CASE ASSIGNMENT, THEMATIC ROLES AND INFORMATION STRUCTURE

Second, revised manuscript, 2022

Abstract. A formal model is presented that deduces the properties of Finnish structural case assignment by relying on graph-theoretical paths and intervention. More complex and controversial features such as nonlocal dependencies, adverbial case marking, case competition, DP internal case patterns and interaction of case with agreement, aspect and polarity are also calculated from the model. Finally, the model links case assignment with word order, thematic roles and information structure, suggesting that case could play a role in language comprehension.

Keywords: Structural case; case; case assignment; thematic roles; information structure; Finnish

1 Introduction

Finnish structural case assignment has evoked a considerable amount of controversy in the linguistic literature. The most interesting features of the system are its nonlocal dependencies (Anttila & Kim, 2017; Brattico, 2009, 2014; Ikola, 1950, 1986, 1989; Linden, 1956; Toivonen, 1995; Vainikka & Brattico, 2014; Wiik, 1972), sensitivity to agreement, aspect and polarity in addition to syntactic position (e.g., Anttila & Kim, 2010; Brattico, 2020b; Heinämäki, 1994; Huumo, 2013; Itkonen, 1976, 1977; Kiparsky, 1998, 2001; Nelson, 1998; Reime, 1993; Timberlake, 1975; Vainikka, 1988, 1989), adverbial case marking (Maling,

1993; Vainikka & Maling, 1996) and layered case assignment and case competition (Brattico, 2010, 2011; Nelson, 1998). Moreover, Finnish exhibits at least fifteen different case forms, with four separate structural case forms alone. Thus, the empirical footprint of the Finnish structural case assignment is considerable.

I present a formula that seizes the structural case assignment signature of this language. The formula is based on the hypothesis that overt morphological case features in the linguistic input are checked against lexical elements (“case assigners”) by means of a graph-theoretical upward path dependency, developed on the basis of Kayne’s connectness hypothesis (1983, 1984). Path dependencies are limited by intervention, however, which confines case checking into well-defined domains. Abstract Case plays no role in the model. The case checking mechanism is further embedded inside a Python-based recognition grammar that maps input sentences into syntactic and semantic representations. The resulting model detects oddball arguments that appear in noncanonical positions and attempts reconstruction on the basis of overt case information, and filters out failed solutions that come out of the syntactic parsing pathway before they are forwarded to the semantic systems for interpretation. These mechanisms, which operate during language comprehension, correlate morphological case forms with thematic roles and information structure.

Section 2 introduces the basic properties of Finnish structural case assignment, key principles of the analysis, and provides few examples towards justification. Section 3 reports a computational experiment where the model is applied to a dataset containing a significant portion of the structural case assignment signature of Finnish. Most of the concrete empirical data concerning Finnish case assignment can be found from this section. Section 4 contains the conclusions. There is also a technical supplementary that provides some details excluded from the main article.

2 Case assignment, upward paths, and intervention

2.1 Background

In many languages, nominal words such as adjectives and nouns take different morphological forms depending on their morphological, syntactic, and semantic context. For example, the two forms *he ~ him* are traditionally classified as the two case forms, nominative and accusative, respectively, of the one and the same underlying masculine singular pronoun. The term *case assignment* is used in this connection to refer to the process of selecting some case form, given a context. For example, English prepositions can be said to assign the accusative to their complement since they control its distribution (e.g., *to him*, **to he*). A linguistic theory of case assignment is concerned with specifying the necessary and sufficient conditions for the distribution of some or all case forms, in one or several languages. Here we are interested in developing a theory of Finnish case assignment in this sense.

Finnish has fifteen nominal case forms, with four structural case forms (these numbers depend slightly on the theoretical prism used in the analysis)(1). Further comments concerning this system are provided below.[1] All examples in this article are in Finnish unless otherwise stated.

(1) a. *Nominative*

Merja/ kengä-t/ hän hävis-i.

Merja.NOM show-PL.NOM he.NOM disappear-PST.3SG

'Merja/shoes/he disappeared.'

b. *Partitive*

Pekka ihaile-e Merja-a/ kenk-i-ä/ hän-tä

Pekka.NOM admire-PRS.3SG Merja-PAR shoe-PL-PAR he-PAR

'Pekka admires Merja/shoes/him.'

c. *Accusative (n-accusative ACC(N), t-accusative ACC(T))*

Pekka näk-i Merja-n/ kengä-t/ hän-et.

Pekka.NOM see-PST.3SG Merja-ACC(N) shoe-PL.ACC(T) he-ACC(T)

'Pekka saw Merja/shoes/him.'

d. *Accusative (0-accusative ACC(0), t-accusative)*

Me näh-tiin Merja/ kengä-t/ hän-et.

we.NOM see-PST.IMPASS Merja.ACC(0) shoe-PL.ACC(T) he-ACC(T)

'We saw Merja/shoes/him.'

e. *Genitive*

Pekka käsk-i Merja-n/ kenk-i-en/ hän-en tulla.

Pekka.NOM order-PST.3SG Merja-GEN shoe-PL-GEN he-GEN came.

'Pekka ordered/asked Merja/shoes/he to come.'

Nominative case (1a) can be regarded as the canonical subject case. It is assigned to the grammatical subjects of both canonical intransitive and transitive clauses. Partitive and accusative (1c-d) are canonical direct object cases and tend to represent objects or patients. The genitive is assigned to the subject of the infinitival in the example (1e) but has many more uses. The system is complicated by the existence of the three accusative forms: the t-accusative (for plurals and pronouns), n-accusative ACC(N) and the zero-accusative ACC(0) (for singular full DPs). I will have much to say about these three forms later. The case forms are summarized in Table 1 for later reference.

Table 1. Case marking of full argument DPs and pronouns

	FULL DPS		**PRONOUNS**	
	SINGULAR	PLURAL	SINGULAR	PLURAL
NOM	*hevonen* 'horse'	*hevos-et* 'horses'	*minä, se* 'I, it'	*me, ne* 'we, it.pl'

GEN	*hevos-en*	*hevos-ten*	*minu-n, se-n*	*me-idän, ni-den*
ACC	*hevonen* (ACC(0)) *hevos-en* (ACC(N))	*hevose-t* (ACC(T))	*minu-t,* (ACC(T)), *se-n* (ACC(N))	*me-idät* (ACC(T)), *ne* (ACC(0))
PAR	*hevos-ta*	*hevos-i-a*	*minu-a, si-tä*	*me-itä, nii-tä*

Notice that the two accusative forms, the zero-accusative (ACC(0)) and the n-accusative (ACC(N)), are homophonous with the nominative and genitive cases, respectively. This pattern is restricted to full singular DPs: pronouns and plurals have their own unique t-accusative forms (ACC(T)) in all contexts where the zero-accusative and n-accusative are attested. Most descriptive grammars assume that the zero-accusative is the nominative, the n-accusative the genitive. So far I have been unable to calculate the data from a system that makes this simplification, so the issue was left for future research. Consequently, the n-accusative will be glossed as ACC(N), the zero-accusative as ACC(0).

2.2 The hypothesis

We propose two principles regulating the distribution of the Finnish case forms listed in (1) and Table 1. First, overt morphological case forms are checked against sets of lexical features instead of a single feature or head.[2] This will capture situations in Finnish where several syntactic and/or semantic factors (e.g., aspect, polarity, agreement) affect one case form. The assignment dependency between the assigner and assignee is then defined by means of a graph theoretical *path*. Suppose a case assignee α requires checking by lexical features $F = \{f_1 \ldots f_n\}$; then

(2) Case checking and feature intervention

F checks α if and only if *F* occurs inside an *upward path* from α such that there is no closer nonempty set *G*, $G \subset F$, inside the same path;

(3) *Upward path*

the upward path from α contains all constituents that dominate α and their immediate daughters.

We imagine the case assignee as searching for a suitable case checker by "scanning through the path." The search continues until the case assignee encounters either a full match of features *F*, leading into checking, or partial match *G*, $G \subset F$, leading into failure; or reaches the end of the structure, which will also lead into failure. Intuitively case forms are licensed inside the "syntactic scopes" of lexical elements, where the notion of syntactic scope is defined by (2-3) and the relevant lexical elements by *F*. I will use the term "government" when referring to the syntactic scope from the point of view of the case assigner. Case checking establishes that the case form and its grammatical context match. To illustrate both the terminology and analysis, consider (4a-b).

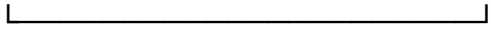
(4) a. Pekka [$_{\text{NegP}}$ **e-i** voitta-nut *kilpailu-n/ kilpailu-a.]
Pekka.NOM not-3SG win-PST.PRTCPL competition-ACC(N) competition-PAR
'Pekka did not win the competition.'

b. Pekka [$_{\text{AuxP}}$ **o-n** voitta-nut kilpailu-n/ *kilpailu-a.]
Pekka.NOM be-pst.3sg win-PST.PRTCPL competition-ACC(N) competition-PAR
'Pekka did win the competition.'

These data show that the Finnish partitive-accusative alteration is in some way sensitive to polarity. The accusative cannot be governed by the negation, while the partitive has the opposite profile. Furthermore, this is a well-known feature of the Finnish case system. The principles (2-3) proposed above define the relevant checking configuration, shown in (5).

(5) Pekka [$_{NegP}$ e-i [voitta-nut *kilpailu-n.]]

Pekka not-3SG win-PST.PRTCPL competition-ACC(N)



The dependency, like all case dependencies examined in this study, is formed by creating a path from the case assignee to the assigner through the phrase structure. The assigner, in turn, is defined by a set of features F, in this case features that have to do with polarity (the details are examined later). As a consequence, the direct object appears inside the syntactic scope of the negation, and the latter is said to govern the former. Standard local case assignment, such as that holding between a preposition and its complement, is modelled as a special case of the same dependency. If the case form and the grammatical context match, we say that the case features are checked.

2.3 Case forms and their features

2.3.1 Introduction

Next, we specify the feature sets F involved in the mechanism. These features define the elements that will govern case assignees in our model. For example, suppose we want to say that arguments with direct object cases must be governed by transitive verbs. We would then use F to define what we mean by "transitive verb," most likely by means of at least two features 'being a verb' and 'being transitive'. Similarly, if we want to capture (4-5) by linking the Finnish direct object case forms to polarity, F will define what we mean by "polarity." Finally, these definitions must be provided in a fully formal way so that the system can be implemented computationally.

2.3.2 Partitive

Vainikka (1988, 1989, 1993, 2003) has argued that the Finnish partitive behaves like a "default complement case." It occurs in the complement position of prepositions (*kohti talo-a*

163 ‘towards house-PAR’), numerals (*kolme talo-a* ‘three house-PAR’), participle adjectives (*talo-a*
164 *ostava* ‘house-PAR buying’), noun heads (*joukko sukki-a* ‘stack sock-PAR’), quantificational
165 elements (*paljon sukki-a* ‘many socks-PAR’), and further encodes aspectual properties when
166 occurring as a direct object (4). For an explicit argument that the Finnish partitive constitutes
167 a structural complement case, not semantic or inherent case, see (Vainikka & Maling, 1996).
168 While the notion of “complement” does not occur in (2-3), the preposition is inside the
169 upward path generated from the case assignee at the complement position. Furthermore, the
170 cases just mentioned are unified by the fact that none of the lexical items assigning the
171 partitive agree in phi-features with the case assignee. I will show in this article that the facts
172 follow if we assume that the partitive is checked against non-agreeing case assigners.
173 This requires that we define the class of case assigners. Case assigners will be
174 distinguished in this study by the lexical feature +ARG. This will prevent determiners,
175 conjunctions, complementizers, numerals and many other case-neutral lexical items, lacking
176 this feature, from participating in case dependencies. Whether a lexical item can exhibit
177 agreement is marked by lexical feature +VAL: +VAL allows the head to exhibit overt
178 agreement, –VAL prohibits it. Hence, we will assume PAR ~ +ARG, –VAL which says that the
179 partitive DP must occur inside the syntactic scope of a non-agreeing (–VAL) case assigner
180 (+ARG)(i.e. F in (2-3) will be {–VAL, +ARG}). We show that this calculates the correct results
181 over the whole dataset and subsumes Vainikka’s default complement rule. To illustrate,
182 consider the Finnish adposition data (6).

183	(6)	a.	lähellä	minu-a/		b.	minu-n	lähellä(-ni)/		c.	*lähellä-ni	minu-a
184			near	I-PAR			I.GEN	near(-PX/1SG)			near-PX/1SG	I-PAR
185			‘near me’				‘near me’				‘near me’	

Some Finnish adpositions have two forms, one that assigns the partitive to the argument at the complement position (6a), another assigning the genitive to the specifier position (6b). When the genitive is assigned, the adposition exhibits optional phi-agreement with its argument. Agreement is not possible if the argument is marked for the partitive case (6c). Rule PAR ~ +ARG, −VAL is designed to capture generalizations of this type in our dataset.

2.3.3 Accusative (three forms)

In addition to the partitive, direct objects of verbs and deverbal predicates can be assigned the accusative. Its presence correlates with certain telic properties of the event denoted by the verb phrase (e.g., Carlson, 1981; Csirmaz, 2012; Heinämäki, 1994; Kiparsky, 1998; Thomas, 2003; Vainikka, 1989)(7).

(7) a. Pekka pes-i hevos-en.
Pekka wash-PST.3SG horse-ACC(N)
'Pekka washed the (whole) horse.'

b. Pekka pes-i hevos-ta.
Pekka wash-PST.3SG horse-PAR
'Pekka washed the horse (but the horse did not necessarily become clean).'

Let us assume, following Kiparsky (1998), that (7a-b) are distinguished from each other by whether the event denoted by the verb phrase includes an end point ('complete action')(7a) or not ('incomplete action')(7b), and that the feature representing the relevant distinction in the lexicon is ASP:BOUNDED. The feature is part of a verbal head (V, v), possibly a separate Asp head. To capture (7), we assume that the accusative rule refers to this aspectual feature. The hypothesis is illustrated in (8).

(8) Pekka pesi hevos-en.
Pekka wash$_{[+ASP]}$ horse-ACC(N)

There is a complication, however. The accusative, when licensed by aspect in the manner illustrated in (8), can take several forms depending on whether the upward path contains an agreeing predicate (1c-d). This is illustrated by (9).[3]

(9) a. Me pes-i-**mme** hevose-n/ *hevonen/ hevose-t.
We.NOM wash-PST-1PL horse-ACC(N) horse.ACC(0) horse.ACC(T).PL
'We washed the horse.'

b. Me pest-**iin** *hevose-n/ hevonen/ hevose-t
we.NOM wash-PST.IMPASS.0 horse.ACC(N) horse.ACC(0) horse-ACC(T).PL
'We washed the horse.'

To capture (9), I assume that also overt agreement enters into the feature sets checked by the accusative. Since plural full DPs are not affect, as shown by (9), this rule is restricted to singular full DPs. Finally, polarity is also relevant, as already shown by (4). Consequently, we add polarity into the accusative rule. Finally, both the agreement and polarity effects are nonlocal. This is an uncontroversial feature of the Finnish case system (for recent work, see Anttila & Kim, 2017; Vainikka & Brattico, 2014). Example (10) shows how the main clause agreement affects direct object case forms inside an infinitival complement clause α.

(10) a. Me halus-i-mme [$_{\alpha}$ rakenta-a *talo / talo-n.]
we.NOM want-PST-**1PL** build-A/INF home.ACC(0) home-ACC(N)
'We wanted to build a house.'

b. Me halut-tiin [$_{\alpha}$ rakenta-a talo / *talo-n.]

231 we.NOM want-PST.IMPASS.**0** build-A/INF home.ACC(0) home-ACC(N)

232 ‘We wanted to build a house.’

233 The first person plural agreement in the main clause affects the direct object case forms inside
234 the infinitival complement clause. The case assigner and assignee are separated from each
235 other by at least four grammatical heads and the infinitival clause boundary. This type of
236 nonlocality is an intrinsic feature of the path mechanism (2-3): the upward path may continue
237 until either there is intervention or no more structure. This is how the proposed analysis will
238 calculate nonlocal case dependencies in the dataset.

239 In sum, to calculate the distribution of all accusative forms in Finnish we will refer to
240 four features: case activity (+ARG), aspect (ASP:BOUNDED), agreement (±PHI) and polarity
241 (±NEG), all which must be checked by (2-3).

242 *2.3.4 Genitive and nominative*

243 Vainikka suggested that the Finnish genitive case is a “default specifier case.” The genitive is
244 assigned to what looks to be specifier positions of prepositions (*minun lähelläni* ‘I.GEN near’),
245 infinitival complement clauses (*Pekka käski minun lähteä* ‘Pekka ordered I.GEN to.leave’),
246 nouns (*minun auto* ‘I.GEN car’), participle adjectives (*minun löytämä* ‘I.GEN found’, i.e.
247 something found by me), and certain finite constructions, such as the modal construction
248 (*minun täytyy lähteä* ‘I.GEN must leave’). The present approach is incompatible with her
249 proposal because there is no upward path from the specifier to its head. On the other hand, it
250 is not uncommon that at least one element in a chain headed by the genitive argument occurs
251 in a potential licensing position. Brattico (2020a) proposed on such grounds that the genitive
252 is checked at the base position of the chain headed by the genitive argument. To illustrate,
253 consider the modal construction (11).

(11) Minun täyty-y lähte-ä
I.GEN must-PRS.0 leave-A/INF
'I must leave.'

There is no licencing structure inside the upward path from the genitive argument at the preverbal subject position. On the other hand, the subject receives its thematic role from the A-infinitival verb *lähte-ä* 'leave-A/INF', which suggests that it reconstructs into the infinitival phrase. If we assume rule GEN ~ +ARG, −FIN and allow the genitive argument to check its case against the A-infinitival head inside the reconstructed position (thus at $\_\__1$ in [DP_1 [must…[A/inf [$\_\__1$ leave]]]]), the dataset can be calculated correctly. Nominative case can then be handled by rule NOM ~ +ARG, +VAL, +FIN which checks it against agreeing finite verbs from the base position of the subject chain (12). In this example, the finite T checks the nominative case from the grammatical subject at the reconstructed position $\_\__1$.

(12) $Minä_1$ T_{fin} $\_\__1$ v löysin avaim-en.
I.NOM T v found key-ACC(N)
[+ARG] 'is a case checker'
[+VAL] 'can (and often does) exhibit phi-agreement'
[+FIN] 'is finite'

This generalization will capture nominative case checking in connection with grammatical subjects.

2.3.5 Summary

The complete feature system, elucidated above, is summarized in Table 2.

Table 1. Case checking rules

Case	Suffix	Feature set	Example
NOM	-0	{+ARG, +VAL, +FIN}	*Pekka nukkuu* 'Pekka.NOM sleeps'
PAR	-(t)A	{+ARG,−VAL}	*Pekka söi omenaa* 'Pekka.NOM ate apple.PAR'
GEN	-n	{+ARG,−FIN}	*Merja näki Pekan lähtevän* 'Merja saw Pekka.GEN to.leave'
ACC(T)	-t	{+ARG, +ASP:BOUNDED}, {−NEG}	*Merja näki hän-et* 'Merja saw he-ACC(T)' *Merja osti kuka-t* 'Merja bought flower-PL.ACC(T)' *Me nähtiin hän-et* 'We saw.IMPASS he-ACC(T)' *Me näimme hän-et* 'We saw.1PL he-ACC(T)' *Me ei nähty *hän-et/hän-tä* 'We did not see he-ACC(T)/he-PAR'
ACC(N)	-n	{+ARG, +ASP:BOUNDED}, {−NEG}, {+PHI}	*Me näimme talo-n* 'We saw.1PL house-N/ACC' **Me nähtiin talo-n* 'We saw.IMPASS house-N/ACC'
ACC(0)	0	{+ARG, +ASP:BOUNDED}, {−NEG}, {−PHI}	*Me nähtiin talo* 'We saw.IMPASS house-0/ACC' **Me näimme talo* 'We saw.1PL house-0/ACC'

±FIN = finiteness; ±ARG = case assigner; ±VAL = whether overt phi-agreement is possible; ±NEG = negative polarity; ±PHI = actual overt phi-agreement, ASP:BOUNDED = aspectual boundedness.

A few details concerning the Table 2 require a further comment. First, pronouns and plural DPs are marked by the t-accusative form (ACC(T)) that does not involve checking +PHI. It is an empirical fact that this form is not sensitive to agreement, while it is sensitive to polarity and aspect. See the examples in Table 2, row ACC(T).

Second, −NEG and ±PHI occur inside separate sets in Table 2. This is because according to the more or less standard theory of Finnish finite clause structure (e.g., Holmberg et al., 1993; Huhmarniemi, 2012; Manninen, 2003; Mitchell, 1991), aspect, polarity and agreement occur inside different heads: aspect at a verbal head (v, V, Asp), agreement at finite T, and the polarity at Neg. Each must therefore be checked by a separate dependency established between the case assignee and the corresponding head. If the analysis is applied inside a grammatical framework that does not make this assumption, then the feature sets have to be adjusted accordingly.

Third, there is no binary distinction between structural and semantic cases. The accusative is sensitive to both syntax and semantics: while aspect and polarity can be said to be semantic, the presence/absence of verbal phi-agreement is a formal property. We can perhaps say that the Finnish accusative represents a "mixed" case. The nominative, partitive

and genitive can be said to be structural: only formal features, agreement (±VAL), finiteness (±FIN) and case activity (±ARG), are relevant.

Finally, the features listed in Table 2 appear to have very little intuitive justification. Why AGR, VAL or PHI enter into case checking? These features are posited solely on the grounds that the proposed case checking mechanism plus these features yielded the simplest formula I could come up with for calculating all the data.

3 Simulation experiment

3.1 Introduction

We will verify that the logical consequences of the hypothesis converge with empirical observations. There are two ways to do this. One is to formulate the theory as an enumerative grammar that generates sentences and their meanings by using the linguistic mechanisms, principles and lexical resources posited in the theory. We check that the theory generates only grammatical and/or acceptable sentences and further provides them with correct or at the very least plausible syntactic and semantic analyses. This corresponds to a literal generative grammar. An alternative is recognition grammar, which analyses sentences instead of generating them. Thus, instead of deriving sentences from a given set of lexical items, recognition grammars derive syntactic and semantic analyses from surface sentences. Enumerative and recognition grammars are mathematically equivalent under very weak assumptions, thus either one can be used in principle, although they do have nontrivial empirical differences. A recognition grammar was used in this study.

To this end, the analysis was embedded inside a minimalist-oriented Python-based language processing algorithm that maps linguistic inputs into syntactic and semantic representations (Brattico, 2019a). Once the system was up and running, it was tested with a battery of Finnish sentences exhibiting possible and impossible case configurations. The

background model is explained in Section 3.3, with some further details available in the supplementary (→S2).

3.2 Test corpus

Recognition grammars are tested by feeding them with sentences, both grammatical and ungrammatical. A *test corpus* was created for this purpose. The test corpus used in the present study contains most of the structural case assignment signature of Finnish. Contents of the test corpus are summarized in Table 3.

Table 3. Contents of the test corpus file (containing a total of 293 construction types)

MAJOR GROUPS	SUBGROUP (# OF CONSTRUCTION TYPES)	EXAMPLES
1. Nominative and partitive	1.1.1 Grammatical, canonical (4)	*Pekka ihailee Merja-a* (SVO) Pekka.NOM admires Merja-PAR 'Pekka admires Merja.' *Pekka antoi kirja-n Merjalle* (SVO-IO) Pekka.NOM gave book-ACC to.Merja 'Pekka gave a/the book to Merja.'
1.1. Finite clause	1.1.2 Noncanonical (32)	*Merja-a ihailee Pekka* (OVS) Merja-PAR admire Pekka.NOM 'It is Pekka who admires Merja.' *Merja-a halusi ihailla Pekka* (OVvS) Merja-PAR wanted to.admire Pekka.NOM 'It was Pekka who wanted to admire Merja.'
	1.1.3 Wrong case forms (43)	**Merja-a nukkuu* Merja-PAR sleeps **Merja ihailee Merja-n* Merja-NOM admires Merja-GEN
	1.1.4 Superfluous arguments (6)	**Pekka ihailee Merjaa Merjaa* Pekka.NOM admires Merja-PAR Merja-PAR **Pekka Pekka ihailee Merja-a* Pekka.NOM Pekka.NOM admires Merja-PAR
1.2. Infinitivals	1.2.1 Grammatical, canonical (2)	*Pekka halusi ihailla Merja-a* Pekka.nom wanted to.admire Merja-PAR 'Pekka wanted to admire Merja.' *Pekka nukahti lukemalla kirja-a* Pekka.NOM sleep by.reading book-PAR 'Pekka fell asleep by reading a/the book.'
	1.2.2 Noncanonical (5)	*Merja-a halusi ihailla Pekka* Merja-PAR wanted to.admire Pekka.NOM 'It was Pekka who wanted to admire Merja.' *Kirja-a lukemalla nukahti Pekka* book-PAR by.reading sleep Pekka.NOM 'It was by reading a/the book that Pekka fell asleep.'
	1.2.3 Noncanonical + wrong case (32)	**Pekka-a halusi ihailla Merja-a* Pekka-PAR wanted to.admire Merja-PAR **Peka-n halusi ihailla Merja-a* Pekka-GEN wanted to.admire Merja-PAR
1.3 Adpositions	1.3.1 Grammatical (3)	*lähellä Pekka-a* near Pekka-PAR 'near Pekka' *Peka-n lähellä* Pekka-GEN near

		‘near Pekka’
	1.3.2 Wrong case forms (6)	**lähellä Pekka*
		near Pekka.NOM
		**Pekka lähellä*
		Pekka.NOM near
	1.3.3 Superfluous arguments (4)	** lähellä Pekka-a Pekka-a*
		near Pekka-PAR Pekka-PAR
		**Pekka-a Pekka-a lähellä*
		Pekka-PAR Pekka-PAR near
	1.3.4 Ungrammatical, wrong order (1)	**lähellä Peka-n*
		near Pekka-GEN
1.4 Partitive subjects	1.4.1 Grammatical, canonical (1)	*Pekka-a pelottaa*
		Pekka-PAR feels.frightened
		‘Pekka feels frightened.’
	1.4.2 Ungrammatical (4)	**Pekka pelottaa*
		Pekka.NOM feels.frightened
		**Peka-n pelottaa*
		Pekka.GEN feels.frightened
1.5 Numerals	1.5.1 Grammatical, canonical (6)	*ne kaksi sukka-a hävisi*
		those.0 two.0 sock.sg-PAR disappeared
		‘those two socks disappeared.’
		Pekka löysi ne kaksi sukka-a’
		Pekka found those.0 two.0 sock.SG-PAR
		‘Pekka found those two socks.’
	1.5.2 Wrong case forms (13)	**ne kaksi sukka hävisi*
		those.0 two.0 sock.NOM disappeared
		**ne kaksi suka-n hävisi*
		those.0 two.0 sock-GEN disappeared.
2. Accusative Case	2.1.1 Grammatical, aspect-related (6)	*Pekka voitti Merja-n*
		Pekka.NOM won Merja-ACC
		‘Pekka won/beat Merja.’
		Pekka pesi Merja-a
		Pekka.NOM washed Merja-PAR
		‘Pekka washed Merja.’
2.1 Accusative and aspect	2.1.2 Wrong case form, aspect-related (5)	**Pekka tönäisi Merja*
		Pekka.nom pushed Merja.nom
		**Pekka tönäisi Merja-n*
		Pekka.NOM pushed Merja-GEN
	2.1.3 Noncanonical (3)	*Merja-n voitti Pekka*
		Merja-ACC won Pekka.NOM
		‘It was Merja who Pekka won/beat.’
		Merja-a pesi Pekka
		Merja-PAR washed Pekka.NOM
		‘It was Merja who Pekka washed.’
	2.1.4 Wrong case form, aspect-related (4)	**Merja tönäisi Pekka*
		‘Merja.NOM pushed Pekka.NOM’
		**Merja-n tönäisi Pekka*
		‘Merja-GEN pushed Pekka.NOM’
2.2 Accusative and negation	2.2.1 Grammatical, canonical (1)	*Pekka ei voittanut Merjaa*
		Pekka.NOM not.3sg won Merja-PAR
		‘Pekka did not win/beat Merja.’
	2.2.2 Wrong case forms (4)	**Pekka ei voittanut Merja*
		Pekka.NOM not won Merja.NOM
		**Pekka ei voittanut Merja-n*’
		Pekka.NOM not won Merja-GEN
	2.2.3 Noncanonical (5)	*Merjaa ei voittanut Pekka*
		‘Merja-PAR not won Pekka.NOM’
		‘It was Pekka who didn’t win/beat Merja.’
		Merja-a Pekka ei voittanut
		Merja-PAR Pekka.NOM not won
		‘When it comes to Merja and Pekka, he didn’t win her.’
	2.2.4 Wrong case forms, noncanonical (4)	**Merja-n ei voittanut Pekka*
		Merja-ACC not won Pekka.NOM
		*Merja ei voittanut Pekka’
		Merja.0ACC not won Pekka.NOM
2.3 Accusative and agreement	2.3.1 Grammatical, canonical (2)	*Me löysi-mme avaime-n*
		we.NOM found-1pl key-ACC
		‘We found a/the key.’
		Me löydet-tiin avain
		we.NOM found.IMPASS key.0ACC’
		‘We found a/the key.’
	2.3.2 Noncanonical (2)	*Avaime-n löysi-mme me*
		key-ACC found-1SG we.NOM
		‘It was us who found the key.’
		Avain löydet-tiin me

		key.0ACC found.IMPASS we.NOM 'It was us who found the key.'
	2.3.3 Wrong case forms (5)	**Me löydettiin avaime-n* we.NOM found.IMPASS key-ACC **Me löysimme avain*' 'we.NOM found-1PL key.0ACC'
2.4 Negation and agreement	2.4.1 Grammatical, canonical (1)	*Me ei löydetty avain-ta* we.NOM not found key-PAR 'We did not find a/the key.'
	2.4.2 Noncanonical (3)	*Avain-ta me ei löydetty* key-PAR we.NOM not found 'As for the key, we did not find it.' *Me ei avain-ta löydetty* we.nOM not key-PAR found 'We didn't find the key.'
	2.4.3 Wrong case forms (4)	**Me ei löydetty avain* we.NOM not found key.NOM **Me ei löydetty avaime-n* we.NOM not found key-GEN
2.5 Long-distance effects	2.5.1 Grammatical, V + infinitival (7)	*Pekka halusi voittaa Merja-n* Pekka.NOM wanted to.win Merja-ACC' 'Pekka wanted to win/beat Merja,ä *Me ei haluttu voittaa Merja-a* we.NOM not want to.win Merja-PAR 'We didn't want to win/beat Merja.'
	2.5.2 Noncanonical, V + infinitival (7)	*Merja-n halusi voittaa Pekka* Merja-ACC wanted to.win Pekka.NOM 'It was Pekka who wanted to beat Merja' *Merja haluttiin voittaa me* Merja.0ACC want.IMPASS to.win we.NOM 'It was us who wanted to beat Merja,ä
	2.5.3 Wrong case forms (2)	**Me haluttiin voittaa Merja-n* we.NOM want.IMPASS to.win Merja-ACC **Me ei haluttu voittaa Merja-n* we.NOM not wanted to.win Merja-ACC
3. Genitive case	3.1.1 Grammatical, canonical (3)	*Pekka käski Merja-n lähteä* Pekka.NOM ordered Merja-GEN to.leave' 'Pekka ordered Merja to leave.' *Peka-n täytyy lähteä* Pekka.GEN must to.leave 'Pekka must leave.'
3.1 Infinitival subject	3.1.2 Noncanonical (2)	**Pekka käski lähteä Merja-n* Pekka.NOM ordered to.leave Merja-GEN **Pekka sanoi lähtevän Merja-n* Pekka.NOM said to.leave Merja-GEN
	3.1.3 Wrong subject case (4)	**Pekka käski Merja lähteä* Pekka.NOM ordered Merja.NOM to.leave **Pekka käski Merja-a lähteä* Pekka ordered Merja-PAR to.leave
	3.1.4 Wrong S case, noncanonical (4)	**Pekka käski lähteä Merja* Pekka.NOM ordered to.leave Merja.NOM **Pekka käski lähteä Merja-a* Pekka.NOM ordered to.leave Merja-PAR
3.2 Possessive use	3.2.1 Grammatical, canonical (1)	*Se Merja-n kello hävisi* that Merja-GEN watch disappeared 'That Merja's watch disappeared.'
	3.2.2 Noncanonical (3)	**se kello Merja-n hävisi* that watch Merja-GEN disappeared **se kello hävisi Merja-n* that watch disappeared Merja-GEN
	3.2.3 Wrong case forms (4)	**se Merja kello hävisi* that Merja.NOM watch disappeared **se Merja-a kello hävisi* that Merja-PAR watch disappeared
3.3 Adpositions	3.3.1 Grammatical, canonical (2)	*Merja nukkui Pekan lähtellä* Merja.NOM slept Pekka-GEN near 'Merja slept near Pekka.' *Merja nukkui lähellä Pekkaa* Merja.NOM slept near Pekka-PAR 'Merja slept near Pekka.'
	3.3.2 Noncanonical (1)	**Merja nukkui lahella Peka-n* Merja.NOM slept near Pekka-GEN
3.4 Possessor + numeral	3.4.1 Grammatical, canonical (2)	*Ne kaksi Merja-n puhelinta hävisi* those two Merja-GEN phones disappeared 'Those two Merja's phones disappeared.' *Ne Merja-n kaksi puhelinta hävisi*

		those Merja-GEN two phones disappeared 'Those two Merja's phones disappeared.'
	3.4.2 Wrong case (4)	**Ne kaksi Merja puhelinta hävisi* those two Merja.NOM phones disappeared **Ne kaksi Merja-a puhelinta hävisi* those two Merja-PAR phones disappeared
4. Special constructions	4.1.1 Grammatical, canonical (4)	*Me löysimme avaimen* we.NOM found-1PL key-ACC 'We found a/the key.' *Me löydettiin avain* we.NOM found.IMPASS key.0ACC 'We found a/the key.'
4.1 Impersonal passive	4.1.2 Wrong object case (2)	**Me löysi-mme avain* we.NOM found-1PL key.0ACC **Me löydet-tiin avaime-n* we.NOM found-IMPASS key-ACC
4.2 Raising constructions	4.2.1 Grammatical, canonical (1)	*Merja näyttää lähtevän* Merja.NOM seems to.leave 'Merja seems to leave.'
	4.2.2. Wrong case (4)	**Merjaa näyttää lähtevän* Merja-PAR seems to.leave **Merjan näyttää lähtevän* Merja-GEN seems to.leave
4.3 Copular constructions	4.3.1 Grammatical, canonical (2)	*Pekka on Pekka* Pekka.NOM is Pekka.NOM 'Pekka is Pekka.' *Merjalla on Pekka* Merja.ALL is Pekka.NOM 'Merja has Pekka.'
	4.3.2 Wrong case (8)	**Pekka on Pekkaa* Pekka.NOM is Pekka-PAR **Pekka on Pekan* Pekka.NOM is Pekka-ACC(N)
5. Adverbials and case marking	5.1 Grammatical, canonical (5)	*Pekka nukkui koko päivä-n* Pekka.NOM slept all day-ACC 'Pekka slept all day.' *Pekka ei nukkunut koko päivä-ä* Pekka.NOM not slept all day-PAR 'Pekka did not sleep all day.'
	5.2 Wrong case forms (7+1)	**Pekka ei nukkunut koko päivän* Pekka not slept all day-ACC **Pekka ihailee Merja-a koko päivää* Pekka.NOM admires Merja-PAR all day-PAR

The test sentences were linear lists of bare phonological words without morphosyntactic or syntactic tagging or analyses. All words were normalized (e.g., capitals, punctuation and some umlauts were removed), while some words were disambiguated when testing specific lexical items for an otherwise ambiguous word. Disambiguation blocks irrelevant parsing derivations but has no impact on the evaluation of the case checking analysis. Virtually the whole case assignment signature was included. Special complex constructions exhibiting labile case alternations where both the zero-accusative and n-accusative are possible were left for future research and excluded from the dataset. See (Anttila & Kim, 2017). The matter is discussed in the supplementary (→S5.2.4, pp. 30-31). Some predicative copular sentences

were tested but the examination was not systematic due to the controversial and to me still unclear nature of this class.

3.3 Procedure

The test sentences were fed into a Python based recognition grammar (Brattico, 2019a) that was assumed as a syntactic background theory in this study. The algorithm creates an idealized brain model for the speaker of any language that it uses to model language processing in that language. It maps input sentences into phrase structure representations and interprets them semantically. Figure 1 illustrates the information flow in the system. The underlying grammatical theory is minimalist in orientation.

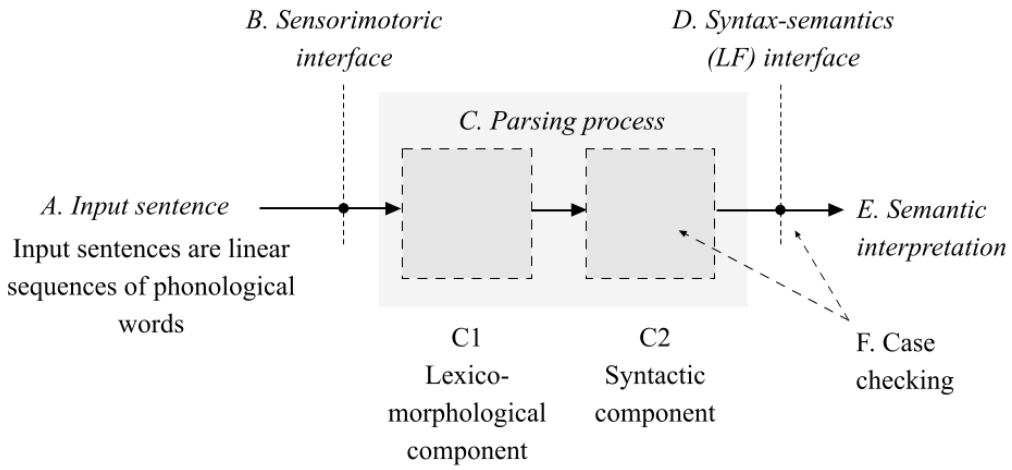


Figure 1. Syntactic background theory and the position of the proposed case checking mechanisms within the architecture. See the main text for explanation.

Each input sentence is processed through (i) the *lexico-morphological component*, retrieving lexical items on the basis of the phonological words present in the input, and (ii) the *syntactic component* which generates parsing solutions on the basis of the lexical items it receives from the former. For example, a sentence such as *the horse ran past the barn* is mapped into a

syntactic parsing solution [[$_{DP}$ *the horse*] [$_{VP}$ *ran* [$_{PP}$ *past the barn*]]] where the terminal elements are lexical items. Lexical elements are sets of features. Case checking principles (2-3) function as a filter before α is forwarded to semantic interpretation. In addition, the algorithm detects oddball arguments that occur in "wrong" positions in the input where their case features cannot be checked and attempts to reconstruct them into canonical thematic positions where the case features can be checked (Brattico, 2020a). We can perhaps think of overt morphological case forms "guiding" the parser towards plausible solutions. This mechanism then feeds an independent pragmatic pathway that links noncanonical word orders with information structural interpretations (e.g., topic, focus). We are interested in whether the resulting model is able to separate grammatical case configurations from the ungrammatical ones and provide the former with plausible syntactic and semantic interpretations. Since the model uses case forms to guide reconstruction, we are also interested in whether the proposed case checking mechanism handles noncanonical word orders.

3.4 Results: Observational adequacy

First, we compare the grammaticality judgments provided by the model with grammaticality intuitions provided by a native speaker (here, the author). The model and native speaker judgments were compared by an automatic file comparison tool. The model judged 290 out of 293 constructions correctly. Correct judgment means that the grammaticality judgment of the model matched with that of a native speaker. Overall, then, the case checking principles proposed here suffice to separate grammatical case configurations from the ungrammatical ones. The three errors were: a spurious reconstruction inside a complex noun phrase leading the model to accept an ungrammatical expression (13a)($\rightarrow$S5.5.3); an illegitimate reconstruction of a rightward genitive argument (13b)($\rightarrow$S5.3.4); a partitive-marked adverbial

(13c)(→S5.10). These are all judged ungrammatical by native speakers, but wrongly accepted by the model.

(13) a. *Ne sukka-a$_1$ kolme __$_1$ hävi-si. (#162)
those sock.SG-PAR three.0 disappear-PST.3SG
Intended: ‘Those/the three socks disappeared.’

b. *Pekka sano-i __$_1$ lähte-vän Merja-n$_1$. (#234)
Pekka say-PST.3SG leave-VA/inf Merja-GEN
Intended: ’Pekka said that Merja will leave.’

c. *Pekka nukku-i koko päivä-ä. (#293)
Pekka sleep-PST.3SG all day-PAR
Intended: ‘Pekka slept all day.’

The fact that they appear here means that I was unable to find a formula that calculates all the data: adjusting the grammar to derive these data correctly always caused errors elsewhere. Further exploration of these errors (after this article was finalized) suggests that (13a-b) are most likely irrelevant to case checking and involve issues that have to do with reconstruction, while (13c) is indicative of a residuum problem in the adverbial case checking analysis.[4]

3.5 Results: Descriptive adequacy

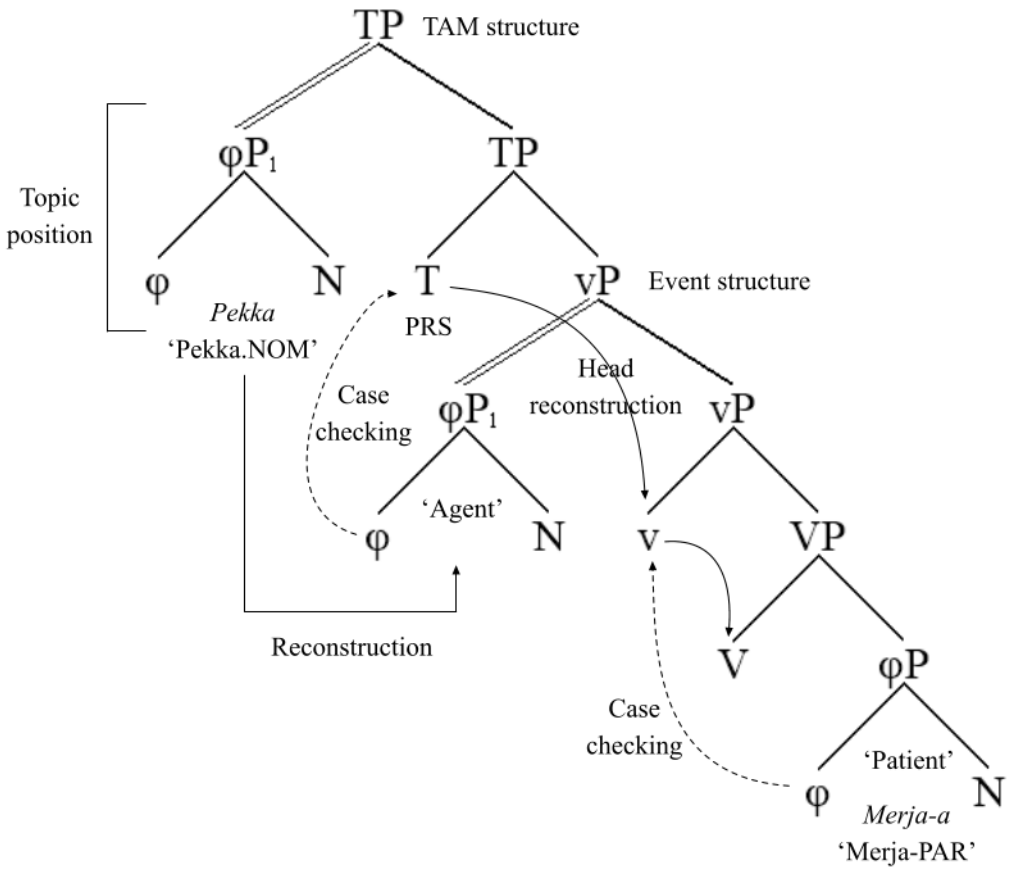
3.5.1 Canonical and noncanonical finite clauses

Here we examine if the model calculates analyses and interpretations that are linguistically plausible and/or match with the syntactic and semantic interpretations elicited from native speakers.

We begin by considering the processing of a canonical transitive finite clause *Pekka ihaile-e Merja-a* ‘Pekka.NOM admire-PRS.3SG Merja-PAR’ (sentence #5 in the test corpus) with a canonical nominative subject and canonical partitive object. The model judges the input

sentence as grammatical and calculates (14). The underlying phrase structure image was generated by the algorithm while some text and other symbology was added by the author to facilitate readability. The original figures generated by the model are available online. Case checking dependencies established by (2-3) are notated by dashed arrows, reconstruction by solid arrows.

(14)



The model generates binary-branching asymmetric bare phrase structure representations of the form α = [A B] where A and B are the immediate left and right constituents of α, respectively. They are created by operation *Merge*, which joins the two constituents A and B to form a new constituent [A B]. We can think of [A B] as a "chunk" of two previously assembled elements. Constituents A and B can be primitive or complex. A primitive constituent has no daughters; complex constituent has two. The system, apart from

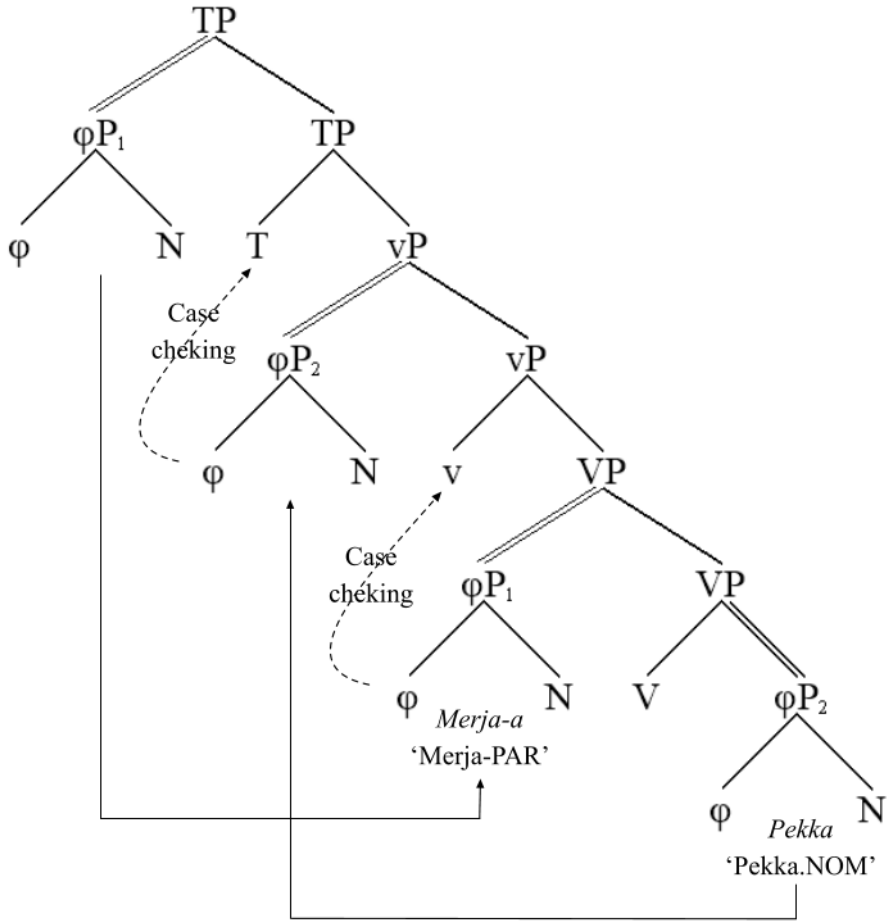
asymmetry, is based on the bare phrase structure model proposed by Chomsky (2001, 2008). Since the phrase structure system is used to support a recognition grammar, these representations are constructed from the input feed of lexical items, not by selecting lexical items by "free will." In this case the feed is a linear string of words /Pekka/ + /ihailee/ + /Merjaa/ 'Pekka + admires + Merja'. Consequently, the arguments that appear in these representations have their case forms in place and are subjected to a compatibility check by (2-3).

Let us consider case checking. The subject *Pekka* is marked for the nominative case.[5] The nominative case was mapped into F = {+ARG, +FIN, +VAL}, but this set cannot be checked at the surface position SpecTP. The argument is therefore reconstructed from SpecTP into SpecvP, where it checks F against finite T. Finite verbs are both finite (+FIN) and show agreement (+VAL), hence we capture the connection between nominative case, finiteness and agreement. The reconstructed SpecvP position is further associated with an *agent* interpretation during semantic interpretation. The preverbal SpecTP, on the other hand, can be occupied by almost anything in Finnish as long as it constitutes the topic of the sentence or is otherwise topical (Brattico, 2019b; Holmberg & Nikanne, 2002; Huhmarniemi, 2019a; Vilkuna, 1995). The whole reconstruction operation therefore pairs the subject with *two* semantic attributes: topic and agent. The partitive object *Merja-a* 'Merja-PAR', on the other hand, was merged directly into the postverbal position where it checks +ARG and −VAL against v. It will be interpreted as the *patient*. There is no object agreement in Finnish, hence v has −VAL. No reconstruction occurred, and therefore the patient argument was not linked with any special information structural interpretation.

Consider next how the model reacts to a noncanonical OVS structure *Merja-a ihaile-e Pekka* 'Merja-PAR admire-PRS.3SG Pekka.NOM' (#11) where both the thematic agent and patient occur in unexpected noncanonical positions. The thematic patient is in the preverbal

443 topic position, while the grammatical subject occurs postverbally. OVS sentences are
444 grammatical in Finnish. Neither argument can check their case features at the surface
445 positions. The calculated result is (15).

446 (15)



447

448 The postverbal argument reconstructs to SpecvP, the preverbal partitive argument to VP. This
449 assigns them the correct thematic roles 'agent' and 'patient', respectively. The direct object is
450 further interpreted as the topic, while the postverbal subject is interpreted as representing the
451 information focus (that is, new information in the discourse). In sum, then, the postverbal
452 grammatical subject is interpreted as the focus/agent, the preverbal direct object as
453 topic/patient. In this way, case information is linked with the computation of two semantic

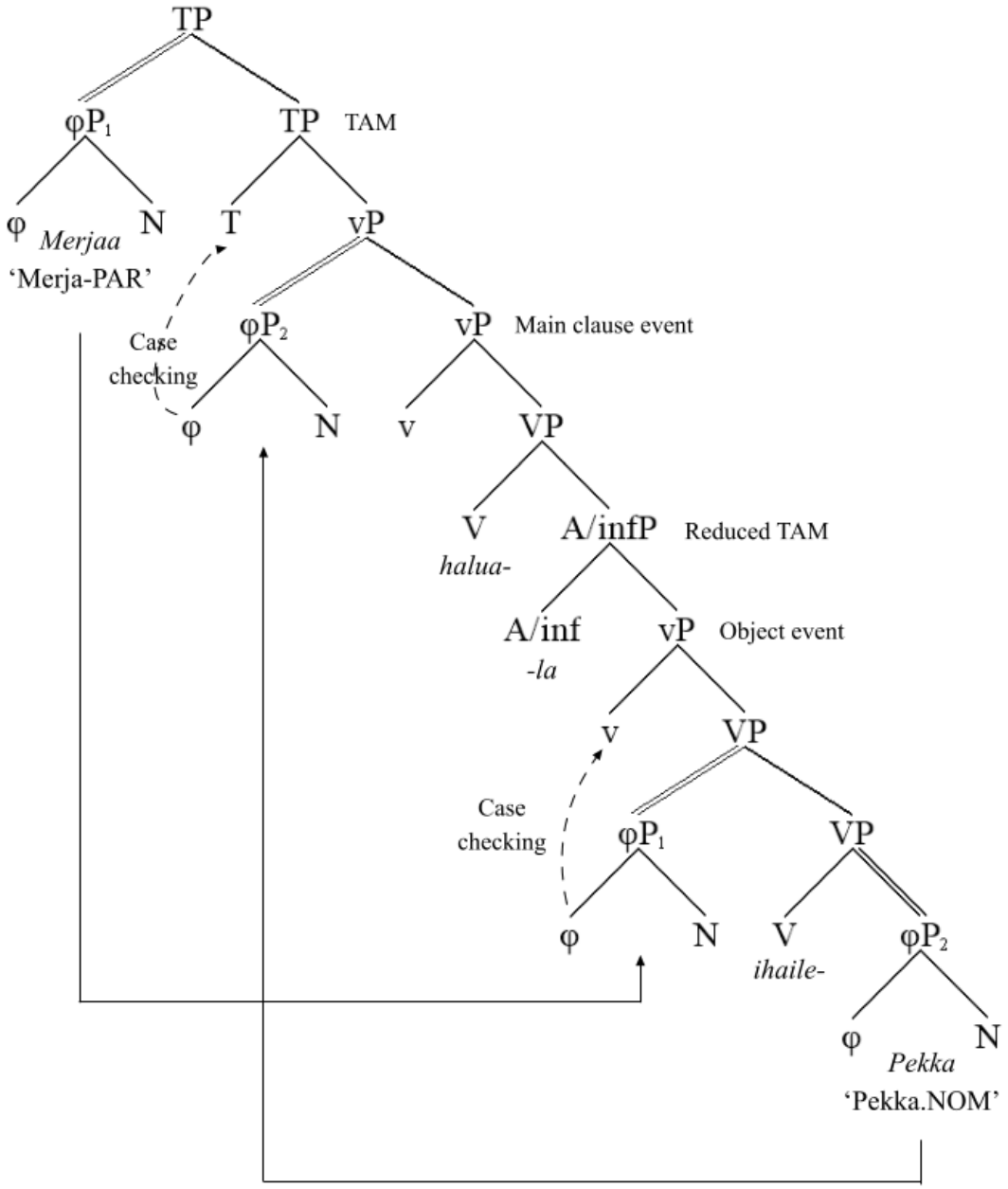
attributes: it allows an argument to retrieve its thematic role even if it encodes topic/focus information by appearing in an unexpected position.

The same mechanism works if the grammatical subject occurs further to the right, as in the sentence (16).

(16) Merja-a halu-si [ihail-la Pekka.] (#14)
Merja-PAR want-PST.3SG admire-A/INF Pekka.NOM
'When it comes to Merja, it was Pekka who wanted to admire her.'

The model calculates (17).

462 (17)



463

464 The nominative subject is reconstructed from the rightmost/lowest position in the clause to
465 SpecvP, while the partitive argument goes to CompVP. The infinitival clause itself is derived
466 by combining the v/VP-shell with an infinitival head corresponding to the overt infinitival
467 suffix *-(t)A*. This provides an analysis of Finnish infinitivals, in which their syntactic and
468 semantic structure mirrors closely the overt morphological composition in the input (→S5.3),
469 an idea that goes back to Koskinen (1998). Because the grammatical subject occurs further to

the right, it is interpreted as the marked focus. There is a very strong sense in which Finnish rightward movement represents marked focus, as if the speaker specifically wanted to designate new information by using a markedly unexpected word order.

The model was tested with all logically possible word order variations for the transitive clause (sentences #8-13 in the test corpus, see examples (18)) and for the clause containing a complement infinitival (#14-37, 87-93, some examples (19)), which it calculated correctly (S=main clause subject, O=main clause object, s = embedded clause subject, o=embedded clause object, V=main clause verb, v=embedded infinitival verb).

(18) a. Pekka Merja-a ihaile-e. (#8)
Pekka.NOM Merja-PAR admire-PRS.3SG
S O V

b. *Ihaile-e Pekka Merja-a. (#12)
admire-PRS.3SG Pekka.NOM Merja-PAR
V S O

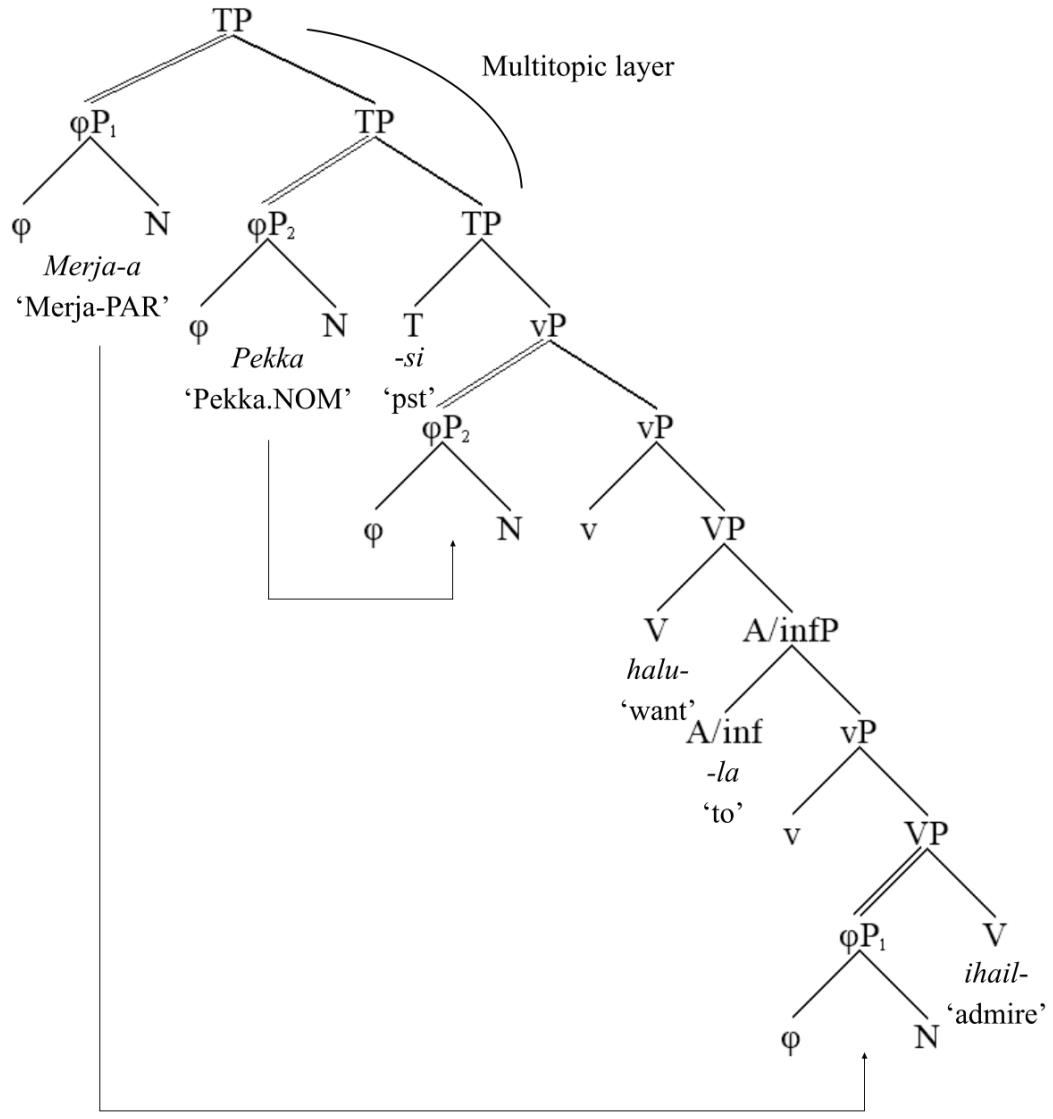
(19) a. Merja-a halus-i Pekka ihail-la. (#15)
Merja-PAR want-PST.3SG Pekka.NOM admire-A/INF
o V S v

b. Merja-a Pekka halu-si ihail-la (oSVv, #16)
Merja-PAR Pekka.NOM want-PST.3SG admire-A/INF
o S V v

c. Pekka halu-si Merja-a ihail-la. (SVov, #18)
Pekka.NOM want-PST.3SG Merja-PAR admire-A/INF
S V o v

Canonical verb-initial clauses are ungrammatical in Finnish (18b), as correctly judged by the model. A preverbal object (19a,b) is always interpreted as the marked topic, and is correctly interpreted as such. If both the object and subject are fronted, they are both interpreted as topics (19b)(line 495). Sentence internal fronting is registered as creating secondary topics (19c, line 559), but whether this is semantically correct is difficult to judge. (20) illustrates how the model calculates multitopic constructions (19b). Both topics are reconstructed into correct thematic positions.

(20)



Ungrammatical case combinations, correctly ruled out, are sentences #45-80, 94-125 in the test corpus. Some of these sentences are illustrated in (21). All possible case combinations were tested.

(21) a. *Merja ihaile-e Merja. (#45, 48)
Merja.NOM admire-PRS.3SG Merja.NOM/0ACC

b. *Merja ihaile-e Merja-n. (#46, 47)
Merja.NOM admire-PRS.3SG Merja-GEN/ACC

c. *Merja-a ihaile-e Merja-a. (#49)
Merja-PAR admire-PRS.3SG Merja-PAR

When a wrong case form is encountered, reconstruction is always attempted, hence we must make sure that there are no spurious reconstruction sites. In the case of (21a), for example, the model reconstructs both arguments to SpecvP where their nominative case features are checked by finite T, but correctly rejects this configuration because only one argument can be theta-marked at this position (see line 34990 in the derivational log file) and *admires* lacks an obligatory patient argument. The result is rejected at the syntax-semantics interface (line 34999). I tested also sentences that had too many or too few case-marked arguments (#38-44, 81-86), which the model correctly classified as ungrammatical. Some examples are provided in (22).

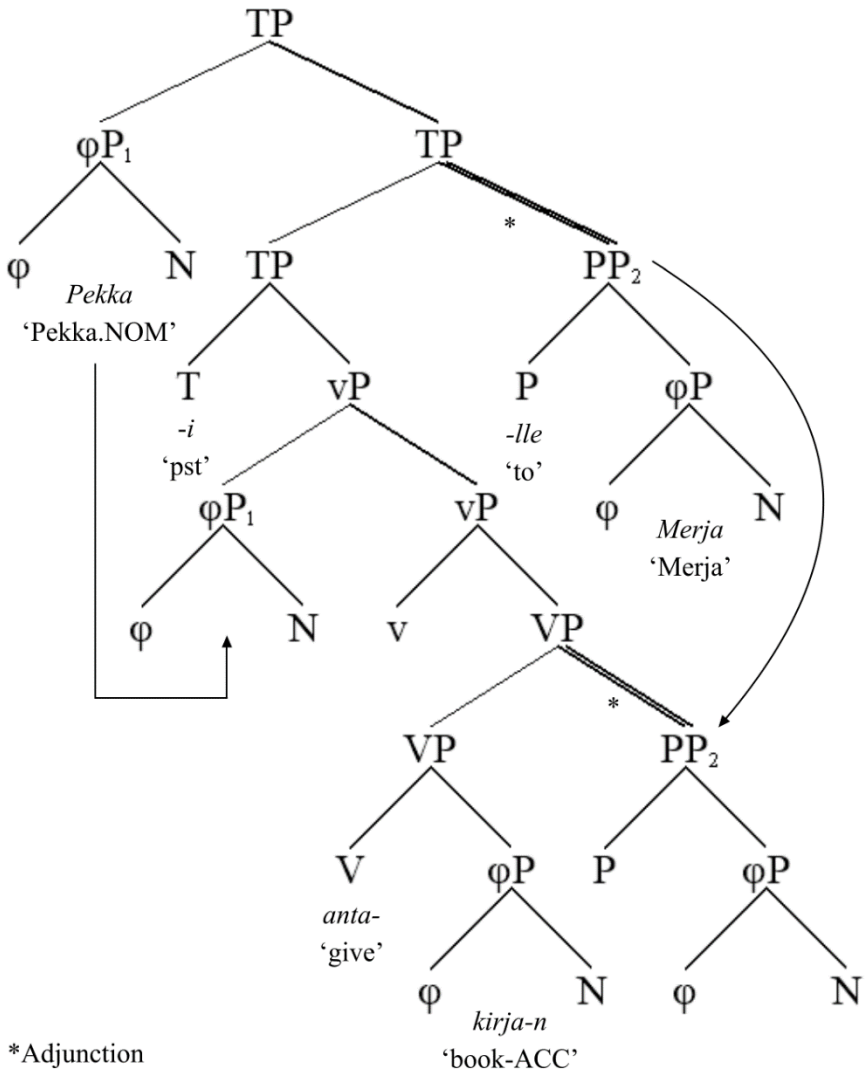
(22) a. *Merja-a/ *Merja-n nukku-u. (#38, 39)
Merja-PAR Merja-GEN/ACC(N) sleep-PRS.3SG

b. *Merja/ *Merja ihaile-e. (#40, 41)
Merja.NOM Merja.ACC(0) admire-PRS.3SG

c. *Pekka Pekka nukkuu. (#80)
Pekka.NOM Pekka.NOM sleep-PRS.3SG

Finnish semantic cases, although not in the focus in this study, deserve a comment. Example (21) illustrates how the model analyses ditransitive clauses such as *Pekka antoi kirjan Merjalle* 'Pekka.NOM gave book-ACC(N) Merja-ALL' (#6) that contains an allative argument *Merja-lle* 'to Merja'. Allative is one of the Finnish semantic cases.

(23)



This analysis follows Nikanne (1993), who proposed that Finnish semantic cases such as the allative are checked by a phonologically covert preposition. The preposition P *-lle* 'to' selects a φP complement. The parser attached the preposition phrase at a high right position and then reconstructed it into a lower position inside the VP. The reconstruction mechanism is almost

identical to the one that reconstructs thematic arguments: P must be linked with a lexical feature (or several) that controls its syntactic distribution and semantic interpretation.[6]

Finnish licenses partitive subjects in an experiencer construction (24).

(24) Pekka-a pelo-tta-a. (#140)
Pekka-PAR fear-CAU-PRS.3SG
'Pekka feels frightened.'

Partitive arguments cannot be licensed at the subject position according to the analysis proposed in this article, so the sentence looks problematic. The algorithm nevertheless accepts these sentences and reconstructs the partitive subject inside the VP (25).

(25) [$_{TP}$ Pekka-a$_1$ [$_{TP}$ T [$_{VP}$ Cau^0 [$_{VP}$ __$_1$ pelkää-]]]] (#139)
Pekka-PAR PRT -tta- fear-
'(Something, not mentioned) causes Pekka to fear.'

The causative morpheme has +ARG and −VAL checking the partitive. The calculated output agrees with the style of analysis proposed by Huhmarniemi (2019b, 2019c) and Pylkkänen (2002). This construction was also tested with ungrammatical case configurations (#139-143). In general, partitive preverbal subjects cannot be reconstructed to SpecvP if finite T is encountered locally in the path; they must always have a lower reconstruction site.

3.5.2 Accusative

All accusative case forms (t-accusative, n-accusative and the zero-accusative) presuppose that the verb or deverbal phrase containing the case marked direct object has a specific aspectual interpretation. The data is repeated in (26).

(26) a. Pekka pes-i hevos-en. (#166)
Pekka.NOM wash-PST.3SG horse-ACC(N)

559 ‘Pekka washed the (whole) horse.’

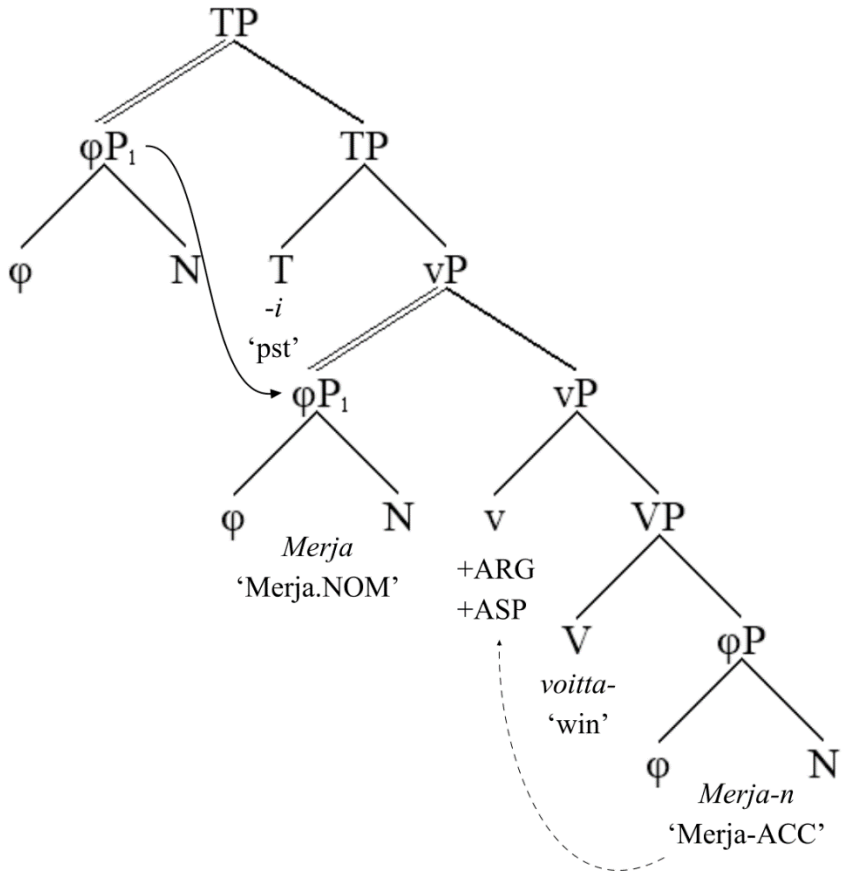
560 b. Pekka pes-i hevos-ta. (#167)

561 Pekka.NOM wash-PST.3SG horse-PAR

562 ‘Pekka washed the horse (but the horse did not necessarily become clear).’

563 Presence of the accusative direct object correlates with an interpretation where the whole
564 horse was washed and washing reached an endpoint; this is not true when the partitive is used.
565 To model these data, it was assumed that the accusative is checked by ASP:BOUNDED that is
566 part of the verb or any verbal head. Aspectually non-telic verbs such as *tönäistä* ‘to nudge’,
567 which accept only the partitive when occurring without further modifiers, do not have
568 ASP:BOUNDED, correctly rendering the accusative ungrammatical in the dataset.[7] If the verb is
569 ambiguous, the feature may be present or absent, which was handled in this study by lexical
570 ambiguity. These assumptions are illustrated by (25), which shows how the algorithm
571 calculates *Pekka voitti Merja-n* ‘Pekka.NOM won Merja-ACC(N)’ (#163). I abbreviate
572 ASP:BOUNDED as +ASP. The aspectual feature +ASP is part of the lexical entry of the verb
573 ‘win’.

574 (27)



575

576 Since the accusative rule requires checking of +ARG and +ASP, the dependency cannot look
577 past any head with +ARG. This causes partial match and intervention. For example, if the
578 accusative occurred together with a non-telic verb, lacking +ASP, the presence of +ARG would
579 terminate the checking mechanism and lead into rejection independently of what happens
580 higher up in the clause (see #171). This captures locality. Furthermore, I have assumed above
581 that the relevant features are part of the small verb v. Case marking of adverbials (Section
582 3.5.5) suggests that both features can be part of V and T; indeed, perhaps all verbal
583 constituents can and do host aspectual features. Finally, when the accusative case form is
584 matched with an aspectually unbounded verbal element, the results file contains an aspect
585 field which reads "Aspectually bounded." It is here then that we record the fact that the model

interpreted the construction as denoting an aspectually bounded event. This information is calculated in the semantic system.

All verb types were successfully tested, both with grammatical and ungrammatical case forms (#163-180), with some examples shown in (28).

(28) a. Pekka pes-i Merja-n/ Merja-a. (#166, 167)
Pekka.NOM wash-PST.3SG Merja-ACC(N) Merja-PAR
(Ambiguous, both interpretations possible.)

b. Pekka tönai-si *Merja-n/ Merja-a (#171, 165)
Pekka.nom push-PST.3SG Merja-ACC(N) Merja-PAR
(Telic reading not possible.)

Achievement verbs such as (29) constitutes a problem, however.

(29) Pekka voitt-i Merja-n/ *Merja-a. (#163, 164)
Pekka beat-PST.3SG Merja-ACC(N) Merja-PAR
'Pekka beat Merja.'

Rule PAR ~ +ARG, −VAL does not refer to aspect and ignores the fact that 'win/beat' must contain a culmination point. The model is unable to rule out partitive direct objects in connection with aspectually bounded events. Sentence (29) with the partitive direct object has a coerced or anomalous reading in which 'an event that occurred in an instant is ongoing'. This should be judged ungrammatical, in my view. There is, however, a second reading analogous to 'Pekka won money', which translates into something like 'Pekka won part of Merja, such as a piece of her hair'. The sentence is grammatical under this interpretation. The problem is how the algorithm could predict what the intended reading is while it is still parsing and does not know what the structure of the sentence is. It seems, moreover, that the difference between *Pekka voitti raha-a/Merja-a* 'Pekka won money-PAR/Merja-PAR' can only

be established once the whole sentence has been parsed and further evaluated in a larger context by accessing knowledge of the world (e.g., what is gold, who is Merja, and so on). I therefore propose that the partitive case checking mechanism is not sensitive to aspect, but the semantic system is. Specifically, when the partitive is connected by an upward path to a lexical item marked for ASP:BOUNDED, the semantic component alerts language-external systems that (29) is possibly aspectually anomalous. This information occurs in the aspect field in the results file which reads "aspectually anomalous." This means that we account for the contrast (29) in the semantic component.

There are two empirical arguments supporting this hypothesis. First, the partitive can occur with an achievement verb if the object is in plural (30).

(30) Pekka voitt-i kilpailu-i-ta.
Pekka.NOM win-PST.3SG competition-PL-PAR
'Pekka won competitions.'

This is interpreted to mean that Pekka won several competitions. The sentence is grammatical. In addition, it is well-known that the aspectual properties of the sentence depend on the properties of the whole VP, not just on the verb, which suggests that at least some aspect computations target the parsed output structure. This motivates further the hypothesis that some aspecutal computations take place in the semantic component that has access to the larger context. See (Kiparsky, 1998) for discussion.[8]

Let us consider polarity and agreement. The accusative constitutes a positive polarity case and is ungrammatical inside a negative polarity context (31).

(31)

a. Pekka e-i voitta-nut *Merja-n/ Merja-a. (#184, 181)
Pekka not-3SG beat-PST.PRTCPL Merja-ACC Merja-PAR

634 ’Pekka did not beat Merja.’

635 b. Pekka ei halun-nut voitta-a *Merja-n/ Merja-a.

636 Pekka not-3SG win-PST.PRTCPL beat-A/INF Merja-ACC Merja-PAR

637 ’Pekka did not want to beat Merja.’

638 They were judged and calculated correctly. The mechanism checks the accusative case against

639 −NEG. The test sentences are #182-195 in the test corpus, probing grammatical and

640 ungrammatical case combinations with and without noncanonical word orders. Few examples

641 are provided in (32).

642 (32) a. *Pekka e-i voitta-nut Merja. (#182, 185)

643 Pekka.NOM not-3SG win-PST.PRTCPL Merja.NOM/ACC(0)

644 b. *Pekka e-i voitta-nut Merja-n. (#183, 184)

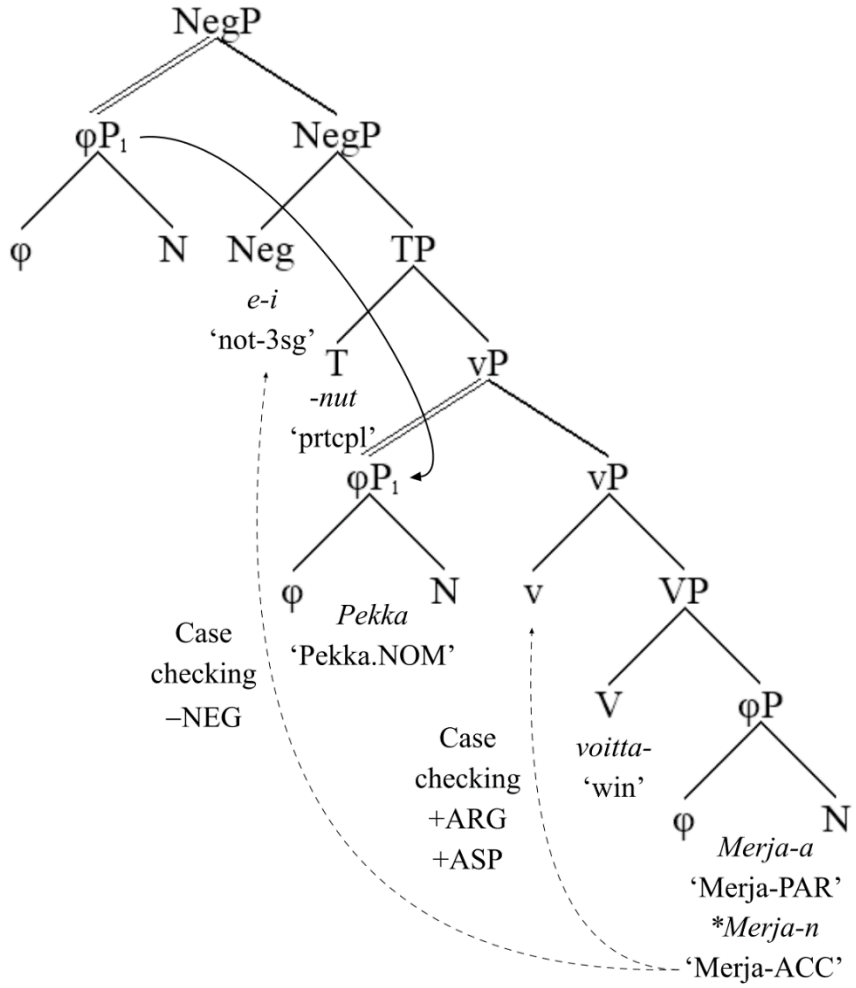
645 Pekka.NOM not-3SG win-PST.PRTCPL Merja-GEN/ACC(N)

646 Crucially, since only −NEG is checked, partial feature match is impossible, and the

647 dependency becomes nonlocal. This is illustrated by (33), which shows the phrase structure

648 analysis and case checking dependencies generated for (32a).

649 (33)



650

651 Aspect (+ASP, +ARG) and polarity (–NEG) are checked separately by v and Neg. Some word
652 order variations, affecting information structure, were also tested (34)([T] = marked topic, [F]
653 = marked new information focus).

654	(34) a.	Merja-a[T]	e-i		voitta-nut	Pekka[F]. (#186)
655		Merja-PAR	not-3SG		win-PST.PRTCPL	Pekka.NOM
656		O	Neg		V	S
657	b.	Merja-a[T]	e-i	Pekka[F]	voitta-nut. (#187)	
658		Merja-PAR	not-3SG	Pekka.NOM	win-PST.PRTCPL	
659		O	Neg	S	V	

c. Pekka[T] e-i Merja-a[T] voitta-nut. (#188)
Pekka.NOM not-3SG Merja-PAR win-PST.PRTCPL
S Neg O V

d. Merja-a[T] Pekka[T] e-i voitta-nut. (#189)
Merja-PAR Pekka.NOM not-3SG win-PST.PRTCPL
O S Neg V

e. Pekka[T] Merja-a[T] e-i voitta-nut. (#190)
Pekka.NOM Merja-PAR not-3SG win-PST.PRTCPL
S O Neg V

I also tested the combination of noncanonical word orders and ungrammatical case forms (#191-194). An alternative hypothesis which assumes that negated events are necessarily aspectually unbounded is discussed in the supplementary (→S5.2.3, pp. 28-29).

Let us consider agreement. The nominative-looking accusative is grammatical if the direct object is not c-commanded by an agreeing predicate, whereas the genitive-looking alternative occurs when there is overt agreement, an analysis that goes back to Timberlake (1975) and Reime (1993). These assumptions cover the following accusative data (#196-212):

(35)

a. Me löys-i-mme avaim-en / *avain.
we.NOM found-PST-1PL key-ACC(N) key.ACC(0)
'We found the key.'

b. Me löydet-tiin *avaim-en / avain.
we.NOM found-PST.IMPASS key-ACC(N) key.ACC(0)
'We found the key.'

c. Pekka tönäis-i *Merja-n / Merja-a / *Merja.

Pekka push-PST.3SG Merja-ACC(N) Merja-PAR Merja.ACC(0)
'Pekka pushed Merja.'

d. Me e-i löydet-ty avain-ta / *avaim-en / *avain.
we.NOM not-3SG find-PST.PRTCPL key-PAR key-ACC(N) key-ACC(0)
'We did not find the key.'

Presence of the specific accusative forms ACC(0) and ACC(N) require that ±PHI is checked. Because these checking relations are based only on one feature, long-distance effects are also captured (#212-229)(36).

(36)

a. Me halut-tiin [voitta-a Merja / *Merja-n.] (#216, 226)
we.NOM want-PST.IMPASS win-A/INF Merja.ACC(0) Merja-ACC(N)
'We wanted to win Merja.'

b. Me halus-i-mme [voitta-a *Merja / Merja-n.] (#227, 218)
we.NOM want-PST-1PL win-A/INF Merja.ACC(0) Merja-ACC(N)

(37) Me e-i haluttu [voitta-a *Merja / *Merja-n / Merja-a.]
We not-3SG want win-A/INF Merja.ACC(0) Merja-ACC(N) Merja-PAR
'We did not want to win Merja.' (#228, 229, 217)

The checking mechanism explores the structure until either one of the relevant features ±NEG/±PHI is encountered or there is no more structure.[9] Uncanonical words orders were also tested (#219-225).

Pronouns, which take an unambiguous *t*-suffix in these contexts, were correctly judged and analyzed. Plural direct objects are assigned the t-accusative forms. These facts are captured in the lexicon: accusative pronouns and plural DPs (*hän-et* 'he-ACC', *auto-t* 'car-

PL.ACC') map into ACC(T) that does not require checking against ±PHI. However, polarity and aspect are still relevant (38).

(38) a. Pekka pes-i hän-et. (#168)
Pekka.NOM wash-PST.3SG he-ACC(T)
'Pekka washed him.'

b. *Pekka tönäis-i hän-et. (#172)
Pekka.NOM push-PST.3SG he-ACC(T)

c. *Pekka e-i voitta-nut hän-et.
Pekka.NOM not-3SG win-PST.PRTCPL he-ACC(T)

d. Me löydet-tiin hän-et.
we.NOM found-PST.IMPASS he-ACC(T)
'We found him.'

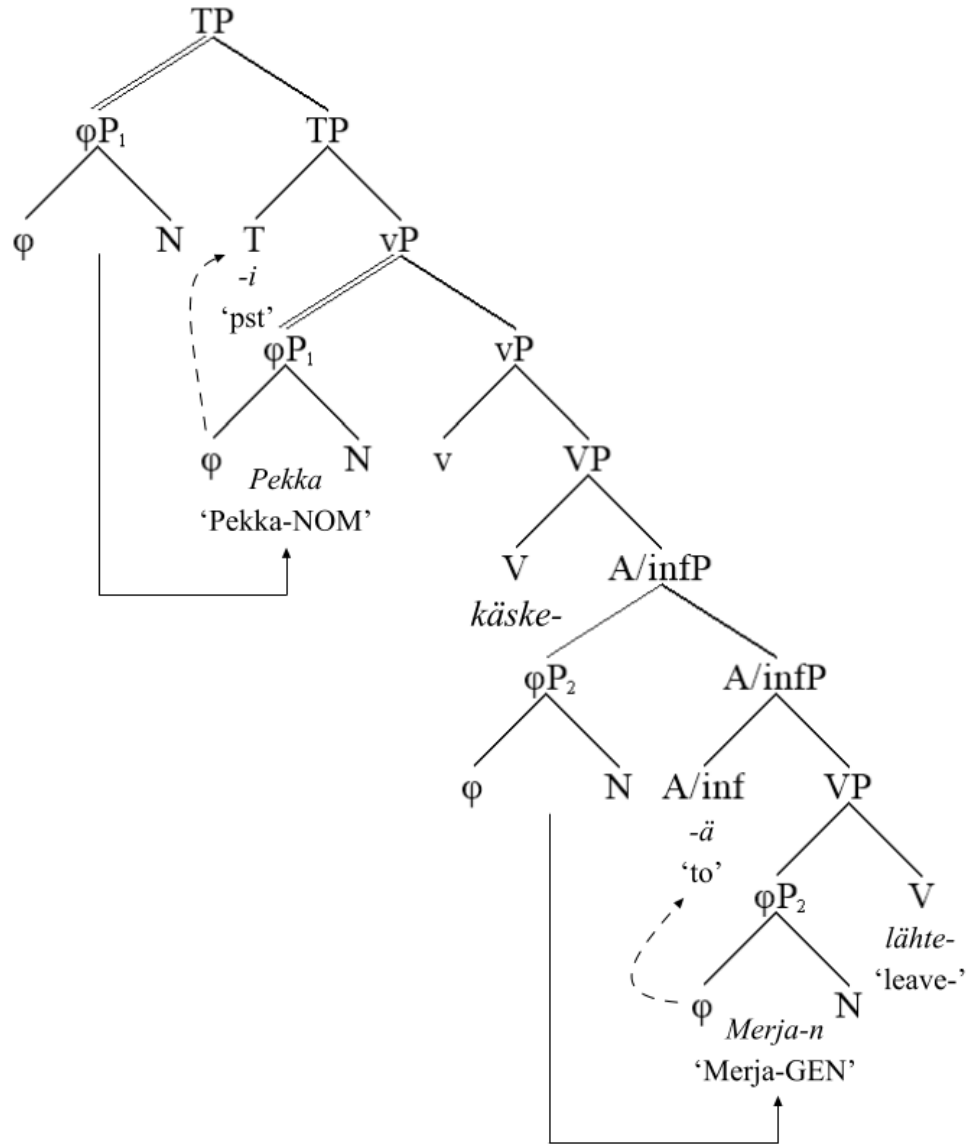
3.5.3 Genitive

Vainikka (1989, 1993, 2011) showed that the Finnish genitive behaves like a default specifier case. This generalization is quite powerful, but incompatible with the analysis proposed here. We derive it by assuming that final case checking is applied after reconstruction. Brattico (2020a) applied this analysis to the A-infinitival (39).

(39) Pekka käsk-i [Merja-n lähte-ä.] (#230)
Pekka.NOM order-PST.3SG Merja-GEN leave-A/INF
'Pekka ordered Merja to leave.'

In that study, the genitive was associated with −FIN that was checked against the infinitival head A/inf *-(t)A-* after the argument reconstructed to SpecVP. Rule GEN ~ +ARG, −FIN calculates essentially the same output.

(40)



The preverbal subject is reconstructed to SpecvP, where it checks the nominative, while the infinitival subject reconstructs to SpecVP inside the infinitival where it receives its thematic role. The genitive is checked against the A/inf head. The relevant test sentences are #230-242, which cover grammatical and ungrammatical case forms together with noncanonical word orders. Some of these sentences are illustrated in (41).

(41) a. Pekka sano-i Merja-n lähte-vän. (#231)
Pekka.NOM say-PST.3SG Merja-GEN leave-VA/INF

739 ’Pekka said that Merja would leave.’

740 b. *Pekka käsk-i Merja/Merja-a lähte-ä. (#235, 236)

741 Pekka.NOM order-PST-3SG Merja.NOM/Merja-PAR leave-A/INF

742 c. *Pekka käsk-i Merja-n lähte-ä.

743 Pekka.NOM order-PST.3SG Merja-ACC(N) leave-A/INF

744 The assumption that the genitive subject reconstructs into VP is not ad hoc: it links the
745 argument with a thematic role.

746 The Finnish modal construction (42) seems at first to violate the rule GEN ~ −FIN, +ARG.
747 The genitive is in the subject position of the finite modal verb, which cannot, by the analysis
748 proposed here, check it. Finite verbs can only check the nominative case.

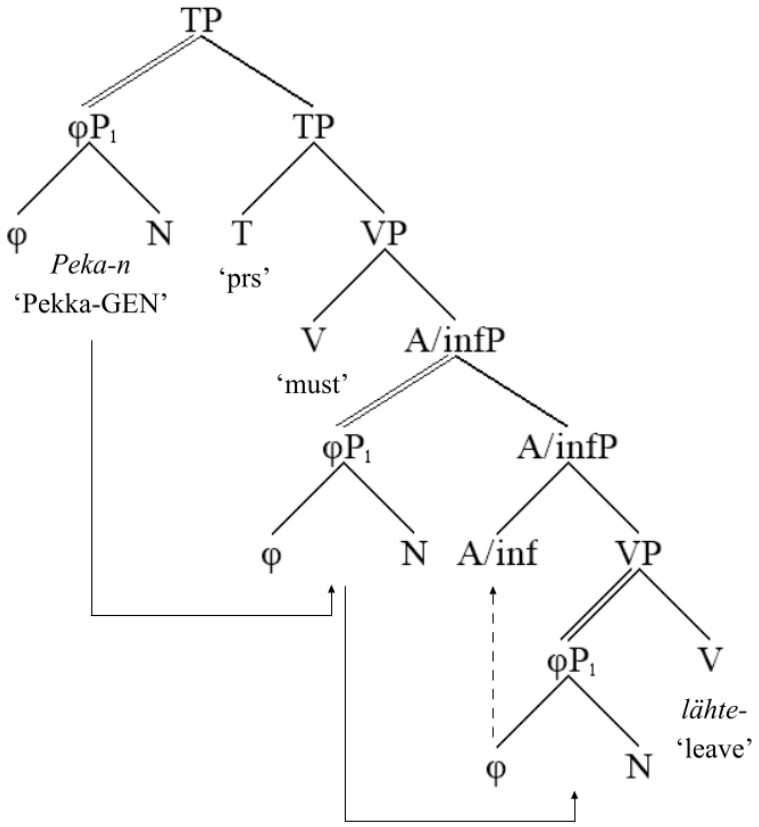
749 (42) Peka-n täyty-y lähte-ä. (#232)

750 Pekka-GEN must-PRS.0 leave-A/INF

751 ‘Pekka must leave.’

752 The model judges these sentences correctly as grammatical and returns (44). The genitive
753 argument is reconstructed successively-cyclically (→S5.8) to the SpecVP inside the A-
754 infinitival, where it checks the genitive at the lowest position of the three-member chain.

(43)



This structure cannot be judged outright implausible, since the genitive subject is the thematic subject of the infinitival ('who is leaving') and the construction is monoclausal, sustaining thematic positions for one standard set of arguments and adverbials. The meaning is approximately 'must: Merja to leave'. The A-infinitival clause appears in the analysis (44) because the complement of the modal verb is morphologically an A-infinitival *lähte-ä* 'leave-A/INF'.

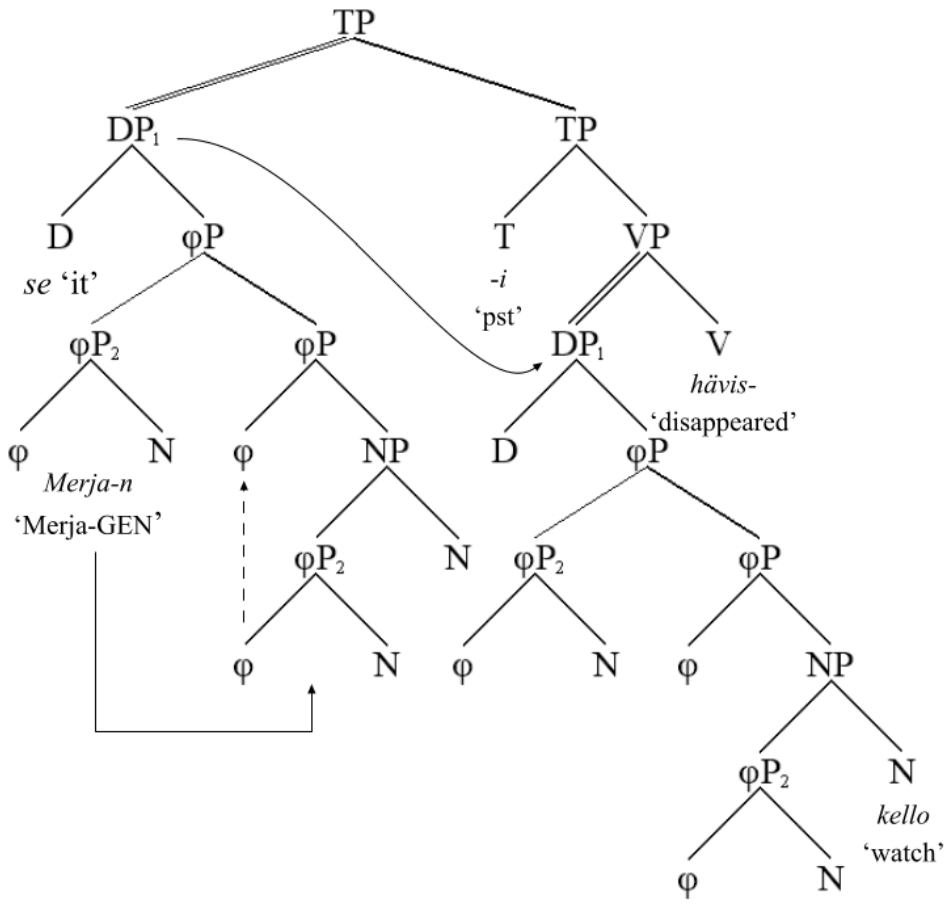
3.5.4 Noun phrase

The genitive has also a possessive role (44).

(44) Peka-n avain
Pekka-GEN key
'Pekka's key'

This construction violates the GEN ~ –FIN, +ARG rule since the genitive is not governed locally with an infinitival head. In fact, there appears to no governing head. One solution is to assume that the Finnish noun head decomposes into '*n* + root' structure (Brattico, 2005; Brattico & Leinonen, 2009; Pylkkänen, 2002) and that the genitive is checked against *n* (*n* = nominalizer, as in *juokse-minen* 'run-ing', possibly a zero morpheme). Another possibility is that the genitive case is checked against φ that is part of all noun phrases, as suggested earlier. I assumed the latter in this study. The algorithm calculates (45) for the input sentence *se Merja-n kello hävisi* 'the/that Merja-GEN watch disappeared' (#243, variations 244-250).

(45)



The essence of this analysis is that the possessor *Merja-n* 'Merja-GEN' reconstructs to NP, where it checks the genitive case against φ.

Adpositions were tested both with grammatical and ungrammatical case configurations. The basic cases are (46a-b), where the argument occurs either in the complement position of the adposition (46a) or its specifier position (46b).

(46) a. lähellä Pekka-a. (#125)
near Pekka-PAR
'near Pekka'

b. Peka-n lähellä. (#127)
Pekka.GEN near
'near Pekka'

The model reconstructs the genitive argument in (46b) to CompPP, where the preposition checks its case. It looks contradictory that the preposition checks both the partitive and genitive, but on closer inspection we find that two lexical items are at stake. First, the adposition assigning the genitive exhibits overt phi-agreement, while the adposition assigning the partitive does not:

(47) a. *lähellä-ni minu-a/ b. minun lähellä-ni.
near-PX/1SG I-PAR I.GEN near-PX/1SG
'near me' 'near me'

Example (47a) follows directly from the partitive rule PAR ~ +AGR, −VAL. Second, the agreeing form requires that the genitive argument occurs at its specifier position (48a); this is not true of the non-agreeing form (48b).

(48) a. minu-n lähellä/ *lähellä minu-n. (#138)
I-GEN near near I-GEN
'near me'

b. minua lähellä/ lähellä minua (#126, 125)
I.PAR near near I.PAR
'near me' 'near me'

This means that the agreeing adposition must have an additional EPP requirement forcing the genitive argument to SpecPP. In sum, adpositions checking the genitive case have the agreement/EPP profile, while adpositions checking the partitive do not. Ungrammatical case configurations were tested by #128-138.

One feature that complicates the analysis of the Finnish noun phrase is the behavior of numerals. Finnish cardinal numerals fall into two paradigms. The first contains bare singular numerals that assign the partitive inside the hosting noun phrase. These facts follow if these numerals have +ARG and −VAL. The model calculates (49)(#144, variations 145-149).

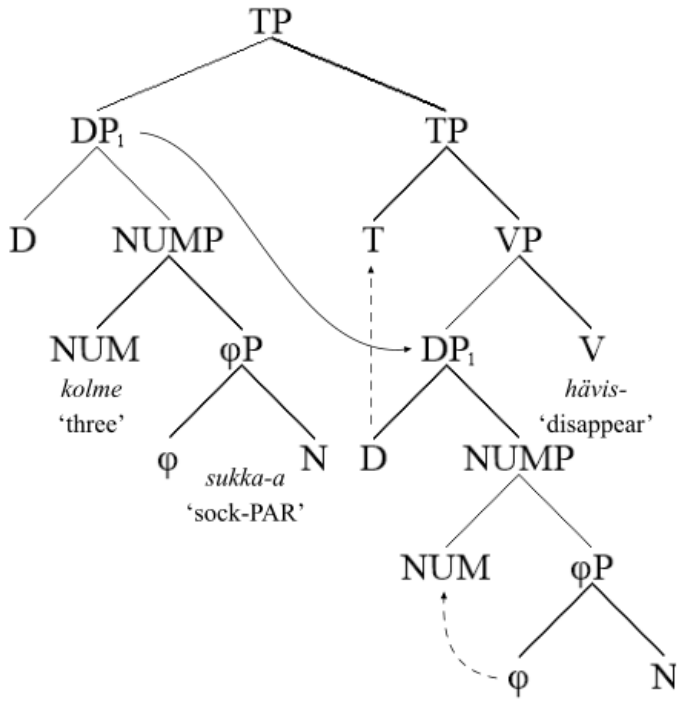
(49) kaksi sukka-a
two.0 sock.SG-PAR
'two socks'

Numerals in the second group inflect like adjectives (or are adjectives) and do not assign cases to the elements inside their syntactic scope (50) (#145).

(50) [Ne kahde-t suka-t/ *sukka-a] hävis-i-vät.
those.NOM two-PL.NOM sock-PL.NOM sock-SG.PAR disappear-PST-3PL
'Those two pairs of socks (=4 socks) disappeared.'

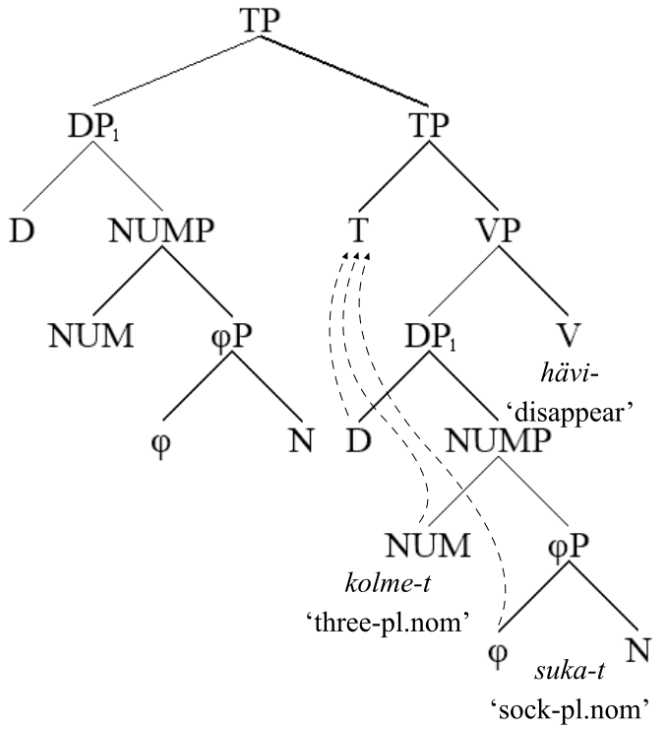
If these numerals do not have +ARG, then case checking ignores them and finds the relevant assigners from the main clause (e.g., T, v)(#144-147). These properties were correctly derived. Example (52) illustrates the first group, (53) the second.

825 (51)



826

827 (52)



828

829 The distinction between case concord and case assignment disappears: all nominal words

830 check their case features independently. What has made the behavior of the numerals subject

to some debate is the fact that the numerals in the first group only occur in contexts where the hosting DP is assigned either the nominative or the accusative case. If the DP is assigned either the genitive or any of the lexico-semantic cases, the numeral-partitive pattern disappears (53).

(53)

a. Pekka sanoi [kahde-n suka-n häviä-vän.] (#148)
Pekka said two.SG-GEN sock.SG-GEN disappear-VA/INF
'Pekka said that the two socks will disappar.'

b. *Pekka sanoi [kaksi sukka-a häviä-vän.] (#158)
Pekka said two.0 sock-PAR disappear-VA/INF

Brattico (2010, 2011), following a tradition in the Slavic linguistics that exhibits somewhat similar phenomenon (e.g., Babby, 1987), analyzed this pattern by relying on case competition. The "weak cases" accusative and nominative are outperformed by the "strong cases" genitive and the lexico-semantic cases. A case competition analysis for Finnish structural case assignment was also presented by Nelson (1998). However, these data follow if we assume that the bare numerals are not caseless but exhibit an ambiguous NOM/ACC case form. This prevents them from appearing in any other context and derives (53) and correctly rules out constructions where the case forms are wrong (#148-153, 257-260). Ungrammatical word orders (54) are also correctly ruled out, with the exception of (54)d that the model wrongly accepts. I was not able to solve the root problem with (d). The analysis predicts a phantom reconstruction (→S5.5.3).

(54) a. *Sukka-a_1 ne kaksi $\__1$ hävisi. (#160)
sock-PAR those two disappeared

b. *Kaksi$_1$ ne $\__1$ sukka-a hävisi. (#161)

two those sock-PAR disappeared

c. *[Kaksi sukka-a]$_1$ ne _$_1$ hävisi. (#162)

two sock-PAR those disappeared

d. *Ne sukka-a$_1$ kaksi _$_1$ hävisi. (#162, wrongly accepted)

those sock-PAR two disappeared

3.5.5 Special constructions

Some special constructions that have played a major role in Finnish case theories were added to the dataset. The impersonal passive construction, shown again in (55a), is one.

(55)

a. Me löydet-tiin avain/ *avaim-en.

we.NOM found-PST.IMPASS key.ACC(0) key-ACC(N)

'We found the key.'

b. Me löys-i-mme *avain/ avaim-en.

we.NOM found-PST-1PL key.ACC(0) key-ACC(N)

'We found the key.'

This effect is captured by the rule which associates the two accusative forms with phi-agreement (±PHI). The impersonal passive form (*löydet-tiin* 'found-PST.IMPASS') is created by a special impersonal functional head replacing standard v, following the analysis of (Manninen & Nelson, 2004). If the first-person plural subject is suppressed, the model accepts the sentence with a plural generic meaning (56). This agrees with the fact that the implicit agent of the Finnish impersonal prototypically represents a collective (perhaps plural) sentient agent.

(56)

a. Löydet-tiin avain.

find.PST.IMPASS key.ACC(0)

‘A key was found (by a collection of people).’

b. Avain löydet-tiin.

key.ACC(0) found-PST.IMPASS

‘The key was found (by a collection of people).’

The test sentences are #260-265 in the test materials.

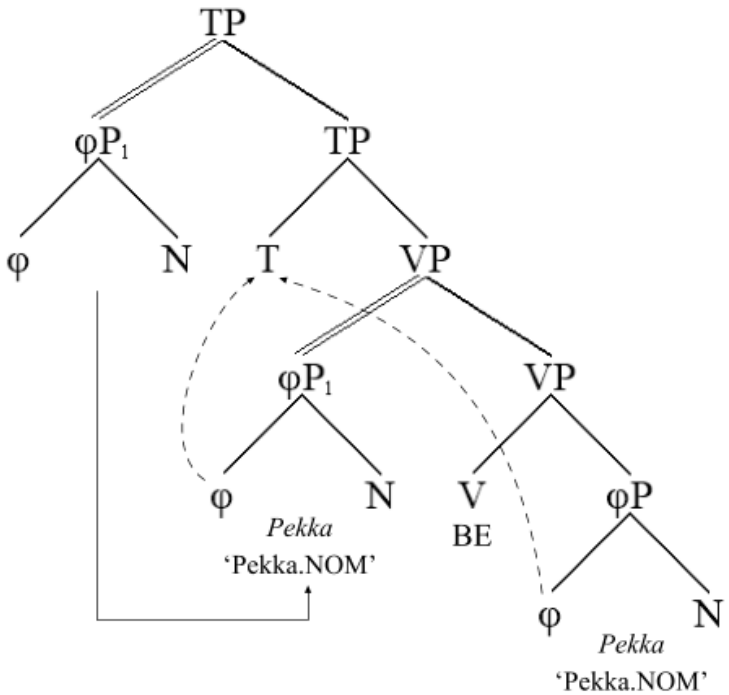
Copular constructions (57) were correctly judged as grammatical and calculated as (59).

(57) Pekka o-n Pekka.

Pekka.NOM be-PRS.3SG Pekka.NOM

‘Pekka is Pekka.’

(58)



The grammatical subject reconstructs to SpecVP, the direct object remains in situ. Both check their nominative cases by T because the copula does not, by assumption, intervene in case

checking, leading into nonlocal case checking. The test sentences are #271-280. Copular and predicative constructions have complex and controversial properties and were not examined systematically in this study.

Finnish has one possible raising construction (59a), which should be compared to the non-raising variant (59b).

(59) a. Merja$_1$ näyttä-ä __$_1$ lähte-vän.
Merja.NOM seem-PRS.3SG leave-VA/INF
'Merja seems to be leaving,

b. Pekka näk-i Merja-n lähte-vän.
Pekka.NOM see-PST.3SG Merja-GEN leave-VA/INF
'Pekka saw Merja leaving.'

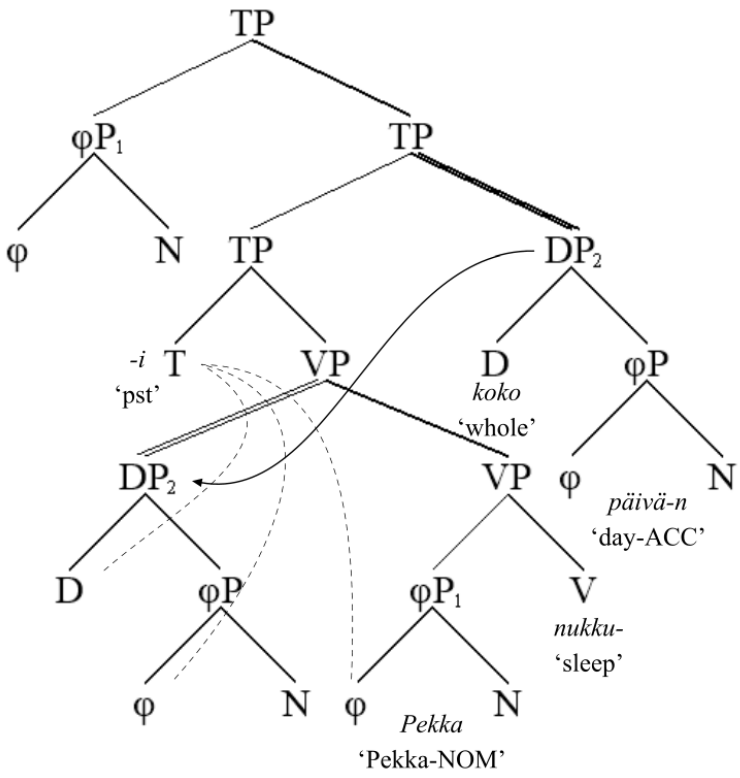
The model cannot reconstruct the preverbal subject to the infinitival clause SpecVP because it cannot check the nominative at that position. The position is associated with the genitive (59b). If we assume that 'seem' projects a thematic role, then the subject stops at its specifier position and the thematic agent for 'leave' will be determined by control, effectively making (59) an obligatory control (OC) construction and not a raising structure. Although the existence of this derivation makes the model observationally adequate (#266-270), I judge that the analysis is not obviously correct and an anonymous *SL* reviewer concurs. The model does not allow an argument to change its case during reconstruction, which prevents it from reconstructing a nominative marked argument (59a) into a genitive position (59b). This is impossible since the model uses case forms to guide reconstruction; it cannot change them during parsing. The issue was left for future research (→S5.8).

Finnish DP-adverbials can be marked with direct object cases (60)(Maling, 1993).

(60) Pekka nukku-i [koko päivä-n.] (#281)
Pekka.NOM sleep-PST.3SG all day-N/ACC
'Pekka slept all day.'

Adverbial case marking follows from the proposed analytic principles because the relevant lexical features occur inside the upward paths generated from the adverbs. Example (60) shows that the accusative case occurs in connection with intransitive verbs, communicating that the event has a fixed duration. The aspectual feature could be at T or V. If it is at T, then the model calculates (61).

(61)



The adverbial is reconstructed to SpecVP where it checks the accusative case against T. The aspectual feature is at T, corresponding to the telic interpretation. If neither T nor V has the aspectual feature, the sentence is judged ungrammatical. Similarly, the accusative is ungrammatical if the clause is negated, grammatical if the adverbial is in the partitive (62a).

Also the zero-accusative is correctly licensed (62b). These forms are correctly checked against properties of T and Neg, both which appear inside the upward path from the reconstructed adverbial. Notice that no contradiction results if T checks both the nominative and accusative case: case checking is based on features, not functional heads.

(62)

a. Pekka e-i nukku-nut *koko päivä-n / koko päivä-ä.
   Pekka not-3SG sleep-PST.PRTCPL all day-ACC(N) all day-PAR
   'Pekka did not sleep all day.'

b. Me nukut-tiin koko päivä / ??koko päivän.
   we slept-PST.IMPASS all day.ACC(0) all day-ACC(N)
   'We slept all day.'

The analysis succeeds in deriving the relevant pattern (#281-292) with the exception of **Pekka nukkui koko päivä-ä* 'Pekka.NOM slept all day-PAR' (#293) which the model judges wrongly as grammatical. I do not know at present how to solve this issue (→S5.10). Furthermore, the accusative object in (62b) is regarded as ungrammatical in the underlying test corpus, based on my own grammaticality judgment, although this variant is sometimes used (see Anttila & Kim, 2017).[10]

Finnish VP-fronting raises nontrivial questions. This matter came up in the present study because some of the word order permutations give rise to a possible VP-fronting analyses. Since verb-initial clauses are ungrammatical in Finnish (e.g., #24-29), this phenomenon is limited to sentences that contain fronted infinitivals. Example (63) shows one.

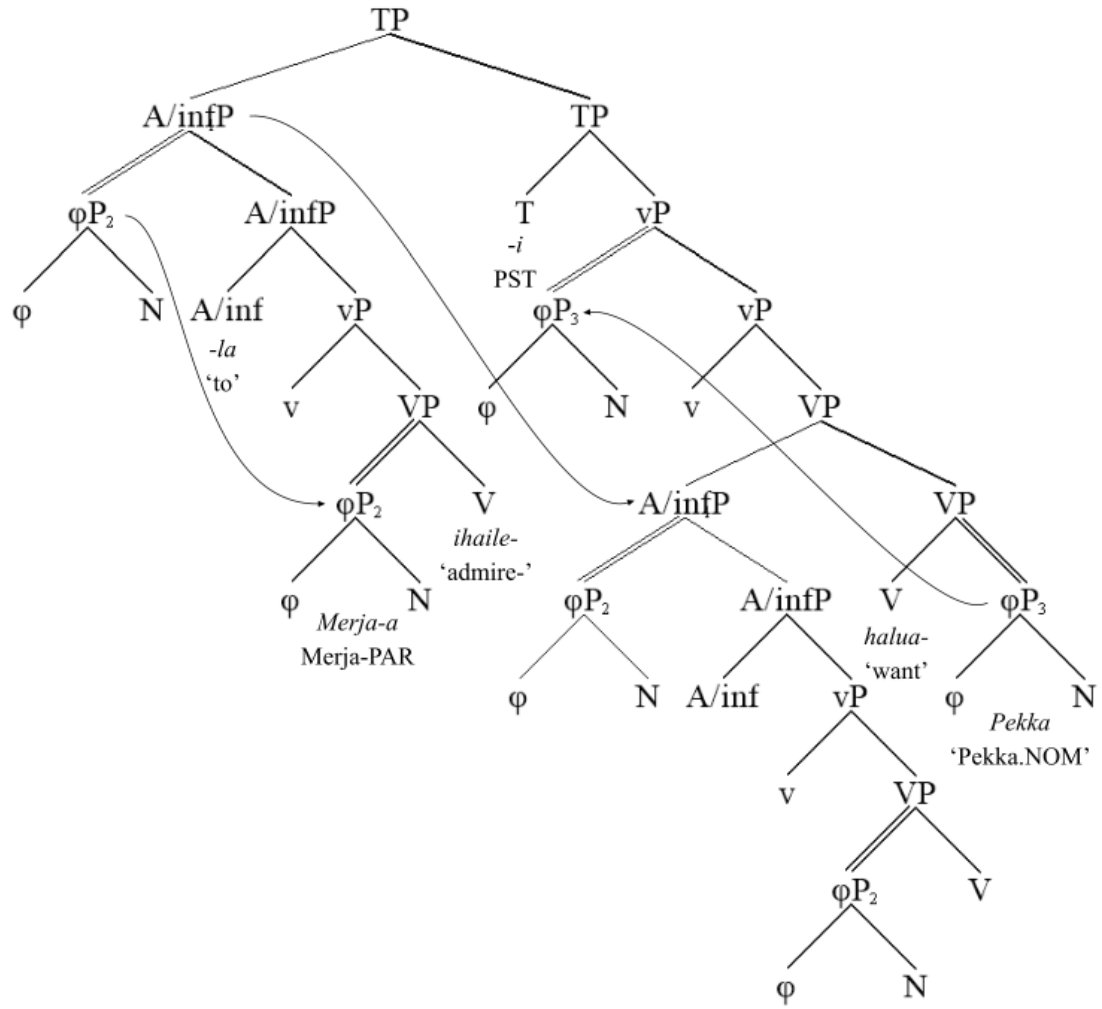
(63) $[_{A/infP}$ ihail-la Merja-a$]_1$ halus-i $\_\__1$ Pekka. (#21)
   admire-A/INF Merja-PAR want-PST.3SG Pekka.NOM
   'To admire Merja, Pekka wanted.'

To me (63) is grammatical, and was marked as such in the test corpus, but does not seem to have any use in communication. The fronted infinitival does not have a clear topic reading. It seems to function as an idle EPP filler. The model analyses sentences like this by reconstructing the A-infinitival from the preverbal subject position into the complement position of ‘want’, and furthermore by reconstructing the postverbal grammatical subject to SpecvP. Several variations were tested. Example (64) contains few examples (I ignore reconstruction of the grammatical subject).

(64) a.	[Merja-a$_1$	ihail-la __$_1$]$_2$	halus-i	__$_2$	Pekka. (#20)
	Merja-PAR	admire-A/INF	want-PST.3SG		Pekka.NOM
	o	v	V		S
b.	Pekka	[Merja-a$_1$	ihail-la __$_1$]$_2$	halus-i	__$_2$. (#22)
	Pekka.NOM	Merja-PAR	admire-A/INF	want-PST.3SG	
	S	o	v	V	
c.	[Merja-a$_1$	ihail-la __$_1$]$_2$	Pekka	halus-i	__$_2$. (#30)
	Merja-PAR	admire-A/INF	Pekka.NOM	want-PST.3SG	
	o	v	S	V	

A calculated full analysis of (64a) is shown in (65). This shows how both the grammatical subject and the fronted infinitival were reconstructed into correct thematic positions.

(65)



Since fronted infinitivals do not elicit clear topic interpretations, the model was designed so that they were excluded from calculations involving information structure. This is the reason they do not appear in the marked topic and marked focus fields in the output.

4 Conclusions

Finnish structural case assignment was explored by developing a formal model that judges and analyses sentences involving the nominative, partitive, accusative (three forms) and the genitive cases. The model was observationally and descriptively adequate over a representative test corpus. Some remaining problems were noted.

The proposal in a nutshell is that morphological case forms are linked with a notion of syntactic scope defined by the upward path mechanism. If the surface position of the element does not satisfy its case requirements, reconstruction is attempted. Both abstract Case and case concord were eliminated. No binary distinction was made between syntactic and semantic cases; indeed, in Finnish some case forms such as the accusative exhibit a mixed profile, responding to both syntactic and semantic features. Locality properties were captured by relying on relativized feature intervention.

Overt case forms guide reconstruction. Detection of a case checking violation causes the system to seek alternative positions where case checking succeeds. This allows the system to survive a limited amount of word order perturbations that it uses to communicate information structural notions such a topic and focus. In some cases argument dislocation can grammaticalize, leading into the specifier case marking pattern first documented for Finnish by Vainikka (1989). The Finnish genitive, in particular, behaves in this way. It was assumed, contra Vainikka, that the surface position is not where case checking takes place; rather, checking is applied at the reconstruction site. In languages with little or no overt case forms, such as English, the link between word order and thematic interpretation freezes.

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Conflicts of interest

No conflicts of interest

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[1] Abbreviations: 0 = no agreement or the default agreement; 1, 2, 3 = first, second and third person; ACC = accusative case, any form; ACC(0) = zero accusative, homophonous with the nominative in singular; ACC(N) = n-accusative, homophonous with the genitive in singular; ACC(T) = the t-accusative (assigned for pronoun and plural direct objects); A/INF = A-infinitival (corresponding loosely to the English *to*-infinitival); ±ARG = case assigner (also "predicate"); CAU = causative morpheme/head; GEN = genitive; MALLA = MALLA-infinitival (i.e. one particular MA-infinitival, such as *juokse-malla* 'by running'); NEG = negation; NOM = nominative; IMPASS = impersonal passive; O/o = object of the main clause/embedded infinitival clause; PAR = partitive; PL = plural; PRS = present tense; PRTCPL = participle; PST = past tense; S/s = subject of the main clause/embedded infinitival clause; SG = singular; V/v = verb of the main clause/embedded infinitival clause; VA/INF = VA-infinitival (a 'propositional' complement clause); ±VAL = licenses overt agreement.

[2] Theories of case can rely on assignment or checking. Case assignment is an operation where one element determines the case form of the other. Case checking, on the other hand, verifies elements for compatibility. For most purposes assignment and checking are interchangeable. Case checking is perhaps the more natural choice for recognition grammars, and even more so when case forms are used for reconstruction purposes, as is the case here.

[3] Sentence (a) is part of written Finnish, (b) colloquial language. The Institute for the Languages of Finland writes that (b) is "frequently used" but not "recommended" due to its colloquial character (http://www.kielitoimistonohjepankki.fi/ohje/345, retrieved 4. 8. 2020). Use of the standard from in colloquial speech feels hypercorrect, whereas the use of the impersonal form in standard written Finnish is (still) "not recommended" but not grammatically offensive either, not to me at least.

[4] An anonymous *SL* reviewer pointed out that the sentence *Pekka on Peka-n* 'Pekka.NOM is Pekka-GEN' (#274) is wrongly marked as ungrammatical in the test corpus and has a reading 'Pekka owns/possesses Pekka'. The reason it was marked ungrammatical is because the intended reading is the identity statement 'Pekka is Pekka'. If we assume that 'Pekka owns/possesses Pekka' involves the same (feature-wise identical) copular verb used in identity statements, then this specimen must be added to the list of problems. Predicative copular sentences were not tested systematically in this study, however.

[5] Referential arguments are represented as φPs, which are regarded as minimal elements able to sustain referential interpretation. φ is a grammatical head that contains phi-features (number, person) triggering reference management computations inside the semantic component. This system is used in the background theory because Finnish lacks grammaticalized articles. If the input contains D-elements, such as articles or demonstrative pronouns, a full DP is projected and is visible in the output (→S5.6).

[6] I have not been able to accomplish complete unification between DP and PP reconstruction, but since this work is not focused on semantic cases, I leave the details to the supplementary document (→S6.1).

[7] A telic reading is possible if a further modifier is added to the VP, as in *Pekka tönäisi naise-n päin seinää* 'Pekka pushed/nudged woman-ACC(N) against wall'. It is a general feature of Finnish that the aspectual properties of the sentence depend on the VP as a whole. "Readings" were implemented in this study by relying on lexical ambiguity, but this cannot be the whole explanation (→S5.2.1).

[8] One alternative hypothesis is to assume that ASP carries no specific aspectual interpretation; rather, it represents a more general verbal-aspectual feature that licenses the accusative and only biases the interpretations towards telic readings. Whether the event is interpreted as bounded or not is created in the semantic component by synthesizing information from multiple sources. This change has no impact on the formal case checking mechanism.

[9] The current rules allow polarity and agreement-based accusative rules to penetrate finite clause boundaries, which is not correct. Agreement in the main clause cannot determine direct object forms inside finite embedded clauses. This could be handled by stipulating the restriction to the upward path mechanism, positing the relevant polarity and agreement features to the finite clause boundary, or by relying on the phase theory (Chomsky, 2000, 2001) which generates locality domains, CP among them. I excluded this issue from the present study, however, because as a matter of fact the negation effect *does* penetrate the finite clause boundary. One example is *Pekka ei uskonut että Merja voittaa kilpailu-a/kilpailu-n* 'Pekka not believe that Merja wins competition-PAR/competition-ACC', where the

negation in the main clause licenses the partitive inside the embedded finite clause. This makes the issue very nontrivial.

[10] I had marked sentences of this type as ungrammatical in the original test corpus, but an anonymous reviewer pointed out that also the n-accusative could also be used (for me, that option is ungrammatical or extremely marginal). If so, then this data falls under the category of labile case constructions (excluded here).