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THIRD-PERSON OVERT PRONOUN AND ZERO REFERENCE IN ESTONIAN: INSIGHTS FROM TWO EXPERIMENTS

Helen Hint[a], Maria Reile[a], Elsi Kaiser[b]
[a] *University of Tartu, EE*
[b] *University of Southern California, USA*
helen.hint@ut.ee, maria.reile@ut.ee, elsi.kaiser@usc.edu

Abstract. This study reports two experiments that investigate the variation between two Estonian third-person referential devices – zero reference vs. the overt pronoun *ta*. First, in a speech-restoration paradigm (Experiment 1), we test whether the structure of a reference chain affects referential choice. Second, drawing on Experiment 1, we designed an acceptability judgement task (Experiment 2) to explore a possible systematic variation between zero reference vs. overt pronoun in different sentential configurations (two separated sentences vs. one coordinated sentence). Our findings suggest that sentential configuration affects referential choice. This result accords with earlier observations that salience-only accounts cannot fully explain referential choice. Furthermore, this study supports the form-specific account of reference, by showing that zero reference is more sensitive to sentential configuration than the overt pronoun. We suggest that the use of referential devices reflects a dualistic nature of discourse processing, and local coherence as well as discourse segmenting effects should be considered for a convincing explanation of referential usage patterns.

Keywords: zero reference, third-person pronoun, reference, referential choice, speech restoration experiment, acceptability rating, Estonian

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1. Introduction

This study reports two psycholinguistic experiments that investigate the possible effect of various discourse factors on the choice of anaphoric referential devices in Estonian. We focus on the alternation between two third-person devices – the overt third-person pronoun *ta*

's/he' and its phonetically null counterpart, i.e., zero reference.[1] The phenomenon of zero reference has also been described as an 'omission' or 'ellipsis' of the coordinated coreferential subject pronoun from the later clause(s) in a longer sequence of active clauses (Lindström 2001; Metslang 2013; Erelt 2017a). In the context of referential choice, however, we deem the term 'zero reference' more transparent. While there is a growing body of research explaining the system of Estonian referential devices (e.g., Pajusalu, 2005, 2009; Hint, Nahkola & Pajusalu 2017, 2020; Reile et al., 2019), the distinction between zero reference and the overt pronoun in Estonian is not fully understood yet.

It is often proposed that there is a direct link between the type of referential noun phrase (NP) and the level of salience of its referent, i.e., the quality of the information that makes it cognitively accessible to the interlocutors (see e.g., Vogels, Krahmer & Maes 2019). The widely accepted cognitive salience account (Givón 1983; Ariel 1990; Gundel, Hedberg & Zacharski 1993; Chafe 1994) states that more reduced devices, that is, zero reference and (unstressed) personal pronouns, refer to more salient referents (i.e., to the referents that are at interlocutors' focus of attention in the ongoing discourse at the current moment). At the other end are phonologically longer and more elaborate devices, such as demonstrative pronouns and full NPs, that can refer to less salient referents and, in the cases of some full NPs, introduce new referents into discourse. The corresponding standard hierarchy of various types of referential devices is presented in (1), where forms used for more salient entities are further left.

(1) zero > pronoun > demonstrative > full NP

Based on this general approach, it seems plausible that the Estonian overt third-person pronoun *ta* 's/he' and zero reference exhibit different degrees of salience, with zero picking out more salient referents than the overt form. However, the actual usage patterns of Estonian third-person referential devices do not support this assumption, as both forms refer

1 In Estonian active affirmative sentence constructions, verbal inflection always exhibits person information on the verb. However, since the functions of person inflection in verbs cannot be directly compared to the referential function of pronouns, we have chosen to use the term zero reference even in the contexts where person information is grammatically expressed.

to equally highly salient discourse entities (Hint 2015; Hint, Nahkola & Pajusalu 2020).

An alternative explanation to the cognitive salience account is that two pronouns can be functionally equivalent and express a similar level of salience (see also Gundel, Hedberg & Zacharski 1993). This view could be supported by the fact that both overt third-person pronoun and zero reference are highly reduced anaphoric devices, that is, they are informationally poor and very vague in their lexical-semantic content (see Kaiser & Trueswell 2008; Kibrik 2011). For example, studies on English have shown that it is possible to omit the overt personal pronoun in certain contexts and use a 'zero' or 'null' instead without a tangible change in the function or semantic content of the sentence (Haegeman 2013; Scott 2013). The alternation between Estonian zero and overt reference is similar, since switching between these devices does not seem to lead to significant perceptible differences of the sentences (Hint 2015; Hint, Nahkola & Pajusalu 2020).

Yet, the latter explanation is problematic, since it has been shown that even subtle differences in grammatical structures are conveying different construals of events (e.g., Goldberg 1995; Silvennoinen 2018). More specifically, different semantic, pragmatic, and extralinguistic contexts might be related to the use of different linguistic devices (Silvennoinen 2018). Therefore, it is plausible that "the alternation between overt and zero forms relates to something other than the cognitive status of the intended referent" (Scott 2013: 74).

Consequently, as a response to the salience-only perspective, other approaches to referential devices acknowledge that the one-dimensional salience scale cannot fully explain all the different usage patterns of referential expressions. Instead, a form-specific multiple-constraint approach (Kaiser & Trueswell 2008) or multifactorial concept of anaphora (Kibrik 1996, 2011) is preferred for explaining the distribution of referential forms. This multifactorial approach suggests that besides salience-driven aspects, other factors related to, for example, referent, referential distance, or a particular antecedent's features, must also be considered to adequately describe the usage profile of a referential device (Kibrik et al. 2016). Moreover, the influential factors can vary across different forms and, also, across languages.

The aim of this paper is twofold. First, we aim to shed light on the referential differences between anaphoric overt and zero reference in

Estonian. In this, we seek to enhance the description of the Estonian referential system and investigate two factors beyond salience – the structure of reference chain, and sentential configuration – that can have an effect on the referential choice. Second, our goal is to advance the form-specific multifactorial analysis of referential devices (Kaiser & Trueswell 2008; Kibrik 2011) by applying this approach to under-explored devices in a less-studied language.

2. Theoretical background

2.1. Multifactorial approach to reference

The choice of referring expressions can be guided by various factors, including those that relate to referent's internal properties and those that arise from the sentence- or discourse-level context (Kibrik et al. 2016). To name a few, these factors include animacy (e.g., Yamamoto 1999), grammatical role (e.g., Fukumura & Van Gompel 2015), grammatical role parallelism (e.g., Chambers & Smyth 1998), word order (e.g., Kaiser & Trueswell 2008), information structure (e.g., Rohde & Kehler 2013), the presence of other referents in discourse (Arnold & Griffin 2007), semantics and general world knowledge (Hobbs 1979; Kehler & Rohde 2013), and referential distance (Kibrik 2011). As of now, there have been attempts to model referential choice by including as many as 25 linguistic factors in one model (Kibrik et al. 2016). Furthermore, not only linguistic but also non-linguistic factors affect referential choices (Heine 2019; Vogels, Krahmer & Maes 2019).

While the list of possible factors that affect referential choice is extensive, it must also be kept in mind that not all factors are relevant to all referential devices. Rather, different referential devices can be sensitive to different factors (Kaiser & Trueswell 2008). Furthermore, the importance of particular factors on particular devices diverges across languages (Kaiser 2013; Hint, Nahkola & Pajusalu 2017, 2020; Reile et al. 2019).

In addition to effects stemming from specific referential devices and specific languages, another aspect also relevant to referential choice is the level of language. For example, based on an extensive literature review and neurolinguistic evidence, Heine (2019) suggests a general division between microstructure and macrostructure in language.

Drawing on Van Dijk's (1980) distinction, macrostructure relates to more 'global' representations of what a text is about, and it serves to organise 'local' microstructures. Microstructure, on the other hand, associates with local aspects of text, such as the structure of sentences and the meanings of words, phrases, and clauses (Van Dijk 1980). These two levels complement each other, and both are necessary for effective communication, where macrostructure correlates with higher level of discourse processing and microstructure forms the basic level (Heine 2019: 434).

In this paper, we directly test the effect of two factors for explaining the distinction of third-person pronoun and zero reference in Estonian: i) the structure of reference chain, and ii) sentential configuration, i.e., whether the referential devices must work within one or across two sentences.

We focus on the combination of givenness effects (given vs. new) and the referential form of the antecedent as the structural features of the reference chain. Reference chain is understood as a sequence of co-referential devices in discourse. Expressions that refer to the same entity constitute one reference chain. Aspects related to the structure of the reference chain have been found to be useful in earlier work on referential devices in Estonian (Kaiser & Hiietam 2003; Pajusalu 2005; Kaiser & Vihman 2010; Hint 2015; Hint, Nahkola & Pajusalu 2020). For example, the occurrence of a particular referential device (e.g., full NP vs. pronoun, see Hint 2015), the position of that device in a sentence (e.g., before or after the verb, see Kaiser & Vihman 2010), or the presence or absence of certain kinds of entities (e.g., one or more than one animate entity in a sentence, see Hint, Nahkola & Pajusalu 2020) can affect the choice of a referential device in the following sentence(s).

The possible importance of sentential configuration on the referential choice has been previously discussed, for example, under the more general distinction between local vs. global referential coherence, and between continuity vs. discontinuity of reference (Givón 1993) or in the context of micro- vs. macrostructure, and the corresponding formal features (e.g., Heine 2019). Furthermore, the results from Experiment 1 reported in this paper suggest that the organisation of sentences in discourse, even as seen on the level orthography (that is, whether there is a conjunction *ja* 'and' or a full stop between sentences) can influence referential choice. In addition, we include the effects of word

order in the analysis to see whether different word order patterns have consequences for the use of zero reference.

2.2. Estonian background and the phenomenon of zero reference

In the paradigm of Estonian personal pronouns, each grammatical person is associated with a pronoun that has both a short and a long form. In terms of third-person reference, the short form of personal pronoun – *ta* 's/he' – is considered the most unmarked, neutral, and phonetically unstressed choice for referring to the most salient entities in discourse (example 2) (Pajusalu 2005, 2009, 2017; Hint, Nahkola & Pajusalu 2020). The long form *tema* 's/he' is considered a pragmatically motivated form and it usually expresses contrast (Pajusalu 2005), and this form is not under discussion in this paper.

The phenomenon of zero reference (example 2) in Estonian shares many similar referential properties with the short form of the third-person pronoun (Hint 2015; Hint, Nahkola & Pajusalu 2020), but it also has certain contextual restrictions. For example, zero reference is more common in the second clause of a coordination structure when its coreferential subject is already explicitly mentioned in the preceding clause (Lindström 2001). In addition, the usage of zero reference requires that its antecedent is expressed with the same case and in the same syntactic position in a sequence of clauses and that there are no intervening animate referents (Lindström 2001).

(2) *Mees* *sõi* *saia,* *siis* *jõi*
man.NOM eat.PST.3SG bread.PRT then drink.PST.3SG
***ta**/ø* *kohvi*
3SG.SHORT/ø coffee.PRT
'A man ate bread, then he drank coffee.'

Due to the structural non-obligatoriness of Estonian zero reference, the term partial pro-drop has been used to describe such a phenomenon (Koeneman 2006; Lindström & Vihman 2017). Thus, zero reference in Estonian is essentially different from full pro-drop in 'sentence-oriented languages' such as Romance languages (e.g., Filiaci, Sorace & Carreiras 2014), as well as from topic pro-drop in 'discourse-oriented languages', such as Asian languages (e.g., Kwon & Sturt 2013). The fact that

Estonian is a partial pro-drop language is best visible in contrasting first and second-person pronouns, which can always be omitted, to the third-person pronouns, whose omission is much more constrained. As verbal inflection of the predicate verb usually indicates the person in Estonian (Erelt 2017b), all three persons in singular as well as in plural may be expressed with zero reference in certain contexts. However, while sentences where the first or second person is expressed with zero reference are always grammatical and acceptable, third-person zero reference can only be used in certain (narrative) contexts, and it might sound unnatural in some contexts for native Estonian speakers.[2]

Previous research regarding Estonian zero reference has been more concerned with first and second-person subjects (e.g., Duvallon & Chalvin 2004; Lindström 2005; Lindström et al. 2009) or on all three persons together (e.g., Kivik 2010; Vihman 2015; Lindström & Vihman 2017). According to Siewierska (2004: 7), the first and the second person are inherently deictic speech-act pronouns, and their interpretation is related to the extra-linguistic context: the typical pattern is that the first person is the speaker and the second person is the hearer of the utterance. Third-person forms, on the other hand, are mostly used anaphorically and therefore the referent of the third-person pronoun must be previously mentioned with an explicit NP in the ongoing discourse (Siewierska 2004: 7). Therefore, Estonian overt third-person devices are omitted less frequently than the first and the second person pronouns, and their omission is only licensed by strong contextual cues (Vihman 2015), meaning that Estonian zero reference is only common with highly salient subject referents (Lindström et al. 2009; see also Metslang 2013: 240). Thus, this paper focuses on the prototypical subject position, i.e., the sole core argument of the active intransitive clause or the most actor-like participant of the active transitive clause, that is in the nominative case, agrees with the predicate verb and occurs in the clause-initial position (Metslang 2013: 224; Lindström & Vihman 2017).

2 The omission of third-person argument in Estonian sentences may also result in the generic, so-called zero-person constructions (Kaiser & Vihman 2006; Jokela 2012). Such uses are not discussed in this paper.

Until now, only one study (Hint 2015) has directly compared Estonian overt third-person *ta* to third-person zero reference. This earlier study aimed to detect whether there are differences in the discourse coherence implications imposed by zero reference vs. the overt form *ta*. Although minor differences emerged, there remains a large overlap in the use of *ta* and zero (Hint 2015), suggesting that discourse coherence is not the most important factor affecting the choice between zero and overt reference. The present study addresses the issue in more detail by applying experimental methods, to help us to better understand which factors and which linguistic environments distinguish the use of third-person overt and zero reference in Estonian.

3. Experiment 1: speech restoration

3.1. Speech restoration predictions

Experiment 1 tests whether the structure of a reference chain, specifically seen in the forms of preceding NPs used to refer to the same entity, affects the choice of a referential device. We use a speech-restoration method, where participants hear a short noise in the position of a referential device and are asked to repeat what they heard. This allows us to see whether they think the noise was masking a zero or overt reference, i.e., whether participants 'restore' an overt form or a zero. Using noise-replaced stimuli is a natural and unobtrusive way to look at how listeners perceive words or utterances that are potentially ambiguous: by instructing participants to concentrate on the noise, their attention is diverted away from the exact phenomenon under study (see also Stoyneshka, Fodor & Fernández 2010; Mack et al. 2012). Furthermore, it is possible to use restoration-based designs for studying spoken language related phenomena that might be hindered in written experimental settings.

This experiment builds on the premise that salience alone is not the key factor for determining which device (zero or overt) is restored by the speaker, but rather that the effect appears in an interaction with the structure of the reference chain. We hypothesise that the characteristics of the reference chain play a role in the choice of referring expressions. Namely, we predict that Estonian speakers do not perceive the overt pronoun *ta* and zero reference as expressing different levels of salience.

Instead, we expect that the preceding referential device referring to the same entity (i.e., whether there is a pronoun or a full NP used), and its interaction with salience effects, affects the choice between zero and overt reference.

3.2. Speech restoration design and materials

We used a speech restoration paradigm to test whether the form of the previous referential expression, combined with the salience level of the referent it refers to, influences speakers' choice between third-person referential devices. In this experimental design, the participants hear a dialogue partly covered with noise, and are asked to repeat what they heard. In their repetition, participants have to fill in ('restore') the noise-covered part of the dialogue. We are interested in whether participants, when asked to repeat a sentence where the pronoun is acoustically 'hidden' by the noise, will use a zero reference (*Then ø made coffee*) or an overt pronoun form (*Then she made coffee*) in their repetition. A similar experimental design has been used to investigate the expletive and null subject alternation in English sentences (Mack et al. 2012), and ambiguity resolution in Bulgarian (Stoyneshka, Fodor & Fernández 2010).

For this experiment, we devised 18 short three-turn stimulus dialogues (as in 3), and each dialogue is presented in three experimental conditions, resulting in 54 dialogues altogether. The first two turns in each dialogue serve to indicate that the dialogue is in a colloquial register. The organisation of the dialogues was constant across all items: in the first turn, the speaker indicates that she is about to start talking about an event or circumstance, the second turn is for the addressee to shortly indicate that she is listening, and the third turn is a short uninterrupted story by the speaker. The crucial part of the experiment is the last turn of the dialogue. Next, we take a closer look at the structure of this three-utterance narrative.

(3) A: *A* *tea-d?*
um know-PST.2SG
'Um, you know what?'

B: *Mida*?
what
'What?'

A: *Oli* *öö* *ja* *varas* *oli*
be.PST.3SG night.NOM and thief.NOM be.PST.3SG
vangla-s. *Ta* *kirjuta-s* *memuaare.*
prison-INE 3SG.SHORT write-PST.3SG memoirs.PRT.PL
Siis *{ta/ø}* *kimu-s* *suitsu.*
then {3SG.SHORT /ø} smoke-PST.3SG cigarette.PRT
'It was night-time and a thief was in prison. He was writing his memoirs. Then {he/ ø} smoked a cigarette.'

The overt form *ta* in the critical sentence (the third sentence, see Table 1) was masked by noise (more details below). We manipulated the nature of the reference chain involving the masked pronoun in the critical sentence by alternating the givenness and referential form of *ta*'s antecedent in the second sentence. As regards givenness effect (given vs. new), we manipulated whether the critical referent (e.g., *varas* 'thief' in 3 and Table 1) was discourse-new (mentioned for the first time in the second sentence) or discourse-old, that is, given (mentioned in the first and in the second sentence) (see Table 1). As regards referential form (pronoun vs. full NP), we manipulated whether the critical referent was mentioned in the second sentence with a pronoun or with a full NP. Note that not all combinations of NP types and referent salience levels are presented in Experiment 1 conditions. In particular, the combination New Pronoun is excluded from the experiment, as new referents are (normally) not introduced using third-person pronouns.

The narratives were in the past tense. On target items, the coherence relation between the second and third sentences was kept constant: it always involved the occasion (or "narrative") coherence relation, which signals to the hearer that the entities are partially connected by an event that takes the initial state of the ongoing utterance as the end state of the preceding one (Kehler et al. 2008).

Table 1. Example test item of Experiment 1 in the three experimental conditions.

Sentence no.	Condition		
	Given Full NP	**Given Pronoun**	**New Full NP**
1	*Oli öö ja **varas** ja mõrvar olid vanglas* 'It was night-time and **a thief** and a murderer were in prison.'	*Oli öö ja **varas** oli vanglas.* 'It was night-time and **a thief** was in prison.'	*Oli öö ja vanglas oli hämar.* 'It was night-time and the prison was dim.'
2	***Varas** kirjutas memuaare.* **'The thief** was writing his memoirs.'	***Ta** kirjutas memuaare.* **'He** was writing his memoirs.'	***Üks varas** kirjutas memuaare.* **'A thief** was writing his memoirs.'
3	*Siis kimus **~~ta~~** suitsu.* 'Then **~~he~~** smoked a cigarette.'	*Siis kimus **~~ta~~** suitsu.* 'Then **~~he~~** smoked a cigarette.'	*Siis kimus **~~ta~~** suitsu.* 'Then **~~he~~** smoked a cigarette.'

The dialogues were recorded in a soundproof room by two female native Estonian speakers. The dialogues were then spliced so that utterances that were identical in their linguistic content were also kept acoustically identical across conditions. In the final utterance of each narrative, it is possible to refer to the critical referent (e.g., *varas* 'thief') by using either the overt pronoun *ta* or zero reference. All final sentences were recorded with the overt pronoun present in the recording (i.e., we did not record any sentences with the zero). This was done to keep the acoustic input across conditions constant, such that any differences observed between conditions cannot be attributed to differences in the original recording.

We distorted the overt pronoun *ta* in the final utterance of each narrative by completely covering it with so-called 'coffee shop' background noise (from a free sound file found via googling). First, the critical words were covered with silence in Adobe Audacity ('Generate silence' function). The silence completely covered the whole pronoun, and the transitions from/to the adjacent phoneme, where necessary (e.g., 'It was night time and **a thief** was in prison. **He** was writing his memoirs. Then

<SILENCE> smoked a cigarette.'). Then, the silence was covered by a section extracted from the background noise file. To make the sound files sound natural to naive listeners, additional background noise was superimposed on the recordings. For the final sound files, native speaker judgments confirm that when the noise was present, it was unclear whether the underlying sentence had an overt pronoun or a zero reference.

Each experimental dialogue also contained another part that was acoustically distorted to make the placement of noise less predictable for participants. This was done either by adding an extra background noise somewhere in between the words or by masking another word or part of a word by noise. The second distorted part was kept identical within items.

We also used 27 filler dialogues with approximately the same length as test items and with 2–3 distorted parts. The items and fillers were presented using a Latin Square design in pseudo-randomized order. Every participant heard one version of each 18 test dialogue, distributed evenly across the three conditions.

3.3. Speech restoration procedure

The Paradigm Stimulus Presentation software[3] was used to present the stimuli and record participants' answers. Participants, one at a time, sat in a small quiet room in front of a computer screen. Stimulus dialogues were presented through headphones. Participants were instructed that they would listen to short dialogues that might occasionally be noisy. They were asked to listen to the dialogues carefully and then, after seeing a prompt (question mark) on the screen, to repeat out loud the final sentence of the dialogue. Crucially, they were asked to repeat verbatim exactly what they had heard, or what they thought the speaker had most probably said if they were not completely sure what they had heard. After they repeated the sentence, participants pressed the spacebar and the next dialogue began. Before the main experiment, participants completed three practice trials.

3 http://www.paradigmexperiments.com/

3.4. Speech restoration participants

32 adult native Estonian speakers (22 females, 10 males) volunteered to participate in the experiment. Participants were recruited via mailing lists and social media. All participants reported having normal hearing. Participants were 23–78 years old (mean age 31). No incentives were given for participation.

3.5. Speech restoration data coding and pre-processing

We did not include data from five participants in the analysis. Three of them indicated in post-task debriefing that they started listening to pronouns more carefully and tried to answer "correctly" when the pronoun was covered by noise. One participant always repeated the whole narrative instead of only the last sentence, and due to more extensive repetitions, the final sentences were rephrased to the extent that they were not strictly comparable to original versions (i.e., the result was a retelling, not a verbatim repetition). One participant had to be excluded due a technical error. Thus, we had 27 participants for the final data analysis.

Based on how the participants repeated the final sentence, we coded each experimental item for the use of overt pronoun *ta* or zero reference. In the coding process, we noticed that instead of repeating only the third utterance, some participants precisely repeated also the second or even the first and the second utterance. Thus, we decided to tag the data and analyse whether participants repeated only the final (= one) or the final plus one or two preceding utterance(s) (= two). In the two-utterance repetition group, there were also nine cases of three-utterance repetitions included, but for the sake of clarity, we only make a distinction between one-utterance vs. two-utterance repetitions in the analysis.

In retrospect, we realised that repetitions of more than one utterance can presumably be traced back to our experiment instructions, which instructed the participants to repeat *a sentence* (Estonian *lause*).[4] The data we obtained suggest that participants differed in how they

4 We avoided using the more formal term *utterance* (Estonian *lausung*) in the instructions since we assumed that participants with no background in linguistics might not be familiar with the term.

interpreted this term and/or in how they perceived the discourse structure of our stimuli. Indeed, there are 52 cases of two-utterance repetitions, where participants added coordinating conjunction *ja* 'and' between the two utterances. This suggests that they construed the second and third sentences as actually comprising a single sentence. While the conjunction *ja* was not present in the original experimental recordings, we included such coordinated sentences in the final analysis when there were no other changes made (e.g., changes in word order, substituting the pronoun with another word, etc.).

Out of the 27 participants, 9 did not use zero reference at all in their repetitions (i.e., only used the overt form), and 5 did not produce any overt pronouns (i.e., only used the zero). The remaining 16 participants' answers included a mix of overt and zero pronouns. 62 responses (12,8%) were excluded from the analysis because participants failed to use the pronoun forms under study (e.g., participants used the third-person plural pronoun *nad* 'they' or a full NP instead of a pronoun). Thus, the analysis is based on 423 responses.

3.6. Speech restoration analysis and results

For data analysis and visualisation, we used R version R-4.1.2 (R Core Team 2021). We applied *lme4* (Bates et al. 2015) for building the binomial mixed effects regression model, *ggplot2* (Wickham 2016) for creating the plots, and *sjPlot* (Lüdecke 2021) for computing the odds ratios with 95% confidence intervals and evaluating the performance of the models.

Altogether, participants restored the overt pronoun in 241 (57%) of all analysed utterances and used zero reference in 182 (43%) responses. In 239 (57%) responses, participants only repeated one, i.e., the very final utterance, and in 184 (43%) responses, two utterances were repeated.

Figure 1 shows the proportion of *ta* restorations grouped by experimental condition (i.e., the structure of reference chain) and whether participants repeated only the last utterance, or the last two utterances of the stimulus narrative. A considerable difference across the conditions is apparent only when the participants repeated more than just the final utterance they heard.

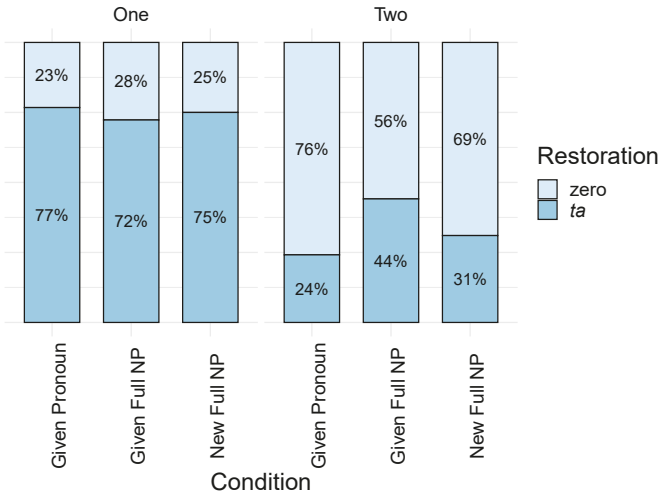

Figure 1. Proportional distribution of the restoration of overt pronoun *ta* per condition (i.e., the structure of reference chain) and number of utterances repeated. One = one utterance repeated. Two = two (or more than two) utterances repeated.

To pinpoint the exact effect of the structure of the reference chain on the pronoun restoration, we used binomial mixed effects regression for predicting the restoration of the third-person pronoun *ta*. Whereas the structure of the reference chain has no clear effects on use of *ta* vs. zero when participants only repeated the final clause (i.e., construed the final utterance as an independent sentence), this factor does influence whether participants restore *ta* or zero when multiple utterances were repeated (see Figure 1). We did not include the number of utterances in the model as a fixed effect because we did not systematically vary it in the experiment. However, we decided to subset the data based on the number of utterances: one subset includes data points only when one utterance was repeated, and the other includes data points from two (or more) repeated utterances.

Based on the two datasets, we built models that included: i) restoration of *ta* vs. zero as the dependent variable, ii) the structure of reference chain (levels: Given Pronoun, Given Full NP, and New Full NP) as an independent fixed effects variable, and iii) participant and experimental item as random effects. The results show (Figure 2, see also Table 1 in the Appendix for a detailed report and the structure of the

models) that there is no statistically significant effect on the structure of the reference chain when only one utterance is repeated (Model one). However, if two utterances are repeated (Model two) and the second utterance in the narrative includes a full NP given in the discourse, the overt pronoun *ta* is restored more likely as compared to when the second utterance already includes an overt *ta* (odds ratio: 17.71, 95% CI 1.55–202.72). There was no statistically significant difference between the Given Full NP and the New Full NP condition ($p > 0.05$).

While the difference between Given Pronoun and Given Full NP conditions is there, the large error bars in Figure 2 indicate considerable uncertainty (the wider the error bars, the larger the uncertainty) in the difference between the levels of the structure of reference chain. The large error bars are probably related to the small sample size of Experiment 1 and the overall considerably large variation that naturally occurs in language use.

Importantly, while the total explanatory power of the Model two is quite good (Conditional $R^2 = 0.867$), the part explained by fixed effects alone (Marginal R^2) is of 0.057.[5] This indicates that the structure of reference chain has only a marginal effect in explaining the choice between the overt pronoun *ta* and zero reference in our data. However, the pattern of restoration of overt pronoun *ta* presented in Figure 1 still suggests that restoration of *ta* is more likely when the preceding realisation of referent is a Given Full NP.

5 The model performance improved considerably when adding participants as a random effect. The conditional R^2 for the model that included only experimental item as random intercepts was 0.056, and for the model that included also participants as random intercepts was 0.867.

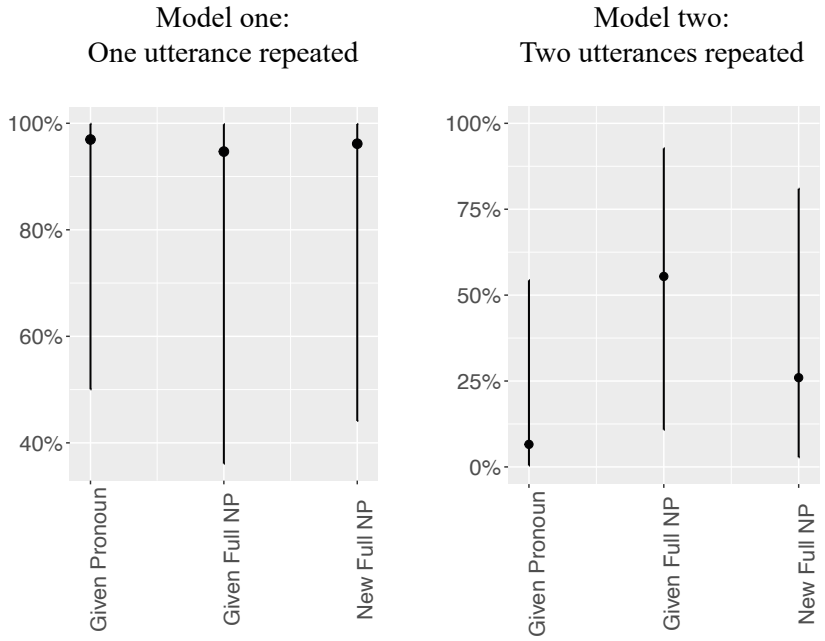

Figure 2. Predicted probabilities of restoration of the overt pronoun *ta* adjusted to the structure of reference chain. The error bars indicate 95% confidence intervals.

3.7. Speech restoration discussion

In Experiment 1, we tested whether participants would or would not use an overt referential device in a sequence of utterances where the referent is already established and does not change. Avoiding the overt expression would be in accordance with the ideas of language users aiming for economy of linguistic structure. In this study, we did not observe a significant effect of the preceding referential device (as seen from the structure of reference chain). This outcome suggests that additional factors must be included in future studies. However, we did notice a tendency to restore more overt *ta* pronouns in the Given Full NP condition than in the Given Pronoun and New Full NP conditions. This might indicate that the presence of several animate entities in discourse (see Table 1) leads speakers to make different referential choices, compared to situations where only one animate entity must be referred to (see also Arnold & Griffin 2007).

However, an unanticipated result from Experiment 1 indicates that sentential configuration affects the choice of a third-person referential form in Estonian. In contexts where reference to an already established (animate) discourse entity is accomplished with a single utterance, speakers seem to prefer the overt pronoun. In case of two utterances following each other, speakers are freer to use zero reference in the final utterance, since they have already explicitly mentioned the referent in their preceding utterance by using an overt pronoun. This effect indicates the importance of sentential configuration on referential choice, more specifically that coordinating conjunction is possibly connected with zero reference. This result largely replicates the previous observations about Estonian zero reference (Lindström 2001), as well as results from other languages (e.g., Kibrik 1996; Van Vliet 2009; Scott 2013). Our experimental data shows that this bias is strong enough to emerge even in an experimental context where explicit coordinating conjunction was not provided. However, based on participants' spoken language responses, we cannot yet draw direct conclusions about how the participants actually perceived the structure of their uttered sentences. Therefore, we designed Experiment 2 that presents written sentences as input to participants.

4. Experiment 2: acceptability judgement

4.1. Acceptability judgement predictions

Following the results from Experiment 1, we wanted to directly test whether the choice of a referential device (overt *ta* vs. zero reference) in different sentential configurations affects speakers' judgments about the acceptability of the sentences. More specifically, we hypothesised that the overt pronoun is more acceptable in contexts with two utterances separated by a full stop (*Õpetaja küpsetas pirukaid**.** Siis ta keetis kohvi.* 'The teacher baked some pastries. Then she made coffee.'), whereas the zero reference would be preferred when two utterances are coordinated with the conjunction *ja* 'and' as one grammatical sentence (*Õpetaja küpsetas pirukaid **ja** siis ø keetis kohvi*. 'The teacher baked some pastries **and** then ø made coffee.'). As Estonian is considered a free-word-order language, we also considered the possibility that the relative position of the verb and overt pronoun might influence the acceptability judgments.

For example, the second utterance in the example above might be either *Siis **ta** keetis kohvi* (‘Then she made coffee’) or, following the verb-second principle, *Siis keetis **ta** kohvi* (lit. ‘Then made she coffee’). Therefore, we included Pronoun+Verb (PronV) and Verb+Pronoun (VPron) word order as different alternatives in Experiment 2.

4.2. Acceptability judgement design and materials

Experiment 2 was designed as a within-subjects acceptability judgement task crossing two factors. We manipulated i) the sentential configuration (Cross-sentential vs. Intra-sentential) and ii) referential device (zero reference vs. overt pronoun). In addition, we added word order alternatives (PronV vs. VPron) to the overt pronoun sentences. This sub-division served two purposes. First, it allowed us to take into account the Estonian free word order and estimate its possible effects on the choice of referential device. Second, it also brought more variation to the experimental sentences and made the phenomenon under study less predictable to participants. The selected structure of factors resulted in six conditions (Table 2).

Table 2. Experiment 2 conditions. PronV means Pronoun+Verb. VPron means Verb+Pronoun.

	PronV	**VPron**	**Zero reference**
Cross-sentential	*Kuller viis saadetise kohale. Siis **ta** kihutas lattu tagasi.* ‘A courier delivered the package. Then **he** rushed back to the depot.’	*Kuller viis saadetise kohale. Siis kihutas **ta** lattu tagasi.* ‘A courier delivered the package. Then rushed **he** back to the depot.’	*Kuller viis saadetise kohale. Siis **ø** kihutas lattu tagasi.* ‘A courier delivered the package. Then ø rushed back to the depot.’
Intra-sentential	*Kuller viis saadetise kohale ja siis **ta** kihutas lattu tagasi.* ‘A courier delivered the package and then **he** rushed back to the depot.’	*Kuller viis saadetise kohale ja siis kihutas **ta** lattu tagasi.* ‘A courier delivered the package and then rushed **he** back to the depot.’	*Kuller viis saadetise kohale ja siis **ø** kihutas lattu tagasi.* ‘A courier delivered the package and then ø rushed back to the depot.’

30 target sentences were used in Experiment 2: 18 target sentences adapted from Experiment 1 (two final utterances of each narrative) and 12 additional items specifically created for this experiment. Each target sentence was presented in each six conditions. The sentences were arranged into six experimental lists using a Latin Square design. As stimuli, we used written sentences that aimed to mimic the colloquial written register for Experiment 2.

In addition, 36 filler items were constructed. In filler items, we included instances of relative clauses, instances of complex sentences with different conjunctions, and texts which included different pronominal forms. To make sure that the participant was paying attention and understood the task correctly, some fillers were grammatically ill-formed (e.g., used an inappropriate relativiser in a relative clause, or made an ungrammatical connection between a possessive and a preceding referent).

4.3. Acceptability judgement procedure

The experiment was set up as a web-based questionnaire using the LimeSurvey online survey tool.[6] In the task, we asked participants to rate the acceptability of each item on a 4-point Likert scale (1 = 'not acceptable at all', 4 = 'fully acceptable', middle points 2 and 3 without explicit verbal labels). Since the difference in use of *ta* vs. zero proved small in Experiment 1, we used a 4-point Likert scale without a clear midpoint to avoid the possible misuse of the midpoint and reduce response bias (see Chyung et al. 2017). Only one item was presented on the screen at a time. After the participant had clicked on the chosen acceptability rating, the next item appeared.

In the instructions, we explained the colloquial context by saying that all items come from a movie forum on the internet. We also included an example of a real text from one of such forums. We explicitly stated that we are not interested in studying normative language and correct orthography, but in whether the sentences sound acceptable or like good sentences of Estonian.

All participants saw four practice trials before the experiment began. In the practice trials, short explanations were included to guide the

6 https://www.limesurvey.org/

participants on which basis they should make their acceptability judgements (e.g., we explained that the use of slang or describing imaginary events does not make a sentence unacceptable). On average, it took participants approximately 10 minutes to complete the questionnaire.

4.4. Acceptability judgement participants

Participants were invited to the study mainly via mailing lists and social media. No incentives were given for their participation. Altogether, 77 volunteers participated in the study, 18 of them did not finish the experiment. From the 59 participants who completed the experiment, we excluded 10 participants based on the following criteria: Estonian not a first language (n = 2), age not specified (n = 1), the average of given ratings less than 2 (n = 3), unexpected ratings given on practice trials (n = 4). Thus, for the analysis, we had data from 49 participants (42 females, 7 males; 19–60 years old, mean age 31). 48 of them reported Estonian as their native language and one reported themselves as bilingual, speaking Estonian and German as their first languages.

4.5. Acceptability judgement analysis and results

For data analysis, we used cumulative link mixed modelling to build ordinal logistic mixed-effects models applying R package *ordinal* (Christensen 2019). We used ordinal mixed-effects regression because Likert scale responses have concrete ordering of the consecutive points (e.g., *very bad – bad – good*) but the distance between them is unknown (Agresti 2010: 2). That is, the conceptual distance between ‘very bad’ and ‘bad’ could be smaller than the distance between ‘bad’ and ‘good’. While ordered data can be analysed using parametric models, such as ANOVA, the Type I and Type II errors are much more easily avoided when using ordinal models for ordinal data (Liddell & Kruschke 2018). Thus, we opted for mixed effects ordinal regression. In addition to packages mentioned in the Experiment 1 analysis, we also used the package *lsmeans* (Lenth 2016) for post-hoc Tukey tests and *RVAideMemoire* (Hervé 2022) for the Type III test.

In Experiment 2, all experimental items were rated as 3 or higher in the majority of the responses, and very few 'not acceptable at all' ratings (less than 7% in each condition) were given (see Figure 3).

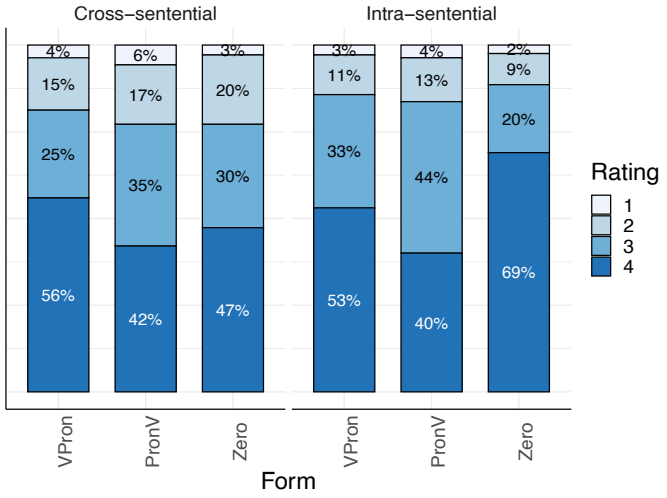

Figure 3. Proportional distribution of ratings of sentences that included zero reference or an overt third-person pronoun *ta* in Cross-sentential and Intra-sentential condition. 1 – 'not acceptable at all', 4 – 'fully acceptable', 2 and 3 did not have explicit verbal counterpart.

In the model, we included i) rating as the dependent variable and ii) form of the referential device (levels: Zero, VPron, PronV) and iii) sentence configuration (levels: Intra-sentential, Cross-sentential) as independent variables. The form of the referential device and sentential configuration were included as fixed effects. We also included random intercepts for participants and experimental items, as well as random slopes for the form per participant in the model. Inherently, the variable of form also included information about the position of the overt pronoun in the sentence (either occurring before or after the verb). The overall explanatory power of the model is quite low (Conditional R^2 is 0.495), the part explained by fixed effects alone (Marginal R^2) is of 0.043.[7]

7 The model performance improved considerably when adding participants as a random effect. The conditional R^2 for the model that included only experimental item as random intercepts was 0.072, and for the model that included also participants for random intercepts and random slopes for form per participants was 0.495.

The results show a statistically significant interaction between the form and the sentential configuration in predicting acceptability ratings ($\chi^2(2) = 23.81$, $p < 0.0001$) (for a detailed report, see Table 2 in the Appendix). The sentence is rated less acceptable when the form is an overt pronoun *ta* that occurs in an Intra-sentential configuration, as compared to a situation where it is a zero reference that occurs in a Cross-sentential configuration. We ran post-hoc tests to pinpoint the statistically significant contrasts for the interaction terms that were meaningful for the study.

In Figure 4, each panel represents the predicted probabilities for responses from 1 ('not acceptable at all') to 4 ('completely acceptable'). It illustrates that with the overt form *ta* the Intra- and Cross-sentential configurations are equally acceptable – the means and error bars are overlapping for the variables VPron and PronV in both configurations, indicating no difference between them. With zero reference, the Intra-sentential configuration is more acceptable than the Cross-sentential configuration (there is no overlap of means or error bars; Tukey test also confirms this with $p < 0.0001$). Moreover, in the Intra-sentential configuration, zero reference is also more acceptable than the overt form (Tukey test confirms this with $p < 0.0001$ for PronV level and $p < 0.05$ for VPron level). In addition, there is a difference between the ratings of sentences that included VPron and PronV word order. In both sentential configurations, the sentences with VPron word order get a higher rating more likely as compared to the sentences that included PronV word order (Tukey test confirms this with $p < 0.05$ for both sentential configurations). Thus, in Intra-sentential configurations, the zero reference is slightly more acceptable than the use of a pronoun (whether preceding or coming after the verb); in Cross-sentential configurations, the sentences that include either zero reference or an overt pronoun are equally acceptable. When it comes to word order effects with the overt form *ta*, the sentences where the pronoun precedes the verb were rated less acceptable than those where the pronoun came after the verb.

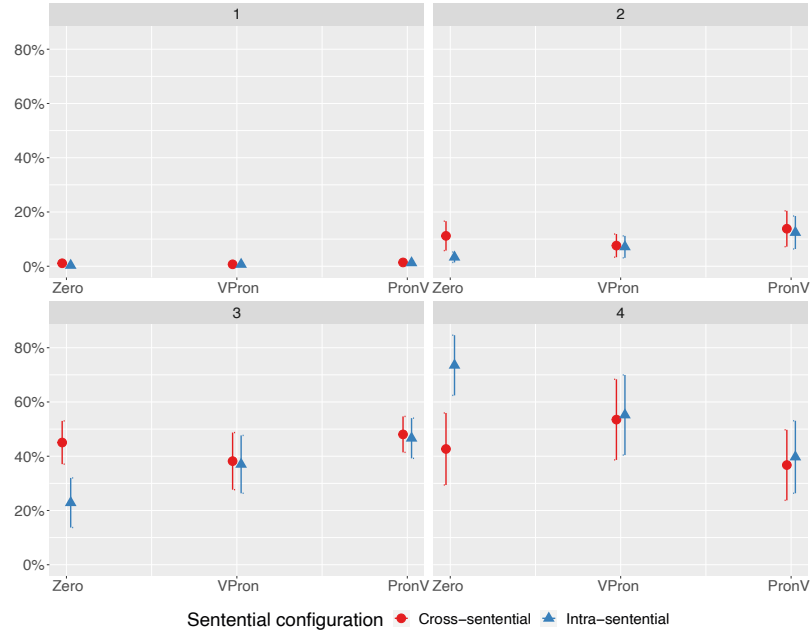

Figure 4. Predicted probabilities of ratings by ordinal mixed effects logistic regression model adjusted to sentential configuration and form of the referential device. The error bars indicate 95% confidence intervals.

4.6. Acceptability judgement discussion

The results from Experiment 2 indicate that for language users, the distinction between third-person zero reference vs. overt pronoun is not a matter of strong structural preferences, and there is a certain overlapping area in the use of these devices. Especially in Cross-sentential configuration, listeners are not sensitive to the contrast between zero reference and the overt form. However, zero reference gets a bigger acceptability boost from Intra-sentential context than overt pronouns, which suggests that zero reference is more characteristic to coordinated sentences, at least in terms of written language. This is in line with previous descriptions of the usage contexts of zero reference in Estonian spoken language (Lindström 2005; Hint 2015) and confirms the importance of sentence-level constraints in the use of referential devices (e.g., Stoyneshka, Fodor & Fernández 2010).

It is interesting to note that overall, the position of the overt pronoun in the sentence (PronV vs. VPron) does not have a substantial effect

on the ratings, especially as compared to the zero reference sentences. However, sentences with PronV order get fewer 'Entirely acceptable' ratings from speakers, as compared to VPron and zero sentences. This outcome accords with the accounts that mark verb-second principle as a characteristic feature of standard written Estonian word order (Lindström 2017) but is also consistent with more recent findings that verb-third clauses are also acceptable and frequent in Estonian, especially in spoken (or colloquial) registers (Vihman & Walkden 2021).

5. General discussion and conclusion

This study set out with the aim of explaining the differences in the referential properties of the overt pronoun *ta* 's/he' vs. zero reference in Estonian. In two experiments, we tested two factors: i) the structure of reference chain, and ii) sentential configuration. In addition, we briefly addressed the effect of word order on referential choice. Our analysis demonstrated the importance of sentential configuration on the referential choice between overt pronoun *ta* vs. zero reference in Estonian. More specifically, in Intra-sentential contexts (that is, when there is no sentence border between two consecutive mentions of the same referent), participants prefer zero reference to the overt pronoun. In addition, the form of the preceding NP can motivate referential choice to some extent: participants tend to choose overt form *ta* when the same referent is mentioned with a given full NP in the preceding utterance but prefer zero reference when the preceding form is an overt pronoun. Overall, these results are compatible with the form-specific multifactorial approach to referential choice (Kaiser & Trueswell 2008; Kibrik 2011), and illustrate that salience account (e.g., Gundel, Hedberg & Zacharski 1993) can be strengthened by adding other factors to the analysis.

In addition to just adding various factors to the analysis, it is also necessary to notice that referential devices differ in whether and how sensitive they are to each factor. For example, in terms of Estonian, previous research has shown that personal pronouns are sensitive to animacy (Pajusalu 2009), syntactic role of the antecedent (Kaiser & Vihman 2010), and referential distance (Hint 2021), whereas the use of zero reference depends on syntactic role, case, and order of mention (Lindström 2001; Hint 2021). The effect of sentential configuration on

Estonian referential devices had not been explicitly tested yet. Therefore, our study sheds new light on a complex distinction between two referentially similar devices, for which a salience-only account has not been able to offer a convincing explanation yet.

Our results also resonate with Heine's (2019) concept of the dualistic nature of discourse processing, and the distinction between microstructure and macrostructure in language. In terms of microstructure, the Estonian overt pronoun *ta* and zero reference express the same semantic content or propositional meaning. However, it is on the level of the macrostructure where the difference arises in the sense that *ta* and zero reference signal differently how to construct a coherent model for a text and give different instructions on how to interpret the text (Heine 2019: 422). While the 'classic' theories of referential choice (Givón 1983; Ariel 1990; Gundel, Hedberg & Zacharski 1993) are only concerned with microstructure and thus explain the local coherence of the text, it is necessary to also consider the macrostructure and the possible effect on discourse segmenting of referential devices.

In earlier research, segmentation-related constraints of referential choice have also been described in Russian, where the use of zero reference is limited for contexts where the antecedent is a grammatical subject, and there is no paragraph distance between two consecutive referential expressions referring to the same entity (Kibrik 1996). This indicates that when zero reference is used, it implies the continuation of the paragraph and there is no perceivable event boundary. The overt form, on the other hand, has the potential to indicate an event boundary and it can start a new paragraph in discourse although the overt pronoun does not necessarily have to realise this potential. A similar account has been offered for Dutch zero subjects by Van Vliet (2009), who claims that zero indicates the continuation of the sentence, whereas the use of pronoun signals the beginning of a new sentence for the speaker. While this account helps to clarify the nature of zero reference, it still leaves some uncertainties in the differences between zero reference and overt pronoun, since both these forms are acceptable within one paragraph and one (coordinated) sentence (see also Scott 2013).

In our analysis, only a small amount of variation in the data was explained by fixed effects, which indicates that more variables should be included in the future studies to get a more complete picture about the alternation of zero reference vs. *ta*. Furthermore, adding partici-

pant as a random effect improved our models' performance considerably which might indicate that in the cases where both alternatives are equally possible, the zero reference vs. overt form distinction relates to speakers' individual usage preferences (cf. Mack et al. 2012; Scott 2013). It is possible that the overt form preference signals that speakers are more influenced by the cognitive needs of a (hypothetical) listener. The preference for zero reference, by contrast, would suggest that the economy of language use is a dominant motivation for the speaker.

The interpretation of the results of this study is subject to certain limitations. First, we have tested the use of referential devices in narrative contexts. It can be expected that in different contexts (e.g., spoken dialogues, synchronous internet communication, written fiction), additional factors, or different combinations of these factors, prove important. For example, the effect of context on the choice of referential expressions has been demonstrated by Pajusalu et al. (2018). Second, we only tested reference to animate (human) characters in subject position, with one main protagonist performing all the actions. It is possible that the functions and usage restrictions of zero reference are different in case of inanimate referents. Also, zero reference can be used for other syntactic roles, although rarely (Hint 2015). Earlier research has shown the importance of clausal semantics on the overt expression or omission of the experiencer constructions (Lindström & Vihman 2017), so it remains a task for future research to reveal the exact behaviour of zero reference in various syntactic positions and semantic contexts.

To conclude, this study has shown that to understand the distinction between third-person zero reference and overt pronoun *ta* in Estonian, it is not sufficient to rely only on a one-factor salience account. We demonstrated that the role of sentential configuration in the choice between these forms should be considered and that this factor is especially relevant in terms of zero reference. Thus, the study adds support to the form-specific account, in that different referential forms are not equally sensitive to selected factors. Further research on the seemingly similar usage contexts and functions of the two referential forms may lead to a better understanding of the more subtle differences between zero reference vs. overt form.

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Abbreviations

INE = inessive, NOM = nominative, PL = plural, PST = past tense, PRT = partitive, SG = singular, SHORT = short form of personal pronoun, 2 = second person, 3 = third person, Ø = zero reference

References

Agresti, Alan. 2010. *Analysis of ordered categorical data*. New Jersey: John Wiley & Sons, Incorporated. https://doi.org/10.1002/9780470594001.

Ariel, Mira. 1990. *Accessing noun-phrase antecedents*. London: Routledge.

Arnold, Jennifer E. & Zenzi M. Griffin. 2007. The effect of additional characters on choice of referring expression: Everyone counts. *Journal of Memory and Language* 56. 521–536. https://doi.org/10.1016/j.jml.2006.09.007.

Bates, Douglas, Martin Maechler, Ben Bolker & Steve Walker. 2015. Fitting linear mixed-effects models using lme4. *Journal of Statistical Software* 67(1). 1–48. https://doi.org/10.18637/jss.v067.i01.

Chafe, Wallace L. 1994. *Discourse, consciousness, and time: the flow and displacement of conscious experience in speaking and writing*. Chicago and London: The University of Chicago Press.

Chambers, Craig G. & Ron Smyth. 1998. Structural parallelism and discourse coherence: A test of centering theory. *Journal of Memory and Language* 39(4). 593–608. https://doi.org/10.1006/jmla.1998.2575.

Christensen, Rune Haubo B. 2019. *ordinal. Regression models for ordinal data*. R package version 2019.12-10. https://CRAN.R-project.org/package=ordinal.

Chyung, Seung Youn (Yonnie), Katherine Roberts, Ieva Swanson & Andrea Hankinson. 2017. Evidence-based survey design: the use of a midpoint on the Likert scale. *Performance Improvement* 56(10). 15–23. https://doi.org/10.1002/pfi.21727.

Dijk, Teun A. van. 1980. *Macrostructures. An interdisciplinary study of global structures in discourse, interaction, and cognition*. London: Routledge. https://doi.org/10.4324/9780429025532.

Duvallon, Outi & Antoine Chalvin. 2004. La réalisation zéro du pronom sujet de première et de deuxième personne du singulier en finnois et en estonien parlés. *Linguistica Uralica* XL(4). 270–286. https://doi.org/10.3176/lu.2004.4.04.

Erelt, Mati. 2017a. Ellips. In Mati Erelt & Helle Metslang (eds.), *Eesti keele süntaks* (Eesti keele varamu III), 590–602. Tartu: Tartu Ülikooli Kirjastus.

Erelt, Mati. 2017b. Öeldis. In Mati Erelt & Helle Metslang (eds.), *Eesti keele süntaks* (Eesti keele varamu III), 93–239. Tartu: Tartu Ülikooli Kirjastus.

Filiaci, Francesca, Antonella Sorace & Manuel Carreiras. 2014. Anaphoric biases of null and overt subjects in Italian and Spanish: a cross-linguistic comparison. *Language, Cognition and Neuroscience* 29(7). 825–843. https://doi.org/10.1080/01690965.2013.801502.

Fukumura, Kumiko & Roger van Gompel. 2015. Effects of order of mention and grammatical role on anaphor resolution. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 41(2). 501–525. https://doi.org/10.1037/xlm0000041.

Givón, Talmy. 1983. Topic continuity in spoken English. In Talmy Givón (ed.), *Topic continuity in discourse: A quantitative cross-language study*, 345–363. Amsterdam/Philadelphia: John Benjamins. https://doi.org/10.1075/tsl.3.

Givón, Thomas. 1993. Coherence in Text, Coherence in Mind. *Pragmatics and Cognition* 1(2). 171–227. https://doi.org/10.1075/pc.1.2.01giv.

Goldberg, Adele E. 1995. *Constructions: A construction grammar approach to argument structure* Chicago/London: University of Chicago Press.

Gundel, Jeanette K., Nancy Hedberg & Ron Zacharski. 1993. Cognitive status and the form of referring expressions in discourse. *Language* 69(2). 274–307. https://doi.org/10.2307/416535.

Haegeman, Liliane. 2013. The syntax of registers: Diary subject omission and the privilege of the root. *Lingua* 130. 88–110. https://doi.org/10.1016/j.lingua.2013.01.005.

Heine, Bernd. 2019. Some observations on the dualistic nature of discourse processing. *Folia Linguistica* 53(2). 411–442. https://doi.org/10.1515/flin-2019-2016.

Hervé, Maxime. 2022. *RVAideMemoire: Testing and plotting procedures for biostatistics*. R package version 0.9-81-2. https://CRAN.R-project.org/package=RVAideMemoire.

Hint, Helen. 2015. Third person pronoun forms in Estonian in the light of Centering Theory. *Eesti ja soome-ugri keeleteaduse ajakiri. Journal of Estonian and Finno-Ugric Linguistics* 6(2). 105–135. https://doi.org/10.12697/jeful.2015.6.2.05.

Hint, Helen. 2021. *From full phrase to zero: A multifactorial, form-specific and cross-linguistic analysis of Estonian referential system* (Dissertationes Linguisticae Universitatis Tartuensis 42). Tartu: University of Tartu Press.

Hint, Helen, Tiina Nahkola & Renate Pajusalu. 2017. With or without articles? A comparison of article-like determiners in Estonian and Finnish. *Lähivõrdlusi. Lähivertailuja* 27. 65–106. https://doi.org/10.5128/LV27.02.

Hint, Helen, Tiina Nahkola & Renate Pajusalu. 2020. Pronouns as referential devices in Estonian, Finnish, and Russian. *Journal of Pragmatics* 155. 43–63. https://doi.org/10.1016/j.pragma.2019.10.002.

Hobbs, Jerry R. 1979. Coherence and coreference. *Cognitive Science* 3. 67–90. https://doi.org/10.1207/s15516709cog0301_4.

Jokela, Hanna. 2012. *Nollapersoonalause suomessa ja virossa. Tutkimus kirjoitetun kielen aineistosta* (Annales Universitatis Turkuensis. Sarja C, Scripta lingua Fennica edita, 334). Turku: University of Turku.

Kaiser, Elsi. 2013. Looking beyond personal pronouns and beyond English: Typological and computational complexity in reference resolution. *Theoretical Linguistics* 39(1–2). 109–122. https://doi.org/10.1515/tl-2013-0007.

Kaiser, Elsi & Katrin Hiietam. 2003. A Comparison of the referential properties of third person pronouns in Finnish and Estonian. *Nordlyd. Proceedings of the Workshop on Generative Approaches to Finnic Languages* 31(4). 654–667. https://doi.org/10.7557/12.31.

Kaiser, Elsi & John C. Trueswell. 2008. Interpreting pronouns and demonstratives in Finnish: Evidence for a form-specific approach to reference resolution. *Language and Cognitive Processes* 23(5). 709–748. https://doi.org/10.1080/01690960701771220.

Kaiser, Elsi & Virve-Anneli Vihman. 2006. Invisible arguments. Effects of demotion in Estonian and Finnish. In B. Lyngfelt & T. Solstad (eds.), *Demoting the Agent: Passive, middle and other voice phenomena*, 111–141. Amsterdam: John Benjamins. https://doi.org/10.1075/la.96.07kai.

Kaiser, Elsi & Virve-Anneli Vihman. 2010. On the referential properties of Estonian pronouns and demonstratives. In Hans Götzsche (ed.), *Memory, Mind and Language*, 193–205. Newcastle: Cambridge Scholars Publishing.

Kehler, Andrew, Laura Kertz, Hannah Rohde & Jeffrey L. Elman. 2008. Coherence and coreference revisited. *Journal of Semantics* 25. 1–44. https://doi.org/10.1093/jos/ffm018.

Kehler, Andrew & Hannah Rohde. 2013. A probabilistic reconciliation of coherence-driven and centering-driven theories of pronoun interpretation. *Theoretical Linguistics* 39(1–2). 1–37. https://doi.org/10.1515/tl-2013-0001.

Kibrik, Andrej A. 1996. Anaphora in Russian narrative prose: A cognitive calculative account. In Barbara Fox (ed.), *Studies in Anaphora*, 255–303. Amsterdam/Philadelphia: John Benjamins. https://doi.org/10.1075/tsl.33.09kib.

Kibrik, Andrej A. 2011. *Reference in discourse* (Oxford Studies in Typology and Linguistic Theory). Oxford/New York: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199215805.001.0001.

Kibrik, Andrej A., Mariya V. Khudyakova, Grigory B. Dobrov, Anastasia Linnik & Dmitrij A. Zalmanov. 2016. Referential choice: Predictability and its limits. *Frontiers in Psychology* 7. 1429. https://doi.org/10.3389/fpsyg.2016.01429.

Kivik, Piibi-Kai. 2010. Personal pronoun variation in language contact: Estonian in the United States. In Muriel Norde, Bob de Jonge & Cornelius Hasselblatt (eds.), *Language Contact: New Perspectives*, 63–86. Amsterdam/Philadelphia: John Benjamins. https://doi.org/10.1075/impact.28.05kiv.

Koeneman, Olaf. 2006. Deriving the difference between full and partial Pro-Drop. In Peter Ackema, Patrick Brandt, Maaike Schoorlemmer & Fred Weerman (eds.), *Arguments and Agreements*, 76–100. Oxford: Oxford University Press.

Kwon, Nayoung & Patrick Sturt. 2013. Null pronominal (pro) resolution in Korean, a discourse-oriented language. *Language and Cognitive Processes* 28(3). 377–387. https://doi.org/10.1080/01690965.2011.645314.

Lenth, Russell V. 2016. Least-squares means: The R package lsmeans. *Journal of Statistical Software*, 69(1), 1–33. https://doi.org/10.18637/jss.v069.i01.

Liddell, Torrin M. & John K. Kruschke. 2018. Analyzing ordinal data with metric models: What could possibly go wrong? *Journal of Experimental Social Psychology* 79. 328–348. https://doi.org/10.1016/j.jesp.2018.08.009.

Lindström, Liina. 2001. Verb-initial clauses in narrative. In Mati Erelt (ed.), *Estonian: Typological Studies V*, 138–168. Tartu: Tartu University Press.

Lindström, Liina. 2005. *Finiitverbi asend lauses. Sõnajärg ja seda mõjutavad tegurid suulises eesti keeles.* (Dissertationes Filologiae Estonicae Universitatis Tartuensis 16). Tartu: Tartu Ülikooli Kirjastus.

Lindström, Liina. 2017. Lause infostruktuur ja sõnajärg. In Mati Erelt & Helle Metslang (eds.), *Eesti keele süntaks.* (Eesti keele varamu III), 537–656. Tartu: Tartu Ülikooli Kirjastus.

Lindström, Liina, Mervi Kalmus, Anneliis Klaus, Liisi Bakhoff & Karl Pajusalu. 2009. Ainsuse 1. isikule viitamine eesti murretes. *Emakeele Seltsi Aastaraamat* 54. 159–185.

Lindström, Liina & Virve-Anneli Vihman. 2017. Who needs it? Variation in experiencer marking in Estonian "need"-constructions. *Journal of Linguistics* 54. 1–34. https://doi.org/10.1017/S0022226716000402.

Lüdecke, Daniel. 2021. *sjPlot: Data visualization for statistics in social science*. R package version 2.8.10. https://CRAN.R-project.org/package=sjPlot.

Mack, Jennifer E., Charles Clifton, Lyn Frazier & Patrick V. Taylor. 2012. (Not) Hearing optional subjects: The effects of pragmatic usage preferences. *Journal of Memory and Language* 67(1). 211–223. https://doi.org/10.1016/j.jml.2012.02.011.

Metslang, Helena. 2013. Coding and behaviour of Estonian subjects. *Eesti ja soome-ugri keeleteaduse ajakiri. Journal of Estonian and Finno-Ugric Linguistics* 4(2). 217–293. https://doi.org/10.12697/jeful.2013.4.2.12.

Pajusalu, Renate. 2005. Anaphoric pronouns in Spoken Estonian: crossing the paradigms. In Ritva Laury (ed.), *Minimal reference: The use of pronouns in Finnish and Estonian discourse* (Studia Fennica Linguistica 12), 107−134. Helsinki: Suomalaisen Kirjallisuuden Seura.

Pajusalu, Renate. 2009. Pronouns and reference in Estonian. *Sprachtypologie und Universalienforschung* 62(1/2). 122–139. https://doi.org/10.1524/stuf.2009.0008.

Pajusalu, Renate. 2017. Viiteseosed. In Mati Erelt & Helle Metslang (eds.), *Eesti keele süntaks* (Eesti keele varamu III), 566–589. Tartu: Tartu Ülikooli Kirjastus.

Pajusalu, Renate, Maria Reile, Helen Hint, Tiina Nahkola & Piia Taremaa. 2018. Relative clauses in spatial and narrative contexts in Estonian, Finnish, and Russian. *SKY Journal of Linguistics* 31. 107−142.

R Core Team. 2021. *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.

Reile, Maria, Piia Taremaa, Tiina Nahkola & Renate Pajusalu. 2019. Reference in the borderline of space and discourse: a free production experiment in Estonian, Finnish and Russian. *Linguistica Uralica* 55(3). 185−208. https://doi.org/10.3176/lu.2019.3.02.

Rohde, Hannah & Andrew Kehler. 2013. Grammatical and information-structural influences on pronoun production. *Language, Cognition and Neuroscience* 29. 912–927. https://doi.org/10.1080/01690965.2013.854918.

Scott, Kate. 2013. Pragmatically motivated null subjects in English: A relevance theory perspective. *Journal of Pragmatics* 53. 68–83. https://doi.org/10.1016/j.pragma.2013.04.001.

Siewierska, Anna. 2004. *Person*. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511812729.

Silvennoinen, Olli O. 2018. Constructional schemas in variation. Modelling contrastive negation. *Constructions and Frames* 10(1). 1–37. https://doi.org/10.1075/cf.00009.sil.

Stoyneshka, Iglika, Janet Dean Fodor & Eva M. Fernández. 2010. Phoneme restoration methods for investigating prosodic influences on syntactic processing. *Language and Cognitive Processes* 25. 1265–1293. https://doi.org/10.1080/01690961003661192.

Vihman, Virve-Anneli. 2015. Pick it up: A look at referential devices in Estonian child-directed speech. *Eesti ja soome-ugri keeleteaduse ajakiri. Journal of Estonian and Finno-Ugric Linguistics* 6(2). 63–83. https://doi.org/10.12697/jeful.2015.6.2.03.

Vihman, Virve-Anneli & George Walkden. 2021. Verb-second in spoken and written Estonian. *Glossa: a journal of general linguistics* 6(1). 15. https://doi.org/10.5334/gjgl.1404.

Vliet, Sarah van. 2009. Reference points and dominions in narratives. A discourse level exploration of the referent point model of anaphora. In Vyvyan Evans & Stephanie Pourcel (eds.), *New Directions in Cognitive Linguistics*, 441–464. Amsterdam/Philadelphia: John Benjamins. https://doi.org/10.1075/hcp.24.27vli.

Vogels, Jorrig, Emiel Krahmer & Alfons Maes. 2019. Accessibility and reference production: The interplay between linguistic and non-linguistic factors. In Jeanette Gundel & Barbara Abbott (eds.), *The Oxford Handbook of Reference*. Oxford, UK: Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199687305.013.16.

Wickham, Hadley. 2016. *ggplot2: Elegant graphics for data analysis*. New York: Springer-Verlag. https://ggplot2.tidyverse.org.

Yamamoto, Mutsumi. 1999. *Animacy and reference. A cognitive approach to corpus linguistics*. Amsterdam/Philadelphia: John Benjamins. https://doi.org/10.1075/slcs.46.

Kokkuvõte. Helen Hint, Maria Reile, Elsi Kaiser: Kolmanda isiku eksplitsiitne pronoomen ja nullviitamine eesti keeles. Tähelepanekuid kahe katse tulemustest. Artiklis analüüsime eesti keele kolmanda isiku nullviitamise ja eksplitsiitse personaalpronoomeni *ta* vaheldumist ja referentsiaalseid omadusi. Viisime läbi kaks katset. Esimeses katses uurisime, kas valikut nullviitamise ja *ta* vahel mõjutab viiteahela struktuur ehk see, millised on olnud eelnevad

samale referendile osutavad viitevahendid. Teises katses testisime, kas viitevahendi vastuvõetavuse hinnangut mõjutab lausete omavahelise ühendamise viis (kas kasutatakse kaht iseseisvat lauset või üht kahe rindliikmega lauset). Katsete tulemused näitavad, et viiteahela struktuur nullviitamise ja eksplitsiitse pronoomeni valikut üksinda ei mõjuta, vaid on seotud lausungite ühendamisega. Viimane on aga oluline tunnus eraldiseisvana: nullviitamine on tavalisem siis, kui kasutatakse üht rinnastusseoses olevate liikmetega lauset, *ta* esineb pigem siis, kui kaks (liht)lauset on omavahel punktiga eraldatud. Teisalt mõjutab lausete ühendamise viis eelkõige nullviitamist, samas kui *ta* kasutus ei näita selle tunnuse suhtes olulisi erinevusi. Siinne uurimus osutab selgelt, et viitevahendite kasutuses peegeldub diskursuse töötluse mitmetahulisus. Lisaks kohesioonisuhetele mõjutab viitevahendi valikut diskursuse üldisem ülesehitus. Seega on siinse uurimuse tulemused kooskõlas mitmefaktorilise ja vormispetsiifilise lähenemisega viitamisele.

Märksõnad: nullviitamine, kolmanda isiku pronoomen, referents, referentsiaalne valik, kõne taastamise katse, vastuvõetavuse hindamise katse, eesti keel

Appendix

Table 1. Binomial logistic mixed effects regression models predicting the restoration of the overt pronoun *ta* adjusted to structure of reference chain.

	Model one: One utterance		**Model two: Two utterances**	
Predictive variables	***Estimate (logit)***	***Odds ratio (95% confidence interval)***	***Estimate (logit)***	***Odds ratio (95% confidence interval)***
Given Full NP	−0.5802	0.56 (0.16–1.99)	2.8740	17.71 (1.55–202.72)*
New Full NP	−0.2385	0.79 (0.23–2.66)	1.6080	4.99 (0.62–40.44)
	N = 239		N = 184	
	Marginal R^2 = 0.002 / Conditional R^2 = 0.867		Marginal R^2 = 0.057 / Conditional R^2 = 0.867	
Structure of the final model	glmer(Restoration~1+ Condition+(1|Subject)+ (1|Item), data=OnlyOne, family="binomial", control=glmerControl (optimizer="bobyqa"))		glmer(Restoration~1+ Condition+(1|Subject)+(1|Item), data=MoreThanOne, family="binomial", control= glmerControl(optimizer= "bobyqa"))	

Statistical significance is indicated *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. The reference category of the independent variable is Given Pronoun.

Table 2. Ordinal logistic mixed effects regression model predicting the acceptability rating of test sentences adjusted to form, sentential configuration, and the interaction between those variables.

Predictive variables	***Estimates (logit)***	***Odds ratio (95% confidence interval)***
Verb-Pronoun[a]	0.4355	1.55 (0.99–2.41)
Pronoun-Verb[a]	−0.2479	0.78 (0.52–1.17)
Intra-sentential configuration[b]	1.3166	3.73 (2.48–5.61)***
Verb-Pronoun*Intra-sentential configuration[c]	−1.2481	0.29 (0.16–0.50)***
Pronoun-Verb*Intra-sentential configuration[c]	−1.1911	0.30 (0.18–0.52)***
Threshold coefficients		
1|2	−4.5078	0.01 (0.01–0.02)***
2|3	−1.9660	0.14 (0.08–0.24)***
3|4	0.2953	1.34 (0.78–2.18)
N = 1470		
Marginal R^2 = 0.043 Conditional R^2 = 0.495		
clmm(Response~1+Form+SentConf+Form*SentConf+(1+Form|ParticipantID)+(1|ItemNo,) data=RatingData, link="logit", Hess=TRUE)		

Statistical significance is indicated *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. The reference categories of the independent variables are [a] Zero, [b] Cross-sentential configuration, and [c] Zero*Cross-sentential configuration.