}.\neg(see(x,saruna))}\,app,\beta}{\vdash \neg(see(vaiva,saruna))}\,app,\beta$$

Figure: Semantic term for Figure 5

Long distance GN: *Vaiva nenori pamatyti Šarūno*

$$\frac{\overline{8e}\ \text{Lex} \qquad \overline{u^s \ ;\ NP(acc) \vdash u^s \ ;\ NP(acc)}\ \text{Id}}{u^s \ ;\ NP(acc) \vdash pamatyti + u \ ;\ NP(nom)\backslash inf}\ /E$$

$$\frac{\overline{8c}\ \text{Lex} \qquad u^s \ ;\ NP(acc) \vdash pamatyti + u \ ;\ NP(nom)\backslash inf}{u^s \ ;\ NP(acc) \vdash nori + pamatyti + u \ ;\ NP(nom)\backslash S}\ /E$$

$$\frac{u^s \ ;\ NP(acc) \vdash nori + pamatyti + u \ ;\ NP(nom)\backslash S}{\vdash \lambda u^s.nori + pamatyti + u \ ;\ (NP(nom)\backslash S) \upharpoonright NP(acc)}\ \upharpoonright I$$

$$\frac{\overline{9}\ \text{Lex} \qquad \vdash \lambda u^s.nori + pamatyti + u \ ;\ (NP(nom)\backslash S) \upharpoonright NP(acc)}{\vdash \lambda q^s.ne + nori + pamatyti + q \ ;\ (NP(nom)\backslash S) \upharpoonright NP(gen)}\ \forall, \upharpoonright E$$

$$\frac{\vdash \lambda q^s.ne + nori + pamatyti + q \ ;\ (NP(nom)\backslash S) \upharpoonright NP(gen) \qquad 8a}{\vdash ne + nori + pamatyti + saruno \ ;\ NP(nom)\backslash S}\ \upharpoonright E$$

$$\frac{\overline{\vdash vaiva^s \ ;\ NP(nom)}\ \text{Lex} \qquad \vdash ne + nori + pamatyti + saruno \ ;\ NP(nom)\backslash S}{\vdash vaiva + ne + nori + pamatyti + saruno \ ;\ S}\ \backslash E$$

Figure: Gen from *ne-nori* in HTLCG

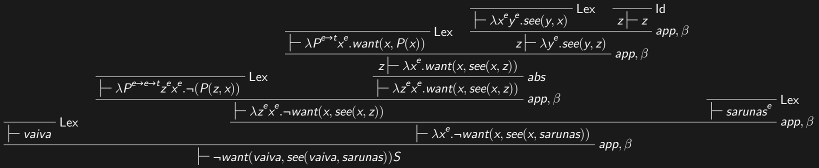


Figure: Semantic term for Figure 6

Interim Conclusions

The HPSG account can be successfully extended to Lithuanian GN.

The HTLCG account can successfully capture Lithuanian GN.

- NP is a property of case.
- This can be extended to sequences of arguments corresponding to features in HPSG.
- It extends to agreement, too, though this isn't modelled here.

But both the HPSG and HTLCG theories, without further restrictions, overgenerate.

Prickly bits of the HTLCG theory

The scheme:

- NP(nom) ne-V NP(gen) inf NP(acc)

correctly follows from the foregoing principles.

By virtue of these principles, the HTLCG theory overgenerates outside transitives by uniform licensing of $\upharpoonright$ introduction.

Scheme representing overgeneration:

- NP(nom) ne-V NP(acc) X.
- Where X is a scheme over the following:
    - NP(obl)
    - NP(x) INF NP({acc, gen})
    - INF NP({acc, gen})
    - NP(x) INF NP({acc, gen}) NP(obl)
    - INF NP({acc, gen}) NP(obl)

Prickly bits of the HPSG theory

- The HPSG theory, like the HTLCG theory, predicts embedded acc and gen are in free variation; for Lithuanian this predicts unattested acc when gen is overwhelmingly preferred.
- Unrestricted raising predicts unattested patterns:
  - NP(nom) V ne-inf NP(acc)
- The HPSG solution is to restrict raising to [neg-] contexts.
- Moreover, the HPSG theory must introduce further features corresponding to whether an argument is raised to resolve case; the head with the property [neg+] requires its arguments (except the first) to be of the form XP^{-}.
- Some Witkoś (2008) object that these techniques are ad-hoc.

Confounds

- Despite the robust judgement that short GN is required, recent corpus work shows that some dialects of Lithuanian don't uniformly enforce short GN (Kozhanov 2017).
- Consequently, the problems of over-generation could be tempered by restricting attention to particular dialects of Lithuanian.
- Modelling the dialects studied by Kozhanov would require generating acc even in short GN environments.

Convergence

The entire overgeneration paradigm of HTLCG is eliminated if, following Przepiórkowski (2000), raising features are included.

- Every non-oblique NP selected by the finite verb includes the argument - for 'doesn't raise'.
- Every NP selected by the infinitive, except possibly the subject cf. (Przepiórkowski 2000, p.151), includes the argument + for 'can raise'.

Then in the tecto scheme for negation T is a meta-variable over:

- $\{NP(nom,-)\backslash S^{inf}, (NP(nom,-)\backslash S) \upharpoonright E\}$

E is a meta-variable over:

- $\{NP(x,-), NP(x,-) \upharpoonright NP(x,+)_1 \ldots \upharpoonright NP(x,+)_{n \geq 1}\}$

Conclusion

The dependence on raising features is present in both theories–the HTLCG theory explicitly borrowing this from the HPSG theory.

This suggests convergence between the theories.

There remains the following question: can the raising features, which we believe are ad-hoc, be dispensed with?

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Genitive of Negation in Lithuanian

object NP: non-accusative case marked objects do not participate in the case alternation

(11)

Vaiva	didžiuojasi	Šarūn-u	/	*Šarūn-o.
Vaiva.nom	be.proud.prs.3	Šarūn-inst		Šarūn-gen

‘Vaiva is proud of Šarūnas.’

(12)

Vaiva	ne-sididžiuoja	Šarūn-u	/	*Šarūn-o.
Vaiva.nom	neg-be.proud.prs.3	Šarūn-inst		Šarūn-gen

‘Vaiva is not proud of Šarūnas.’