CASE MARKING AND LANGUAGE COMPREHENSION: A PERSPECTIVE FROM FINNISH

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Abstract. This article presents a fully computational parsing-oriented theory of nominal case that correctly judges and analyses most structural case assignment patterns in Finnish, a language known for complex case marking. It is assumed that languages with relatively free word order rely on case marking in communicating thematic roles and articulating information structure, and that overt case suffixes guide argument reconstruction (i.e. creation of inverse argument chains) during real-time language comprehension. Moreover, it is argued that abstract Case plays no role in the human language faculty; only morphological case does. The theory is tested computationally with a large sample of case constructions.

Keywords: Structural case; case assignment; Finnish; computational linguistic; language comprehension

1 Introduction

Most theoretical linguists work within a methodological framework that separates knowledge of language from its use, a distinction explicitly endorsed by Chomsky (1965) but tacitly assumed since the birth of first descriptive grammars. The distinction is to a certain extend unavoidable: any description of language use or real-time language processing presupposes some notion of what the basic grammatical categories, rules and regularities of the said language are. On the other hand, the manner in which competence and performance enter into an explanation of any given linguistic phenomena can only be decided by an empirical inquiry, not by philosophical or methodological prejudice.

Consider a situation in which a listener is processing some linguistic sensory input. Although many linguistic and extralinguistic cues support language comprehension, all that is strictly speaking necessary for the listener to succeed in this task in a typical scenario is contained in the sensory object itself. This perspective offers a unique view from which to analyze linguistic phenomena. Consider, for example, the following noncanonical OVS sentence in Finnish:[1]

(1)	Merja-a	ihaile-e	Pekka.
	Merja-PAR	admire-3SG	Pekka.NOM
	'Pekka admires Merja.' (literal meaning)		

Hearing or reading this sentence out of the blue, the only way a hearer can infer who did what to whom is by relying on overt case forms, the nominative and partitive in this case. The third person agreement form on the finite verb is compatible with both the grammatical subject and the direct object, and if anything the word order would mislead one into thinking that Pekka constitutes the object of the verb (Finnish is a canonical SVO language). But this is not the correct interpretation. Overt case forms tell the hearer that the positions of the subject and the object have been reversed, and that they must be reconstructed in some manner in order to

[1] Leipzig glossing conventions will be throughout. Special abbreviations: 0/ACC = zero accusative; ACC = accusative (any of the three forms); A/INF = A-infinitival, loosely corresponding to English to-infinitival; N/ACC = n-accusative; T/ACC = t-accusative; VA/INF = VA-infinitival, a 'propositional' infinitival complement clause that resembles in many of its semantic (but not syntactic) properties finite complement clauses.

infer the thematic roles. Thus, the actual overt case forms constitute a substantial part of the concrete sensory object from which the language comprehension system, which is part of the human language faculty, must recover the underlying proposition. Indeed, there is experimental evidence that Finnish speakers use case information in real-time language comprehension (Hyönä & Hujanen, 1997). This observation is not limited to Finnish.[2] The reason I bring this matter up is because we do not know *a priori* whether this 'comprehension function' of case, not an insignificant factor, is irrelevant or relevant to its ultimate linguistic explanation. I argue in this article that it is relevant.

This perspective is not completely novel. In a recent computational study, Brattico (2020) developed an algorithm for processing finite clauses in Finnish in an attempt to capture its free word order property (e.g., (1)) by a formal language comprehension model.[3] The algorithm, written in Python and tested with 119800 unique word orders in Finnish, relies on overt morphological case forms for argument reconstruction. For example, when processing a

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[2] (e.g., Avetisyan, Lago, & Vasishth, 2020; Bayer, Bader, & Meng, 2001; Bornkessel, McElree, Schlesewsky, & Friederici, 2004; Bornkessel & Schlesewsky, 2006; Chow, Nevins, & Carreiras, 2018; Frisch & Schlesewsky, 2005; Henry, Hopp, & Jackson, 2017; Kamide, Altmann, & Haywood, 2003; Kamide, Scheepers, & Altmann, 2003; Knoeferle, Crocker, Scheepers, & Pickering, 2005; Kröger, Maquate, & Knoeferle, 2017; Lamers, Jansma, Hammer, & Münte, 2006; Nimchinsky et al., 1999; Traxler & Pickering, 1996; Trueswell, Tanenhaus, & Kello, 1993).

[3] Finnish "free word order" property is sometimes referred to as discourse-configurationality due to the fact that in this language word order can articulate information structural notions such as topic and focus (Vilkuna, 1995). The distinction is important but not relevant for the argument I will make in this article.

noncanonical OVS sentence (1), the algorithm detects a mismatch between the surface positions of the arguments and their overt morphological case features and reconstructs them into canonical positions before the sentence is interpreted semantically. This is, therefore, an example of a comprehension-based approach to case marking that is not necessarily linguistically irrelevant, as it connects the free word order signature of Finnish formally to its rich case marking. Yet, the analysis only included few case constructions and, as I will show in detail in Section 2.2, is insufficient and makes wrong predictions on a number of situations. I will argue however that when generalized and modified, an analysis of this type can cover almost all structural case assignment patterns in this language by a simple and elegant system, hence supporting the notion that linguistic theorizing could benefit from taking language comprehension into account.

The article is organized in the following way. Section 2 elucidates the properties of the word order algorithm proposed by Brattico (2020) which serves as my starting point, and then shows that it remains unsuccessful in accounting for case assignment more generally. Section 3 proposes a solution, a general parsing-oriented case licensing mechanism that is tested in Section 4 by computational simulation against the virtually complete structural case assignment paradigm of Finnish together with several special constructions (e.g., impersonal passives, psych-verb constructions, numerals, copular sentences and raising constructions). Moreover, the analysis is successfully applied both to nonlocal case assignement and case assignment to DP-adverbials. I show that the resulting theory is both simple and elegant. Section 5 contains the conclusions.

2 Comprehension and case assignment

2.1 Linear phase comprehension algorithm

Brattico (2019a, 2020) developed a formal, algorithmic “linear phase” comprehension model that processes sentences from sensory inputs into abstract semantic representations. The model uses morphological case for argument reconstruction when processing Finnish sentences. I will introduce the model and then show why it is insufficient to account for case marking more generally. Theoretically the algorithm is based on left-to-right minimalism (Chesi, 2004, 2012; Phillips, 1996, 2003) and the dynamic syntax framework (Cann, Kempson, & Marten, 2005; Kempson, Meyer-Viol, & Gabbay, 2001), with much of its general orientation following minimalism (Chomsky, 2008; Chomsky, Gallego, & Ott, 2019). The algorithm was written in Python and is available in public domain.

The algorithm, summarized in Figure 4 below, works by consuming a linear sequence of phonological words (A, Fig. 4) which it matches with lexical entries in a surface vocabulary by performing lexical retrieval, decomposition and morphological analysis (B), then creates a set of first-pass parse binary bare phrase structure objects (C) that it maps into LF-interface representations (D) by creating inverse chains. If no legitimate solution emerges, the input is judged ungrammatical. Semantic interpretation (E) is generated on the basis of the output of the LF-interface objects. The tool comes with a script that automatizes the processing of large sets of test sentences.

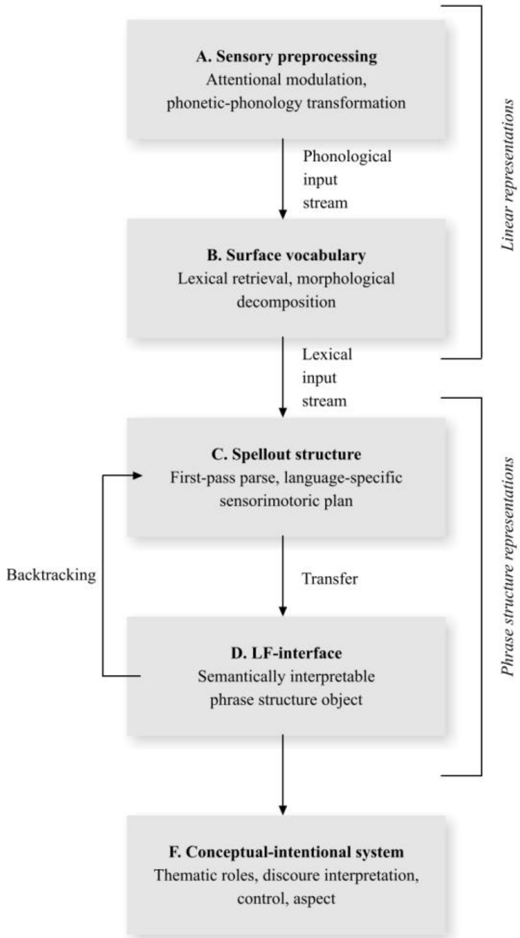
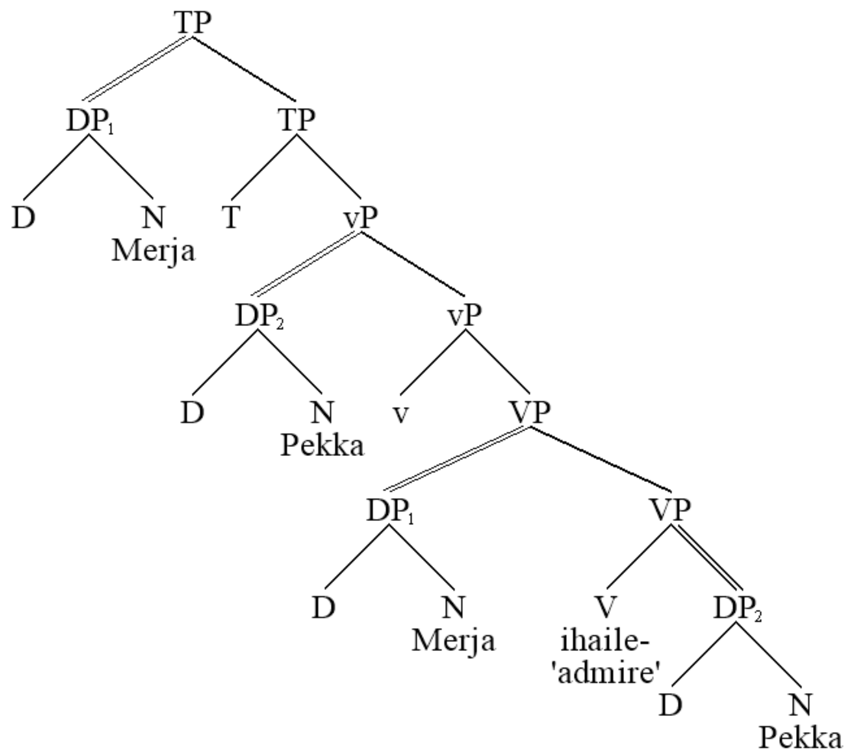


Figure 5. The processing pipeline of the language comprehension model in (Brattico, 2019a, 2020). See the main text for explanation.

The model incorporates a system for extracting and processing case information from the input. It associates overt phonological case suffixes in the input (Component A, Fig. 4) with syntactic case features that are embedded inside lexical items. The Finnish partitive suffix -*(t)A*, for example, is mapped into a partitive feature [PAR] 'partitive'. Syntactic case features are then linked with canonical syntactic positions, which the algorithm uses to reconstruct arguments (during *Transfer*, Fig. 4). If a thematic argument with the partitive suffix occurs in a noncanonical position, as in (1), the algorithm reconstructs it to the direct object position by using case as a guide. The LF-interface (D, Fig. 4) output generated by the algorithm for (1) is (2).

(2)



Let us take a note of few prominent properties of the above phrase structure and what the algorithm has done here. The partitive-marked thematic argument *Merja-a* ‘Merja-a’ is initially parsed to the SpecTP, where it is in the spellout structure (C, Fig. 4), and is reconstructed to SpecVP by using morphological case feature *-a* ~ [PAR] as a guide. By saying that the morphological case and the corresponding lexical feature are used as a “guide,” what I mean is that the formal operation that reconstructs the argument uses this feature when determining what the possible reconstruction sites are. The result in this case is marked by the inverse chain (DP_1, DP_1). Reconstruction leaves a copy of the original element in place, which will trigger discourse interpretation at the LF-interface, often associated with the noncanonical order in this language (Brattico, 2019b; Holmberg & Nikanne, 2002;

Huhmarniemi, 2019a; Vainikka, 1989; Vilkuna, 1989, 1995). I will ignore discourse computations in this article. The reconstructed position is determined by *-a* ~ [PAR], which requires that the argument be c-commanded locally by the small verb v. The grammatical subject is initially merged at the postverbal position and is reconstructed to SpecvP due to the nominative case feature *0* ~ [NOM] checked against a local finite T-head. The checking is done by using an inverse of operation *Agree* (Chomsky, 2000, 2001) and uses the following principles:

(3) *Agree-1*

Nominative case is checked locally by a head with feature +FIN,

Partitive is checked locally by a head with v/ASP,

Genitive is checked locally by a head with feature –FIN.

The main reason arguments are reconstructed into SpecvP and SpecVP, specifically, is because these positions determine their thematic roles (SpecvP = ‘agent’; CompVP, SpecVP = ‘patient’) at the LF-interface (D). Furthermore, these positions are used to check grammatical well-formedness, for example, that the possible complement selection features of the main verb are satisfied. Indirectly, then, overt case suffixes are correlated with thematic roles in the model: morphological cases determine syntactic positions giving rise to thematic interpretations. The analysis was tested with 119800 unique word order variations in Finnish, most of which it analysed and judged correctly.

The algorithm contains a script that processes several test sentences all at once. It provides several types of output that are used to assess its behavior. Each input sentence is categorized as grammatical or ungrammatical, which can be compared with automatized tools with native speaker output to verify observational adequacy. It will also provide each sentence with a structural analysis, or several if the clause is ambiguous. Structural analyses (phrase structure representations) are provided in textual and image formats. These outputs are further associated with several semantic attributes, such as thematic roles, that must match with native speaker intuition. Each derivation leaves a detailed log file containing a report on all linguistically significant computational steps that occurred during the comprehension process, together with reasons for rejection if the sentence was deemed ungrammatical. This makes it possible to track all information processing steps from the sensory input to the reconstruction of meaning. Finally, the algorithm provides quantitative summaries of the computational resources that were consumed, such as the number of garden-paths and other measures of psycholinguistic complexity that can be compared to experimental outcomes. The overall experimental framework is illustrated in Figure 3.

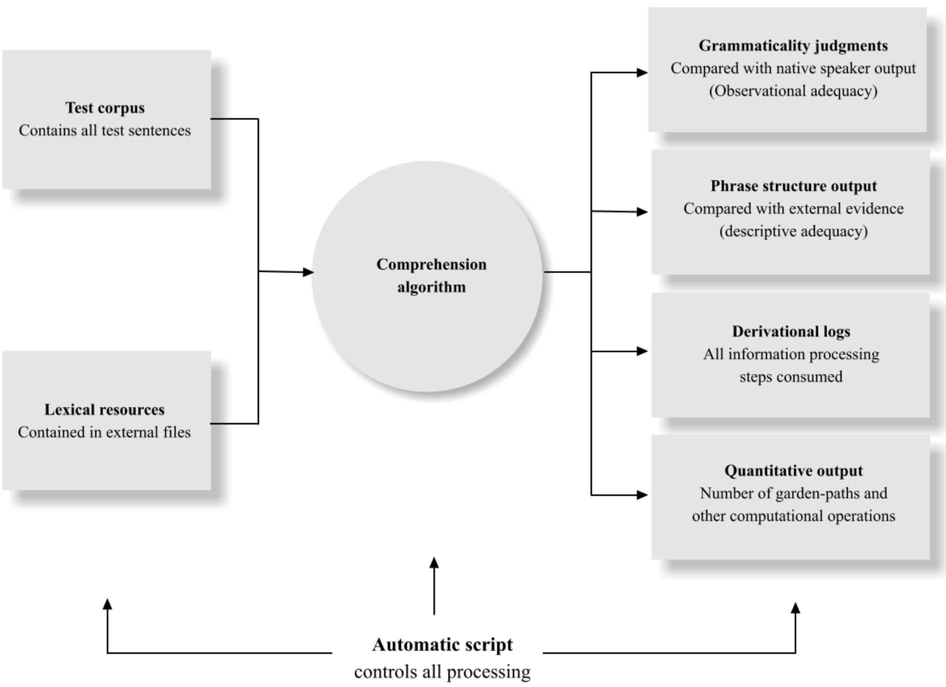


Figure 3. Overall framework. Test sentences and the lexical resources are provided in external input files. These are fed to the comprehension algorithm by a main script, which then produces several types of output that can be used to evaluate the behavior of the model. The main script automatizes the whole process; thus, each study can be associated with unambiguous set of input files, output files and the source code that preformed the mapping.

I will use this methodological framework in this study as well. The sentences discussed in the main article can be found from the output files generated by the modified algorithm. The number identifiers generated by the algorithm for each sentence it processes are referred to in this article by using the symbol #. Thus, symbol #34 refers to the sentence number 34 in the output generated by the algorithm. The same number can be found from all output files.

2.2 Problems

The analysis provided in Brattico (2020) is insufficient to account for Finnish structural case assignment for a number of reasons. First, as argued by Vainikka (1989, 1993, 2003), the partitive constitutes a default complement case in Finnish and is not tied to the small verb v (see also Kiparsky, 2001). It occurs in the complement positions of prepositions (*kohti talo-a* 'towards house-PAR'), numerals (*kolme talo-a* 'three house-PAR'), participle adjectives (*talo-a ostava* 'house-PAR buying'), noun heads (*joukko sukki-a* 'stack sock-PAR'), quantificational elements (*paljon sukki-a* 'many socks-PAR'), and further encodes aspectual properties when occurring as a direct object of a deverbal predicate, as shown further below. Furthermore, all direct objects must take the partitive if they occur under the scope of negation. The rule [PAR] ~ [TAIL:V] works in few cases but is insufficient as a theory of partitive assignment.

In addition to the partitive, the direct object position of a verb (or a deverbal predicate) can be assigned the accusative case [ACC], but the form and interpretation of the accusative is controlled by several factors that have been subject to some controversy in previous literature (Anttila & Kim, 2010, 2017; Brattico, 2014; Hakulinen et al., 2004; Heinämäki, 1994; Ikola, 1950, 1957; Itkonen, 1976, 1977; Kiparsky, 2001, 1998; Linden, 1956; Nelson, 1998; Reime, 1993; Timberlake, 1975; Toivonen, 1995; Vainikka, 1988; Vainikka & Brattico, 2014; Wiik, 1972). We can ignore the controversy and only observe that there is nothing in (Brattico,

2020) that deals with the accusative case or any of these issues. Also the locality assumption, embodied in (3), leads into problems. The form of the accusative direct object depends on several local and nonlocal properties of the clause (Anttila & Kim, 2017; Brattico, 2014; Ikola, 1950, 1986; Kiparsky, 1998, 2001; Linden, 1956; Toivonen, 1995; Vainikka & Brattico, 2014; Wiik, 1972). To illustrate, consider the two sentences in (4).

(4)

a. Pekka voitti kilpailu-n. / *kilpailu-a.
Pekka won competition-ACC competition-PAR
'Pekka won the competition.'

b. Pekka e-i voittanut *kilpailu-n / kilpailu-a.
Pekka not-3SG won competition-ACC competition-PAR
'Pekka did not win the competition.'

Sentence (4)a represents a canonical affirmative achievement clause that is incompatible with the partitive direct object for aspect reasons, discussed later in Section 4.3. However, when the same sentence is negated, the direct object must occur in the partitive, while the accusative is ungrammatical. Thus, there has to be a mechanism for connecting the form of the direct object with the presence of the negation higher up in the clause. Interestingly, this connection is nonlocal, as shown by examples such as (5) in which the partitivization effect of the negation penetrates an infinitival clause boundary (or several).

(5) Pekka ei halunnut [voittaa *kilpailu-n / kilpailu-a.]
Pekka not want to.win competition-ACC competition-PAR
'Pekka did not want to win the competition.'

Of course, we also have to capture the aspectual system illustrated by (4) and other clauses of similar type.

The genitive case was associated with feature –FIN in (Brattico, 2020) to capture its association with the subject position of an infinitival complement clause, but the assumption leads into problems and the original model discussed only one relevant construction. First, there are finite clauses, such as the Finnish modal construction, which takes genitive subjects (6).

(6) Peka-n täytyy [ihailla Merja-a.]
Pekka-GEN must to.admire Merja-PAR
'Pekka must admire Merja.'

This violates the hypothesis that the genitive is linked only with infinitivals heads. Second, there are grammatical heads which cannot be said to be finite, yet their ability to assign the genitive to anything can be called into question (e.g., conjunctions, complementizers, demonstratives, many numerals, quantifiers). This problem is rarely mentioned, but it became acute once computational simulations with current test materials were attempted. Finally, the genitive occurs also in a possessor role (7).

(7) Peka-n suka-t
Pekka-GEN sock-PL
'Pekka's socks'

Thus, the genitive is involved with something more general than just a single feature; Vainikka pointed out, correctly, that it behaves more like a general specifier case.

The word order analysis fails also to account for several special construction types, such as sentences with partitive subjects, impersonal passives, copular constructions or raising constructions, none of which were addressed in the word order study and which have exceptional case properties, reviewed later in this article. Finally, object case marking applies also to DP-adverbials in Finnish.

In sum, then, the case model assumed in (Brattico, 2020) is insufficient and makes predictions that are not borne out.

3 An analysis

3.1 Multifeatural approach

I will propose a generalization to the original case checking mechanism that arguably deals with the abovementioned problems. The system is first proposed tentatively with only a few empirical arguments given, and then tested rigorously in Section 4. Let us begin by considering the Finnish accusative-partitive alteration in some more detail. It is well-known that the alteration represents telic properties of the even denoted by the whole verb phrase (Csirmaz, 2005, 2012; Heinämäki, 1994; Kiparsky, 1998; Thomas, 2003; Vainikka, 1989). This is illustrated by (8). The telic properties, which have been subject to considerable debate in previous literature, are reported in the translations.

(8)

a. Pekka pesi hevos-en.

Pekka washed horse-ACC

‘Pekka washed the (whole) horse.’

b. Pekka pesi hevos-ta.

Pekka washed horse-PAR

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

While the exact semantic attribute involved is controversial (e.g., Csirmaz, 2012; Huumo, 2013; Thomas, 2003), it is not controversial that the comprehension algorithm must evaluate the availability of the partitive and the accusative direct object case against the presence of some aspectual-semantic feature. What that property is will occupy us later; what matters now is the observation that the accusative can take several morphological forms that seem to depend on further grammatical properties of the clause, such as agreement or some related property, illustrated in (9).

(9)	Me	pes-i-mme	hevose-n.
	We.NOM	wash-PAST-**1PL**	horse-**N/ACC**
	'We washed the horse.'		
b.	Me	pest-iin	hevonen.
	we.NOM	wash-past.impass.**0**	horse.**0/ACC**
	'We washed the horse.'		

Putting detailed explanation of this phenomenon aside, the situation observed in (9) can be described so that when a c-commanding verb exhibits full phi-agreement (a), the accusative takes the "genitive form," glosses as n/acc in this paper to reflect the overt *-n* suffix. I will refer to this form as the "n-accusative."[4] When the predicate does not exhibit agreement, as is the case in the impersonal passive form (b), the accusative case changes its form and now looks like the nominative case, glossed as 0/acc and referred to as the "zero accusative." While the details are controversial, these facts alone show that we have to posit a condition which checks overt case forms against at least *two* features, whatever their ultimate

[4] The case is still accusative, because it encodes aspect, contrasts with the partitive, and takes an unambiguous accusative t-form in the case of most pronouns (*Pekka pesi hän-et* 'Pekka washed he-t/acc'). The term "genitive form," which is widely used in the literature (Hakulinen et al., 2004; Kiparsky, 2001), comes from the fact that this case is homophonous with the genitive case in singular full DPs.

explanation and analysis: aspect (ACC vs. PAR) and agreement (0/ACC vs N/ACC). In fact, it seems that we have to posit a *third* feature for the polarity mechanism mentioned earlier (see (4)-(5)). I will therefore propose a generalization to the original "single feature" approach (3), according to which case features are potentially checked against *several* features.

One interpretation of such multifeatural hypothesis would be that case suffixes are checked against several target features always hosted by one functional head. Another implementation is to require case checking potentially against several heads, each with its own target features. The reason I pursue the second formulation in this work is because we have to test the accusative case against at least three features—aspect (8), agreement (9), and polarity (5)—yet they are represented, following the standard analyses of Finnish clause structure (Holmberg, Nikanne, Oraviita, Reime, & Trosterud, 1993; Laka, 1990; Mitchell, 1991; Thomas, 2012), at different heads: the aspect at verbal heads (Asp, v, V), agreement at the finite tense T, while the negation is its own finite Neg head located above tense.

In the original comprehension algorithm of Brattico (2020), target features were matched against feature content at the next c-commanding local head (e.g., T, v)(3). This assumption is too restrictive due to the well-known long-distance structural case assignment effects. To capture long-distance case assignment effects, instead of strict locality I assume that the target feature set at a head triggers a *minimal upstream search*, in which the head possessing case-related target features tries to establish a minimal upward path between itself and a head that contains the target feature(s). An upstream path is defined by (10).

(10) Upstream path

Constituent C and its daughters belong to the upstream path from H if and only if C dominates (or is) H.

The term “minimal” refers to the fact that the algorithm searches upwards until it encounters either a full match, leading into case checking, or partial match, leading into failure; or reaches the end of the structure, which will likewise lead into failure. Minimality means, then, that the procedure only registers the first head in which some target features are checked. Although (10) will be tested rigorously with simulation, it should intuitively be viewed as a generalization of the local Agree model that subsumes the local model as a special case. In the case of local Agree, the upstream path (if we think of it in terms of such notion) connects the target features with the closest functional head reached by minimal upstream search, but the minimal upstream path can reach higher if no features are matched locally. I will show that the long-distance case marking effects attested in Finnish as well as adverbial case marking follow from this generalization.

Suppose that a case suffix is associate with a target feature set $\{F_1, \ldots, F_n\}$ in the lexicon. How does the algorithm know that $\{F_1, \ldots, F_n\}$ require checking in the first place? At the level of computational implementation the case licensing mechanism was triggered by feature [TAIL: $F_1, \ldots, F_n$], where the feature type “TAIL” informed the comprehension algorithm of the fact that $\{F_1, \ldots, F_n\}$ had to be checked.[5] In whichever way the mechanism is implemented, there must be some formal diacritic that tells the algorithm which features must be checked or licensed; I will keep the tail-system. An important consequence of this assumption is that language-specific case assignment patterns can be modelled in the lexicon by changing the tail-features associated with overt morphological case features belonging to any given language’s morphological repertoire. For example, by associating an overt accusative suffix

[5] The term “tail” refers to the fact that the checking dependencies established by this mechanism allow one constituent to “tail” or “shadow” another over a distance. It can also be depicted as an ‘inverse probe-goal dependency’.

with a language-specific target feature set it is possible to distinguish the behavior of English accusative from that of the Finnish accusative.

In sum, the original local single feature checking mechanism was generalized in order to account for case assignment patters involved in checking of several features (e.g., aspect, agreement, polarity) by potentially nonlocal dependencies. A notion of minimal upstream path (10) will be used to replace local checking. These mechanisms are added to the algorithm and tested with Finnish structural case assignment patterns in Section 4.

3.2 Reformulating Vainikka's partitive and genitive generalizations

Partitive case was checked against v in the original linear phase model; in reality it behaves like a default complement case according to Vainikka (1989, 1993, 2003). The assumption has become a standard in the field. Because the generalization is reasonably correct empirically, we want to reformulate it so that it is compatible with the feature approach elucidated in the previous section. Notice, in particular, that the mechanism makes no reference to the notions of "complement" or "default."

Functional heads assigning the partitive (e.g., prepositions, transitive verb or v, numerals) never exhibit overt phi-agreement with a DP argument in Finnish. Let us first imagine that the partitive is checked against the closest functional head reached by minimal upstream path that does not exhibit agreement. Consequently, the partitive would be matched simultaneously against two features, one which coincides with the notion of functional head (thus we ignore lexical heads such as N, V) and another that captures the no agreement property. This hypothesis is illustrated in (11). This formulation is the closest to Vainikka's original proposal that I could work out under the feature approach.

(11)

a. [P^0 DP]

[–PHI] ← [PAR]

[–LEXICAL]

b. kohti talo-a

towards house-PAR

This hypothesis ran into problems. Non-agreeing functional heads that do not assign cases at all, such as complementizers, determiners, plural numerals and quantifiers, among others, now trigger partitive case checking and reconstruction. Assuming that the partitive is reconstructed and checked by a closest non-agreeing functional head licenses such arguments wrongly into positions locally c-commanded by these heads. This problem was immediately encountered in initial simulation tests (Section 4).

On the other hand, functional heads that we have to exclude from the partitive mechanism (e.g., C, conjunctions, D, Q, many numerals) are characterized by the property that they are not "predicates" or parts of predicates in the sense of not requiring the presence of, or interacting with, full DP arguments at all. This behavior, which I will make use in this work, is captured in the comprehension algorithm by feature –ARG. I will replace –LEXICAL with +ARG tentatively in the partitive rule. What the feature ±ARG does in the comprehension algorithm is not trivial and will not be elucidated here; what matters is that it partitions the set of functional heads into two categories, those which interact with arguments (e.g., T, v) and those which do not (C, D).[6] Because the feature is lexical, the partitioning can be sensitive to language. Whether a head can exhibit overt agreement is denoted by feature [±VAL] (from

[6] The most salient property of the feature +ARG is that it generates uninterpretable phi-features to the said lexical element, which then trigger agreement reconstruction and, in some cases, also control. I propose in this work that it is also key to case checking.

"valuation"), +VAL referring to heads that exhibit overt phi-agreement, –VAL designating the opposite behavior. This feature was likewise part of the existing algorithm. Vainikka's partitive generalization can now be captured by rule [PAR] ~ [TAIL: +ARG, –VAL] 'license the partitive by a minimal upstream path to a non-agreeing functional head with feature ARG'.

What if we assumed, instead, that the partitive is a "default complement case," as originally proposed by Vainikka? This assumption, too, leads into problems. First, as pointed above we have to distinguish functional heads which participate in case assignment (e.g., Num, P) from those which do not (C, D), and the only way to achieve this is to stipulate that the former have some property – i.e. feature – that the latter do not have. It seems, therefore, that we cannot work out the partitive rule without referring to some feature and feature checking. But the rule leads into empirical problems as well. One problem is the existence of verbs which do not accept partitive objects at all (4), thus there must be a condition preventing the partitive to appear. A default case cannot be associated with such conditions. Another problem is the partitive of negation phenomenon (5), in which the negation and the partitive object do not form a head-complement configuration. In addition, Finnish allows DP-adverbials to be marked for object cases, including the partitive, but DP-adverbials are not complements of the heads (e.g., Neg, T, v) responsible for their case marking. Moreover, I will later discuss a 'partitive of numeral' phenomenon which shows that the partitive can be assigned by functional heads with special properties instead of being limited to "default" configurations. The same might be true of constructions such as *kasa sukkia* 'stock sock-PL-PAR', in which a special category of nouns assign the partitive to their complements. Finally, there are other situations in which the partitive is not assigned under the head-complement relation, such as the case-marking of complex participle adjectives (author citation). The [PAR] ~ [TAIL: +ARG, –VAL] rule, together with minimal upstream search, will take care of all of these problems while subsuming Vainikka's original generalization as a special case.

Vainikka proposed that the genitive constitutes a general specifier case. Indeed, the genitive is assigned to what looks to be the specifier position of several heads, such as prepositions (*minun lähelläni* ‘I.GEN near’), infinitival complement clauses (*Pekka käski minun lähteä* ‘Pekka ordered I.GEN to.leave’), nouns (*minun auto* ‘I.GEN car’), participle adjectives (*minun löytämä* ‘I.GEN found’, i.e. something found by me), and even certain finite constructions, such as modals (*minun täytyy lähteä* ‘I.GEN must leave’). The feature approach is incompatible with Vainikka’s formulation because there is no upstream path from the specifier to its head. In the original model of Brattico (2020), the infinitival construction was accounted for by reconstructing the genitive argument to a position *below* the infinitival head and checking its case against the infinitival head at the reconstruction position (12). The reconstructed argument receives its thematic role from the reconstructed position inside the VP.

(12)	Pekka	käski	[Merja-n_1	-ä	[$_{VP}$	$\_\__1$	lähte-.]]
	Pekka	ordered	Merja-GEN	–FIN	←	[GEN]	leave
	’Pekka ordered Merja to leave.’						

This model is consistent with the path approach pursued here. Let us adopt it tentatively. Thus, the comprehension algorithm will check the genitive against [–FIN,+ARG]; the argument reconstruction operation will then automatically try to fit genitive arguments into structural positions in which these features can be checked. The nominative, in turn, is checked against [+FIN,+ARG,+VAL], the closest functional head that is finite and exhibits overt agreement, typically the finite verb (or finite T).

The nature and distinction of accusative case, as pointed out earlier, is a complex and particularly controversial issue. I will assume that it is involved in checking three independent target feature sets: an aspectual feature at the closest relevant head {+ASP:BND, +ARG} (examples (4), (8)), agreement [±PHI] (9) and polarity [±NEG] (5).[7] The general approach is the same: an overt case suffix is associated with features that are checked against a functional element that can be reached by a minimal upstream path.

The full case checking system proposed above is summarized in Table 1. Each target feature set is checked by one head reached by upstream path, and each target feature set, if there are several, is checked independently. This system will be used in argument reconstruction, grammatical well-formedness checks at the LF-interface, and thus indirectly also for the creation of semantic/thematic interpretation. The features are written into the surface vocabulary, in which morphological case suffixes at the left column, Table 1, are matched with tail-features using the target feature sets in the middle column.

Table 1. Case checking rules proposed in this article.

Case	Suffix	Rule	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	{+ARG,+ASP:BND}{–NEG}	*Merja näki hänet* ’Merja saw him.’ *Merja osti kuka-t* ’Merja bought flowers.’
[N/ACC]	-n	{+ARG,+ASP:BND}{–NEG}{+PHI}	*Me näimme talo-n* ’We saw house-n/acc’ **Me nähtiin talo-n* ‘We saw.impass house-n/acc’
[0/ACC]	.0	{+ARG,+ASP:BND}{–NEG}{–PHI}	*Me nähtiin talo* ’We saw.impass house-0/acc’ **Me näimme talo* ‘We saw.1pl house-0/acc’

±FIN = finiteness; ±ARG = argument interaction; ±VAL = whether overt phi-agreement is possible; ±NEG = negative polarity; ±PHI = actual overt phi-agreement, ASP:BND = aspectual boundedness. Each target feature set $\{F_1...F_n\}$ is checked against one head, but when there are several sets, they are checked independently of each other.

[7] This three feature model for the accusative case comes from an unpublished descriptive manuscript “Aspect, polarity and agreement in Finnish direct object case marking” by the present author.

4 Formalization and simulation experiment

4.1 *Design and materials*

The analysis was added into the original linear phrase comprehension algorithm, implemented in the Python programming language, and was then tested by means of simulation against a test corpus.[8] Testing was done by collecting all relevant test sentences, discussed below, into a *test corpus file* and by running a main script that processed all sentences from that file. The test corpus, together with annotation and glossing, is provided in Appendix A of this article (submitted as a separate file). I will refer to sentences in the machine-generated output by using their numerical identifiers; this will allow the reader to find a full derivation of each sentence discussed in the main text.

4.2 *Nominative and partitive*

4.2.1 *Clausal contexts*

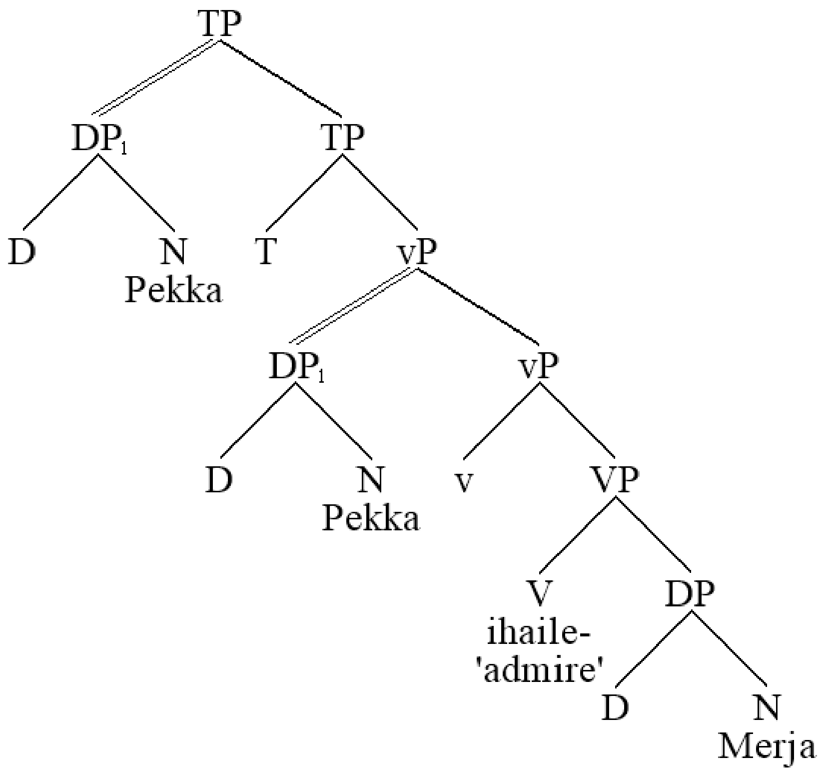
The algorithm is tested by feeding it with both grammatical and ungrammatical sentences. All input sentences, reported here by using standard glossing, are fed to the algorithm as a linear string of (normalized and in most cases disambiguated) phonological words without annotation or other information. Disambiguation was done to avoid the generation of redundant output that occurs when the algorithm tries to derive sentences by fitting several

[8] This required changes into the lexicon, implementation of the minimal upstream path mechanism (10) and reformulation of feature checking so that it can check several sets of features and can deal with negative rules. In addition, aspectual interpretation was added to the semantic component and now appears in the output generated by the algorithm.

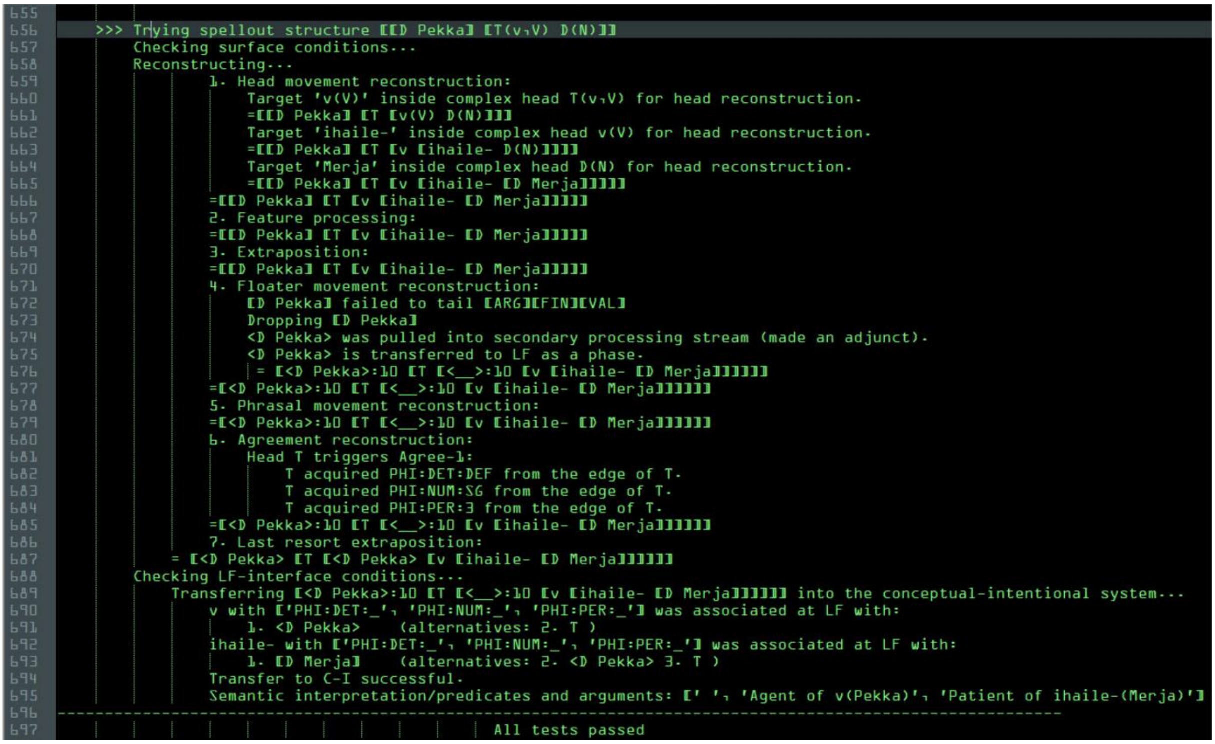
lexical items; however, the algorithm handles ambiguous lexical items as well, as I will show below.

The algorithm analyses transitive finite clause *Pekka ihailee Merjaa* ‘Pekka.NOM admire.3SG Merja.PAR’ correctly as in (13)a-b (LF-interface output from the algorithm, not by author). This sentence is labelled #3 in the machine-generated output.

(13) _



The grammatical subject is reconstructed from SpecTP into SpecvP, failing to check [+FIN, +VAL, +ARG] at the spellout position. It will check this feature against T at SpecvP, since T is finite (+FIN), exhibits agreement (+VAL) and is functional and interacts with an argument (+ARG). The partitive object is merged directly into a position in which it can check the partitive feature [+ARG, –VAL] against v, as v has +ARG and does not exhibit agreement (V-O agreement is not attested in this language). The analysis corresponds to the standard finite clause structure of Finnish (Brattico, Huhmarniemi, Purma, & Vainikka, 2013; Holmberg & Nikanne, 2002; Holmberg, Nikanne, Oraviita, Reime, & Tosterud, 1993; Huhmarniemi, 2019a; Manninen, 2003b). No CP-layer is produced, though: there is nothing in the input to prompt the generation of such structure.[9] Notice that the algorithm performs also head reconstruction (inverse head movement) by creating the T-v-V spread from what was originally a single word *ihailee* 'admire.3SG' in the input. Head reconstruction is performed during transfer just before argument reconstruction and is discussed elsewhere (author citation). All these steps are visible in the derivational log file (sentence #3, lines 656-703), illustrated in Figure 6.



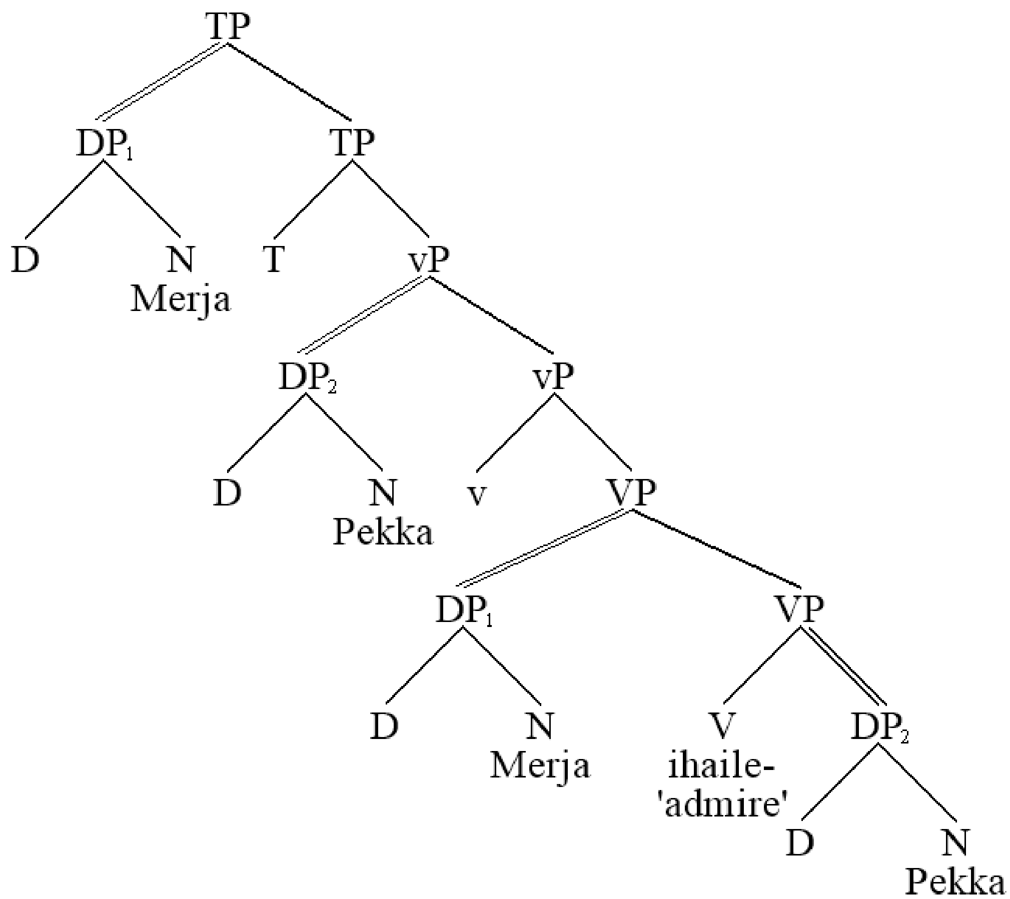
```
655
656  >>> Trying spellout structure [[D Pekka] [T(v,V) D(N)]]
657      Checking surface conditions...
658      Reconstructing...
659              1. Head movement reconstruction:
660                  Target 'v(V)' inside complex head T(v,V) for head reconstruction.
661                  =[[D Pekka] [T [v(V) D(N)]]]
662                  Target 'ihaile-' inside complex head v(V) for head reconstruction.
663                  =[[D Pekka] [T [v [ihaile- D(N)]]]]
664                  Target 'Merja' inside complex head D(N) for head reconstruction.
665                  =[[D Pekka] [T [v [ihaile- [D Merja]]]]]
666              =[[D Pekka] [T [v [ihaile- [D Merja]]]]]
667              2. Feature processing:
668              =[[D Pekka] [T [v [ihaile- [D Merja]]]]]
669              3. Extraposition:
670              =[[D Pekka] [T [v [ihaile- [D Merja]]]]]
671              4. Floater movement reconstruction:
672                  [D Pekka] failed to tail [ARG][FIN][VAL]
673                  Dropping [D Pekka]
674                  <D Pekka> was pulled into secondary processing stream (made an adjunct).
675                  <D Pekka> is transferred to LF as a phase.
676                   = [<D Pekka>:10 [T [<__>:10 [v [ihaile- [D Merja]]]]]]
677              =[<D Pekka>:10 [T [<__>:10 [v [ihaile- [D Merja]]]]]]
678              5. Phrasal movement reconstruction:
679              =[<D Pekka>:10 [T [<__>:10 [v [ihaile- [D Merja]]]]]]
680              6. Agreement reconstruction:
681                  Head T triggers Agree-1:
682                      T acquired PHI:DET:DEF from the edge of T.
683                      T acquired PHI:NUM:SG from the edge of T.
684                      T acquired PHI:PER:3 from the edge of T.
685              =[<D Pekka>:10 [T [<__>:10 [v [ihaile- [D Merja]]]]]]
686              7. Last resort extraposition:
687          = [<D Pekka> [T [<D Pekka> [v [ihaile- [D Merja]]]]]]
688      Checking LF-interface conditions...
689          Transferring [<D Pekka>:10 [T [<__>:10 [v [ihaile- [D Merja]]]]]] into the conceptual-intentional system...
690              v with ['PHI:DET:_', 'PHI:NUM:_', 'PHI:PER:_'] was associated at LF with:
691                  1. <D Pekka>    (alternatives: 2. T )
692              ihaile- with ['PHI:DET:_', 'PHI:NUM:_', 'PHI:PER:_'] was associated at LF with:
693                  1. [D Merja]    (alternatives: 2. <D Pekka> 3. T )
694              Transfer to C-I successful.
695              Semantic interpretation/predicates and arguments: [' ', 'Agent of v(Pekka)', 'Patient of ihaile-(Merja)']
696  -----------------------------------------------------------------------------------------------
697                                            All tests passed
```

[9] The model created also an alternative analysis for this input sentence by assuming that the direct object had been "extraposed" to the right edge and reconstructed. This analysis can be found from the raw output data and is not discussed here.

Figure 6. A Screen capture of part of the derivational log file, illustrating transfer, generated during the processing of sentence #3 in this article. Its contents can be described intuitively as follows: head movement reconstruction (lines 659-666), feature inheritance (667-668), extraposition (669-670), argument reconstruction (671-677), A-bar/A-movement reconstruction (678-679), agreement reconstruction (680-685), last resort extraposition rule (686-687), LF-interface conditions (688-693), outcome (694-5).

To check that the new case system can guide comprehension process, we test what happens if the algorithm is fed with a noncanonical OVS structure. The result is (14) (#5).

(14) _



The algorithm reconstructs noncanonical arguments correctly by using overt case features. The postverbal/rightmost grammatical subject is reconstructed into SpecvP, while the preverbal partitive object is reconstructed into Spec/CompVP, where it receives the patient thematic role.[10] We can see the same information in the derivational log file, Figure 7.

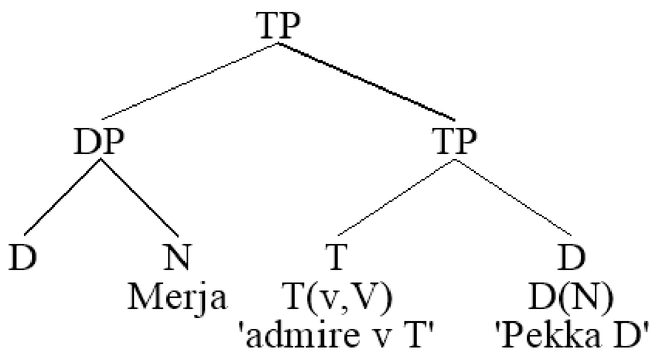
```
4. Floater movement reconstruction:
  [D Merja] failed to tail [-VAL][ARG]
  Dropping [D Merja]
  <D Merja> was pulled into secondary processing stream (made an adjunct).
  <D Merja> is transferred to LF as a phase.
  | = [<D Merja>:26 [T [v [<__>:26 [ihaile- [D Pekka]]]]]]
  D failed to tail [ARG][FIN][VAL]
  <D Pekka> was pulled into secondary processing stream (made an adjunct).
  <D Pekka> is transferred to LF as a phase.
  Dropping <D Pekka>
  | = [<D Merja>:26 [T [<__>:27 [v [<__>:26 [ihaile- <D Pekka>:27]]]]]]
=[<D Merja>:26 [T [<__>:27 [v [<__>:26 [ihaile- <D Pekka>:27]]]]]]
```

Figure 7. A screen capture from relevant part of the derivational log file (processing of sentence #5, (14)). The two key lines are marked with arrows: the comprehension algorithm notices that the tail-features, as defined in this study in Table 1 and provided in the surface vocabulary, cannot be checked at the spellout structure, which initiates reconstruction.

The algorithm will also provide an image of the initial spellout structure that it creates directly from the input string by applying Phillips-style left-to-right parsing. These images contain the string "_spellout" in their names. The spellout structure corresponding to (14) is (15).

[10] The grammatical subject *Pekka* is moved out of the complement position and becomes "invisible" for labeling and sisterhood at its original position; thus, the sister of V will be *Merjaa*. See (Brattico, 2020).

(15)



The order of the arguments still reflects the input order, and all complex words are still represented as complex heads. Thus, this representation can be thought of as a “sensorimotoric plan” for the expression, in that its properties are transparently related to the actual output sentence, obviously because it has been generated directly from the input sentence. The LF-interface object (14) is then generated from this structure by applying transfer.

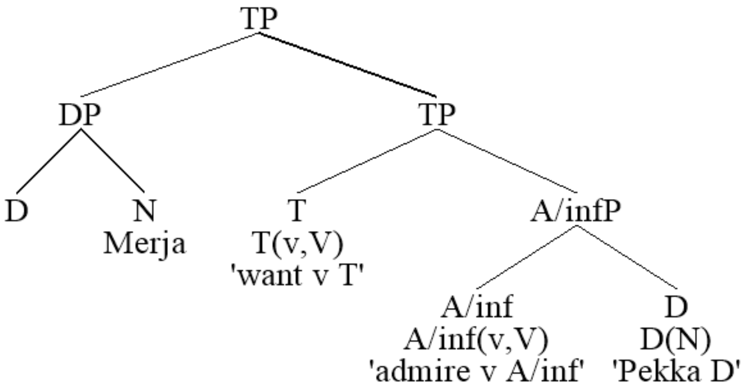
The same mechanism works if the grammatical subject occurs further to the right (16).

(16)	Merja-a	halusi	[ihailla	Pekka.]	(#6)
	Merja-PAR	wanted	to.admire	Pekka.NOM	

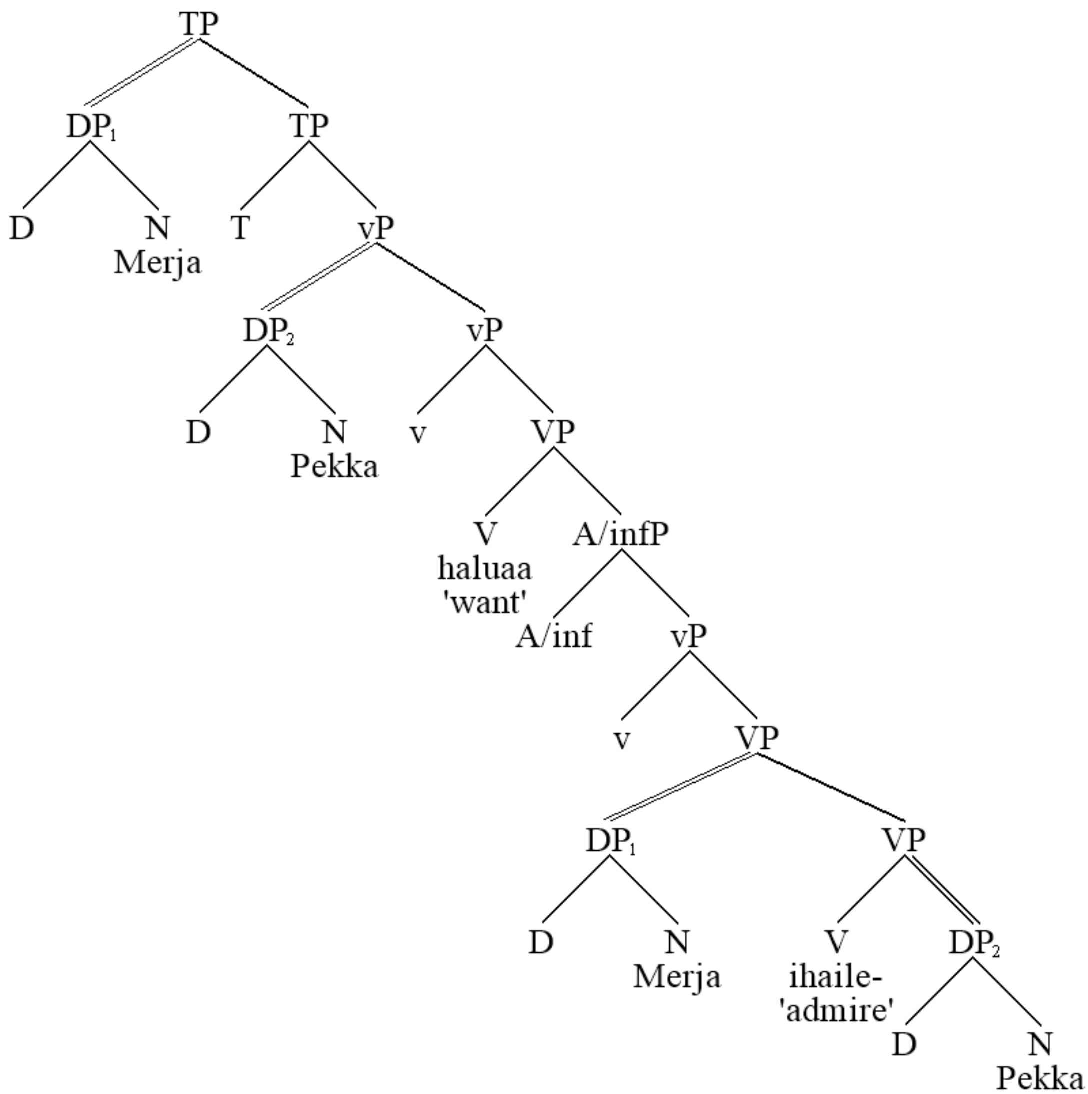
‘When it comes to Merja, Pekka wanted to admire her.’

The algorithm provides the correct analysis:

(17) Spellout structure (generated first)



(18) LF-interface structure (generate by applying transfer to (17))



The preverbal partitive subject forms chain (DP_1, DP_1) bringing it to the complement position of the lower verb, at which the partitive case can be licensed (and nowhere else). The postverbal grammatical subject is reconstructed correctly to SpecvP of the higher verb, which checks the nominative case.

Simulation of noncanonical infinitival constructions brought into light an issue concerning case checking and thematic roles. The first position that satisfies the partitive rule for the preverbal *Merjaa* 'Merja-PAR' is the SpecVP position of the main verb where it can check the partitive case against the main clause v, yet this solution is incorrect: the infinitival verb *to admire* then remains without an object and the reconstructed direct object is not assigned a thematic role at its reconstructed SpecVP position. That sentence corresponds to the meaning '??Pekka wants Merja, to admire'. The algorithm noticed both problems and refused to parse the input. This issue was solved by a lexical feature which prevented the main verb *haluta* 'to want' from projecting a specifier position, removing this reconstruction site. The preverbal object is then reconstructed correctly to the complement position of the embedded infinitival *ihailla* 'to admire'. Thus, what these experiments show is that it is not sufficient to test that an argument has a canonical position in the clause licensed by the case feature; we must also make sure that there are no spurious reconstruction sites.

4.2.2 Infinitivals

The partitive occurs in the complement position of several transitive infinitivals, such as nonfinite verbs and adverbials. These are derived by the same mechanism as the finite clause. The infinitival is derived by combining a v/VP-shell with an infinitival head corresponding to the various overt infinitival suffixes; the small verb v [+ARG, –VAL] then checks the partitive case. The output of the comprehension algorithm provided by (19)b is (20), with the adverbial 'by/while reading the book' attached by the algorithm to a high right adjoined position.

(19)

a. Pekka halusi [ihail-la Merja-a.] (#7)

Pekka.NOM wanted admire-A/INF Merja-PAR

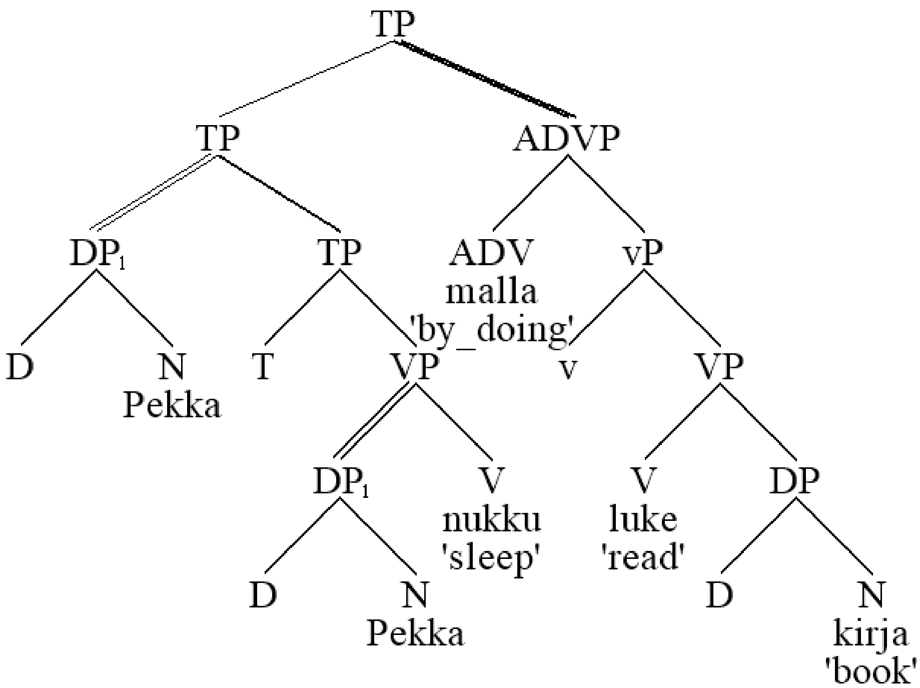
‘Pekka wanted to admire Merja.’

b. Pekka nukahti [luke-malla kirja-a.] (#8)

Pekka.NOM fell.asleep read-MA/LLA book-PAR

’Pekka fell asleep by/while reading a book.’

(20) _



These sentences, at least when it comes to their case marking properties, are therefore correctly derived. For the properties of Finnish infinitivals that I have used as a background here, see especially Koskinen (1998) and Vainikka (1989). Specifically, the analysis assumes that deverbal infinitivals are made from an infinitival head + v/VP structure, so that v can check the partitive. The infinitival head is always overtly marked in the infinitival predicate itself in Finnish, here *-a* and *-malla*. Almost all infinitivals in Finnish are polymorphemic (e.g., *ihail-la* ‘admire-A/INF’) and thus in need of decomposition and head reconstruction. Head reconstruction guarantees that the genitive argument can be reconstructed into a thematic position inside the v/VP, below the infinitival head that can check its case.

4.2.3 Adpositions

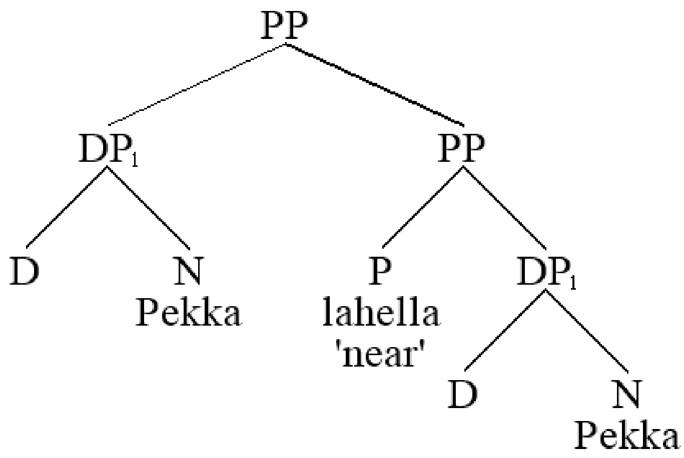
The partitive occurs also in adposition and nominal contexts. Most adpositions take the prepositional form (21), with the argument assigned the partitive case. The comprehension algorithm will check the partitive case against the preposition (21)(a) having features [+ARG, –VAL]. If the partitive argument occurs in the SpecPP position, which is also possible, it is first reconstructed to the canonical position by using case information (21)(b). This derivation, i.e. (21)(b), is illustrated further in (22).

(21)

a. lähellä Pekka-a (#9)
near Pekka-PAR
’near Pekka’

b. Pekka-a lähellä (#10)
Pekka-PAR near
’near Pekka’

(22) _



The two forms in (21), one with the partitive at SpecPP and another at CompPP, do not differ in meaning (in my Finnish). On the other hand, if the argument contains an interrogative feature, movement to SpecPP is obligatory (Huhmarniemi, 2012)(23)a-b, in agreement with the edge generalization of (Heck, 2004, 2008).[11]

(23)

a.	ketä	lähellä	Pekka	asuu?
	who.PAR	near	Pekka	lived
	‘Near who does Pekka live?’			
b.	*lähellä	ketä	Pekka	asuu?
	near	who.PAR	Pekka	lives
	(Only an echo-question is possible)			

[11] The edge generalization states that if a *wh*-feature pied-pipes some phrase XP, then the *wh*-feature must occur at the edge of XP.

This shows that while SpecPP ~ CompPP variation is optional in the case of morphologically unmarked arguments, the fact that the specifier option exists can perhaps be explained as a consequence of the edge generalization. For a formalization of wh-movement and pied-piping within the comprehension algorithm that implements the system argued for in (Huhmarniemi, 2012), see Brattico & Chesi (2020).

4.2.4 Partitive subjects

Finnish allows the use of partitive subject in certain exceptional constructions. One is the experiencer construction (24).

(24) Pekka-a pelo-tta-a. (#11)

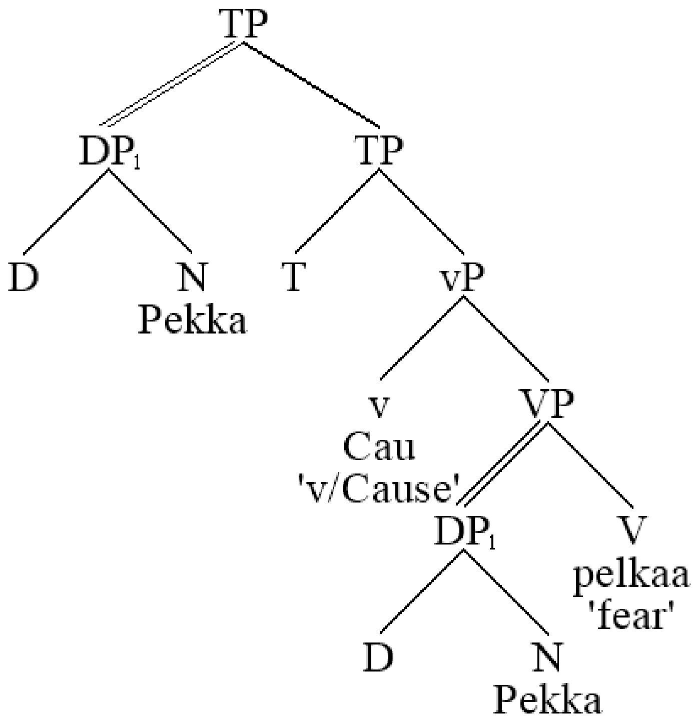
Pekka-PAR fear-CAU-3SG

'Pekka feels frightened.'

The verb contains a stem referring to 'a/to fear'[12] together with the causative suffix *-tta*. The comprehension algorithm accepts these sentences as grammatical and reconstructs the partitive subject inside the v/VP shell (25).

[12] The stem could be either verbal *pelkä-* 'to fear' or nominal *pelko* 'the fear'.

(25) _



The structural analysis provided by the algorithm agrees broadly with the style of analysis by (Huhmarniemi, 2019b, 2019c; Pylkkänen, 2002), who suggest that the partitive subject originates form a structurally low position. It is possible, of course, that the sentence has more structure; for present purposes it suffices that it hosts a functional head able to check the partitive case, which does not seem controversial. The sentence comes with an interpretation, shown in the output of the algorithm, in which the causer of Pekka's fear is an 'unknown third person', as determined by the third person agreement features at the main verb, corresponding to a generic third person null subject. Indeed, these sentences can occur with an overt external causer argument as well (*Merja pelottaa Pekkaa* 'Merja.NOM fear-CAU-3SG Pekka-PAR'), showing that an external causer is also possible. On the other hand, whether this is the correct way to interpret these clauses will be left for future research as many aspects of semantic interpretation are still lacking in the algorithm and not easy to implement formally.

4.2.5 Numerals

Finnish cardinal numerals fall into two paradigms. The first contains bare numerals which are always in the singular and assign the partitive case to the nominal elements below them, such as adjectives and the noun head. The adjectives and the noun head agree in singular with the numeral. These facts follow from the present analysis if these numerals have lexical features [ARG], [–VAL], so let us assume that they do (26).

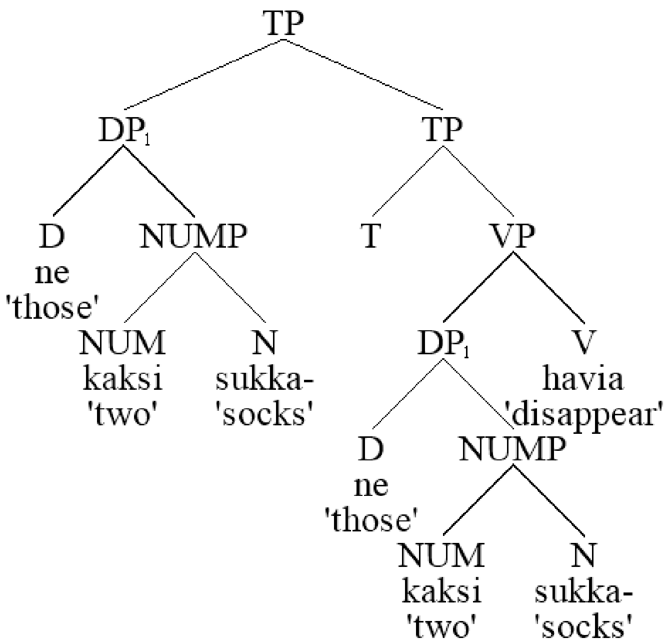
(26)	kaksi	sukka-a.	(#12)
	two.0	sock.SG-PAR	
	{+ARG, –VAL} ←	[PAR]	
	'two socks'		

The partitive is checked by {+ARG, –VAL}, whereas the genitive and nominative are ungrammatical (**kaksi suka-n* 'two sock-GEN'). The numerals in the second group inflect like adjectives by concord and do not assign any case to the elements inside their complement. They can be singular or plural. This element surfaces if we use, for example, the plural form of the numeral (27), as numerals in the first group are always lexically marked for the singular.

(27)	[Ne	kahde-t	sukat/	*sukka-a]	hävisivät.	(#13, 17-20)
	those.NOM	two-PL.NOM	sock-NOM.PL	sock-PAR	disappeared	
	'Those two pairs of socks disappeared.'					

The case checking relation at N ignores the numeral, lacking both +ARG and +VAL, and finds T at the reconstructed SpecVP position, correctly checking the nominative case. Thus, the two types of numerals differ in that the former are case assigners, assigning the partitive, while the latter are not. The analysis captures both (#12-13) with the same LF-interface structure (28).

(28) _



What has made the behavior of these elements subject to some debate in the literature is the fact that bare numerals in the first group only occur in contexts in which the hosting DP is assigned either the nominative or the accusative case. If the DP is assigned the genitive or any of the lexico-semantic cases, the numeral-partitive patterns disappears (29).

(29)

a.	Pekka	sanoi	[kahde-n	suka-n	häviä-vän.]	(#16)
	Pekka	said	two.sg-GEN	sock.SG-GEN	disappear-VA/INF	
	’Pekka said that the two socks will disappar.’					
b.	*Pekka	sanoi	[kaksi	sukkaa	häviä-vän.]	(#21)
	Pekka	said	two.0	sock-PAR	disappear-VA/INF	

Brattico (2010, 2011a) , following a tradition in the Slavic linguistics that exhibit somewhat similar phenomenon (e.g., Babby, 1987), analyzed this pattern by relying on case competition: the accusative and nominative are assumed to be “weak cases” that are outperformed by the genitive and the lexicon-semantic cases. We could imagine the latter cases being assigned "over" the numeral-partitive pattern, which would remain latent. A case competition analysis for Finnish structural case assignment was presented also in Nelson (1998). This analysis could be implemented by collecting case assigners encountered in the upstream path into a list and then evaluating case checking against the whole list. However, independent of whether such mechanism is ultimately needed in the description of case assignment patterns attested in Finnish, or crosslinguistically, it is not needed to account for (29). The data follows if we assume that the bare numeral itself exhibits an ambiguous NOM/0ACC case form and needs to enter into a proper case checking dependency accordingly. This prevents the bare numeral from appearing in any other context and thus derives the data in (29). These specimens can be found from the test corpus, correctly analyzed and judged (#12-21).

4.3 Accusative (three forms)

4.3.1 Aspect

Finnish accusative case constitutes a complex and contested phenomenon. As a first approximation, the accusative case – any of the three forms, discussed later in detail – is grammatical only if the verb phrase denotes an activity that has been completed (i.e. contains an end point). Let us assume, as a tentative working hypothesis, that the relevant feature is *aspectual boundedness* (Heinämäki, 1994; Kiparsky, 1998; Vainikka, 1989) and that it is represented in syntax as feature [ASP:BND] at a verbal head such as v, which is connected to accusative by rule [ACC] ~ [TAIL:+ASP:BND,+ARG]. This assumption is not completely uncontroversial syntactically or semantically (Csirmaz, 2005; Huumo, 2013; Kiparsky, 2001; Thomas, 2003), but what matters here is the fact that if we do *not* relate the partitive to any aspect feature, then we get the approximately correct result, in which the accusative entails boundedness, while the use of the partitive does not. Aspectually non-telic verbs such as *tönäistä* 'to nudge', which only accept the partitive, do not have [ASP:BND], rendering the accusative ungrammatical (#24, 28-31). Verbs that have both readings, such as *pesi* 'wash', are ambiguous: the entry that has [ASP:BND] is compatible with both the accusative and partitive, while the entry that lacks this feature is compatible only with the partitive and must have atelic reading (#25-26). All three combinations were successfully tested with the algorithm. Pronouns, which take an unambiguous t-accusative form, were also tested and correctly derived (#27). However, this system does not capture the behavior of achievement verbs that cannot be combined with the partitive (30). The analysis, as it stands now, predicts the partitive to be always possible in this position.

(30)	Pekka	voitti	Merja-n/	??Merja-a.
	Pekka	won	Merja-ACC	Merja-PAR
	'Pekka won Merja.'			

I have marked the partitive argument with two question marks. This is because either the sentence has a coerced or anomalous reading, in which an even that 'occurred in an instant is interpreted as being ongoing', or it is interpreted analogously to 'Pekka won money', here 'Pekka won part of Merja, such as a piece of her hair'. One solution would be to link the partitive with "unbounded aspect," but the hypothesis is problematic because the partitive is not intrinsically linked with aspect (Section 4.2). For example, it occurs in connection with numerals and prepositions that are inside subjects not necessarily connected to an aspectual feature by an upstream path (Section 3.2). Another solution is to create a *negative* tail-feature for the partitive, checking that the target feature representing boundedness does not exist withing minimal upstream search. Such feature could be denoted by [*ASP:BND] 'ungrammatical if the feature is matched by an upstream path'. However, the partitive is licensed if an achievement event is negated (31), so this approach will also lead into problems.[13]

(31)

a.	Pekka	halusi		[*voittaa*	Merja-n/	*Merja-a.]	(#62)
	Pekka	wanted		to.win	Merja-ACC	Merja-PAR	

’Pekka wanted to win Merja.’

b.	Pekka	ei	halunnut	[*voittaa*	*Merja-n/	Merja-a.]	(#67)
	Pekka	not	want	to.win	Merja-ACC	Merja-PAR	

’Pekka did not want to win Merja.’

The comprehension perspective, however, allows us to examine the issue from a novel angle. Without telepathic abilities, the comprehension system cannot be assumed to know the intended or desired interpretation in advance; rather, it is the parser’s task to *find* what the intended or most likely meaning is. Parsing must proceed with incomplete information, often creating several possible structural and semantic interpretations for any given input sentence as it works with any given input.[14] Thus, in the case of (30), the system cannot know in advance whether the speaker intends the expression to read analogously to ‘John won Mary’,

[13] Descriptively the aspectual reading connected to the accusative-partitive alteration shows up only in those contexts in which the accusative is possible in the first place; everywhere else, as in the negated contexts where the accusative never occurs for independent reasons, the aspectual dimension is neutralized.

[14] Thus, the comprehension algorithm maps each input sentence into a set of spellout and LF-structures. If several LF-interface objects are deemed acceptable, then the original sentence is judged ambiguous.

in which the partitive is deviant, or ‘John won money’, in which it is not. It must rely on the partitive case to guide patient reconstruction into the direct object position and *only then* evaluate the range of possible and plausible meanings (likely against a broader context). This architecture was implemented in this study. Thus, we assume that the tail-mechanism guides parsing and reconstruction and is not sensitive to the aspectual distinction in the case of the partitive, and that the issue raises only *after* reconstruction has been accomplished. Specifically, when the partitive links with a head that is marked for [ASP:BND] and occurs inside a positive polarity context (30), the algorithm infers in the semantic component (D, Fig. 4) that the speaker intended to establish a contrast with the accusative, triggering the atelic interpretation in which the event is interpreted as being ongoing. Sentences of the form (30) will be registered as semantically anomalous, reflecting the coerced reading of an ‘ongoing instant achievement’. The mechanism was added to algorithm, specifically to a piece of code that creates a semantic interpretation from an LF-interface representation (D, Fig. 4), and thus aspectual interpretation now appears in all outputs. Specifically, the algorithm will report (30) as “semantically anomalous” (see, e.g., #23) signaling the fact that it registers a mismatch between the aspectual interpretation entailed by the use of the case suffix and the main verb, but here we must keep in mind that there are intelligible ways of interpreting such sentences if provided a right context.

There is, however, an independent empirical argument supporting this hypothesis. The partitive case can occur together with an achievement verb if the object is in plural, as shown in (32).

(32) Pekka voitti kilpailu-i-ta.

Pekka won competition-PL-PAR

‘Pekka won competition.’

This sentence is grammatical and is interpreted to mean that Pekka won several competitions (Kiparsky, 1998; Megerdoomian, 2008). Thus, again the partitive case must first guide the argument to this position and only then examine if the result is semantically intelligible. In sum, the comprehension perspective allows us to draw a relatively sharp distinction between formal features that guide reconstruction and case checking and mechanisms which evaluate the output.

4.3.2 Polarity and agreement

In addition to its sensitivity to telicity, the accusative constitutes a positive polarity case. This can be expressed by rule [ACC] ~ [TAIL:*POL:POS], which marks it ungrammatical under the scope of the negation. Any 'Neg...ACC' construction will fail if there is an upstream path from the accusative into the negative polarity item, independent of the grammatical distance (33).

(33)

a.	Pekka	ei	voittanut	*Merja-n./	Merja-a	(#39, 40)	
	Pekka	not	won	Merja-ACC	Merja-PAR		
	'Pekka did not win Merja.'						
b.	Pekka	ei	halunnut	voittaa	*Merja-n/	Merja-a.	(#67, 68)
	Pekka	not	wanted	to.win	Merja-ACC	Merja-PAR	
	'Pekka did not want to win Merja.'						

The form of the accusative reflects also overt c-commanding agreement when the object is a singular full DP. The nominative-looking accusative (0/ACC) is checked if the direct object is not c-commanded by an agreeing predicate, whereas the genitive-looking alternative (n/acc) occurs when there is overt agreement, in agreement with (Reime, 1993; Timberlake, 1975; Vainikka & Brattico, 2014). We therefore add [n/ACC] ~ [TAIL:PHI] and [0/ACC] ~ [TAIL:*PHI] to the accusative rule, where [PHI] denotes a predicate that exhibits overt agreement.[15] [*PHI] is a negative feature: ungrammatical if the feature is encountered in the minimal upstream search. Notice that both case forms must also check the aspect rule and the polarity rule, since both are ungrammatical if [+ASP:BND,+ARG] cannot be checked or there is a negative polarity element [POL:NEG]. Thus, the two accusative forms 0/ACC and N/ACC are mapped into three rules in the surface vocabulary, exhibited in Table 1 earlier. These assumptions cover the following accusative data, that were correctly judged and analysed by the algorithm:

(34)

a.	Me	löysi-mme	avai-men /	*avain.	(#53, 56)
	we.NOM	found-1PL	key-N/ACC	key.0/ACC	

‘We found the key.’

b.	Me	löydet-tiin	*avaimen /	avain.	(#54, 55)
	we.NOM	found-IMPASS	key-N/ACC	key.0/ACC	

‘We found the key.’

c.	Pekka	tönäisi	*Merja-n /	Merja-a /	*Merja.	(#28, 24, 29)
	Pekka	pushed	Merja-N/ACC	Merja-PAR	Merja.0/ACC	

‘Pekka pushed Merja.’

d.	Me	ei	löydetty	avain-ta /	*avaimen /	*avain.	(#58, 59-61)
	we.NOM	not	found	key-PAR	key-N/ACC	key-0/ACC	

‘We did not find the key.’

[15] This feature is part of lexical elements in the surface vocabulary exhibiting overt agreement.

These rules cover also the long-distance effects. The key to this phenomenon is partial feature match. Checking for +ARG will terminate minimal upstream search at the first head with +ARG, independent of what other features are being checked. But when there is only one feature to check, the model derives nonlocal dependencies by searching until either the feature is encountered or there is no more structure to search. The upstream path will detect the relevant target features (here phi and polarity) automatically over a distance. These effects are illustrated in (35).

(35)

a.	Me	halut-tiin	[voitta-a	Merja /	*Merja-n.]	(#66, 68)
	we.NOM	want-IMPASS	win-A/INF	Merja.0/ACC	Merja-N/ACC	
	’We wanted to win Merja.’					
b.	Me	halusi-mme	[voitta-a	*Merja /	Merja-n.]	(#62, 70)
	we.NOM	want.IMPASS	win-A/INF	Merja.0/ACC	Merja-N/ACC	

(36)	Me	ei	haluttu	[voitta-a	*Merja /	*Merja-n	/	Merja-a.]	(#67, 71, 72)
	We	not	want	win-A/INF	Merja.0/ACC	Merja-N/ACC		Merja-PAR	
	‘We did not want to win Merja.’								

While this analysis does not capture the whole picture, which is too complex to deal with an article that attempts to model all structural case configurations in Finnish,[16] it shows that the mechanism is in principle sufficient to derive the phenomenon.

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[16] I am referring to the observation that there are special contexts in which the direct object case can take several forms and seem to exhibit a level of indeterminacy. (Anttila & Kim, 2017) propose in a recent paper that such cases involve optimality theoretical (OT) competition between different case forms. (Brattico, 2014) tries to capture the same patterns

In sum, then, the approach is able to cover the Finnish accusative case; the algorithm judges sentences involving the accusative case correctly and provides them with plausible structural analyses. Both local and nonlocal effects are covered. Pronouns, which were included into the test corpus, take an unambiguous *t*-suffix in these contexts that are paired with rule [T/ACC] ~ [TAIL:+ASP:BND, +ARG], [TAIL:*POL:NEG]. They are included in the test corpus and correctly judged and analyzed (#27, 31, 38).

I conclude this section by a brief comment on the nature of 'aspectual boundedness' that was assumed the underlie the syntactic feature checking the accusative case (any form). It seems well established that while there are several examples in which aspectual boundedness does play a role, that notion is insufficient: the accusative-partitive alteration applies systematically to predicates which are spatial, configurational, mathematical or states that have neither spatial or temporal dimension. Sentences containing such predicates do not describe events, less so telic events. What the ultimate semantic attribute is remains debated. But according to the analysis pursued here, that interpretation, in whichever way it is created, is generated after the case mechanism has performed reconstruction. This is consistent with the observation that it is the whole VP instead of the verb or its object alone that determine the semantic outcome (Chomsky, 1973; Csirmaz, 2005, 2012; Kiparsky, 1998; Leino, 1991; Megerdoomian, 2008; Verkuyl, 1972).

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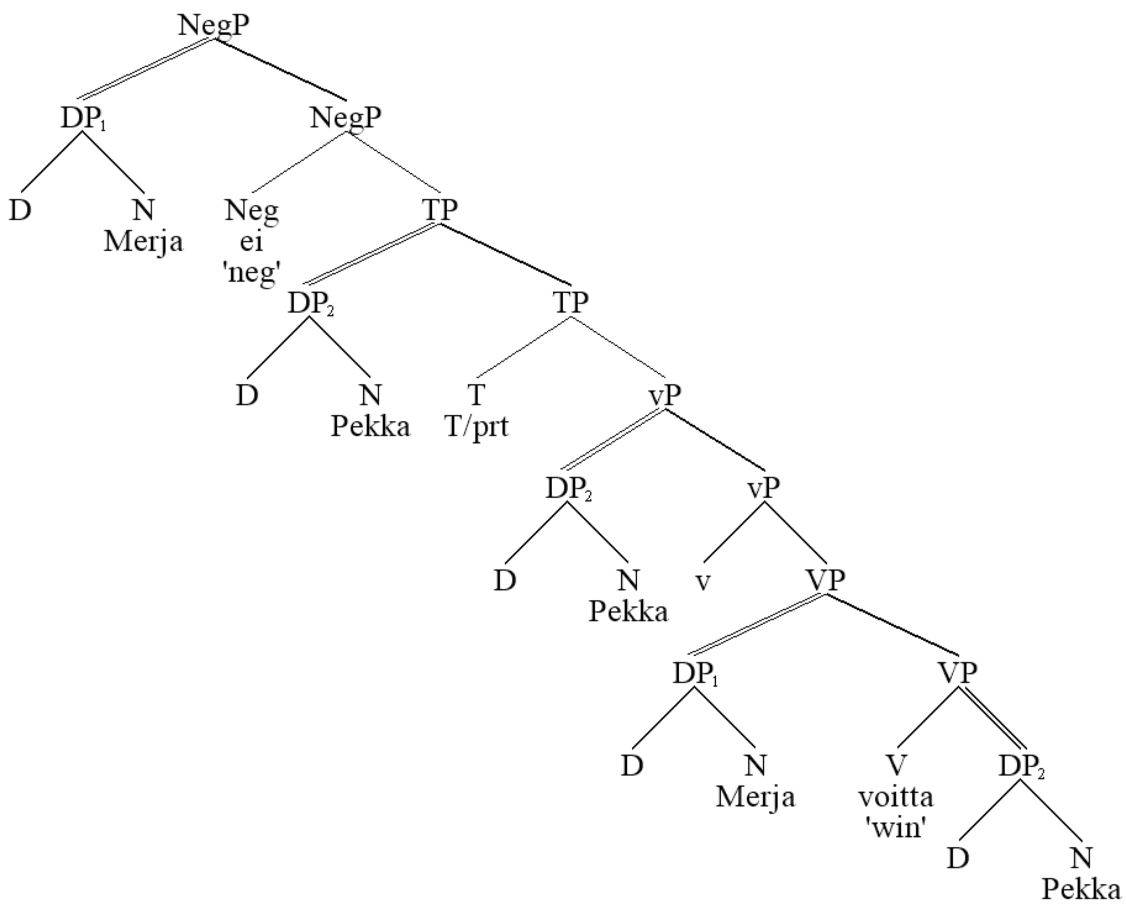
by relying on feature intervention. A third possibility that would be consistent with the comprehension framework is to assume that the indeterminacy exists at the level of the parser, which would provide several solutions (grammatical analyses) for the same input. I leave this topic for future research.

4.3.3 Accusative and reconstruction

The accusative case was tested also in connection with noncanonical OVS word orders in order to verify that it reconstructs the arguments correctly in the case of grammatical sentences and does not accept them accidentally when the direct object case is wrong. Furthermore, such tests show that there are no spurious reconstruction sites for the accusative. All tests were successful: the comprehension algorithm provided correct judgments and analyses (#44-52). Thus, it is able to process also noncanonical word orders, and does so by taking advantage of the accusative case forms. Example (37) shows how the algorithm comprehends a noncanonical O-Neg-V-S sentence (#44).

(37) _



The postverbal subject (DP_2) is first reconstructed to SpecTP where it checks the nominative case, and is then reconstructed further down to SpecvP, as SpecTP does not constitute a thematic position. The latter operation is A-movement. The preverbal direct object (DP_1) reconstructs to SpecVP and is assigned the thematic role of the patient (due to the fact that DP_2 has been moved out). The algorithm was successfully tested with other noncanonical but grammatical word orders (38).

(38)

a.	Merja-a	e-i	Pekka	voittanut.	(#45)
	Merja-PAR	not-3SG	Pekka.NOM	beat.PRTC	
	‘When it comes to Merja, Pekka did not win her.’				
b.	Pekka	e-i	Merja-a	voittanut.	(#46)
	Pekka.NOM	not-3SG	Merja-PAR	won.PRTC	
	‘Pekka did not beat Merja.’				
c.	Merja-a	Pekka	e-i	voittanut.	(#47)
	Merja-PAR	Pekka.NOM	not-3SG	beat.PRTC	
	‘When it comes to Merja and Pekka, he did not win her.’				
d.	Pekka	Merja-a	e-i	voittanut.	(#48)
	Pekka.NOM	Merja-PAR	not-3SG	beat.PRTC	
	‘When it comes to Pekka and Merja, he did not win her.’				

4.4 Genitive

4.4.1 Genitive in clausal context

In the original comprehension model (Brattico, 2020) only one construction was included that exhibited genitive checking, the thematic subject of the A-infinitival shown in (39).

(39) Pekka käski [Merja-n lähte-ä.]

Pekka.NOM ordered Merja-GEN leave-A/INF

'Pekka ordered Merja to leave.'

The genitive was associated with [–FIN] that it checked against the infinitival head A/inf^0 corresponding to the A-infinitival head (the *a*-suffix in the infinitival itself). The genitive argument was reconstructed to SpecVP. The derivation in illustrated in (40).

(40) Pekka käski [$Merjan_1$ -ä $\_\__1$ lähte-.]

Pekka.NOM ordered Merja-GEN A/INF leave-

[–FIN] ← GEN

The slightly more general rule [GEN] ~ [TAIL:+ARG, –FIN] proposed here is almost a notational variant of the above system, thus it is not surprising that it derives the same output (41) (#73).[17]

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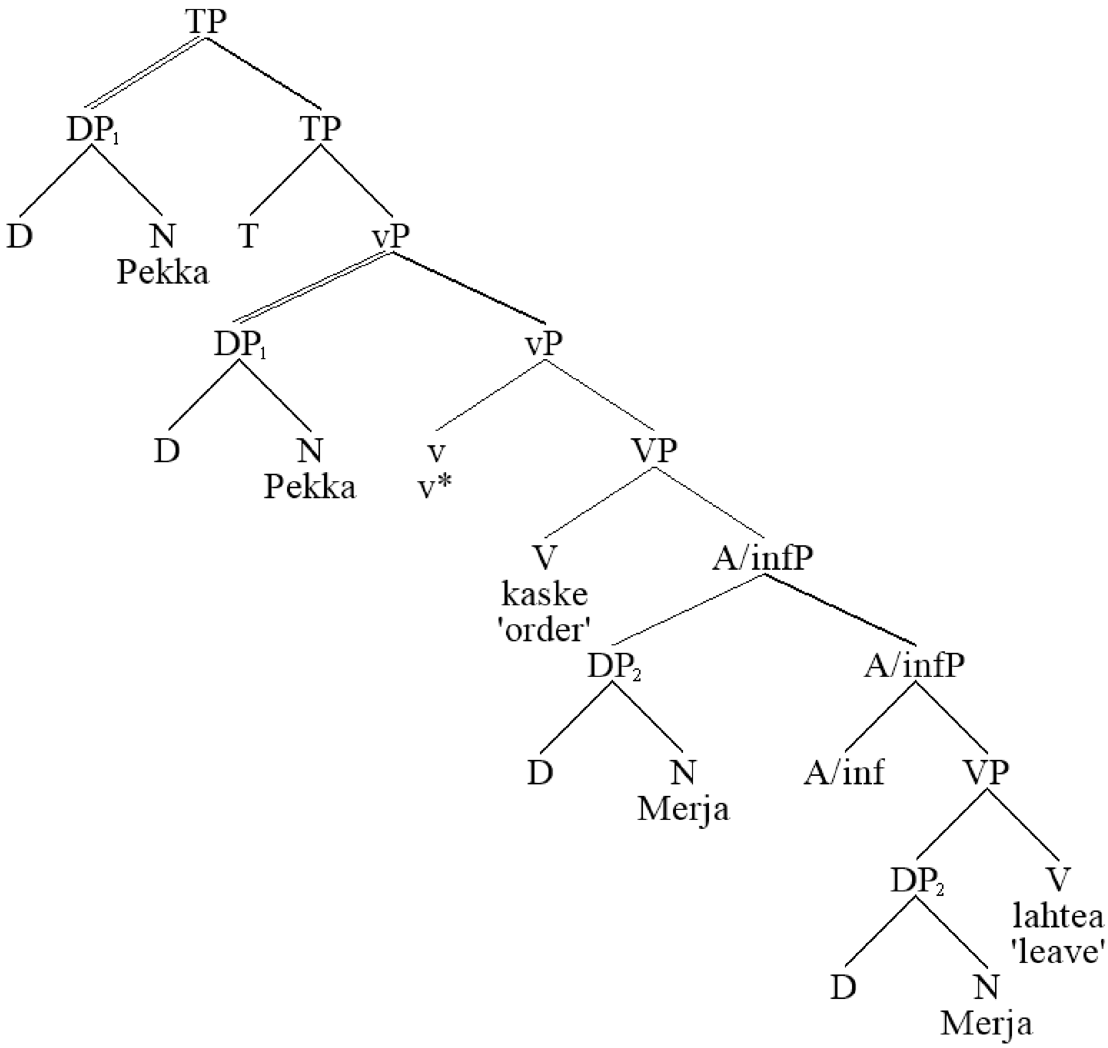
[17] The mechanism was generalized also to the VA-infinitival, which it analysed correctly, and which can be found from the raw data.

(41) _



The syntactic analysis of the infinitival, in which the genitive argument is reconstructed into the SpecVP position, is also supported by empirical evidence. First, the genitive constitutes the thematic subject of the infinitival, thus either it is reconstructed into the thematic position inside the VP, as assumed here, or the thematic position is filled in by PRO that is linked to the genitive argument by control. If the latter, the genitive should be inside the main clause VP and receive a thematic role (most likely ‘patient’) from V. Yet, true genitive arguments never appear in object positions in Finnish (**Pekka osti autoj-en* ‘Pekka bought cars-GEN’), but they do occur systematically at specifier positions of nouns, prepositions, adjectives and modal verbs. The genitive argument, furthermore, fails all direct objecthood tests that the true direct objects, when they occur in this or similar constructions, satisfy.[18] There are also infinitival constructions where genitive arguments co-occur with main clause direct objects (*Pekka osti auto-n Merja-n suostuteltua hänet* 'Pekka bought car.ACC [Merja.GEN after.persuaded him]', 'Pekka bought the car after Merja persuaded him'), showing that genitive arguments do occur inside infinitival phrases. I therefore regard the above analysis as plausible, certainly not something that can be objected without a compelling argument (for an opposite perspective, see (Kiparsky, 2001, pp. 255–259), and for my response, see author-citation[19]).

Finnish genitive arguments have an interesting and still largely unexplained property that they cannot be moved to the right and hence cannot be reconstructed to the left (Brattico,

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[18] One such test is the negation test, which checks if the form of the argument depends on the presence of c-commanding negation. Thus we find *Pekka näki Merja-n/*Merja-a lähtemässä* 'Pekka saw Merja-GEN/Merja-PAR leaving' ~ *Pekka ei nähnyt *Merja-n/Merja-a lähtemässä* 'Pekka not see Merja-GEN/Merja-PAR leaving' but *Pekka käski Merja-n/*Merja-a lähteä* 'Pekka ordered Merja-GEN/Merja-PAR leave' ~ *Pekka ei käskenyt Merja-n/*Merja-a lähteä* 'Pekka not order Merja-GEN/Merja-PAR leave'.

[19] Kiparsky's argument, building on (Carlson, 1978), is theory-internal and depends on specific and controversial assumptions concerning the assignment of direct object cases in the constructions under discussion. In addition, he cites several direct, and in my view compelling empirical reasons *against* the analysis in which the genitive is analyzed as an argument of the main clause. The totality of the evidence supports the hypothesis that the genitive argument is located inside the infinitival.

2016, 2018, 2020; Vilkuna, 1989). Thus, expressions such as (42) are systematically ungrammatical.

(42)

a. *Pekka käski [lähteä Merjan.] (#73)
Pekka.NOM ordered leave-A/INF Merja-GEN
Intended: 'Pekka ordered Mary to leave.'

b. *Pekka sanoi [lähtevän Merja-n.] (#74)
Pekka.NOM said leave-VA/INF Merja-GEN
Intended: 'Pekka said that Merja would leave.'

This was captured in the original linear phase comprehension algorithm as well as here by a formal stipulation that genitive arguments could only be reconstructed by means of directional A-bar and A-reconstruction, not by using case-based reconstruction. This is the reason sentences of this type are marked ungrammatical by the algorithm. The reason for this exceptional behavior of the genitive arguments is not known. English case marked pronouns behave similarly.[20]

The modal construction seems to violate the [GEN] ~ [–FIN, +ARG] rule. The construction is illustrated in (43). The genitive argument appears in the subject position of the finite modal verb (+FIN), which cannot, by the analysis proposed here, check it. This sentence type was not examined in (Brattico, 2020).

[20] Inversed OVS structures such as **her likes he* are not possible in English, although case marking could in theory license them in the same way as similar sentences are licensed in Finnish. There must be an additional (unknown) factor that applies to these examples, as well as to the Finnish genitive, and prevents argument reconstruction.

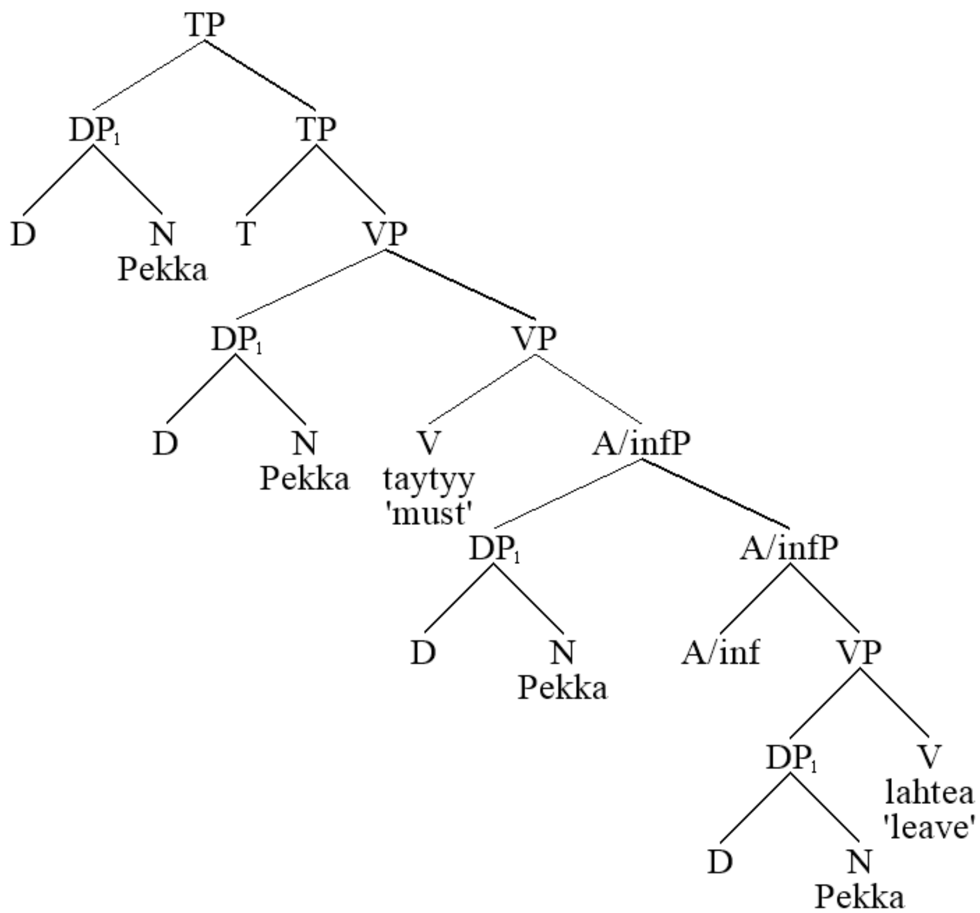
(43) Peka-n täytyy lähte-ä. (#75)

Pekka-GEN must.0 leave-A/INF

‘Pekka must leave.’

Interestingly, when feed with this sentence the algorithm judges the sentence correctly as grammatical and returns the analysis (44). The genitive argument is reconstructed successively-cyclically to the SpecVP position in which it checks the genitive case against the A-infinitival head.

(44) _



This structure cannot be judged as outright implausible, since the genitive subject does constitute the thematic subject of the infinitival verb, and the sentence is furthermore monoclausal, having thematic positions only for one standard set of arguments and adverbials (i.e. sentences such as **Peka-n täytyy Merja-n lähteä* 'Pekka-GEN must Merja-GEN leave' are always ungrammatical). Thus, it is certainly possible that the hearer reconstructs the genitive subject all the way down to the VP where it checks the genitive case against the A-infinitival head. I do not know any direct empirical evidence against this analysis. It was left to the study and can be found from the raw input-output data produced by the algorithm. This provides one possible, though not obviously correct, grammatical analysis for the Finnish modal construction. It is consistent with the analysis of case checking proposed in this study.

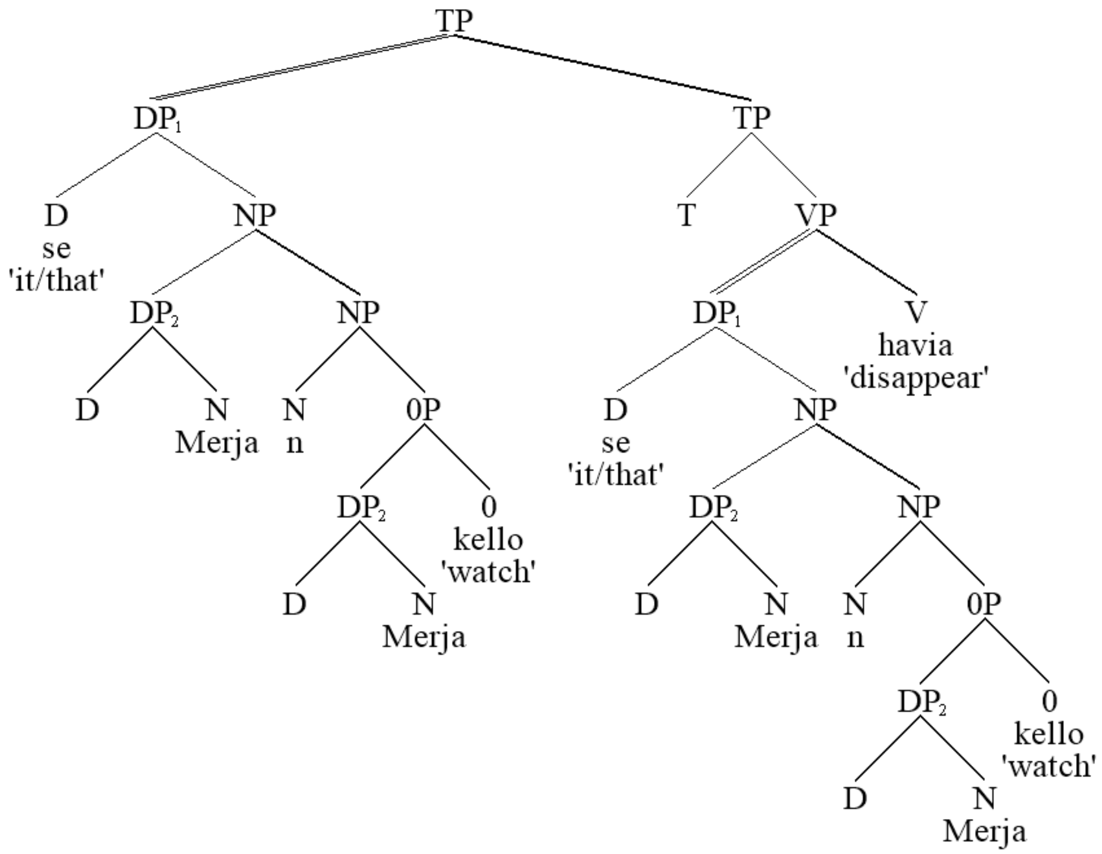
4.4.2 Genitives in nominal and adpositional contexts

The genitive occurs in a possessive role and is located in a prenominal position shown in (45).

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

This construction violates [GEN] ~ [TAIL: –FIN, +ARG] rule, since the genitive is not c-commanded locally with an (overt) functional head, less so an infinitival head. A possible solution is to adopt the analysis in (Brattico, 2005; Brattico & Leinonen, 2009), following (Marantz, 1997) and much subsequent research (see Pylkkønen (2002) for Finnish), who argue that the Finnish noun head decomposes into '*n* + root' structure (*n* = nominalizer), with the possessors being base-generated to SpecRootP where its case is checked by *n*. With these assumptions the algorithm derives (45), as shown by the analysis (46) for input sentence *se Merjan kello häivisi* 'the/that Merja.GEN watch disappeared' (#78).

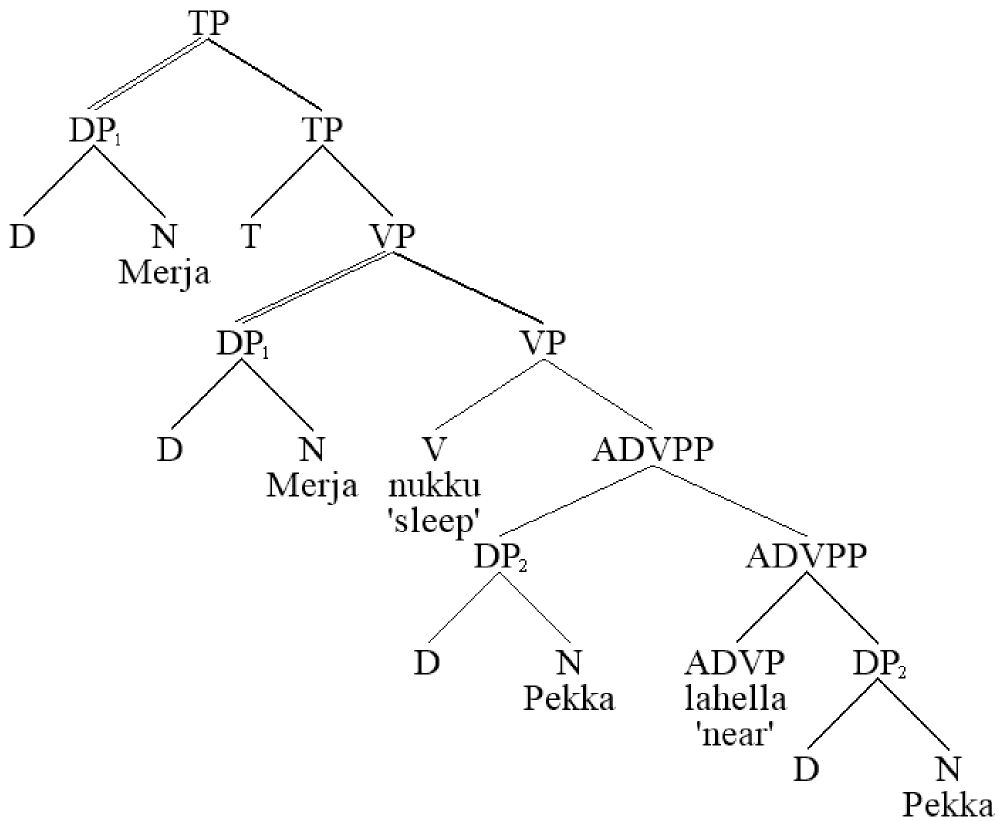
(46) _



The algorithm reconstructs the possessor argument from Spec*n*P to Spec0P (root), while the whole DP is reconstructed from SpecTP to SpecvP to check the nominative case. The decomposition *kello* ‘watch’ = *n* + 0 is provided in the surface vocabulary (0 = root in the input-output).

Adpositions taking genitive arguments are derived in the same way. The genitive is reconstructed to CompPP, where it can check the genitive case, again assuming that P comes with [–FIN]. Sentence (47) shows the analysis for an input sentence *Merja nukkui Pekan lähellä* ‘Merja slept Pekka.GEN near’.

(47)



The genitive argument *Peka-n* ‘Pekka-GEN’ is correctly reconstructed from SpecPP to CompPP (here labelled as AdvP by the algorithm but constituting a PP). The genitive argument cannot, however, appear in the post-head position in the spellout structure. We therefore check that variations (48) are correctly classified as ungrammatical.

(48)

a.	*[Se	kello	Merja-n]	hävisi.		(#79)
	the/that	watch	Merja-GEN	disappeared		
b.	*Merja	nukkui	[lähellä	Peka-n.]		(#82)
	Merja.NOM	slept	near	Pekka-GEN		

The algorithm judges them correctly as ungrammatical due to the fact that the EPP-feature of P and *n* is not checked. The following issue, however, arises: if both P and *n* have the EPP feature, bare nominals (*kello* 'watch') and prepositions that take partitive complements (*lähellä Pekka-a* 'near Pekka-PAR') are wrongly judged as ungrammatical: EPP remains unchecked. The preposition data, which involves free alteration between the genitive and partitive form in the case of several heads (see Section 4.2.3), can be explained by assuming that the EPP-feature can be attached to the preposition "freely" during the derivation (Brattico, 2011b; Manninen, 2003a). From the comprehension perspective this translates to the assumption that the preposition has two entries in the surface vocabulary, one with the EPP and another without. This hypothesis, which was assume here, derives correctly both forms (#80-81).[21] Similarly, the algorithm derives correct output if we assume that nouns are ambiguous between *n* + 0 forms and bare N forms, the latter lacking the EPP. This is not entirely stipulative: it is possible that the function of the nominalizer *n* is to introduce the possessor argument into the nominal domain, much like v introduces an agent argument in the verbal domain.

The genitive/possessor argument can occur at several positions in the nominal projectional spine and is reconstructed to the Spec0P position. The algorithm judges these sentences correctly as grammatical and provides them with the correct analysis, shown in (50) for (b). Interestingly, because the genitive cannot be reconstructed by the case mechanism (see Section 4.4.1), it will reconstruct by means of successive-cyclic A-movement.

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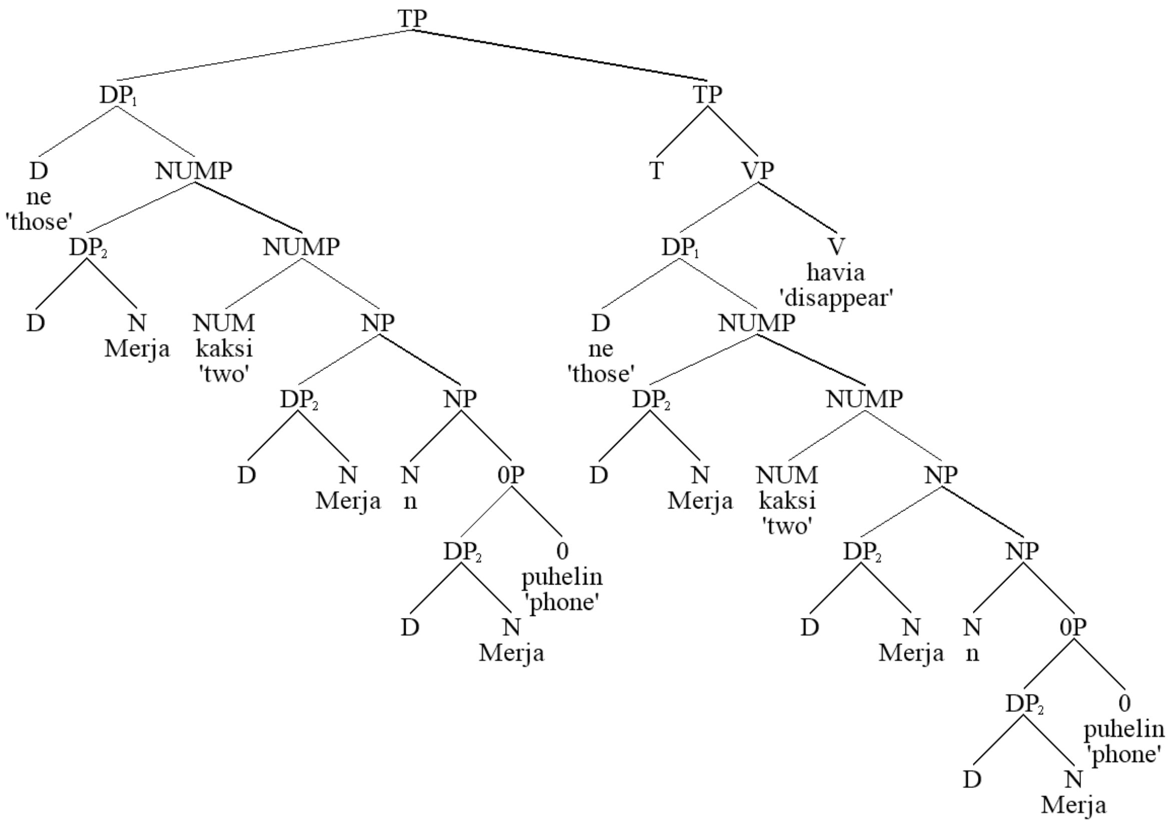
[21] The algorithm deals with lexical ambiguity by trying all of the alternative lexical elements in random order. In a more realistic system, the set of lexical candidates are ordered in terms of their psycholinguistic plausibility. It is also possible that all lexical items are selected and evaluated in parallel.

(49)

a.	Ne	kaksi	*Merja-n*	puhelin-ta	hävisi.	(#83)
	those	two	Merja-GEN	phone-PAR	disappeared	
b.	Ne	*Merja-n*	kaksi	puhelin-ta	hävisi.	(#84)
	those	Merja-GEN	two	phone-PAR	disappeared	

(50) _



4.5 Special constructions

4.5.1 Impersonal passives

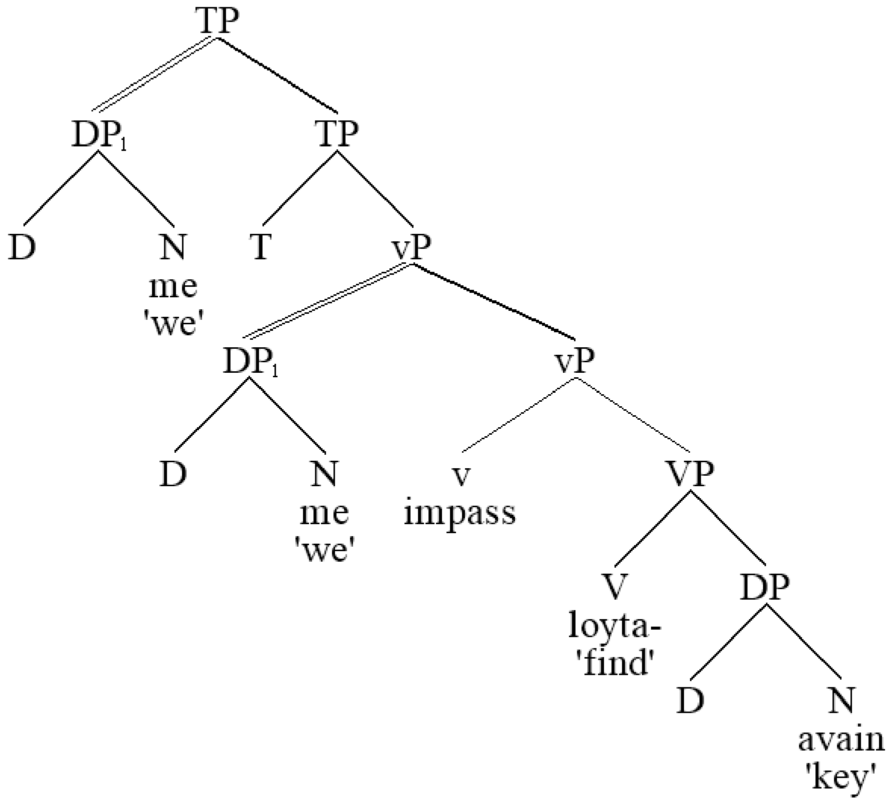
The impersonal passive construction was examined in Section 4.3 in connection with the accusative case. The key contrast is repeated at (51). The impersonal passive verb form that does not exhibit agreement comes with the zero-accusative form (0/ACC), whereas the first person plural form requires the n-accusative (N/ACC).

(51)

a.	Me	löydet-tiin	avain/	*avaim-en.	(#54, 55)
	we.NOM	found-IMPASS	key.0/ACC	key-N/ACC	
b.	Me	löysi-mme	*avain/	avaim-en.	(#53, 56, 57)
	we.NOM	found-1PL	key.0/ACC	key-N/ACC	

This effect is captured by the agreement rule that associates the two accusative forms with the presence of phi-agreement at a predicate reached by minimal upstream path. The impersonal passive form is created by the use of a special functional head corresponding to impersonal passive transitivizer, following the analysis of (Manninen & Nelson, 2004). The analysis is illustrated in (52).

(52)



Because the form is frozen, it does not exhibit phi-agreement (covariation of phi-features with a DP argument). If the first person plural subject is dropped, the algorithm correctly accepts these sentences with a ‘plural generic meaning’ (53). This is based on the observation that the implicit agent of the Finnish impersonal construction prototypically represents a collective of sentient beings (Manninen & Nelson, 2004; Shore, 1988).

(53)

a. Löydettiin avain. (#88)

found.IMPASS key.0/ACC

‘A key was found.’

b. Avain löydettiin. (#87)

key.0/ACC found.IMPASS

‘The key was found.’

In example (53)b, the direct object *avain* ‘key’ is reconstructed by using the zero-accusative case to the correct direct object position. The form is homophonous with the nominative case; this alternative does not lead into a grammatical output, however, because the nominative will guide the reconstruction into SpecTP, leaving the patient role of the main verb unsatisfied. In this case, the algorithm reports that the main verb lacks a mandatory complement/patient.

4.5.2 Raising construction

Finnish has one possible raising construction illustrated in (54)b.

(54)

a. Pekka näki Merja-n lähte-vän. (#74, control)

Pekka saw Merja-GEN leave-VA/INF

’Pekka saw Merja leaving.’

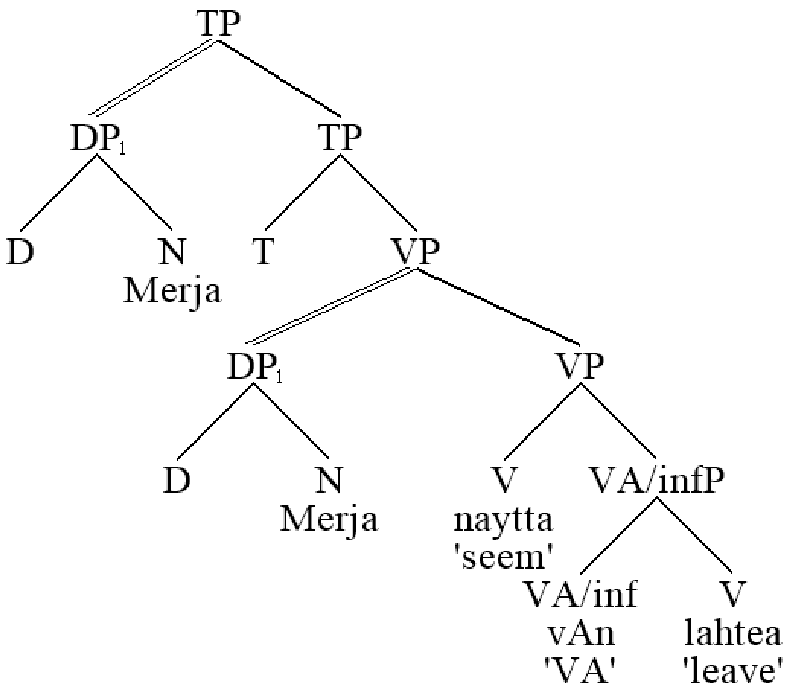
b. Merja$_1$ näyttä-ä __$_1$ lähtevän (#91, raising)

Merja.NOM seem-3SG leave-VA/INF

’Merja seems to be leaving,’

There are, to my knowledge, no systematic studies of this construction as of this writing. The comprehension algorithm reconstructs the grammatical subject to SpecVP position of the raising verb, checking the nominative case by finite T (54)b. However, because this is not a thematic position due to the nature of the raising verb ‘seem’, the algorithm attempts to reconstruct the argument further to the SpecVP position of the embedded infinitival, where it does find a thematic position. The solution fails because the algorithm cannot check the nominative case at that position: the SpecVP position of an infinitival is associated with the *genitive* (compare (54)a). On the other hand, if we assume that ‘seem’ projects a thematic role by providing it with the required lexical selection feature, then the subject stops at its specifier position and the thematic agent for ‘leave’ will be determined by control, effectively making this an obligatory control (OC) construction and not a raising structure (thus, the algorithm interprets Merja as both the agent of ‘seem’ and ‘leave’, see lines 836-7 in the results file; this happens because there is a component in the model which captures control behavior). I left this analysis, illustrated in (55), in this study, as the analysis is not outright implausible.

(55)



4.5.3 Copular construction

The copular construction with two DP arguments is illustrated in (56).

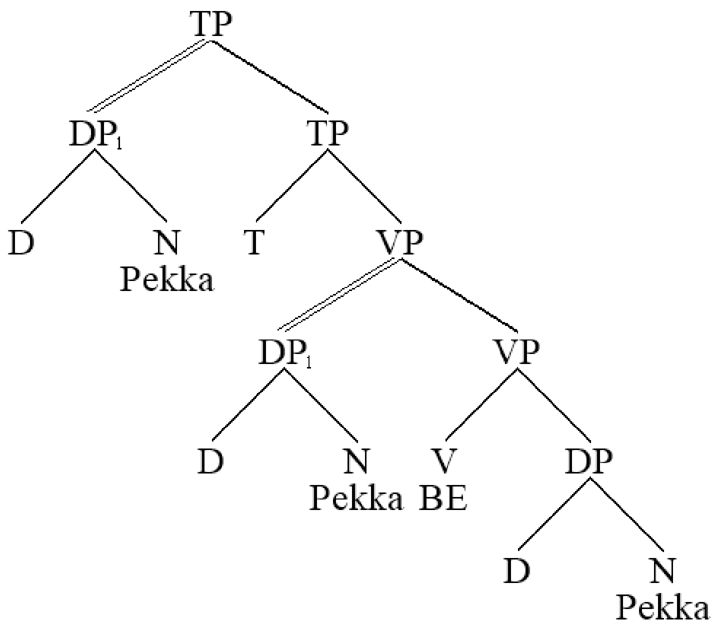
(56) Pekka on Pekka. (#92)

Pekka.NOM is Pekka.NOM

‘Pekka is Pekka.’

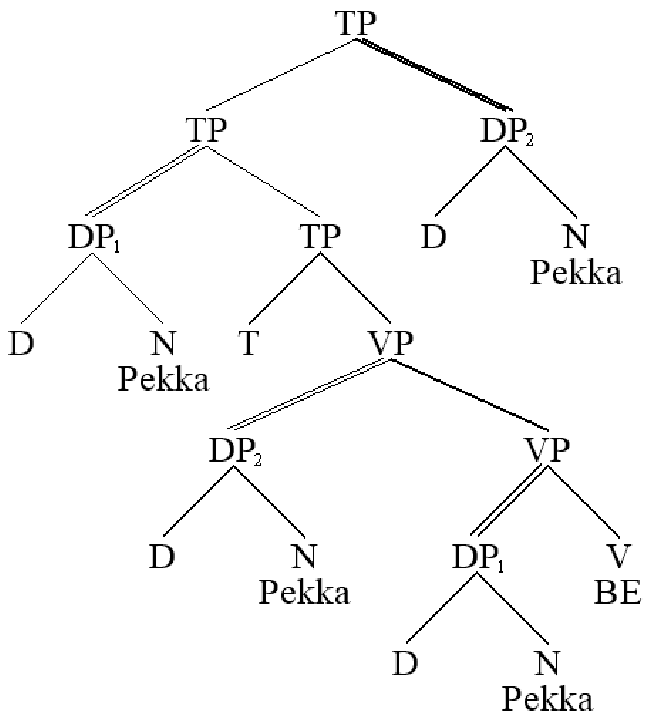
It is correctly judged as grammatical by the algorithm and analyzed as (57).

(57)



The grammatical subject is reconstructed to SpecVP, where it receives a thematic role of 'subject of predication' from the copula. The direct object remains in situ, and checks the nominative case nonlocally by finite T, as the copula has no feature that intervenes case checking. Thus, 'NOM + PAR' and 'NOM + GEN' combinations are correctly ruled as ungrammatical (#95-96). Interestingly, because the expression is symmetric, the algorithm can also shift the thematic roles. It does this by first analyzing the postverbal argument as being right-adjoined or "extraposed," and then reconstructs it into the subject position; the grammatical subject is reconstructed into SpecVP which now remains free (58). This shifts the positions of the 'subject of predication' and 'predicate' when these notions are defined by relying on spellout positions (thus, a Finnish sentence corresponding to *John is a boy* will be interpreted as 'A boy is John').

(58)



The algorithm also analyzes and correctly judges copular sentences with one of the arguments in the allative case (59)(ALL = allative case).

(59)

a. Merja-lla on Pekka. (#93)

Merja-ALL be Pekka.NOM

'Merja has Pekka.'

b. Pekka on Merja-lla. (#94)

Pekka.NOM be Merja-ALL

'Pekka is at Merja's place.'

The nominative argument checks its case against T, while the allative argument is analyzed as a PP, following an influential analysis by (Nikanne, 1993), and reconstructed into the canonical postverbal position (see the detailed output). It fails, however, with copular constructions that have partitive subjects (60).

(60) Merja-lla oli kello-j-a.
Merja-ALL be watch-PL-PAR
'Merja had watches.'

There is nothing to check the partitive case, under the assumption that BE is a non-case assigning head. This construction could be explained by assuming that the plural partitive argument is headed by a null preposition 'of' or a quantifier denoting 'some' or some similar notion that licenses the partitive (Thomas, 2003). The preposition or quantifier must then be provided in the surface lexicon by means of decomposition *kelloja* = watch#D#P.

4.6 Case marking of DP-adverbials

Finnish DP-adverbials are marked for the direct object cases much like direct objects are, as shown in (61)(Maling, 1993; Vainikka & Maling, 1996).

(61) Pekka nukkui [koko päivä-n.]
Pekka.NOM slept all day-N/ACC
'Pekka slept all day.'

Modelling this construction requires us to pay attention to one grammatical mechanism that has not been discussed up to this point, the projection principle, which in the original algorithm imposed a requirement at the LF-interface demanding that each DP-argument receives a thematic role, ruling out sentences such as **John admires Mary Mary Mary*. . . The projection principle rules out (61) as well since it contains an 'extra non-thematic DP'. This issue was dealt with in this study by assuming that any DP may contain feature

‘SEM:nonreferential’ that exempts it from the projection principle. The category includes DP-adverbials as well as expletives but excludes proper names and other DPs that are necessarily referential or can only occur in a position that requires thematic role assignment. Here the feature was assumed to be part of the lexical entry for *päivä* ‘day’, allowing the algorithm to treat it both as a referential and non-referential (durative adverbial) expression.

Construction (61) further presupposes that there is a mechanism that is able to interpret the DP ‘all day’ as an adjunct and not an argument. A mechanism of this type exists in the original algorithm. The algorithm recognizes that the DP cannot be selected at the position where it has been merged during the first pass parse, and because it constitutes an adjoinable phrase, it is ‘promoted’ into an adjunct during the comprehension process. An adjunct, in turn, is a regular geometrical constituent, but it is processed inside a separate processing pipeline, becoming ‘invisible’ for many grammatical processes, such as labelling, sisterhood and selection, in the primary processing plane. It is ‘stretched out’ from the primary processing pipeline and handled (transferred and interpreted) independently while retaining its constituenthood inside the primary plane. I have illustrated the mechanism in Figure 5.

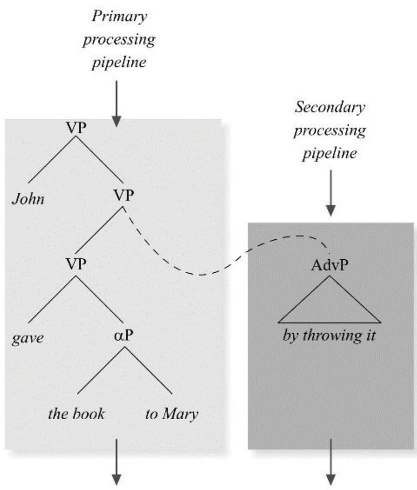
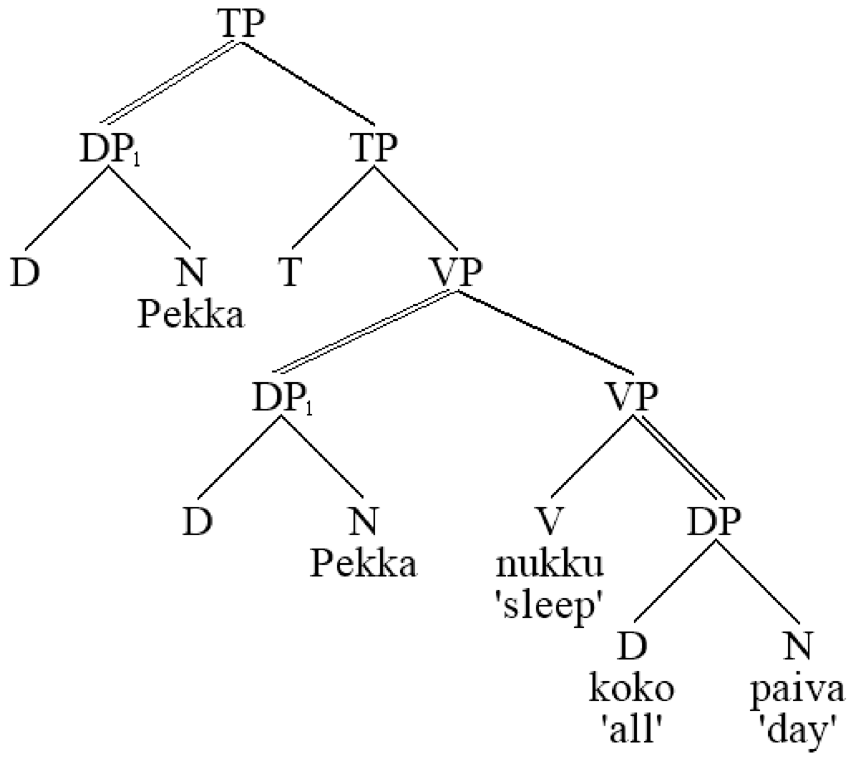


Figure 5. An illustration of the adjunct interpretation in the comprehension algorithm. Adjunct phrases are processed as separate units, although they are geometrically connected to the primary syntactic working space.

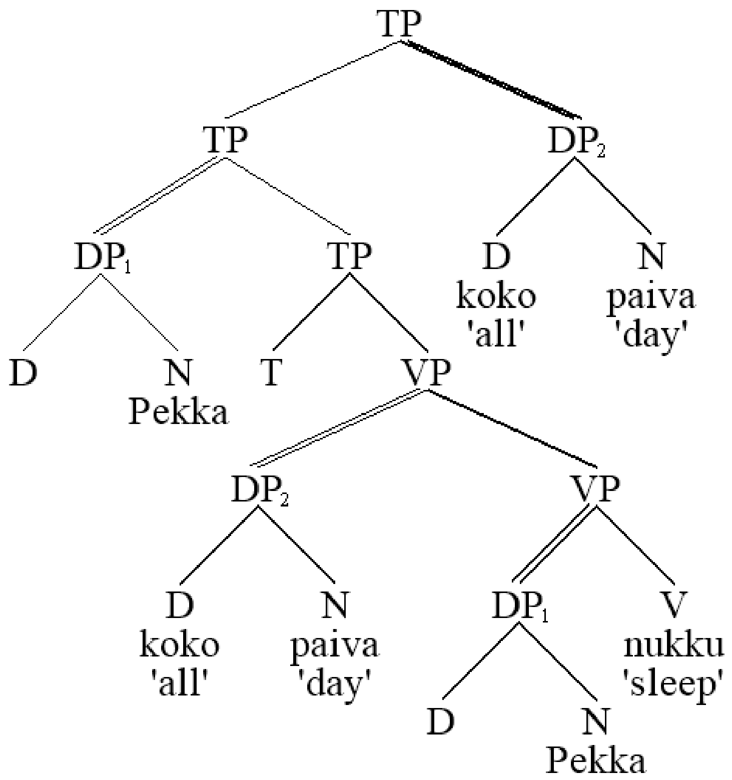
Adjuncts are marked by double line in the algorithm's image output and by <,> in the text output. The theory was developed on the basis of (Chomsky, 2004; Ernst, 2001), applied in (Brattico, 2020; Brattico & Chesi, 2020) and formally specified in (Brattico, 2019a). These assumptions have little impact on the processing of left adjuncts; in the case of right adjuncts the situation is different since the labelling algorithm inside the primary processing pipeline will ignore them. Right adjuncts become what could be described intuitively as 'free satellites', as shown in Figure 5. Consequently, the algorithm analyses DP-adverbials such as 'all day' as adverbial satellite constituents.

Having clarified the above issues, let us consider the case marking of DP-adverbials. Example (61) shows that the accusative case (here the n-accusative) can occur in connection with an intransitive verb. The adverb, like the accusative object, signals the fact that the event has a fixed duration. The corresponding aspectual feature [ASP:BND] could be either at T or at V, with the choice determining the position at which the DP adverbial could be merged according to the upstream path mechanism proposed in this article. I include both options into this study; the analyses produced by the model as shown below.

(62) Aspectual feature at V (#100)



(63) Aspectual feature at T (#99)



The second derivation requires a comment. The parser merges the DP-adverbial initially at the high right position, and then reconstructs it into a left-adjoined position inside vP, where it can check the aspectual feature against T. It is therefore reconstructed from a right adjunct position into a left adjunct position. But in whichever way the sentence is derived, the DP-adverbial can check the accusative case by using the standard accusative rule; we do not need to posit special rules for handling these data. If neither T nor V has the aspectual feature corresponding to the durative adverbials, then the sentence is judged ungrammatical, as can be seen from the input-output. Similarly, the accusative is ungrammatical if the clause is negated, grammatical if the adverbial is in the partitive (64)(a). Also the zero-accusative is correctly licensed (64)(b). These results are an automatic consequence of the upstream path approach: the adverbials, like thematic arguments, will checks its case by minimal upstream path.

(64)

a.	Pekka	ei	nukkunut	*koko	päivä-n /	koko	päivä-ä.	(#101, 105)
	Pekka	not	slept	all	day-N/ACC	all	day-PAR	

‘Pekka did not sleep all day.’

b.	Me	nukuttiin	koko	päivä	/	*koko	päivän	(#102, 106)
	we.NOM	slept.IMPASS	all	day.0/ACC		all	day-N/ACC	

‘We slept all day.’

Adverbial case marking was successfully tested also in the case of transitive sentences (65)(#103, 107-110).

(65)	Pekka	ihailee	Merjaa	koko	päivän	/	*päivä	/	päivä-ä.
	Pekka	admires	Merja-PAR	all	day-N/ACC		day.0/ACC		day-PAR

‘Pekka admires Merja all day.’

I regard it as a welcome consequence that the upstream path analysis can derive the properties of adverbial case marking without any extra rules. As I pointed out when criticism Vainikka’s default complement rule in Section 3.2, adverbials suggest that a more general mechanism is needed; the upstream path approach provides one possible research avenue that at least works when simulated in a rigorous way.

5 Conclusions

The grammar of structural case assignment was explored from the point of view of language comprehension by developing a computational algorithm, based on an earlier study by

Brattico (2020), that judges and analyses Finnish structural case constructions involving the nominative, partitive, accusative and the genitive cases. In addition, all three forms of the accusative case were correctly processed, including nonlocal case dependencies and case marking of DP-adverbials that have been subject to considerable controversy in the past literature. The argument, if correct, shows that the comprehension perspective is perhaps not as irrelevant to linguistic theorizing as has been previously thought.

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Conflicts of interest

No conflicts of interest