Genitive of Negation in HPSG and Categorial Grammar

Symon Stevens-Guille (OSU) and Elena Vaikšnoraitė (Stuttgart University/OSU)

Synopsis. This paper proposes and contrasts two analyses of case alternation in Lithuanian: one in HPSG, the other in Hybrid Type-Logical Categorial Grammar (HTLCG, Kubota & Levine 2020, Moot & Stevens-Guille 2019, Kubota 2020). The results of the two accounts we propose point to a surprising convergence between constraint based (HPSG) and proof theoretic (CG) grammar architectures.

Genitive of Negation in Lithuanian. In Lithuanian, the direct object of a transitive verb is canonically accusative case-marked, as in (1a). Under sentential negation, the non-oblique direct object of a verb is obligatorily genitive case-marked, as shown in (1b). This phenomenon of genitive-accusative case alternation under negation is known as Object Genitive of Negation (henceforth GN) in Balto-Slavic linguistics.

(1) a. Jonas pamatė Tom-ą.
John.NOM see.PST.3 Tom-ACC
'John saw Tom.'

b. Jonas ne-pamatė Tom-o.
John.NOM NEG-see.PST.3 Tom-GEN
'John didn't see Tom.'

Sentential negation on the matrix verb can trigger genitive case on the direct object in the infinitival complement as in (2a). It cannot, however, trigger, genitive in the finite clausal complement as in (2b). GN thus is clause-bound. Interestingly, matrix negation can optionally trigger GN on several direct object NPs as shown in (2c). The direct object of the negated verb teach, *vaikų* 'children', obligatorily surfaces with a genitive case. The direct object in the infinitival complement can surface with genitive case. Following Arkadiev (2016), we dub this long GN.

(2) a. Jonas ne-nori matyti Tom-o / *Tom-ą.
John.NOM NEG-want.PRS.3 see.INF Tom-GEN Tom-ACC
'John doesn't want to see Tom.'

b. Jonas ne-sakė, kad nori matyti Tomą / *Tom-o.
John.NOM NEG-say.PST.3 that want.PRS.3 see.INF Tom.ACC Tom.GEN
'John didn't say that he wants to see Tom.'

c. Tėvai ne-išmokė vaikų dažyti tvor-os / ?tvor-ą.
parent.NOM NEG-teach.PST3 children.GEN paint.inf fence-GEN fence-ACC
'Parents did not teach their children to paint the fence.' (Arkadiev 2016: 86)

The HPSG approach. The HPSG approach extends Przepiórkowski 2000's analysis of GN in Polish to Lithuanian (long) GN. Przepiórkowsi develops an HPSG analysis of GN in Polish in terms of object raising to the complement of a complex predicate, which itself is derived by the HPSG version of function composition developed by Hinrichs & Nakazawa 1990. We show how the account of Polish (long) GN carries over, with little modification, to Lithuanian. This result is expected given that GN is obligatory in both Polish and Lithuanian. The account thus shows cross-linguistic robustness. We defend the account against criticism of Przepiórkowski 2000 by Witkoś 2008. The account in Witkoś 2008, implemented in a variety of Minimalism (though one with major divergences from the standard collection of presumptions), is shown to both over and undergenerate, even with respect to Polish.

The HPSG account of long GN we propose is exemplified by the structures in Figures 1 and 2 for (2a), which are simplified versions of the structures proposed for Polish long GN by Przepiórkowski

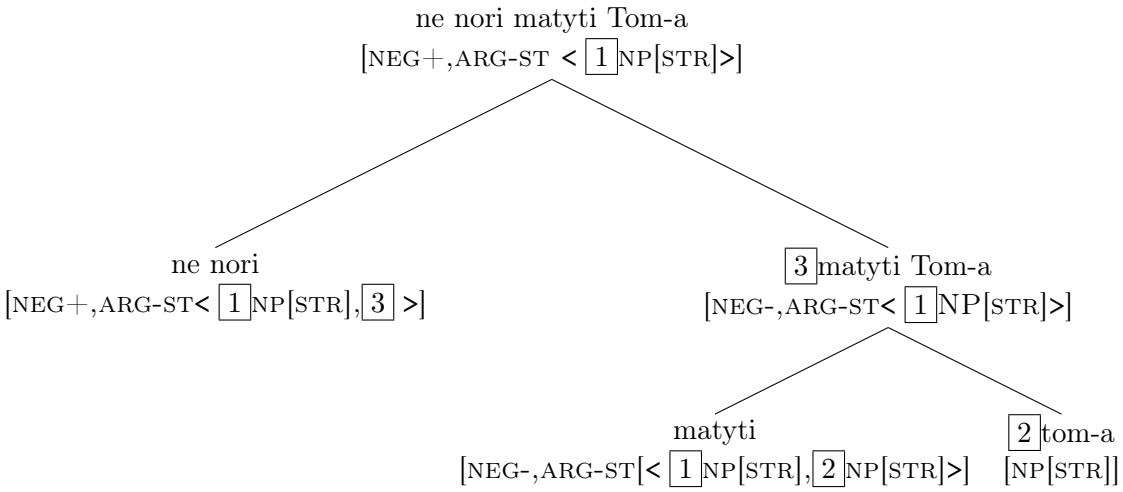

Figure 1: Embedded acc from *matyti* in HPSG

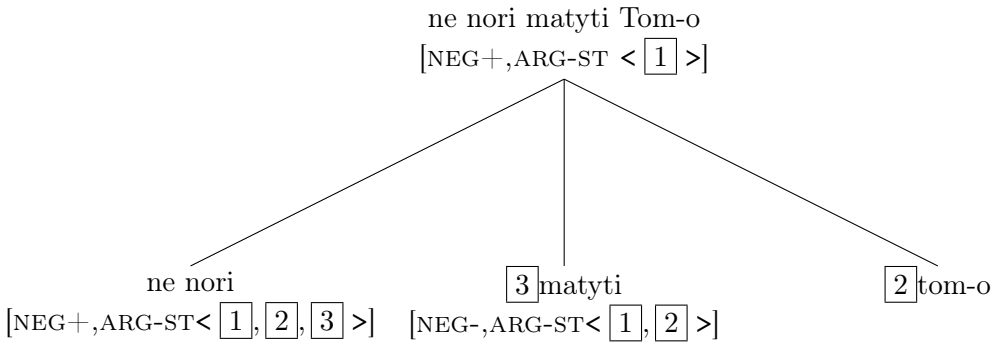

Figure 2: Gen from *ne nori* in HPSG

2000. We presume variation between acc and gen in long GN, which is restricted by further factors currently not well understood, cf. Arkadiev (2016), who argues that genitive is the overwhelmingly preferred case in Lithuanian long GN contexts. While *matyti* 'to see' selects an NP to form an infinitive, the complement of *ne-nori* 'not want' is only required to be headed by an infinitive missing a subject and including a (possibly empty) list of complements. When *ne-nori* 'not want' selects the infintive *matyti* 'to see' it subsequently inherits the selection of *tom-o* 'Tom' by inheriting the list of complements of the infinitive. Case, under the approach developed by Przepiórkowski 2000, is determined by the following (simplified) set of constraints, which ensure genitive when the NP is selected by something with the NEG+ property, and accusative when the NP is selected by something with the NEG- property.

(3) $[\text{NEG-,ARG-ST}[\boxed{1}_{nelist} \oplus < [\text{CASE } str] > \oplus \boxed{2}_{list}]] \rightarrow [\text{ARG-ST}[\boxed{1} \oplus < [\text{CASE } acc] > \oplus \boxed{2}]]$

(4) $[\text{NEG+,ARG-ST}[\boxed{1}_{nelist} \oplus < [\text{CASE } str] > \oplus \boxed{2}_{list}]] \rightarrow [\text{ARG-ST}[\boxed{1} \oplus < [\text{CASE } gen] > \oplus \boxed{2}]]$

While complex hierarchies have been less frequently employed in more recent HPSG accounts (Przepiórkowski 2020), Przepiórkowski (2000) uses a rich case hierarchy distinguishing between structural versus inherent case. Both gen and acc are of the former type. However, it is precisely this distinction between case determined by configurations and case determined by lexemes which requires further rules to restrict complex predicates overruling GN. The account without further

restrictions erroneously predicts the following sentence, with the acc determined by the higher NEG-verb, should be well-formed:

(5) *nori ne-matyti Tom-a
want.PRS.3 NEG-see.INF Tom-ACC
'wants to not see Tom.'

This sentence could be licensed by the same principles of composition which produce long GN. To restrict the NP from being selected outside the negated verb, Przepiórkowski 2000, p.151 defines a further constraint on NEG+ verbs such that their complements must be selected by the negated verb, not some higher verb. He distinguishes raised versus unraised NPs in the grammar itself, restricting selection of NPs by this dichotomy. In effect this blocks the composition of the NEG+ infinitive with the higher verb, since the selection restriction of the infinitive would not be met by the complex selecting the NP complements. This technique is further used to refine the case assignment principles for resolving the multiple feature assignments of sequences of NEG*NEG*′ when they combine to form complexes (where * and *′ are combos of +/-).

The HTLCG approach. Hinrichs & Nakazawa (1990), Przepiórkowsi notes, were inspired by CG, where function composition is a theorem of the underlying logic. We propose a return to the CG account and argue that it doesn't require the further restrictions needed to prevent spurious raising in the HPSG account. Under the HTLCG approach, there is no need to maintain the distinction, endorsed by both Przepiórkowski 2000 and Witkoś 2008, between structural and non-structural case. Case is uniformly represented in terms of subtypes of the underspecified type NP. Verbs subcategorize for an NP of a particular subtype, i.e. case. Some operators, exemplified by sentential negation in Lithuanian, rewrite the case subcategorization conditions of their complements. The resulting account is extremely simple yet is powerful enough to accounts for case alternation in Lithuanian, which otherwise requires commitment to multiple levels of case and interactions between them. Long GN is modelled in the spirit of Kubota 2014's account of Japanese complex predicates in CG. But we argue the present account of long GN, which distinguishes word order from syntactic combinatorics, improves on the architecture employed by Kubota, in some respects, by being closer in style to the HPSG theory of Przepiórkowski 2000. The account is exemplified with a fully compositional fragment for the Genitive of Negation (GN).

Hybrid Categorial Grammar is a lexical theory of grammar based on linear logic (Girard 1987). 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. Categorial Grammars have a simple mapping to semantic structure by virtue of the Curry-Howard correspondence, which ensures proofs correspond to terms of the corresponding type in lambda calculus. Hybrid Categorial Grammar differs from standard Lambek Categorial Grammar (Moortgat 1997) in dividing syntax between the 'pheno' and 'tecto' components–roughly word order and argument structure. The argument structure component corresponds to the inference system, i.e. a fragment of linear logic with directed ($/$,$\backslash$) and undirected ($\uparrow$) implications. The present account further adds $\forall$ to the fragment, lifting it to first order linear logic. The word order component, like the semantics, is implemented in lambda calculus.

We propose the different cases in Lithuanian correspond to different constants, which are the arguments of NPs in the type logic. NPs are then properties of inflections. This approach can be extended to agreement, but we avoid showing this extension for brevity. A toy lexicon is provided in (6). Linguistic expressions are represented by tuples $\langle \phi; \sigma; \kappa \rangle$ where ϕ is the phonological term (pheno), σ is the semantic term, and κ is the syntactic type (tecto). The genitive NP *Tom-o* 'Tom' thus corresponds to the lexeme in (6a). It's pronounced *tomo*, it's an NP(gen), and semantically it corresponds to a constant *tom*. The transitive verb *nori* 'wants' corresponds to the lexeme in

(6b). The transitive verb will combine via Modus Ponens on its right with an infinitive missing its subject and a nominative NP to its left to make a sentence (S).

(6) a. $tomo$; $NP(gen)$; tom
b. $nori$; $(NP(nom)\backslash S)/(NP(nom)\backslash INF)$; $\lambda P_{e\to t}, x_e.want(x, P(x))$
c. $matyti$; $(NP(nom)\backslash INF)/NP(acc)$; $\lambda x, y.see(y, x)$

We propose that the Lithuanian prefixal negation *ne-* corresponds to the lexical entry in (7).

(7) $\lambda s, q.ne \cdot s(q)$; $\forall x.(VP \uparrow NP(f(x))) \uparrow (VP \uparrow NP(x))$; $\lambda P_{e\to e\to t}.\lambda x, y.\neg(P(x, y))$

In the syntactic component of the lexical entry in (7), VP is a shorthand over expressions missing a subject to produce a sentence, i.e. VP = (NP(x)\S). In the VP scheme x is some case specified by the verb, which extends to constructions with non-nominative subjects. Negation thus combines with some verb missing an argument to its right which, once provided this argument, will look for some NP to its left to form a sentence.

We propose that the genitive-accusative case alternation is captured by the axiom in (8). 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. Thus oblique-case objects (e.g. dative, instrumental) are unaffacted by GN, a welcome consequence of the foregoing.

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

We extend our analysis of GN to long distance GN in (2a), whereby the infinitival verb composes with the matrix verb to form a complex predicate. Thus *nori matyti* 'want to see' ends up being a derived verb complex. The foregoing suffices to predict long distance GN in Lithuanian. Further case alternations will be shown to follow from the same architecture. The proof of long GN for (1b) is shown in Figure 3 with bracketed expressions being hypotheses, E for the elimination of a connective, and I for the introduction of a connective. We ignore the semantics terms for exposition. The inference rules, which we omit for exposition, are discussed in length in Moot & Stevens-Guille 2019; see Moot 2015 for discussion of quantifiers, the deductions for which we omit from the proof for exposition.

$$\dfrac{jonas\ ;\ NP(nom) \qquad \dfrac{(7)\quad \dfrac{(6b)\quad \dfrac{(6c)\quad [u\ ;\ NP(acc)]}{matyti \cdot u\ ;\ NP(nom)\backslash inf}/E}{nori \cdot matyti \cdot u\ ;\ VP}/E}{\lambda u.nori \cdot matyti \cdot u\ ;\ VP \uparrow NP(acc)} \uparrow I}{\lambda q.ne \cdot nori \cdot matyti \cdot q\ ;\ VP \uparrow NP(f(acc))} \forall, \uparrow E \qquad (6a)$$
$$\dfrac{}{ne \cdot nori \cdot matyti \cdot tomo\ ;\ VP} \uparrow E$$
$$\dfrac{}{jonas \cdot ne \cdot nori \cdot matyti \cdot tomo\ ;\ S} \backslash E$$

Figure 3: Gen from nori in HTLCG

We argue that the theory of case in the HTLCG account provides some possible directions for revising the HPSG account of (long) GN, which would render it immune to criticisms levied by Witkoś 2008 concerning the principle for restricting raising out of the complement of negation. On the other hand, the account of Polish long GN in HPSG inspired the account of Lithuanian long GN in HTLCG proposed here. The results point to convergence between HPSG and HTLCG, thereby providing further support for Kubota 2020's suggestion that 'there are still many occasions for fruitful interactions between the two approaches both at the level of analytic ideas for specific empirical phenomena and at the more general, foundational level pertaining to the overall architecture of grammatical theory.'.

Selected References

• Arkadiev, P. (2016), 'Long-distance genitive of negation in Lithuanian', *Argument realization in Baltic* **37**, 81. • Girard, J.-Y. (1987), 'Linear logic', *Theoretical computer science* **50**(1), 1–101. • Hinrichs, E. & Nakazawa, T. (1990), Subcategorization and vp structure, *in* 'Proceedings of the Third Symposium on Germanic Linguistics. Benjamins, Amsterdam'. • Kubota, Y. (2014), 'The logic of complex predicates', *Natural Language & Linguistic Theory* **32**(4), 1145–1204. • Kubota, Y. (2020), HPSG and categorial grammar, *in* S. Müller, A. Abeillé, R. D. Borsley & J.-P. Koenig, eds, 'Head-Driven Phrase Structure Grammar: The handbook'. • Kubota, Y. & Levine, R. D. (2020), *Type-Logical Syntax*, MIT Press. • Moortgat, M. (1997), Categorial type logics, *in* 'Handbook of logic and language', Elsevier, pp. 93–177. • Moot, R. (2015), Comparing and evaluating extended Lambek calculi, *in* 'Empirical advances in categorial grammars', Yusuke Kubota and Robert Levine, Barcelona, Spain. • Moot, R. & Stevens-Guille, S. J. (2019), Proof-theoretic aspects of hybrid type-logical grammars, *in* 'International Conference on Formal Grammar', Springer, pp. 84–100. • Przepiórkowski, A. (2000), 'Long distance genitive of negation in Polish', *Journal of Slavic Linguistics* **8**(1/2), 119–158. • Przepiórkowski, A. (2020), Case, *in* S. Müller, A. Abeillé, R. D. Borsley & J.-P. Koenig, eds, 'Head-Driven Phrase Structure Grammar: The handbook', Berlin: Language Science Press. • Witkoś, J. (2008), 'Genitive of negation in Polish and single-cycle derivations', *Journal of Slavic Linguistics* **16**(2), 247–287.