Interplay between Case, Animacy and Number: Interpretations of Grammatical Role in Estonian[*]

Merilin Miljan, Elsi Kaiser, Virve-Anneli Vihman

This paper reports on a psycholinguistic experiment investigating information used in incremental interpretation to assign grammatical roles to case-marked nouns. The three core grammatical cases in Estonian – nominative, partitive and genitive – are syntactically ambiguous, in that they may function in various grammatical roles depending on the context. Our study probed what grammatical functions Estonian speakers assign to nouns marked in these cases prior to any knowledge of the syntactic structure of the clause. We investigated the effect of animacy and number, in combination with case-marking, on grammatical role assignment of clause-initial nouns. Results show that these cases are underspecified, and that the interpretation of nouns, when presented without prior context, involves semantic cues like animacy and number, which interact with morphological case to guide the assignment of grammatical functions.

Keywords: *grammatical relations, incremental interpretation, morphological case, Estonian*

1   Introduction

Grammatical role assignment, or building syntactic relationships between words, forms a fundamental part of language comprehension. Building syntactic structure from the words we read or hear takes place *incrementally* (e.g. Altmann & Kamide 1999, Kaiser & Trueswell 2004, Tanenhaus et al. 1995 *i.a.*). That is, a comprehender starts building an interpretation incrementally, before the end of the sentence, at a point when the linguistic information is still potentially syntactically ambiguous. Prior work shows that a variety of constraints guides the extent to which the language comprehension system considers or 'activates' alternative structures.

The incremental nature of language processing raises questions for the role that morphological case-marking plays in the process of grammatical role assignment. Morphological case-marking can encode relations between linguistic elements, such as signaling whether a noun is the subject or object of a (potentially as yet unseen) verb. Indeed, morphological case has often been taken to be a reliable, one-to-one means for indicating the grammatical relation between a case-marked argument and the verb (see, e.g. de Swart 2005, Lamers 2005 or most traditional grammars). This seemingly straightforward interpretation of case, however, depends on a linguistic context, which necessarily includes a verb and possibly other arguments of the verb. Even in a context where the verb is known, a particular case does not always unambiguously signal a specific grammatical relation. This is illustrated in the Estonian examples in (1) and (2). Example (1) shows that when more than one genitive-marked noun occurs in sequence, the modifier function is indistinguishable from the object function, unless we take the discourse context into account; in this case, the question is whether the noun 'cone' in (1)

---

should be interpreted as a possessor, hence a modifier of the noun 'hiding place', or the object of the verb 'to bring' (see Roosmaa et al., 2003, who discuss the ambiguity of the genitive in Estonian).

(1) *Orav   viis   selle   käbi   peidukohta.*[1]
    squirrel.NOM.SG[2] took this.GEN   cone.GEN.SG hiding.place.INE.SG
    a.   'The squirrel took this pinecone to a hiding place.'
    b.   'The squirrel took this to the pinecone's hiding place.'

Another example of ambiguity is in (2), where two arguments occur in nominative case form. As Estonian word order is generally determined by information structure, with topics preceding the verb and foci occurring later, the pre-verbal nominative argument in (2) may turn out to be either subject or object. In other words, without further context, the initial noun may be interpreted as the subject or the object argument.

(2) *Eestlased   vahetasid   välja läti   rahuvalvajad.*
    Estonian.NOM.PL   replaced   out Latvian.GEN.SG   peacekeeper.NOM.PL
    a.   'The Estonians replaced the Latvian peacekeepers.'
    b.   'The Latvian peacekeepers replaced the Estonians.'

So far, we have been considering whole sentences, where the verb information is assumed to be available during the interpretation process. However, recall that processing is known to be highly incremental: Comprehenders start to build an interpretation early on, as soon as they process the first words, before they have encountered the full sentence. Since Estonian sentences tend to be verb-medial, this means that comprehenders often encounter at least one nominal element before the verb. This brings up the fundamental question of how case morphology guides the relational interpretation of a noun when verb-based information is *not yet present*.

In related work, Bornkessel-Schlesewsky & Schlesewsky also note that interpretational effects driven by nominal elements can be "observable prior to the verb, attest[ing] to the verb-independence of role prototypicality assessment, that is, to an abstract, verb-independent notion of A [agent-like] and P [patient-like] roles" (Bornkessel-Schlesewsky & Schlesewsky 2009, 33).

The question of how case morphology guides noun interpretation is relevant for any model of processing, and especially for languages which allow word order variation (i.e., comprehension cannot rely on word order to identify grammatical role). Currently, the role of morphology in language processing is not yet fully understood, and the present paper aims to contribute to these ongoing explorations.

The experiment reported in this paper investigates the interpretation of morphological case by native Estonian speakers, in order to probe the factors relevant to determining the grammatical role of a constituent and the structure of a sentence. Estonian has several characteristics which make it a particularly fruitful language for this

---

[1]   Example from http://kodu.ut.ee/~kaili/Loengud/Mudelid08/lnotes1.pdf

[2]   The abbreviations for glosses used in this paper are as follows: NOM = nominative, GEN = genitive, INE = inessive, PAR = partitive, ALL = allative, ELA = elative, ILL = illative, ADE = adessive, SG = singular, PL = plural, PST = past tense, PRS = present tense, 3 = third person, 2 = second person, 1 = first person, IMP = imperative, IMPERS = impersonal, NEG = negation marker, PCPL =participle, PRTCL = particle.

investigation. First, word order is variable, which means that linear order does not determine the grammatical role of a noun. For example, one can encounter either subjects or objects early in sentence interpretation. Second (and relatedly), case-marking is the most reliable cue to grammatical roles in Estonian, and thus one might expect comprehenders to be especially attuned to it. Third, although case markers are reliable cues, they do not map uniquely to grammatical roles: ambiguity exists both in the morphological case system and in the mapping between morphological case and syntactic role. (This is discussed in more detail in Section 3). Hence, comprehenders have experience in predicting and adjusting their expectations regarding the function of morphologically case-marked nouns.

How informative are morphological case-markers on their own; or, conversely, how ambiguous are case-markers in the absence of a verb which assigns semantic roles to its arguments? What factors become relevant for interpreting case before the verb is available, when core cases are syntactically ambiguous? What properties of the nominal argument help determine its grammatical role assignment and interpretation? It is well known that preverbal argument interpretation relies on interacting information such as animacy and definiteness (see, e.g. Bornkessel & Schlesewsky 2006, Lamers & de Swart 2012). Yet, determining exactly what type of information interacts with what, and under what conditions, is still a major challenge for both linguistic theory and psycholinguistic explanations.

1.1   Aims of this work

This work investigates whether and to what extent morphological information in case-marked nouns in Estonian affects their interpretation in terms of grammatical relations: How well will a case-marker predict the grammatical role of the noun it marks, independent of any verb? Estonian has three basic grammatical cases (nominative, partitive, genitive[3]), each of which can be used in at least two different grammatical roles (see Section 3); hence, without any linguistic context, all three are syntactically ambiguous. In addition, Estonian has relatively free word order.

We investigated how morphological case-marking, in combination with animacy (animate/inanimate) and number (singular/plural), constrains argument interpretation, in order to see how native speakers' interpretations of nouns and their grammatical roles are influenced by these three factors. As we discuss below, we used an offline production experiment which, in certain key respects, imitates the incremental nature of online comprehension. It allows us to probe how people interpret case-marked nouns, in the absence of any verb information, and hence to ask what information is read off the case-marking itself.

The results can shed light on the kinds of (potential) syntactic relations that comprehenders activate when they see a case-marked noun before any verb-related information is available, e.g. in sentence-initial position. In Estonian, word order is driven by pragmatic constraints, and, although prototypical transitive sentences have SVO word order, word order can and does vary. Hence, case-marking is the most reliable cue for disentangling grammatical relations.

Yet case-marking is not a fully deterministic indication of grammatical role either. For example, in situations involving case homonymy, a noun's case is morphologically

---

[3]   The genitive has also been referred to in the literature as (syntactic) accusative, morphologically realised as genitive in singular and nominative in plural.

ambiguous. Furthermore, even when the case-marking is morphologically unambiguous, a noun on its own in any of the three grammatical cases is syntactically ambiguous (Section 3). For example, genitive case may signal a possessive relation or a direct object, both of which are possible in sentence-initial position. Partitive case may be used to mark either a (partially affected) direct object or a subject in certain constructions. Nominative case is used for both canonical subjects as well as certain affected direct objects, e.g. plural direct objects in declarative sentences and any affected object in imperatives.

In light of the incremental nature of language comprehension, we pose the overarching question of what happens when people encounter a sentence-initial case-marked noun whose syntactic role is ambiguous. From a *structural perspective*, one prediction is that comprehenders will initially prefer interpretations compatible with the minimal amount of structure (e.g. extended Argument Dependency Model in Bornkessel-Schlesewsky & Schlesewsky 2009a,b). For example, nominative-marked nouns will tend to be interpreted as subjects of intransitives, thereby assuming the minimal amount of structure.

From a *frequency-based perspective,* a likely prediction is that nouns will tend to be interpreted in accordance with the most frequent patterns in the language (e.g. Bybee & Hopper 2001, Gries & Divjak 2012, MacDonald 2013, see also Hale 2001 and Levy 2008 for related work). For example, based on what is known about Estonian word order and frequency patterns, it is reasonable to assume that sentence-initial nominative nouns will be interpreted as subjects and sentence-initial genitive nouns as possessors. A frequency-based account is not mutually incompatible with a minimal structure based account, as it could well be that frequent structures also tend to involve minimal structure.

Crucially, our central aim in this paper is not to test or disentangle minimal-structure-based or frequency-based accounts, though we do consider both factors to be important and discuss them in the results section. Prior work on sentence-processing more generally has already yielded considerable evidence in favor of both of these accounts. Instead, our focus here is on how properties of the case-marked noun influence comprehenders' expectations about the noun's grammatical role. Prior work has found that preverbal argument interpretation also relies on other factors such as *animacy* and *definiteness* (e.g. Bornkessel & Schlesewsky 2006, Lamers & de Swart 2012). We chose to investigate animacy in our experiment because its relation to case-marking is an unexplored area in Estonian. In addition to testing whether the *animacy* of the case-marked noun influences its interpretation, we also investigate whether the *number* of the noun (singular/plural) matters. Number distinctions have not been closely examined in the context of grammatical role interpretation, but they are known to be relevant in the assignment of grammatical case in Estonian (Cann & Miljan 2012, Erelt et al. 1993, Rajandi & Metslang 1979). For example, a basic fact about Estonian case-marking is that *singular* affected objects are genitive, whereas *plural* affected objects take nominative case. (We did not investigate definiteness, as Estonian does not mark definiteness with any distinctive obligatory markers, and also because definiteness is a category which is entangled with other features.)

In sum, the general question underlying this study is: Which factors are relevant for noun interpretation in a situation where the core cases are syntactically ambiguous and comprehenders have not yet encountered verb information? Under a view where case-marking acts as a clear, deterministic marker indicating a noun's grammatical role, the prediction is that number and animacy will have no effect on how a case-marked noun is interpreted. However, based on the ambiguities inherent in Estonian case-marking, this outcome seems highly unlikely. Instead, if case-marking is a cue that provides

constraining information about a noun's possible grammatical role, yet does not, on its own, map directly onto a particular grammatical role, then we may well find factors like animacy and number modulating comprehenders' interpretation of case-marked nouns. Our experiment will shed light on (i) how number and/or animacy guide interpretation of case-marking, (ii) the relative contributions of animacy and number for the interpretation of nominative, genitive and partitive case, and (iii) whether these three core cases differ in the extent to which animacy and number guide their interpretation.

2   Prior work on the interplay between case, animacy and number

In this section, we briefly review existing views from theoretical linguistics and psycholinguistics on case-marking, with a particular focus on the effects of animacy and number. We then turn more specifically to prior work on how animacy and number interact with case-marking, with a special focus on Estonian.

2.1   Animacy and case-marking

Although it is not clear whether a noun's animacy status is an independent factor (an 'ontological' category in Dahl's terms, 2008) or an artefact reducible to other factors (see discussion in Rosenbach 2005, 2008, Dahl 2008), animacy clearly has consequences for linguistic encoding. For example, in terms of grammatical role, subject referents in nominative-accusative languages tend to be animate and objects tend to be inanimate (e.g., Aissen 2003, Comrie 1989 *i.a.*). Furthermore, this pattern leads to certain tendencies in case marking (e.g. Comrie 1989, de Hoop & de Swart 2008). For example, animate nouns in the direct object function are cross-linguistically more likely to be overtly case-marked (e.g. by accusative), because this is not their typical role (e.g. Comrie 1989, 128).

Animacy has also been shown to have an independent effect in *syntactic* construction alternations. For instance, Rosenbach argues – based on English constructions with *'s* and *of* (*the king's box* vs. *the box of chocolate*) – that animacy is an independent factor in guiding grammatical variation, as well as a processing factor contributing to efficiency in parsing (Rosenbach 2005, 639). Other work highlighting the effect of animacy in syntactic alternations comes from research on the English dative alternation (Bresnan et al. 2007).

Psycholinguistic studies provide ample evidence showing that the animacy of nouns plays an important role during real-time processing, for example in resolving structural ambiguity (e.g. Lamers 2005, Tanaka et al. 2005, Prat-Sala & Branigan 2000, Christianson & Ferreira 2005, Traxler et al. 2002, 2005, Mak et al. 2002, 2006). The focus has been on how animacy contributes to grammatical function assignment in locally ambiguous structures and to word order during production and comprehension (see e.g. Branigan et al. 2008 for an overview). Most of these studies, however, investigate languages like English that do not have rich case-marking paradigms, and thus their main focus is on syntactic alternations.

Less research has considered animacy paired with case-marking, but work that has been done shows that the interaction between morphological case and animacy in determining grammatical role assignment need not be absolute even in a single language, but rather may vary according to the case information available in a particular construction (Bornkessel-Schlesewsky & Schlesewsky 2009b). A particularly clear example investigated how German speakers interpret nouns, morphologically marked as

nominative, dative or accusative, that could act as syntactic subjects or objects. On the one hand, the interpretation of nouns in constructions with *nominative and accusative* arguments (where the nominative noun must be semantically interpreted as the actor, and the accusative noun as the undergoer) is determined by the case-marking of the arguments (nominative=subject, accusative=object, regardless of animacy, Grewe et al. 2007). On the other hand, in constructions with *nominative and dative* arguments (either of which could in principle be interpreted as the actor *or* the undergoer), the animacy of the nouns plays a key role: Animate entities are more preferred as subject (actor) arguments than inanimate ones, leading to a favored linearisation of animate-before-inanimate (Schlesewsky & Bornkessel 2004, Grewe et al. 2006). This shows that animacy affects interpretation preferences in situations where case-marking is ambiguous, in this case between the actor and the undergoer argument (Bornkessel-Schlesewsky & Schlesewsky 2009b, 43–44).

In sum, although animacy clearly plays a role in guiding the interpretation of case-marked arguments, relatively little is known about 'cue reliability' of case-markers in morphologically rich languages, and what type of information they interact with when this cue is ambiguous.

2.2   Number and case-marking

The relationship between number, grammatical role assignment, and case-marking has not received much attention in theoretical or psycholinguistic work. Prior psycholinguistic studies on number mostly focus on subject-verb agreement effects, not case-marking (see Lago et al. 2015 for a review). Yet the same factors that interact with grammatical role assignment have also been found to play a role in number agreement: animacy, definiteness, specificity/referentiality, topicality (e.g. Corbett 2000, Bamyaci et al. 2014).

In Estonian, object case-marking crucially involves number: In predicates denoting unbounded events and/or unaffected objects, *both singular and plural objects* are partitive; as well as objects in the scope of negation (3c). However, for transitive, affirmative predicates involving affected (countable) objects and bounded events, objects have heterogeneous case-marking *depending on number and clause type*, as shown in (3a). Singular affected objects in unmarked, active voice constructions take genitive case, whereas nominative case marks plural affected objects as well as affected objects in subjectless constructions, such as imperatives (as in 3b) and impersonals (Erelt et al. 1993). (The count/mass distinction as well as numeral constructions also play an important role in the use of the partitive, but this paper only focuses on count nouns without numerals.)

(3)   a.   *Poiss   kirjutas   luuletuse / luuletused.*
            boy.NOM.SG   wrote   poem.GEN.SG/poem.NOM.PL
            '(The) boy wrote (a) poem / poems.'

      b.   *Loe   luuletus   /   luuletused   ette!*
            read.IMP.2SG   poem.NOM.SG/poem.NOM.PL   forward
            'Recite the poem!'

      c.   *Poiss   ei   kirjutanud   luuletust / luuletusi.*
            boy.NOM.SG   NEG   write.PCPL   poem.PAR.SG/PAR.PL
            '(The) boy did not write (a) poem / poems.'

3   Core cases and word order in Estonian

3.1   The core cases

Estonian has a rich system of morphological case-marking, including differential marking of grammatical relations and the variable use of nominal case-marking. The canonical subject-marking form, nominative, is also used for objects in various constructions (Section 2.2); and some subjects are partitive. Likewise, partitive and genitive – the object cases[4] – are also used to mark other syntactic relations, e.g. adverbial and possessor, respectively. Thus, there is no one-to-one mapping between morphological case and grammatical function. All three core cases can give rise to differing interpretations, and each grammatical role can be instantiated with more than one case.

    This ambiguity is particularly evident with nouns in sentence-initial position. For instance, upon encountering the clause-initial, nominative noun *õpetajad…* 'teachers' (as in 4), the listener does not know whether it will function as the object, as in (4a) or the subject, as in (4b) – because at the point where a listener or reader encounters the sentence-initial noun, the rest of the sentence has not yet been seen/heard. This ambiguity also occurs with nouns in other cases: the partitive noun *külalisi* 'guests' in (5) may turn out to be the subject (5a) or the object (5b), and the genitive noun *sõbra* 'friend' in (6) may turn out to be a possessor (6a) or a direct object (6b). Note that the partitive subject interpretation is primarily available to plural and mass nouns, as in (5).[5]

(4)   *Õpetajad…*
        teacher.NOM.PL
        a.   *…kutsuti   koosolekule.*
              invite.PST.IMPERS   meeting.SG.ALL
              '(They) invited (the) teachers to a meeting.'

        b.   *…läksid   koosolekule.*
              go.PST.3PL meeting.SG.ALL
              '(The) teachers went to a meeting.'

(5)   *Külalisi…*
        guest.PAR.PL
        a.   *…saabub   igast   ilmakaarest.*
              arrive.PRS.3SG every.SG.ELA cardinalpoint.SG.ELA
              'Guests are arriving from every corner of the world.'

        b.   *…on kutsutud   saja   ringis.*
              is   invite.PST.PCPL   hundred.GEN about
              'About one hundred guests have been invited.'

---

    [4]   Note that the functions that are typically marked by accusative in other languages are marked by genitive in Estonian; that is, there is no morphologically distinct accusative case in Estonian.
    [5]   This is not a grammatical constraint, as pragmatically felicitous contexts can be found for count nouns as singular partitive subjects (for some discussion of partitive nouns, see, e.g., Cann & Miljan 2012; Huumo & Lindström 2014; Rajandi & Metslang 1979).

(6) *Sõbra…*
     friend.GEN.SG

    a.   *…ema*   *helistas.*
        mother.NOM.SG   call.PST.3SG
        'A friend's mother called.'

    b.   *…kutsus*   *ta*   *ikka*   *kaasa.*
        invite.PST.3SG   3SG.NOM   EMPHATIC.PRTCL along
        'S/he still invited a friend along.'

Prior work on Estonian argument-encoding has mainly focused on verb semantics, aspect and the (in)determinate quantity of the noun (e.g. Erelt et al. 1993, Metslang 2013, Tamm 2004). According to the reference grammar of Estonian (Erelt et al. 1993), the verb determines the case of its arguments and object cases depend on the lexical meaning of the verb (see also e.g. Tamm 2004). Metslang (2013, 26) highlights that the most relevant semantic factors for argument encoding in Estonian are the determinate and indeterminate quantity of the nominal referent.

Animacy has not been investigated as a relevant factor in grammatical role assignment in Estonian; neither has animacy been invoked in descriptions of case assignment rules in Estonian.[6] As the core case markers themselves are 'unreliable cues' for grammatical role assignment, we expect other types of information to be used, potentially including animacy.

3.2   Word order

Estonian has flexible word order. The basic word order is SVX (Koptjevskaja-Tamm & Wälchli 2001), but Tael (1988) found that only 25% of sentences in her written corpus had SVX order, and 24% had XVS order (cf. footnote 8 in Section 5.1). She ascribes this to an interaction of various factors affecting word order, including sentence type, properties of the noun phrase, predicate semantics, information structure, and a tendency toward verb-second order. From an information-structural perspective, the topic (or given information) normally precedes the comment (or new information). Indeed, all else being equal, placing new information somewhere other than the final position yields an infelicitous word order (Erelt et al. 2007, 524). However, various focusing particles (e.g. *ka* 'also, too'; the emphatic particle *ju*; *isegi* 'even'; *hoopis* 'on the contrary'), enable a speaker to indicate new information elsewhere than the final position.

4   Experiment

We conducted a sentence-completion study to investigate whether and how the case-marking of sentence-initial nouns – in nominative, partitive and genitive case – interacts with number and animacy in guiding what grammatical relations Estonian speakers assign to these nouns. On each trial, participants saw a sentence-initial noun, which they used as

---

[6]   In related work on illative and allative cases, two semantic case markers that we do not investigate, Kittilä (2005) shows that in Finnish (closely related to Estonian), the encoding of indirect objects with the goal function depends on animacy: animate goals occur in allative, while the inanimate ones are marked by illative.

the starting point for their sentence, as illustrated in (7). Participants could write any sentence that came to mind. Examples (a-c) show some possible continuations for the prompt word in genitive case in (7). As can be seen here, flexible word order in Estonian means that sentence-initial nouns are not restricted to acting as the subject of the sentence.

(7)   ***Sõbra*…**
         'friend.GEN.SG'…

    a. **[*Sõbra*   *ema*]**_{NP}   *tuli*   *külla.*
        friend.GEN.SG   mother.NOM.SG   come.3SG.PST   to-visit
        '(A) friend's mother came to visit.'

    b. **[*Sõbra*]**_{NP}   *kutsus*   *ta*   *pulma.*
        friend.GEN.SG   invite.3SG.PST   3SG.NOM   wedding.SG.ILL
        'S/he invited a friend to the wedding.'

    c. **[*Sõbra*   *juures*]**_{PP}   *vaatasid*   *nad*   *filmi.*
        friend.GEN.SG   at   watch.3PL.PST   3PL.NOM   film.PAR.SG
        'At (their) friend's house, they watched a film.'

In work using sentence-completion methodology, it is widely assumed that participants' production patterns (in this case, what grammatical role to assign to the noun) provide an indication of people's interpretation preferences (e.g. Trueswell et al. 1993, Snedeker & Trueswell 2004 for related work). When faced with a case-marked noun (or any other kind of linguistic element), participants first have to interpret it before they can provide their continuation. Thus, frequent continuations reflect frequent interpretations. Essentially, completion preferences provide a window into interpretation preferences. Sentence-completion methodology has been successfully used within psycholinguistics to tap into a variety of language-processing related questions.

Crucially, we chose to test sentence-initial nouns because this approach allows for the noun to be presented without any information about the verb or the syntactic structure of the clause. This is desirable, because it means that these factors do not limit or guide the interpretation of case. Bearing in mind our aim of obtaining a measure of how case-marking, animacy and number guide speakers' interpretations of the noun, we want to control and minimize the impact of other potential limiting factors.[7]

---

[7]   All the cases used in the experiment, when used in sentence-initial position, can in principle signal more than one grammatical function. It is worth noting, however, that our design does constrain people to using the noun in sentence-initial position (see Kaiser, Miljan & Vihman (under review) for a follow-up study which tests nouns that are not constrained to initial position). Although nouns in a variety of grammatical roles can occur in sentence-initial position in Estonian, some grammatical roles – e.g. subjects – are more frequent sentence-initially than others. We discuss this in more depth below.

4.1 Method

4.1.1 Participants
Forty-two adult native speakers of Estonian participated in our sentence-completion study via the Internet.

4.1.2 Materials and design
We manipulated the number (singular, plural) and case-marking (nominative: NOM, partitive: PAR, genitive: GEN) of the initial noun. This yields the six variants shown in Table 1. We also manipulated the animacy of the noun (animate, inanimate). This was done between-items: Each item either used an animate noun (e.g. 'mouse' in Table 1) or an inanimate noun (e.g. 'pencil' in Table 1). (We also tested both count and mass nouns, but discuss only count nouns here.)

NOUN	ANIMATE 'MOUSE'	CASE FORM	INANIMATE 'PENCIL'
SG	*hiir*	NOM.SG	*pliiats*
	hiirt	PAR.SG	*pliiatsit*
	hiire	GEN.SG	*pliiatsi*
PL	*hiired*	NOM.PL	*pliiatsid*
	hiiri	PAR.PL	*pliiatseid*
	hiirte	GEN.PL	*pliiatsite*

Table 1: *Examples of animate noun* hiir *'mouse' and inanimate noun* pliiats *'pencil'*

We used a Latin-square design, common in psycholinguistic research, which ensures that each participant would see each specific noun (e.g. 'mouse') only once, but would see equal numbers of nouns in all six conditions. Furthermore, each participant saw equal numbers of animate and inanimate nouns.

In all, our study included 18 target count nouns, which are the data we present in this paper. We also tested 9 mass nouns and 6 time expressions, but we do not consider that data here. In addition, the study included 32 filler items, which involved a range of different cases and parts of speech (e.g. *kaua* 'long.time', *pargis* 'park.INE', *kiiresti* 'fast', *suuri* 'large.PAR.PL').

4.1.3 Procedure
The sentence-completion task was conducted over the Internet using LimeSurvey (https://www.limesurvey.org/). Participants saw nouns and were asked to write a sentence beginning with the noun provided. Thus, the task is fairly unconstrained: participants can write whatever comes to mind, as long as it starts with the initial word we provided. As mentioned above, this kind of sentence-completion task taps into grammatical-role expectations triggered in participants' minds by information from case-marked nouns, in a context where no information is available about the verb or clause structure. Participants were not told beforehand that our aim was to investigate case or grammatical roles, and their comments regarding the experiment suggest that they remained unaware of our aim even as they completed the experiment.

4.2   Data analysis

We analyzed the grammatical role that participants assigned to the case-marked noun in their continuation sentence. The data was coded by two Estonian speakers, and 28% of the data was fully double-coded to ensure consistency across coders in their use of the coding labels.

A number of coding categories were used to label the grammatical roles assigned to the case-marked nouns when used in sentences. The most frequent grammatical role labels are in Table 2. Examples from our data are in (8)-(17).

CATEGORY LABEL	GRAMMATICAL ROLES
subj	Subject, e.g. (8)
part-subj	Partitive Subject, e.g. (9)
poss-subj	Possessor of the subject, e.g. (10)
obj	Object, e.g. (11)
obj-adv	Object inside a gerund clause, e.g. (12)
obj-pp	Object of an adposition, e.g. (13)
poss-obj	Possessor of an object, e.g. (14)
poss-adv	Possessor of an adverbial, e.g. (15)
compx-obj	Object of a complex structure, e.g. (16)
compx-subj	Subject of a complex structure, e.g. (17)

Table 2: *Summary of the main coding labels used in data analysis*

(8)   *Porgand…*   (carrot-NOM.SG)
Porgand   on   väga   tervislik.   [subj]
carrot.NOM   is   very   healthy
'(A) carrot is very healthy.'

(9)   *Poisse....*   (boy-PAR.PL)
Poisse   tuli   joostes   juurde.   [part-subj]
boys.PAR.PL   come.3SG.PST running to-nearby
'More boys were running to join in.'

(10)   *Rebase…*   (fox-GEN.SG)
Rebase   saba   on   kohev   ja   ilus.   [poss-subj]
fox.GEN.SG   tail.NOM.SG is   fluffy.NOM   and   pretty.NOM
'(A) fox's tail is fluffy and beautiful.'

(11)   *Jänest…*   (rabbit-PAR.SG)
Jänest   [ajasid taga]   *rebane,   hunt   ja   karu.*   [obj]
rabbit.PAR.SG chase.3PL.PST fox.NOM   wolf.NOM   and   bear.NOM
'(A) fox, wolf and bear chased (the) rabbit.'

(12)   *Medalit…*   (medal-PAR.SG)
[*Medalit   saades*] *on alati   hea   tunne.*   [obj-adv]
medal.PAR.SG getting is always   good.NOM feeling.NOM
'One always feels good when receiving a medal.'

(13) *Pildi…* (picture-GEN.SG)
      Pildi   peal   oli   konn.   [obj-pp]
      picture.GEN.SG on.ADE   be.3SG.PST frog.NOM.SG
      'In the picture, there was (a) frog.'

(14) *Sõbra…* (friend-GEN.SG)
      Sõbra   nahka   ei   maksa   koorida.   [poss-obj]
      friend.GEN.SG skin.PAR.SG NEG   pay.PCPL   peel
      'It is not wise to cheat your friend.' (lit 'it doesn't pay to peel a friend's skin.')

(15) *Kaardi…* (card-GEN.SG)
      Kaardi   tagaküljel   oli   hinnasilt.   [poss-adv]
      card.GEN.SG   reverse.SG.ADE be.3SG.PST price.tag.NOM.SG
      'On the reverse of the card, there was a price tag.'

(16) *Raamatute...* (books-GEN.PL)
      Raamatute   lugemine   avardab   mõttemaailma.   [compx-obj]
      book.GEN.PL   reading.NOM   broadens   mental-world.PAR.SG
      'Reading books broadens the mind.'

(17) Vahu… (foam-GEN.SG)
      Vahu   pulbitsemine   pani   koka   tegutsema.   [compx-subj]
      foam.GEN   bubbling.NOM   made   chef.GEN.SG act
      '(The) bubbling of the foam made the chef act.'

It is worth noting that Estonian has a range of complex nominalization structures, such as the ones exemplified in (16) and (17) above. Thus, the prompt noun could be used as the subject, object or modifier inside a complex nominalized structure. An example of compx-mod is given in (18) below. The grammatical role coded as obj-adv in (12) above differs from compx-obj in that the former occurs inside a gerund clause rather than inside a noun phrase.

(18) compx-mod = modifier in the complex NP
      [[**Sajandi**   *parima   lillesordi*]   *valimine*]   *lõppes…*
      century.GEN.SG best.GEN.SG flower.type.GEN.SG choosing.NOM finished
      '(The) selection of the best flower of the century was completed…'

      In the section below, we report the most common grammatical roles for each of the case-markers. The other, less frequent grammatical roles are grouped together in the 'other' columns in each graph for ease of presentation.

5   Results and discussion

In this section, we present the results separately for each of the three case-markers, in order to highlight the different ways in which they interact with animacy and number. We also investigate the frequency of negation (Section 5.2.1) and the distribution of transitive and intransitive sentences in our data (Section 5.1.1).

To analyze the data statistically, we used mixed-effects logistic regression models (R Core Team, http://www.R-project.org/). Mixed-effects logistic regression is better suited for this kind of categorical data than analyses of variance. We analyzed the sentence continuation patterns for each case separately, and tested for effects of number (singular/plural) and animacy (animate/inanimate). A p-value of 0.05 or less is regarded as significant. Our mixed-effect models used the maximal random effect structure justified by the design and supported by the data.

5.1   Nominative nouns

Figure 1 shows the grammatical roles that participants assigned to nominative nouns when writing their sentence completions. As can be seen in Figure 1, there is a very strong bias to interpret NOM nouns as subject, regardless of animacy and number: roughly 90% of nominative nouns are interpreted as subjects, across both conditions.
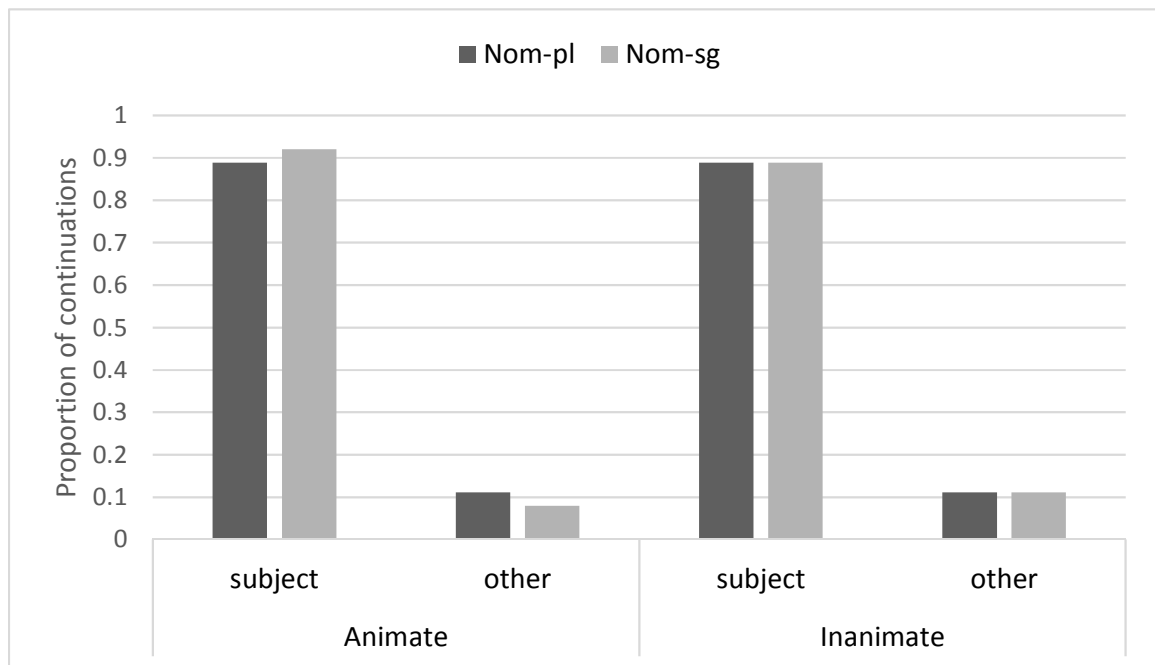
Figure 1: *Grammatical role assigned to nominative nouns*

The strong bias to interpret nominative nouns as subjects is presumably strengthened by the sentence-initial position. Although Estonian has flexible word order, SV(X) is the most frequent core constituent order. While, as noted above, Tael (1988) found only 25% of sentences in a *written* corpus had SVX order, Lindström (2004) reports that in *spoken* Estonian, 41% of all sentences have SV(X) order. Results of our own (ongoing) corpus study indicate that 45% of sentences in the written data and 55% of utterances in the spoken corpus are subject-initial.[8] It is clear that subject-initial order

---

[8]   This is currently based on analysis of 1510 sentences: 752 from a fiction corpus (a subcorpus of 5 million words in the University of Tartu's Balanced Corpus of Written Estonian; online search engine at http://cl.ut.ee/korpused) and 758 from a spoken dialogue corpus (from the University of Tartu's Corpus of Spoken Estonian, maintained by the research group of Spoken Estonian). The difference between our numbers and Tael's may be due in part to differences in the kinds of texts that were included in the corpora. Note that our figures above are for S(X)V(X).

is frequent, though not overwhelmingly so. Importantly, *non-subject-initial* sentences tend to have initial adverbials (32%, according to Tael), rather than other core arguments. Our finding that nominative, sentence-initial nouns are predominantly interpreted as subjects fits well with data based on corpus frequencies.

It is worth noting at this point that a growing body of psycholinguistic research suggests that frequency effects pervade the language processing system in many ways (e.g. Hale 2001, Levy 2008, MacDonald 2013). Thus, our finding that our participants interpreted nominative nouns in a way that matches the frequency patterns of Estonian is not unusual, and not specific to offline tasks. Online methods also show that the human language processing system is highly attuned to the frequency patterns of human languages on a variety of levels (Hale 2001, Levy 2008, see also Wu et al. 2012).

5.1.1 Transitive and intransitive sentences with nominative nouns

The strong subject bias we observe with nouns in nominative allows us to ask a follow-up question regarding potential effects of a minimality bias. More specifically, prior work has argued that people should have a preference for interpretations that are compatible with minimal structure (e.g. the extended Argument Dependency Model in Bornkessel-Schlesewsky & Schlesewsky 2009a,b). For example, nouns in unmarked form, i.e. nominative, are predicted to be interpreted as subjects of intransitives rather than transitives, as intransitives involve less structure.
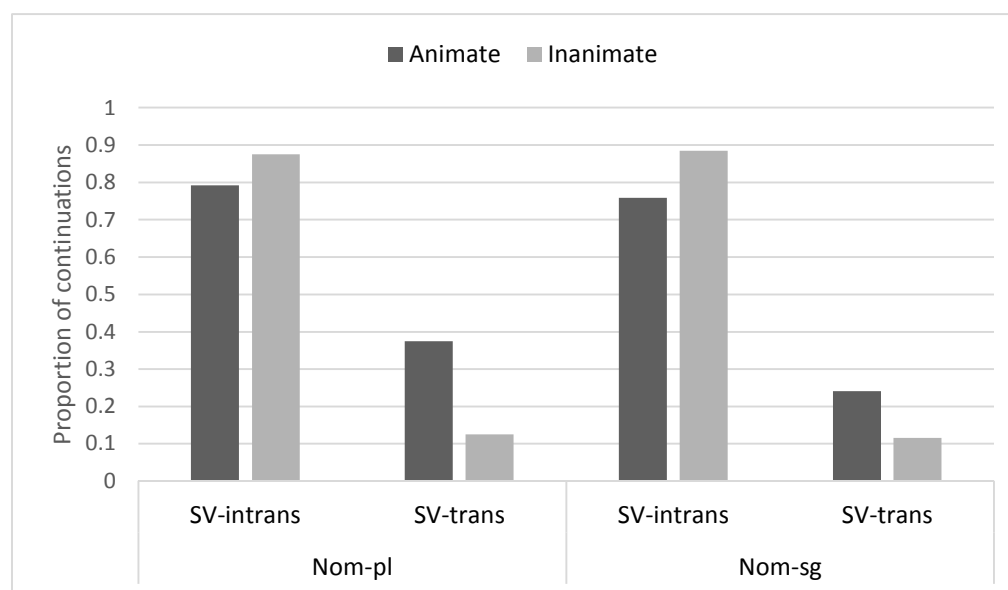

Figure 2: *Proportion of transitive and intransitive continuations with SV and SVO word order elicited by nominative nouns*

We tested this prediction with nominative nouns by comparing the proportions of intransitives with SV word order and transitives with SVO word order. As Figure 2 shows, intransitive continuations are much more frequent than transitive continuations, with both plural and singular, animate and inanimate nouns. This pattern supports the minimality-based idea that there is a preference for minimal structure.

It is important to note, as we show in more detail in Section 6, that this prevalence of intransitives seems to indicate a preference for intransitive over transitive argument structure, and cannot be blamed on 'lazy participants', i.e. it is *not* due to participants

simply writing short sentences in order to finish the task quickly. As we show in Section 6, participants often write rather lengthy, complex continuations.

5.2   Partitive nouns

Figure 3a shows the grammatical roles assigned to partitive nouns in participants' sentence completions. As can be seen in the figure, partitive nouns show considerably more sensitivity to number and animacy than nominative nouns. Animate partitive nouns are most frequently interpreted as objects (singular and plural) and partitive subjects (plural only), and inanimate partitive nouns are most frequently interpreted as objects, partitive subjects or adverbial complements (e.g. see ex. 12 above, obj-adv). Let us assess these three most common continuation types statistically, to determine whether their frequency is significantly influenced by animacy or number.
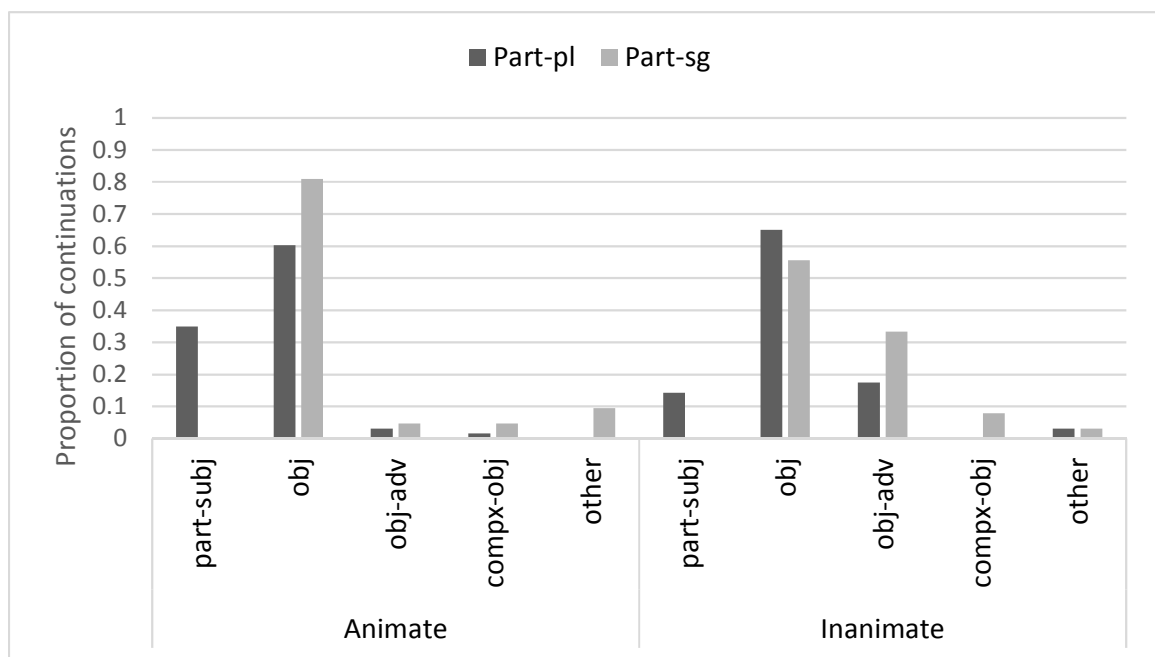

Figure 3a: *Grammatical role assigned to partitive nouns*

When we assess the rate of *object continuations* statistically, we find a main effect of animacy ($\beta = 0.337$, $z = 2.024$, $p<.05$), no main effect of number ($\beta = 0.23$, $z = 1.137$, $p>.25$) and a number-by-animacy interaction ($\beta = 0.58$, $z = 3.463$, $p<.001$). Planned comparisons reveal that *animate nouns* result in significantly more object interpretations when they are singular than when they are plural ($\beta = 0.8102$, $z = 3.138$, $p<.002$). We suggest that this is best interpreted as a consequence of the availability of *subject* interpretations with plural vs. singular nouns. More specifically, as mentioned in Section 3.1, animate *plural* (count) nouns in the partitive case can easily be interpreted as subjects, but animate *singular* (count) nouns in the partitive case can only be interpreted as subjects in specific contexts.[9] The availability of the subject interpretation with animate partitive

---

[9]   It is important to note that this is not a grammatical constraint, but a pragmatic one. Partitive seems to coerce a mass noun interpretation on nouns which are not the direct object of a verb, and one needs to construct felicitous contexts for singular partitive-marked count nouns to be interpreted as subjects.

plural nouns seems to be why the rate of object interpretations with those nouns is lower than with animate partitive *singular* nouns.

With *inanimate nouns*, the rate of object interpretations is not significantly influenced by the singular/plural distinction (β = -0.269, z = -1.298, p>.19). This is not surprising, for at least two reasons. First, inanimate nouns are crosslinguistically well-known to be less suitable 'subject candidates' than animate nouns – as is also reflected by the lower rate of subject interpretations with inanimate partitive plural nouns, compared to animate partitive plural nouns, in Figure 3a – and consequently an inanimate plural partitive noun is less likely to be interpreted as a subject (and thus less likely to generate the number asymmetry seen with animate nouns). Second, partitive inanimates – especially singular nouns – are also often interpreted as adverbial complements. In essence, on a singular inanimate noun, partitive case is not a strong cue for any one single grammatical role.

When we look more closely at the rate of *adverbial complements (i.e. obj-adv) continuations,* we find that the likelihood of these continuations is not influenced by the number of the noun (β = 0.301, z = 0.854, p>.39) but does show significant effects of animacy (β = -3.188, z = -2.541, p<.02), and no significant number-by-animacy interaction (β = -0.222, z = -0.629, p>.5). As can be seen in Figure 3, adverbial complement (obj-adv) continuations are significantly more likely with inanimate nouns than animate nouns, regardless of number. In our view, this fits well with cross-linguistic observations about objects being prototypically inanimate (all else being equal[10]), and suggests that this link between objects and inanimates extends beyond objects of the matrix verb and also applies to objects inside gerund clauses, even in sentence-initial position.

When we look more closely at the rate of *partitive subject continuations* (in this case, only with plural count nouns), we find that subject continuations are significantly more frequent with animate (plural) nouns than inanimate (plural) nouns (β = 0.564, z = 2.434, p<.02). In other words, *animate* partitive plural nouns are more likely to be interpreted as (existential/presentational) subjects (as in 9 above) than are *inanimate* partitive plural nouns. This finding suggests that the cross-linguistic observations regarding correlations between subjects and animacy also extend to presentational subjects and are not limited to canonical agentive subjects.

In sum, these patterns show that Estonian speakers' expectations regarding the grammatical role of a sentence-initial partitive noun is sensitive to *both* number and animacy. In particular, the overarching object preference is modulated by *number* of the noun if the noun is *animate*: partitive plural nouns are also likely to be interpreted as subjects. We attribute this to a general preference to interpret animate nouns as subjects.

5.2.1 Negation and partitive nouns

Given that objects in the scope of negation in Estonian are always in the partitive case, an obvious question arises regarding the frequency of negative sentences with partitive prompt nouns. In particular, can the high rate of objects that we observed in Figure 3a be attributed to partitive case creating an expectation that the partitive noun is the object in a negated predicate.

---

[10] It is worth noting that although inanimates crosslinguistically tend to be 'non-subjects', there are multiple cues to grammatical role in a rich case-marking language like Estonian (indeed, that is the focus of our paper). Thus, we do not expect inanimates to necessarily show an overwhelming object preference across the board, especially in light of the fact that Estonian also has a variety of other constructions in which partitive inanimates can be realized in non-subject position.

This is worth investigating, because it has implications for the directness of the relation between case and grammatical role expectations. If the object continuations that participants produce with partitive case are mostly in the form of negative sentences, this might suggest that partitive case leads people to expect negation, which in turn leads them to expect a partitive-marked object, rather than partitive case directly triggering an expectation of the noun acting as an object. To look into this, we investigated what subset of the data, shown in Figure 3b, involves negative sentences.
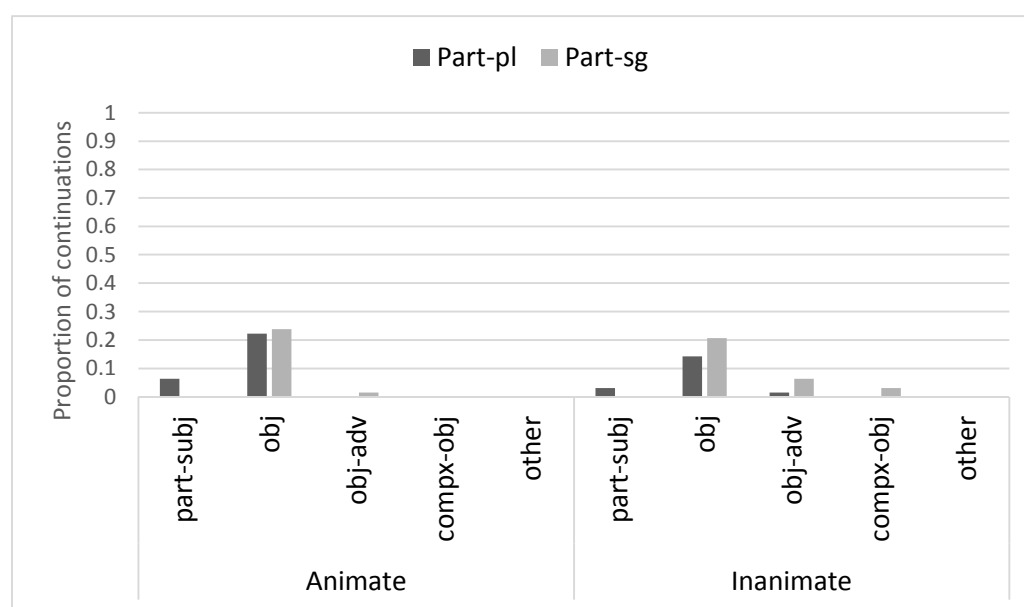

Figure 3b: *The proportion of negative sentences produced by participants as a function of the number, animacy and grammatical role assigned to partitive nouns*

Figure 3b shows the proportion (subset) of negative sentences, relativized to the proportion of continuations for the different grammatical roles. The key point to note is that when we restrict ourselves to the subset of the data that contains just negative sentences, we see that with both animate and inanimate nouns, the proportion of object continuations is *relatively low*.

The fact that negative sentences are not to 'blame' for the patterns we obtained can be seen more specifically if we consider the 60% object continuations with *animate* plural nouns and the 81% object continuations with animate singular nouns (in Figure 3a), these numbers are made up of 22% negative and 38% affirmative sentences (to make up a total of 60% objects with animate plurals), and 24% negative sentences and 57% affirmative sentences (to make up 81% objects with animate singular nouns) respectively. Thus, in both cases, most object continuation sentences are *not negative*.

A similar pattern obtains with *inanimate* nouns: if we consider the 65% and 56% object continuations seen overall, with inanimate plural nouns and inanimate singular nouns respectively, these numbers are made of up 14% negative + 51% non-negative sentences, and 21% negative + 35% non-negative sentences respectively. Again, most of these sentences are *non-negative*. This means that the patterns we obtained are not triggered by the association of partitive case marking with object arguments in the scope of a negated verb.

In sum, the high rate of object proportions that we observe in the dataset of partitive-marked nouns as a whole (shown in Figure 3a) is not an artefact of participants

producing a high rate of negative sentences. Rather, an interaction between animacy, number, and partitive case-marking is observed.

5.3   Genitive nouns

The grammatical roles that participants gave to genitive nouns in their sentence continuations can be seen in Figure 4. (Recall that genitive is one of the core object cases in Estonian, which has no morphologically distinct accusative case.) With genitive nouns, we see that both animacy and number influence the interpretation of the case-marked noun. Animate genitive nouns are likely to be interpreted as possessors of the subject at a higher rate than inanimate nouns. Indeed, as can be seen in Figure 4, none of the animate nouns was assigned the grammatical role of (direct) object. On the other hand, inanimate nouns show higher rates of compx-obj modifier continuations than animate nouns. Compx-obj structures embed the prompt noun as an object inside a complex nominalized structure (as in 16 above). Let us now assess the statistical significance of these patterns.
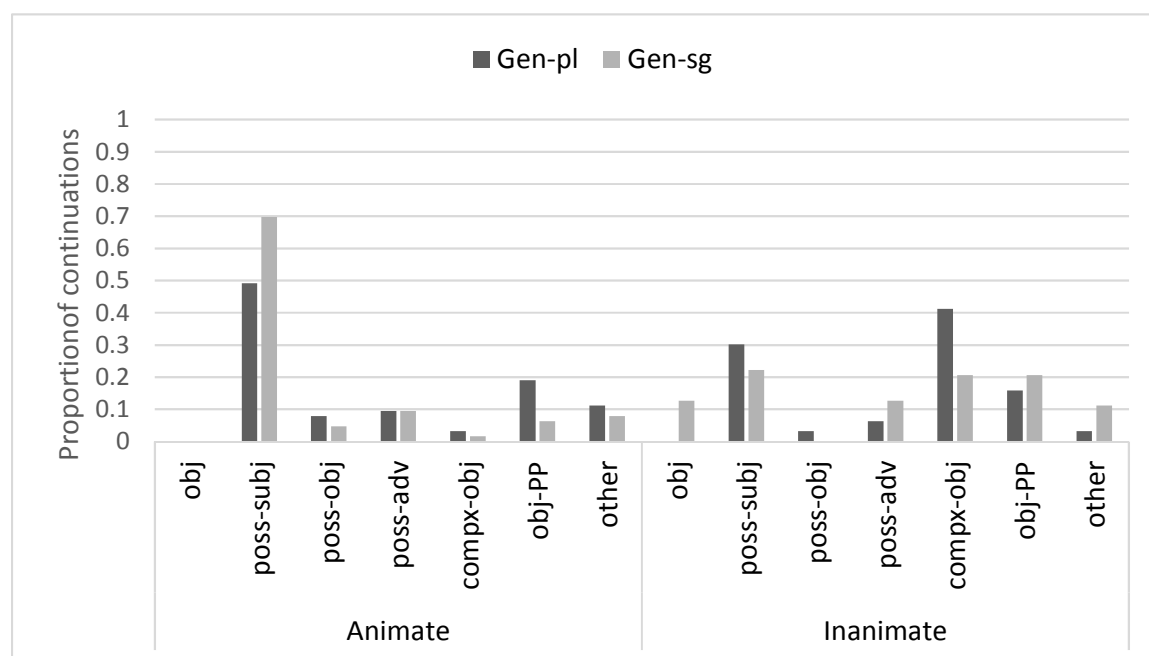

Figure 4: *Grammatical role assigned to genitive nouns*

The proportion of *possessor-of-subject continuations* shows no significant effects of number ($\beta = 0.188$, $z = 0.964$, $p>.03$), but does reveal a significant effect of animacy ($\beta = 0.989$, $z = 4.396$, $p<.0001$) and a significant number-by-animacy interaction ($\beta = 0.415$, $z = 2.047$, $p<.05$). More specifically, there are more possessor-of-subject continuations with animates than inanimates. Furthermore, with *animates,* the rate of possessor-of-subject continuations is marginally higher with singular than plural nouns ($\beta = 0.512$, $z = 1.733$, $p<.083$), whereas with *inanimates,* number has no significant effect ($\beta = -0.309$, $z = -1.243$, $p>.2$). In sum, animate singular nouns are the most likely to be interpreted as possessors of the subject of the sentence. This pattern can perhaps be attributed to a dispreference for associating animate nouns with an object role and a preference for associating them with the subject role: although a genitive-marked noun

cannot be interpreted as a subject, it can be interpreted as the possessor of the subject, i.e., as part of the larger subject constituent.

The rate of *compx-obj continuations* shows an effect of animacy (β= -4.634, z = -1.979, p<.05) but no effect of number (β = -0.87, z = -1.386, p>.17) and no interaction (β = -0.71, z =-1.167, p>.2). Thus, compx-obj continuations occur more with inanimates than animates, regardless of number. Given that compx-obj continuations embed the noun as an object inside a complex nominalized structure, this pattern makes sense in light of the cross-linguistically observed association between objects and inanimates. In general, the two most frequent continuation types with inanimates are poss-subj and compx-object.

It is worth noting that only 13% of genitive singular inanimate nouns were interpreted as the direct object of a transitive verb (what some would analyse as accusative), which may seem surprisingly low, considering that genitive marks prototypical highly affected objects. This low rate may be related to word order effects related to genitive in Estonian: whereas sentence-initial objects do occur, they are very rarely genitive case-marked objects.[11] The initial position may have led our participants to embed genitive marked nouns in complex subject constituents. Further study is needed to tease out the effect of word order from the likelihood of assigning an object role to a genitive case-marked noun (see Kaiser, Miljan & Vihman (under review)).

6   General discussion and conclusions

In this paper, we report on a sentence-continuation experiment that investigated how native Estonian speakers interpret syntactically ambiguous, case-marked nouns. We used nominative, genitive and partitive case-marked nouns and manipulated animacy (animate/inanimate) and number (singular/plural), in order to investigate whether and how these factors influence the grammatical role speakers assign to the nouns. We used an offline production experiment that imitates the incremental nature of online processing, designed to elicit interpretations of case-marked, verb-independent nouns, in order to determine how much information is read off of the case-marked noun itself.

Broadly speaking, our results show that morphological partitive and genitive case-markers do provide information about the grammatical role interpretation of a noun. This is supported by the fact that the nouns marked by these cases show biases for grammatical roles, distinct from that preferred by the nominative nouns, which are (in effect) unmarked for case. Unmarked case forms tend to be interpreted as subjects, regardless of animacy, as has been previously demonstrated (e.g. Demiral et al. 2008, Bornkessel-Schlesewsky & Schlesewsky 2009a,b).

The interpretation of genitive and partitive case shows significant effects of animacy and number in determining the more precise functions of case-marked nouns. This underscores the syntactic ambiguity of these case-markers and points to an analysis whereby morphological case-markers should be taken as underspecified: the more precise syntactic function of a case-marked noun is determined through interpretation of the case, animacy and number of the noun, even without the context. For example, genitive

---

[11] In our ongoing analysis of written and spoken Estonian corpus data (see footnote 8), we have found low rates of object-initial sentences overall (6% of 1510 sentences, with equal proportions in written and spoken samples), but extremely low rates with sentence-initial, genitive case-marked objects: only 4 sentences (0.3%) in our sample.

nouns may be interpreted as objects or possessors, and the likelihood of a reader or hearer considering each of these possible roles is influenced by factors such as animacy and number. Thus, when a case-marked noun is encountered without any linguistic or discourse context, the case-marker does not seem to provide specific information for mapping it directly to a grammatical function. The morphological case seems to function as a partial cue rather than a 'deterministic' marker.

The interpretations of grammatical roles triggered by partitive and genitive case point to information contributed by each case-marker: while partitive is strongly associated with argument functions (subject, object), genitive is used almost exclusively for non-argument functions, at least in the sentence-initial positions that we tested. Pinning down the more precise information these case-markers signal is left for further study.

In addition, we also find evidence which suggests that comprehenders prefer structurally simple structures over more complex ones. In earlier work, Bornkessel-Schlesewsky & Schlesewsky (2006) suggest that "[i]n the absence of explicit information to the contrary, the human language comprehension system assigns minimal structures." This kind of 'simplicity-based' processing system predicts that, whenever possible, participants should opt for intransitives over transitive clauses, since intransitives involve less structure. Indeed, we found that nominative nouns more often prompt intransitive sentences with SV order than transitive sentences with SVO order.

One important note is that the intransitive preference should not be attributed to participants being 'lazy' and writing short, simple continuations. On the contrary, our data contains many examples of long, complex continuations, as exemplified in (19)-(20).

(19) *Kingituse*   *leidmine*   võttis aega, kuna   *sünnipäevalapse*
      present.GEN.SG   finding   took time because forbirthdaychild.GEN.SG
      hobidest   *oli*   *vähe*   *teada.*
      hobby.PL.ELA   was   little know
      'Finding a present took time, because little was known about the hobbies of the birthday child.'

(20) *Luuletuse*   *ettelugemine*   läks tal   *paremini*
      poem.GEN.SG reciting   went 3SG.ADE   better
      kui   *selle*   *kirjutamine.*
      than this.GEN   writing
      'Reciting a poem went better for him/her than writing one.'

Moreover, effects of animacy on interpretations of case-marked nouns depend on the case-marker itself. On one hand, animacy seems to be a genuinely influential factor, involved in determining the functions of genitive nouns, independent of number. With nominative nouns, on the other hand, animacy has no effect. With partitive nouns, it is number rather than animacy which indicates the likelihood of certain grammatical roles over others. This raises the question of whether animacy should be treated as an independent factor in determining grammatical role assignment (see also Section 2.1; and Bornkessel-Schlesewsky & Schlesewsky 2009b). In our study, animacy affects the interpretation of partitive and genitive marked nouns, but not nominative. More importantly, animacy interacts with number in interpreting partitive nouns, but not genitive nouns. Thus, animacy interacts differently with different case-markers.

In sum, the results from our experiment suggest that the interpretation of nouns and their grammatical roles, even in the absence of any information from the verb or the syntactic structure of the sentence, is narrowed based on semantic cues – such as animacy and number – as well as morphological information, namely case-marking. Furthermore, our findings regarding transitivity provide evidence in favor of a cognitive preference for simple structures. Frequency is also shown to have an effect on grammatical role assignment. We are exploring this in more detail in further work.

References

Aissen, Judith. 2003. Differential object marking: iconicity vs. economy. *Natural Language and Linguistic Theory* 21. 435–483.

Altmann, Gerry T. & Kamide, Yuki. 1999. Incremental interpretation at verbs: Restricting the domain of subsequent reference. *Cognition* 73(3). 247–264.

Bamyaci, Elif, Häussler, Jana & Kabak, Baris. 2014. The interaction of animacy and number agreement: An experimental investigation. *Lingua* 148. 254–277.

Bornkessel, Ina & Schlesewsky, Matthias. 2006. The extended argument dependency model: A neurocognitive approach to sentence comprehension across languages. *Psychological review* 113(4). 787–821.

Bornkessel-Schlesewsky, Ina & Schlesewsky, Matthias 2009a. *Processing Syntax and Morphology: A Neurocognitive Perspective*. Oxford: Oxford University Press.

Bornkessel-Schlesewsky, Ina & Schlesewsky, Matthias. 2009b. The Role of Prominence Information in the Real-Time Comprehension of Transitive Constructions: A Cross-Linguistic Approach. *Language and Linguistics Compass* 3(1). 19–58.

Branigan, Holly P., Pickering, Martin J. & Tanaka, Mikihiro. 2008. Contributions of animacy to grammatical function assignment and word order during production. *Lingua* 118. 172–189. doi:10.1016/j.lingua.2007.02.003

Bresnan, Joan, Cueni, Anna, Nikitina, Tatiana & Baayen, Harald R. 2007. Predicting the dative alternation. *Cognitive Foundations of Interpretation*. (Royal Netherlands Academy of Arts and Sciences.) 69–94.

Bybee, Joan L. & Hopper, Paul J. (eds.). 2001. *Frequency and the emergence of linguistic structure*. Vol. 45. Amsterdam: John Benjamins Publishing.

Cann, Ronnie & Miljan, Merilin. 2012. Differential case-marking: Syntactic descriptions and pragmatic explanations. *The Linguistic Review* 29(4). 585–605.

Christianson, Kiel & Ferreira, Fernanda. 2005. Conceptual accessibility and sentence production in a free word order language (Odawa). *Cognition* 98(2). 105–135.

Comrie, Bernard. 1989. *Language Universals and Linguistic Typology*, 2nd edn. Oxford: Blackwell.

Corbett, Greville G. 2000. *Number*. Cambridge: Cambridge University Press.

Dahl, Östen. 2008. Animacy and egophoricity: Grammar, ontology and phylogeny. *Lingua* 118(2). 141–150.

Demiral, Sükrü B., Schlesewsky, Matthias & Bornkessel-Schlesewsky, Ina. 2008. On the universality of language comprehension strategies: Evidence from Turkish. *Cognition* 106. 484–500.

Erelt, Mati, Kasik, Reet, Metslang, Helle, Rajandi, Henno, Ross, Kristiina, Saari, Henn, Tael, Kaja & Vare, Silvi. 1993. *Eesti keele grammatika II* [The Grammar of the Estonian Language]. Tallinn: ETA Eesti Keele Instituut.

Erelt, Mati, Erelt, Tiiu & Ross, Kristiina. 2007. Eesti keele käsiraamat, 3rd edn. [The Handbook of the Estonian language]. Tallinn: Eesti Keele Sihtasutus.

Grewe, Tanja, Bornkessel, Ina, Zysset, Stefan, Wiese, Richard, von Cramon, D. Yves & Schlesewsky, Matthias. 2006. Linguistic prominence and Broca's area: The influence of animacy as a linearization principle. *NeuroImage* 32. 1395–1402.

Grewe, Tanja, Bornkessel-Schlesewsky, Ina, Zysset, Stefan, Wiese, Richard, von Cramon, D. Yves & Schlesewsky, Matthias. 2007. The role of the posterior superior temporal sulcus in the

processing of unmarked transitivity. *NeuroImage* 35. 343–352.

Gries, Stefan Thomas & Divjak, Dagmar (eds.). 2012. *Frequency effects in language learning and processing* (Vol. 244). Berlin: Walter de Gruyter.

Hale, John. 2001. The information conveyed by words in sentences. *Journal of Psycholinguistic Research* 32(2). 101-123.

de Hoop, Helen & de Swart, Peter (eds.) 2008. *Differential Subject Marking. Studies in Natural Language and Linguistic Theory.* Dordrecht: Springer.

Huumo, Tuomas & Lindström, Liina. 2014. Partitives across constructions: on the range of uses of the Finnish and Estonian "partitive subjects". In Luraghi, Silvia & Huumo, Tuomas (eds.). Partitive Cases and Related Categories. 153−176. Berlin: De Gruyter.

Kaiser, Elsi & Trueswell, John C. 2004. The role of discourse context in the processing of a flexible word order language. *Cognition 94*. 113–147.

Kaiser, Elsi, Miljan, Merilin & Vihman, Virve-Anneli (under review). Estonian speakers' interpretations of morphological case: Implications for Case/Agree. *Linguistische Arbeiten.* de Gruyter.

Kittilä, Seppo. 2005. Recipient-prominence vs. beneficiary-prominence. *Linguistic Typology* 9(2). 269–297.

Koptjevskaja-Tamm, Maria & Wälchli, Bernard. 2001. The circum-Baltic languages: An areal-typological approach. In Dahl, Östen & Koptjevskaja-Tamm, Maria (eds.). *The Circum-Baltic Languages: Typology and Contact.* Vol. 2, 615–750. Amsterdam: John Benjamins Publishing Co.

MacDonald, Maryellen C. 2013. How language production shapes language form and comprehension. *Frontiers in Psychology 4(226).* 1–16. doi: 10.3389/fpsyg.2013.00226

Lago, Sol, Shalom, Diego E., Sigman, Mariano, Lau, Ellen F. & Phillips, Colin. 2015. Agreement processes in Spanish comprehension. *Journal of Memory and Language* 82. 133–149.

Lamers, Monique J.A. 2005. The on-line resolution of subject-object ambiguities with and without case-marking in Dutch: Evidence from Event-related brain potentials. In Amberber, Mengistu & de Hoop, Helen (eds.). *Competition and Variation in Natural Languages: The Case for Case.* (Perspectives on Cognitive Science), 251–293. Oxford: Elsevier.

Lamers, Monique J.A. & de Hoop, Helen. 2004. Animacy information in human sentence processing: an incremental optimization of interpretation approach. In Christiansen, Henning, Skadhauge, Peter Rossen & Villadsen, Jorgen (eds.), *Constraint Solving and Language Processing* (Lecture Notes in Computer Science. Vol. 3438). Berlin, Heidelberg: Springer. 158–171.

Lamers, Monique J.A. & de Swart, Peter (eds.). 2012. *Case, Word Order, and Prominence: Interacting Cues in Language Production and Comprehension.* (Studies in Theoretical Psycholinguistics. Vol. 40) Dordrecht: Springer.

Levy, Roger. 2008. Expectation-based syntactic comprehension. *Cognition 106*(3). 1126–1177.

Lindström, Liina. 2004. Sõnajärg lause tuumargumentide eristajana eesti keeles. [Word order distinguishing between core arguments in Estonian]. In Lindström, Liina (ed.) *Lauseliikmeist eesti keeles* [Grammatical relations in Estonian]. (Tartu Ülikooli eesti keele õppetooli preprindid 1.), 40–49, Tartu: Tartu Ülikooli Kirjastus.

Mak, Willem M., Vonk, Wietske & Schriefers, Herbert. 2002. The influence of animacy on relative clause processing. *Journal of Memory and Language* 47. 50–68.

Mak, Willem M., Vonk, Wietske & Schriefers, Herbert. 2006. Animacy in processing relative clauses: The hikers that rocks crush. *Journal of Memory and Language*, 54, 466–490.

Metslang, Helena. 2013. *Grammatical relations in Estonian: subject, object, and beyond.* PhD thesis. University of Tartu.

Prat-Sala, Mercè & Branigan, Holly P. 2000. Discourse constraints on syntactic processing in language production: a cross-linguistic study in English and Spanish. *Journal of Memory and Language* 42. 168–182.

Rajandi, Henno & Metslang, Helle. 1979. *Määramata ja määratud objekt* [The Indefinite and definite object]. Tallinn: Valgus.

Roosmaa, Tiit, Koit, Mare, Muischnek, Kadri, Müürisep, Kaili, Puolakainen, Tiina & Uibo, Heli. 2003. Eesti keele arvutigrammatika: mis on tehtud ja kuidas edasi? *Keel ja Kirjandus* 3. 192–209.

Rosenbach, Anette. 2005. Animacy versus weight as determinants of grammatical variation in English. Language 81(3). 613–644.

Rosenbach, Anette. 2008. Animacy and grammatical variation – Findings from English genitive variation. *Lingua* 118. 151–171.

Schlesewsky, Matthias & Bornkessel, Ina. 2004. On incremental interpretation: degrees of meaning accessed during sentence comprehension. *Lingua* 114. 1213–1234.

Schlesewsky, Matthias & Bornkessel, Ina. 2006. Animacy in processing relative clauses: the hikers that rocks crush. *Journal of Memory and Language* 54. 466–490.

Snedeker, Jesse & Trueswell, John C. 2004. The developing constraints on parsing decisions: The role of lexical-biases and referential scenes in child and adult sentence processing. *Cognitive Psychology*, 49(3). 238–299.

de Swart, Peter. 2005. Noun Phrase Resolution: The Correlation between Case and Ambiguity. In Amberber, Mengistu & de Hoop, Helen (eds.) *Competition and Variation in Natural Languages: The Case for Case.* (Perspectives on Cognitive Science), 205–222. Oxford: Elsevier.

Tael, Kaja. 1988. *Sõnajärjemallid eesti keeles (võrreldudna soome keelega)* [Word order patterns in Estonian (in comparison with Finnish)]. (Preprint, KKI-56.) Tallinn: Eesti Keele ja Kirjanduse Instituut.

Tamm, Anne. 2004. *Relations between Estonian verbs, aspect and case*. PhD thesis. Budapest: ELTE BTK.

Tanaka, Mikihiro, Branigan, Holly P. & Pickering, Martin J. 2005. The role of animacy in Japanese sentence production. Paper Presented at CUNY Conference, Tucson Arizona, USA.

Tanenhaus, Michael K., Spivey-Knowlton, Michael J., Eberhard, Kathleen M. & Sedivy, Julie C. 1995. Integration of visual and linguistic information in spoken language comprehension. *Science* 268. 1632–1634.

Traxler, Matthew J., Morris, Robin K. & Seely, Rachel E. 2002. Processing subject and object relative clauses: evidence from eye movements. *Journal of Memory and Language* 47. 69–90.

Traxler, Matthew J., Williams, Rihana S., Blozis, Shelley A. & Morris, Robin K. 2005. Working memory, animacy, and verb class in the processing of relative clauses. *Journal of Memory and Language* 53. 204–224.

Trueswell, John C., Tanenhaus, Michael K. & Kello, Christopher. 1993. Verb-specific constraints in sentence processing: Separating effects of lexical preference from garden-paths. *Journal of Experimental Psychology: Learning, Memory and Cognition* 19(3). 528–553.

Wu, Fuyun, Kaiser, Elsi & Andersen, Elaine. 2012. Animacy effects in Chinese relative clause processing. *Language and Cognitive Processes* 27(10). 1489–1524.

Merilin Miljan
Tallinn University, School of Humanities & University of Tartu, Institute of Estonian and General Linguistics
merilin.miljan@tlu.ee OR merilin.miljan@ut.ee

Elsi Kaiser
University of Southern California, Department of Linguistics
emkaiser@usc.edu

Virve-Anneli Vihman
University of Tartu, Institute of Estonian and General Linguistics
virve.vihman@ut.ee