Liv Molich
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Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

Solving translational problems through constraint grammar - a practical case study of possession homographs

Supervisor: Karen Langgård

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Liv Molich
Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

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Liv Molich
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Introduction

This bachelor thesis is closely connected to my job at the Language Secretariat of Greenland, where I in connection to a machine translation project am refining the parser of Greenlandic in order to obtain a higher level of correct disambiguation of words and their interrelationship in Greenlandic texts. At some points, the existing parser is still quite imprecise, so improving one of these fields – the disambiguation of possessives – will be the topic of my thesis.

The translation machine builds on a two-level morphological analyzer (GFST, Greenlandic Finite State Transducer), which breaks down a word and outputs all possible morphological analyses of it (Oqaasileriffik 2012:13). This output is input to the parser (GCG, Greenlandic Constraint Grammar), which selects the right morphological reading and adds to it information about syntactic role, and, to some degree, about dependencies. My focus will be on the Greenlandic parser which is an important part of the machine translation project aiming at automatic translation between Greenlandic and Danish (Oqaasileriffik 2016:9).

Greenlandic is a highly ambiguous language with a large amount of homographs, and the GCG must choose between an average of three readings per word.[1] Therefore, morphological and syntactic disambiguation are extremely important aspects of Greenlandic machine translation. Only Central West Greenlandic which is the official language of Greenland will be considered here, referred to simply as “Greenlandic”.

An interesting example of ambiguity is that possessed nouns are often homographic without clear indication of which person and number the possessor has. Furthermore, the possessor is often not explicitly expressed in Greenlandic. Therefore, a noun like *aallarnerami* could mean either “my departure” or “his/her departure”, “when he/she began” or “whether he/she departed”.[2] The most frequent cases of syncretism of this kind only include the two uppermost nominal

[1] For 14,870 tokens (clause boundaries excluded) in *Ukiut Trettenit Qaangiummata* (Vebæk 1992), there are 40,840 readings, giving an average of 2,75 readings per word (September 14th 2018). According to Oqaasileriffik 2010 there is an average of four readings per word. The difference may be due to different corpora or developments of the analyzer.

[2] Greenlandic has no gender marking in the inflection. This will not be part of my thesis, so “his” or “he” in the following could be “its”, “her”, “it” or “she”.

readings below. A list of abbreviations and tags are found in appendices I and VII, and full paradigms are drawn in Langgård and Langgård 1988:231.

Translation	**Base**[3]	**DM**	**POS**	**Case/ Mood**	**Person/ Number**	**Possessor**	**Clitic**[4]
"My departure"	aallar	NIQ	N	Abs	Sg	1SgPoss	Intense
"His departure"	aallar	NIQ	N	Abs	Sg	3SgPoss	Intense
"When he began"	aallarner	(none)	V	Cau	4Sg	(none)	(none)
"Whether he departed"	aallar	NIR	V	Cau	4Sg	(none)	(none)

Only if the word of the *aallarnerami* type ends in *mi*, verbal readings are possible. If a nominal reading is selected there is only an ambiguity in the absolutive case, and the noun is almost always derived with NIQ.

Likewise, a noun in an oblique case like *atuarfinni* in the locative case with an implicit possessor can be rendered "in my school", "in your (sg.) school", "in my schools", and "in your (sg.) schools". A last possibility is "in the schools", non-possessed and plural. This kind of syncretism is very frequent, and several other examples of inflectional syncretism exist.

A Greenlandic possession hypotagm consists of "possessor" and "possessum". The possessor is the core of a nominal phrase possessing another nominal phrase and has a possessor marking. The head of the possession hypotagm is called the "possessum", or "possessive", referring to its possessive inflection. The inflection of the possessum includes information about the possessor as well as about the possessum. This will be explained in more detail in part I.

The examples above show how ambiguous possible possessives can be, pointing at the need for morphological disambiguation of possessives since there isn't always an explicit possessor that can be used for disambiguation. The morphological disambiguation of each word is therefore

[3] Different terminology is used among different scholars, e.g. "root", "stem" or "base", sometimes used interchangeably. Here, the discussion about what is a stem and a root is irrelevant. I will use the term "base".
[4] The term "clitic" is used in various ways among different scholars. Here, it is used from a morphological point of view designating an affix added after the inflection, even though it may not be a clitic from a phonological point of view (Langgård and Langgård 1988: 219).

closely connected to the syntax and semantics of the clause. I will try to pinpoint the parameters necessary for morphological disambiguation and show how rules for this purpose could be written for the parser, with special focus on nouns of the *aallarnerami* type.

Hypothesis

My thesis builds on established theories of disambiguation. It has been shown that constraint grammar can be used for disambiguating word forms in several languages (Wikipedia 2018). General disambiguation rules for Greenlandic have been written over the last decade (Oqaasileriffik 2010, 2012, 2016), but rules specifically written for possession disambiguation, bringing the failure rate down to a minimum on this point too, are still needed.

On January 2nd 2018, 46 of 223 occurrences of the *aallarnerami* type in my main corpus[5] were disambiguated wrongly, corresponding to an error rate of 21%. This indicates that the rules already written do not take into account every possible structure, and that they may not have been written specifically for the purpose of disambiguating possessives of the *aallarnerami* type, but for the disambiguation of other ambiguities, and more accidentally disambiguates the possessives. This leads to my hypothesis that the parser (GCG) can select the correct analysis of the word form also for possessives if appropriate rules for selection are applied.

Outline

My thesis contains three main parts: part I contains a short introduction to possession in Greenlandic. Semantic and syntactic theories will be considered in order to investigate how the ambiguous possessive in theory can be disambiguated correctly. In part II, I will explain how the GCG can disambiguate correctly between possessives of the aallarnerami type, and I will write rules for this on the basis of the theories discussed in part I. In part III, the rules will be proof checked, and adjustments for the rules will be suggested.

[5] The corpora are presented below and can be found in appendix VI.

Materials and methods

Corpora

In order to investigate the homographic inflection I will need a text corpus. My main corpus consists of three novels and is supplemented by the main corpus of the Language Secretariat of Greenland (Oqaasileriffik 2018a).

The three novels are all in the genre of fictional literature, and they are chosen for their variety of narrators, direct speech and authors. They are all written in a fairly normal language, most of which is covered by the dictionaries and the GFST. Most structures are also part of the GCG, however still with many failures. Sentences in the books are of medium length and complexity.

The first novel is the children's book *Ataqqinartuaraq* (Antoine de Saint-Exupéry 1943:*Le Petit Prince*).[6] It has a first person narrator. When the main character visits the different planets in the Universe and talks to their inhabitants, there is a lot of direct speech. Examples from this book will be marked (A).

The second novel, *Ukiut Trettenit Qaangiummata* ([After thirteen years], Maliâraq Vebæk 1992), is originally written in Greenlandic and has some direct and indirect speech, too, when the young main character is discussing her family relations. It has a third person narrator. In some cases, it is unclear if the possessor is 1st or 3rd person if the context of the period in question is disregarded. Therefore, this text is highly interesting for my purpose. References to this novel will be marked (U).

The third novel, *Tarrarsuummi Tarraq* ([The mirror shadow], Ole Korneliussen 1999), is also written in Greenlandic. It has a first person narrator like *Ataqqinartuaraq*, but not much direct speech. The main part of the novel is a description of what the main character watches and of his excessive, existential thoughts. These thoughts are unspoken, but shaped inside his head, in 1st,

[6] Probably the newest Danish translation (Bjørn Bredal 2017), rather than the French original, is the basis for the Greenlandic translation by Mira Kleist, Juana Petrussen and Carla Rosing Olsen (2017).

2nd and 3rd persons, as if he was speaking to himself, with another one or about someone. (T) will mark examples from this text.

In these three books, all sentences containing the possessives of the *aallarnerami* type are considered in detail.

The main corpus will be supplemented by the regression corpus of the Language Secretatiat will be used for validation (Oqaasileriffik 2018b),[7] and by the novel *Inuillisimasup ikioqqunera* (Steenholdt: 2001) from the extended corpus of literature collected by the Language Secretariat of Greenland (Oqaasileriffik 2018f).[8] The novel has a 1st person narrator. Other examples from this corpus will be used as inspiration for the rules of disambiguation.

The parser (GCG)

The morphological disambiguator and syntactic tagger, the Greenlandic Constraint Grammar (GCG), is part of the Greenlandic translation machine. Among other things, the GCG disambiguates between identical word forms. The input – text in Greenlandic – is run through the finite state transducer (GFST) which outputs one or more morphological analyses of the word, and this output is used as input for a grammar, the output of which is input for the next grammar, and so on. The different grammars provide rules on morphological, syntactical and lexicographical levels. In this way, the output will gradually be more and more disambiguated. The structure of the Greenlandic translation machine is developed by Eckhard Bick and basically works in the same way as his other translation machines, e.g. Danish-English (Bick 2007). On all levels, regular expressions – a way of writing a string or pattern that can be matched in a text – are used. Guides for regular expressions are found many places, e.g. Jurafsky and Martin 2009:17-26.

An FST "defines a *relation* between sets of strings" (Jurafsky and Martin 2009:57).[9] Its basis was laid by Kimmo Koskenniemi, Lauri Karttunen, Ronald M. Kaplan and Martin Kay in the

[7] Sentences for this regression corpus have been selected from texts of different genres by Karen Langgård during the summer 2018, aiming at covering all different syntactic structures in Greenlandic.
[8] The extended corpus include 92 texts (November 2018) and is still growing.
[9] Introductions to finite state morphology and machines are found in Jurafsky and Martin 2009: 26-79 and, more comprehensively in Beesley and Karttunen 2003.

early 1980'ies. It differs from a finite state automaton by working on not only one, but on two levels at the same time. This two-level morphology method was initiated by Koskenniemi and has the strength that it has an input, but also creates an output (Karttunen and Beesley 2005:71ff.). This is an important feature for text parsing, as both the morphological structure and the surface form of a word can be seen. The GFST was initiated by Per Langgård and Trond Trosterud in 2005 (Langgård 2014:112; Oqaasileriffik 2010).

The text input for the GFST is tokenized, i.e. split into words,[10] and the output of the GFST shows both levels for each word:

"<aallarnerami>"
"aallar" NIQ N Abs Sg 1SgPoss MI
"aallar" NIQ N Abs Sg 3SgPoss MI
"aallar" NIR V Cau 4Sg
"aallarner" V Cau 4Sg

The word in the angle bracket is the lower level, that is, the surface form of the word. The next four lines form a cohort of possible readings of the context-free word. This is the higher level. The readings can also include other kinds of information, such as semantics.

In order to ensure that the correct analysis of a word form is selected, the output from the GFST is run through different constraint based grammars. One of the first of these is the Greenlandic Constraint Grammar describing the Greenlandic input in terms of syntactic functions.

The constraint grammar has been under development since the early 1980'ies, Fred Karlsson being the initiating force (Karlsson 1995:iii). It is a method for parsing, that is, "automatic assignment of morphological and syntactic structure (but not semantic interpretation) to written input texts of any length and complexity" (Karlsson 1995:1). A constraint grammar is used for flat analyses of word structures, and thus basically not dependencies; however, the syntactic tags on dependents show in which direction their heads are (Karlsson 1995:33-34). On the basis of this, dependencies can be added to the analyses later in the chain.

[10] How to decide what is a "word" in this context will not be discussed here.

Some of the main goals of the CG are that it should be robust, language-independent, and applicable to and adjustable to fit different text types (Karlsson 1995:1-2). The latest development of the CG formalism, the CG-3, has been done in connection to the VISL project (Bick and Didriksen 2015). This CG-3 will be referred to simply as "CG", and the Constraint Grammar for Greenlandic will be named the "GCG". The GCG has a long history, the first steps having been taken by Per Langgård a decade ago, in 2008 (Oqaasileriffik 2010). The CG formalism is documented in Didriksen 2018. Tags, sets and lists used in the GCG are explained in appendices I, II, III and IV.

A CG consists of a number of different rules. Basically, two kinds of rules are written for disambiguation, namely REMOVE and SELECT rules.[11] A SELECT rule must be safe, as it selects a reading matching the requirements of the rule, deleting all other readings. A REMOVE rule is more gentle, only removing the readings matching the rule. Multiple REMOVE rules can be used for disambiguating one word form, gradually removing wrong readings (Didriksen 2018; Bick 2000:113).

To make sure the right reading is selected by the CG, the parser needs a vast number[12] of machine readable selection or removement rules such as the following one:

```
SELECT 1SgPoss IF (-1 Gram/Pers + Pron + 1Sg) ;
```

This rule selects a 1st person singular possessum reading (1SgPoss) if there is a 1st singular personal pronoun (Gram/Pers Pron) right to the left (-1) of it. By selecting the 1st singular reading, the rule removes all readings of the possessum which are not 1st person singular possessum. Selection rules like this one should only be used if the reading is safe. If it could have been either a 1st or a 2nd singular personal pronoun, but not a 3rd, a removement rule should have been written instead:

```
REMOVE 3SgPoss IF (-1 Gram/Pers + Pron + 1Sg) ;
```

[11] Other kinds of rules used for disambiguation are APPEND and COPY rules, which are effective when dealing with analyses missing in the morphological analyzer.
[12] How many rules are needed depends on many factors. For the English-Danish translation machine, approximately 6,000 rules were written (Bick 2007: 37).

The rules are ordered in sections and each section run one or more times, from top to bottom. The optimal result is fully disambiguated and mapped words, but it is not mandatory to end up without ambiguities. Some words are hard, or even impossible to disambiguate due to real ambiguities. If safe rules cannot be written for them using lexical or semantic knowledge, rules for these problematic words can be written in the lower part of the grammar. It is important that the safe rules are placed higher than the unsafe ones because they have a higher risk of error (Voutilainen 1995:181-183). It is also possible not to write rules for those words, just leaving the disambiguation of them to later grammars.

Methods

As exemplified in the introduction, an ambiguous word form such as *aallarnerami* can be either possessed by 1st person singular, 3rd person singular or be a verb and not a noun. Thanks to the tagged output from the GFST, I am able to extract all possessives of this type automatically in order to use them for further investigation.[13]

To check which analysis is the right one for each word, I will try different methods exemplified in part I. It turns out that the context-free syntactic analysis (and hence also the morphological analysis of ambiguities) sometimes changes when context is added, so any method should be balanced against context. My colleagues employed at the Language Secretariat of Greenland with Greenlandic as their mother tongue have been helpful for this task.

The selected corpus is morphologically analyzed by the GFST. I will go through the input for the GCG in order to disambiguate the sentences and map them for syntactic roles. During the disambiguation process of the GCG, the rules for disambiguation of possessives are written and refined. I will map my corpus for direct and indirect speech, and semantics of explicit possessors in order to be able to add rules based not only on syntactic theories, but also on semantics and stochastics. However, when the rules based on the theories have been applied, some sentences

[13] Automatic extraction is of course only possible if the GFST, or another program run before the GCG, outputs an analysis of the word. An alternative to the extraction based on the morphological analysis is an extraction based on the surface form of the inflection (*nera*) which never changes in words of the *aallarnerami* type.

will still remain ambiguous. The GCG will then work as a tool of finding these remaining sentences and of testing which rules can refine the output.

Once the disambiguation rules have been written, they will be proof checked by running a traced GCG analysis and checking that all word forms in question are correctly disambiguated by the intended rule. I will run the GCG on the regression corpus for validation. Furthermore, I will manually go through additional examples found in the extended corpus and check if the rules already written are covering these examples.

The disambiguation rules based on semantics and syntax can be proofed in this way, while rules based on stochastics are less safe and should be checked against a much larger corpus. This can only be done on a corpus with a correct morphological and syntactic analysis. The GFST and GCG are not yet ready for this task, and rules based on stochastics only will therefore not be written.

Part I: Disambiguation in theory

In this part, the theories of possession in general and specifically for Greenlandic will be outlined. These theories will provide the basis for part II.

Possession in Greenlandic

In Greenlandic, all words except the particles consist of a root, optional derivation and obligatory inflection. Often, several derivational morphemes are added to the same word, increasing its length significantly. These derivational morphemes can change the word class and/or the semantics. After the inflectional morpheme(s), one or more enclitics can be added. A brief introduction to the West Greenlandic language is Langgård and Langgård 1988 (in Danish and partly in Greenlandic) or Sadock 2003 (in English). Fortescue 1984 (in English) is more comprehensive.

Two cases are used for congruent subjects and objects in Greenlandic: relative case marks subjects of dicongruent verbs, while the unmarked absolutive case is used for objects of dicongruent verbs or subjects of monocongruent verbs.[14] These two cases also have other functions: some adverbial adjuncts are in the absolutive, and the relative case is also used for marking possessors. Obviously, this double use of relative case can be difficult to handle, as will be shown in example 4 and 6-8 below. A few lexemes follow a nominative-accusative case system, where nominative is used for subjects and possessors. The disambiguation of words using this case system is handled elsewhere in the GCG and will not be discussed here.

In Greenlandic, the possessor must be in the relative case, while the possessed noun can be in any case. Proper nouns, pronouns, nouns and numerals can be possessors, and will all be treated as “nouns” in the following. The possessum bears markings of number as well as case. In the terminology of the Language Secretariat, the possessive inflection is marked in this way:

[14] “Monocongruent” and “dicongruent” are often called “intransitive” and “transitive”. However, also monocongruent verbs can take an oblique object. Therefore, I will use the terms “mono-” and “dicongruent”, referring to subject and/or object marking in the inflection. Nielsen (2019) uses the same terms.

Case	**possessum, number**	**possessor, person**	**possessor, number**	**word form (*isi*, eye)**	**short form**
Absolutive	Pl (plural)	1 (first)	Sg (singular)	*isikka*	N Abs Pl[15] 1SgPoss
Locative	Sg (plural)	3 (third)	Sg (singular)	*isaani*	N Lok Sg 3SgPoss

All combinations of number and case exist.[16] In the following examples, the case will be written after the person and number because the inflectional morphemes follow this order:

1X) *isa-a-ni*
eye-N.Pl.3SgPoss-Lok
"In his eye."

Oblique cases can be verbalized, opening up the possibility of possession in internal inflection:

2X) *isa-a-ni-ip-poq*
eye-iN.iSg.i3SgPoss.iLok-Vbr-Ind.3Sg
"It was in his eye."

Here, the nominal inflection *a-ni* is in the middle part of the word, after which the noun is verbalized. Internal inflection is marked by "i".

Head and dependent marking, and implicit or explicit possessor

A possession hypotagm in Greenlandic is marked on head as well as on dependent. The syntactic role is marked with @, and the angle bracket marks in which way the head is, according to appendix II.

3U)	Unnuk	manna	anaana-mi	qanoq
	evening-N.Sg.Abs	this.Pron.Sg.Abs	mother-N.Sg.4SgPoss.Rel	what.Part
	@CL-ADVL>	@N<	@POSS>	@i-ADVL>

[15] All nouns except personal pronouns are 3rd person, according to Langgård and Langgård 1988:98. This is therefore not marked in the morphological analysis.
[16] However, also singulare tantum and plurale tantum nouns exist, where plural or singular forms are not accepted.

toqu-sima-ner-a	Eskildi-mut
die-Past-being-N.Sg.3SgPoss.Abs	Eskild-Prop.Sg.Trm
@OBJ>	@ADVL>

oqaluttuari-sussaa-nngik-kaluar-pa-a
tell-should-Neg-though-V.Ind-3Sg.3SgO
@PRED

"This evening she shouldn't have told Eskild how her (own) mother died."

Here, *a* in *toqusimanera* marks the possessor and possessum in one portmanteau morpheme. The absolutive case is not marked, as it never is in Greenlandic. In *anaanami* both the possessum and the coreferential possessor have to be expressed in the inflection, together with the relative case, again in one single morpheme, *mi*. The 4th person possessor of *anaanami* is coreferential with the 3rd person subject of the verb. *Toqusimanera* is 3rd person because the possessor is *anaanami*, which doesn't refer to the subject of the verb. For a more comprehensive explanation of coreferentiality in Greenlandic, see Karen Langgård 1997 and 2002:68-69, or Fortescue 1984:146-152.[17] Here, the 4th person in the inflection refers to the subject of the head verb *oqaluttuarisussaanngikkaluarpaa*, "she shouldn't have told that". Hence, from the coreferential marking, it is clear that the subject of the verb and the possessor of the mother must be the same.

The double possession marking of possessor as well as possessum on the head eliminates the need for explicit possessors when information about the possessor has been established by the context. In example 3 above, only one of the possessors is explicit. *Anaanami* does not have an explicit possessor, but is itself the explicit possessor of *toqusimanera*. Information about the possessor of anaanami is established a few sentences before:

> *Emilie akissutissaaruppoq. Ilami ingasalluni oqalussimavoq. Unnuk manna anaanami qanoq toqusimanera Eskildimut oqaluttuarisussaanngikkaluarpaa* (Vebæk 1992:83).

[17] From a purely linguistic point of view, e.g. speech act theories discussed later in part I, the 4th person should be called "3rd person coreferential", which is what Karen Langgård recommends. However, from a computational point of view "4" entails a simpler syntax than "3C[oreferential]" and "3N[on]C[oreferential]" and should therefore be preferred in technological projects, such as the GFST and the GCG.

> "Emilie was not able to answer. Indeed she had said too much. This evening she shouldn't have told Eskild how her (own) mother died."

As soon as a little context is added, it is clear that Emilie is the implicit possessor of the mother as well as the implicit subject of the verb. However, it is not always easy to figure out who is the possessor and subject when the context is left out, as will be shown below in examples 5 and 7-12.

The inflectional system of Greenlandic

In many languages, person marking holds information not only about person and number, but also about gender and case (Siewierska 2004:3). Also in Greenlandic, a nominal person marking cannot exist without a case marking. In the same way, a verb must include not only person(s), but also number and mood:

4A)	Seqern-up	tarrin-ner-a	tako-ruso-qa-a
	Sun-N.Sg.Rel	disappear-doing-N.Sg.3SgPoss.Abs	see-want-much-V.Ind.3Sg.3SgO
	@POSS>	@OBJ>	@PRED

> "He really wanted to see the sunset."

Here, the inflectional ending, *a*, in *tarrinnera* reveals the number and person of the possessor and the person and case of the possessed noun. The parallels between the verbal and nominal systems (Schultz-Lorentzen 1951:15-16; Per Langgård 1997:51-63) are clearly shown in the example: The last morphemes of both the verb *takorusoqaa* and the possessed noun *tarrinnera* appear to be the same, both marking a 3rd person singular subject/possessor and 3rd person singular object/possessum.

Syncretism

As shown in the introduction, Greenlandic is a language with a high level of ambiguity. One kind of ambiguity is the inflectional syncretism, where sometimes two or more word forms are identical but have different grammatical readings, e.g. different word classes, cases, moods or

persons. Inflection is ambiguous not only in Greenlandic, but worldwide “many inflectional systems are replete with a form of ambiguity termed syncretism – a systematic merger of morphological slots” (Cotterell et al. 2018:548). An explicit possessor can reduce the confusion, but frequently, possessor, number and even case are ambiguous.

Syncretism can exist between any of the different persons and numbers (Baerman 2005:3-4). This can have different reasons, one being diachronic changes, where sound changes lead to homophony. Many cases of ambiguity in modern Greenlandic are due to historical changes, where consonants or vowels have become assimilated. Due to these phonological changes, and thus changes in the morphophonology, the characteristics of the different derivational morphemes and of the base and inflection can be difficult to perceive, which heightens the level of ambiguity.

As explained in Per Langgård 1997, the person markings of 1st and 2nd persons singular have, on an earlier language state, been *m* and *k*, respectively. The *m* marking can still be found in the relative case of 1st person singular, but not explicitly with other cases. With oblique cases one can no longer distinguish them. This will often lead to the creation of new or extended use of inflectional markers (Baerman 2005:7-8). This is also seen in the Greenlandic language which is currently developing a new marker for 2nd person singular possessor in oblique cases to be able to distinguish it from 1st person singular (Facebook.com 2018). The new 2nd person singular possessor is pronounced with a radicalized vowel in front of the inflection, which is shown with an *r* in the spelling: *pissannik* vs. *pissarnik*. However, not everyone agrees on the new way to distinguish between the possessors, so it will still be an object of ambiguity. It is neither approved of by the Language Board.

stem	**PoS**	**inflection**	**morphemes**	**old orth.**	**new orth.**	**unofficial orth.**
pissaq, “lot”	N	Sg/Pl 1SgPoss Ins	pissaq-m-nik	*pigssavnik*	*pissannik*	*pissannik*
pissaq, “lot”	N	Sg/Pl 2SgPoss Ins	pissaq-k-nik	*pigssangnik*	*pissannik*	*pissarnik*

In the old orthography developed in the second half of the 19th century by Samuel Kleinschmidt (Kleinschmidt 1851, 1871), the possessors are clearly marked: *pigssavnik*, as opposed to

pigssangnik.[18] The *v* corresponds to the 1st person singular possessor, *m*, and similarly, the *ng* ([ŋ]) corresponds to the 2nd person singular possessor, *k*. In both cases, the sound is articulated in the same place and just changes its manner of articulation. Due to the more extended assimilation in modern Greenlandic, the pronunciation is no more distinctive, and different possessors or numbers often coincide in one homographic and homophonic word form. This kind of syncretism is highly frequent in Greenlandic, and by imitating the spoken language, the new orthography, which was introduced in 1973 (Berthelsen et al. 1998:92, 178), has increased the ambiguity of the written language significantly.

Semantics

On the morphological and syntactic level of the translation it is not yet necessary to decide how each word should be translated. However, the semantics of each word can be helpful in choosing the correct morphological analysis and the correct syntactic role.

Ferdinand de Saussure is famous for his theories about paradigmatic and syntagmatic relations. Paradigmatically related words are words which can fill the same slot in a sentence. Their semantic relations can be drawn in a so-called word net, e.g. the English WordNet (Princeton 2018) or the Danish DanNet (Pedersen et al. 2009). The syntagmatically related words are words which co-occur frequently. Both paradigmatic and syntagmatic information is often found in dictionaries, in form of synonyms and examples (Ravin and Leacock 2000:20).

While knowledge of the paradigmatic relation is essential for translation, information about the semantics of syntagmatic relations can be useful for selecting the right possessessive homograph. The semantic frames of each lexeme are currently being added to the Greenlandic word base, *Katersat* (Oqaasileriffik 2018c). Until this work has been finished, the semantic information for the GCG must come from the GFST or from the GCG itself. In the GFST, such secondary information is marked with a slash:

[18] The double *ss* corresponds to a postalveolar fricative, which is now mostly heard among aged people from central West Greenland. The distinction between [ʃ] and [s] is not visible in the new orthography.

"<ton>"
"ton" N Sem/Unit Abs Sg

The semantic tag “Sem/Unit” designates a unit. If not every unit in the GFST or in Katersat are tagged as units, they can be LISTed directly in the GCG, or the GCG can combine different semantic frames, lexemes and morphemes:

LIST NUMHOVED = "dollar" "dollari" "euro" "franc" "grad" "gram" "kapitali" "kapitel" "kiilu" "kilo" "klasse" "koruuni" "krone" "milliardi" "milliard" "miliuuni" "million" "oori" "procent" ("qupper" NIQ) "side" "øre" Sem/Unit ;

The words in LISTs are commutative in opposition to the order of the rules. These bases including the input from the GFST marked with Sem/Unit all belong to the same paradigmatic group. Often they are found together with numerals, and thus the numerals and the NUMHOVED LIST form a syntagmatic relation. The LIST can be referred to in the rules of the GCG, and in this way, the syntagmatic relation can be found on the basis of the semantics.

Automatic extraction of such semantic relations would be useful and effective (Dolan et al. 2000:179), but requires a bigger corpus which is better aligned than the one existing for Greenlandic. Therefore, the tagging must still be done manually.

Using context to unravel the syntax and disambiguate the possessives

As seen in example 3, the optionality of having an explicit or implicit possessor evokes a problem of disambiguating the possessives, which can be encountered by looking at the context. If the possessor is explicit, there is usually no need to look outside the borders of the sentence, but when the possessum is homographic and the possessor is not explicit, or if the possessor could be taken for a subject, we might have to look outside the borders of the sentence, because knowing context almost always leaves no doubt of what to select.

In example 4, *seqernup tarrinnera takorusoqaa*, “he really wanted to see the sunset [the disappearing of the sun]”, the sun was undoubtedly the possessor of the sunset regardless of the

context, because of its semantics and the lexicalisation of the possession hypotagm. The same will not be the case for the following, which have exactly the same parts of speech:

5U)	Eskild-ip	unnus-sior-ner-a	aseror-pa-a (...)
	Eskild-Prop.Sg.Rel	evening-spend-doing-N.Sg.3SgPoss.Abs	ruin-V.Ind-3Sg.3SgO
	@POSS>	@OBJ>	@PRED

"Someone ruined Eskild's evening (...)"

In example 5, *unnussiornera*, "someone's evening-spending", is theoretically possessed by either a 3rd person singular possessor or a 1st person singular possessor. An overt possessor must be in the relative case, and thus *Eskildip* can be understood as the possessor, leaving the 3rd singular possessor as the only possibility. However, another reasonable analysis is that *Eskildip* is subject of the dicongruent verb *aserorpaa*. Then the possessor is covert, and it must be extracted from the context whether it is 3rd person singular ("Eskild ruined her evening") or 1st person singular ("Eskild ruined my evening). How much context is needed must be approximated by adding more and more context while asking a native speaker of Greenlandic to tell who is the subject and who is the possessor.[19]

If the possessor is overt, substitution can be used, showing an inflectional change of the possessum. However, when the implicit possessor is covert, an overt possessor must be added instead, leading to acceptance or rejection of the sentence. Such a procedure can lead to false conclusions, as the overt possessor will add extra information to the sentence and thus tend to mislead the interpreter in relation to the original text. Substituting or adding a possessor (explicit or implicit) should be avoided when trying to determine who possessum is possessed by. However, substituting subject or object marking in the verbal inflection can yield reliable results:

6T)	ikaarfim-mi-lu	navianar-tigi-ner-a
	ikaarfik-N.Lok.Sg-and	dangerous-so.much-doing-N.Abs.Sg.3SgPoss
	@i-ADVL>	@OBJ>

[19] The following examples are accepted and rejected by my colleagues at the Language Secretariat.

uppernarsi-niar-lu-gu isige-qqaar-paa.
confirm-intend-V.Cont-3SgO look-first-V.Ind-3Sg.3SgO
@ADVL> @PRED

"[When he reached the other side [of the lake] he turned round,] and he first looked to assure himself of the danger at the ford."

Here, it wasn't clear to me if *ikaarfimmilu* was locative or 4th person singular possessive, but changing the inflection in the main verb left no doubt: my informant told me that *ikaarfimmilu* would not change, which it should have done if it had been "his" place of transition. The inflection was thus not possessed.

However, most of the time, the most reliable method of determining which analysis is the right one, is to add context. The possessed noun in example 4 above, *unnussiornera* can be regarded as Sg 3SgPoss Abs as well as Sg 1SgPoss Abs. My informants agree that a 1st person singular possessor in example 8 is less plausible, but not impossible. The nouns in parentheses are added by me for the sake of the reader.

7U) Eskild-ip unnus-sior-ner-a (uuma)
Eskild-Prop.Sg.Rel evening-spend-doing-N.Sg.3SgPoss.Abs he.Pron.Sg.Rel
@POSS> @OBJ> @SUBJ>

aseror-pa-a
ruin-Ind-3Sg.3SgO
@PRED

"Someone ruined Eskild's evening (...)"

8U) Eskild-ip (uuma) unnus-sior-ner-a
Eskild-Prop.Sg.Rel his.Pron.Sg.Rel evening-spend-doing-N.Sg.3SgPoss.Abs
@SUBJ> @POSS> @OBJ>

aseror-pa-a
ruin-Ind-3Sg.3SgO
@PRED

"Eskild ruined another person's evening (...)"

9U) Eskild-ip (uanga) unnus-sior-ner-a
Eskild-Sg.Rel my.1Sg.Rel evening-spend-doing-Sg.1SgPoss.Abs
@SUBJ> @POSS> @OBJ>

aseror-pa-a
ruin-Ind-3Sg.3SgO
@PRED

"Eskild ruined my evening (...)"

Context was needed to choose the right alternative. Adding more context reduces the number of acceptable options, removing the 1st person singular analysis, which my informants liked the least:

10U) Eskild-ip unnus-sior-ner-a
Eskild-Sg.Rel evening-spending-Sg.3SgPoss.Abs
@POSS> @OBJ>

aseror-pa-a, namminer-lu-mi aamma
ruin-Ind-3Sg.3SgO Refl.4Sg-and-Intense also
@PRED @<REFL-SUBJ @<ADVL

"Someone ruined Eskild's evening, and also her own."

This still leaves two possible interpretations:

11U) Eskild-ip unnus-sior-ner-a (uuma)
Eskild-Prop.Sg.Rel evening-spending-N.Sg.3SgPoss.Abs his.Pron.Sg.Rel
@POSS> @OBJ> @SUBJ>

aseror-pa-a	(uuma)	namminer-lu-mi	aamma
ruin-V.Ind-3Sg.3SgO	her.Pron.Sg.Rel	Refl.Pron.4Sg-and-Intense	also
@PRED	@POSS	@<REFL-POSS	@<ADVL

"She ruined Eskild's evening, and also her own."

12U)

Eskild-ip	(uuma)	unnus-sior-ner-a	
Eskild-Prop.Sg.Rel	his.Pron.Sg.Rel	evening-spending-N.Sg.3SgPoss.Abs	
@SUBJ>	@POSS>	@OBJ>	
aseror-pa-a	(Eskild-ip)	namminer-lu-mi	aamma
ruin-V.Ind-3Sg.3SgO	Eskild-Prop.Sg.Rel	Refl.Pron.4Sg-and-Intense	also
@PRED	@<SUBJ	@<REFL-SUBJ	@<ADVL

"Eskild ruined another person's evening, and also his own."

Still two options are left, and both accepted. Adding one more clause on the left hand side removes the last piece of doubt among my informants, as they confidently select Eskild as the subject; but unfortunately, this is not the correct interpretation, looking at the context. The text is still misinterpreted, until Emilie is mentioned, five periods earlier:

> *Emilie akissutissaaruppoq. Ilami ingasalluni oqalussimavoq. Unnuk manna anaanami qanoq toqusimanera Eskildimut oqaluttuarisussaanngikkaluarpaa. Oqaluttuarnianngikkaluarpormi, taamaaliorsimavorli immaqa kukkulluni. Kingusinaareerporli. Eskildip unnussiornera aserorpaa, namminerlumi aamma* (Vebæk 1992:93).
>
> "Emilie was not able to answer. Indeed she had said too much. This evening she shouldn't have told Eskild how her mother died. She shouldn't have told it, but she had, maybe she was wrong. But now it was too late. She had ruined Eskild's evening, and also her own."

When my informants were given the same sentence with a substituted *unnussiornera* for either non-homographic 1st person plural or non-homographic 3rd person plural, both sentences were

accepted. Thus, this test did not add any new information of how to deal with hardly disambiguable sentences. The conclusion must be that addition tests are not reliable for this purpose.

The examples above show the need for context in a translation situation. Not even a real human being can always select the right analysis without context. Ambiguities like these must be taken care of either by not looking at the sole period alone, or by using stochastic rules.

How 1st, 2nd and 3rd persons differ

In *Semantics* (1977), John Lyons explains how the terms 1st, 2nd and 3rd persons are derived from actor roles in the Greek drama, the persons referring to the characters of the drama. Lyons emphasizes that the 1st and 2nd persons have roles that are different from the 3rd persons:

> "It is important to note, however, that only the speaker and addressee are actually participating in the drama. The term 'third person' is negatively defined with respect to 'first person' and 'second person': it does not correlate with any positive participant role. The so-called third-person pronouns are quite different in this respect from the first-person and second-person pronouns" (Lyons 1977:638).

This is also true when persons are marked in other ways. Both 1st and 2nd persons are parts of speech acts. Another way to name them is "speaker" and "addressee", respectively. How interactions between the speaker and the addressee can be interpreted and divided into different speech acts is shown in Austin 1975 and will not be discussed here.

Anna Siewierska refers to this passage in Lyons when she states that 1st and 2nd persons are different from 3rd persons, and that "the discourse roles of speaker and hearer are regularly referred to only by person markers, while reference to a third person can be achieved via any lexical expression" (Siewierska 2004:5; Siewierska 2011:322-323). This difference is seen from the variety of 3rd persons. While 1st and 2nd persons must include me or you, respectively, 3rd persons can include anyone. This is also true for Greenlandic where the 3rd person appears differently if it is coreferent with the subject of the verb, as we saw in example 3.

19U) Anaana-mi-num-mi ajortu-mik
Mother-N.Sg.4SgPoss-Trm-Intense evil-N.Sg.Ins
@i-ADVL> @i-ADVL>

pissuseqar-sima-ner-a nalu-a-a
behave-Past-doing-N.Sg.3SgPoss.Abs not.know-V.Ind-3Sg.3SgO
@OBJ> @PRED

"She didn't know what evil he had done to her (own) mother."

From the example it can be seen that the 3rd person singular possessor marker in the possessum varies between a coreferential and a non-coreferential possessor. In *anaanaminummi* a coreferential possessor marking must be used because the possessor is the same as the subject of the verb (the girl), while *pissuseqarsimanera* must have a non-coreferential possessor marking, because the man who have behaved badly is not the same as the subject of the verb.

On the other hand, 1st and 2nd persons are not marked for coreferentiality:

20A) Uanga teriannia-mik
Pron.1Sg fox-N.3Sg.Ins
@POSS> @i->N

kamma-qar-sima-ner-a nuannaarutige-qa-a-ra…
friend-have-Perf-doing-N.Sg.1SgPoss.Abs appreciate-much-V.Ind-1Sg.3SgO
@OBJ> @PRED

"I very much appreciated having a fox as a friend."

Here, the possessor of the fox, *uanga*, "my", is the same as the subject of the verb; but contrary to the previous example, the possessor is not marked for coreferentiality. The reason is that no one can be in doubt who "my" is, while "his" could mean "another's" or "his own". The same would be the case for 2nd person. This shows that 1st and 2nd persons are different from 3rd person, also in Greenlandic.

Because the speaker and the addressee will always be part of a speech act, only 1st and 2nd persons are actual participants in speech acts (Palmer 1981:128). In example 20 above, there can be a 1st person because it is part of a dialogue and thus a speech act; but example 19 is not, and thus there are only 3rd persons, the 4th person being just a coreferential 3rd person.

It is not unusual that 1st, 2nd and 3rd persons are homophonous in different ways (Siewierska 2004:76-79). This also include Greenlandic, as we saw in the introduction with the nouns of the *atuarfinni* type and the *aallarnerami* type: In Greenlandic 1st and 3rd person singular possessors possessing a 3rd person singular noun can be homographic in absolutive case, and also 1st and 2nd persons in the oblique cases can be impossible to distinguish, if not looking at the context. A focus on whether the period is part of a direct or indirect speech act or not will therefore be useful when disambiguating words of the *aallarnerami* type.

Coordination can clarify the meaning

If the possessives are coordinated, e.g. in enumerations, their possessors typically refer to the same.

21A)	Ataqqinartu-aqqa-p	inuu-sima-ner-a-nut	uppernarsaati-ssa-t
	prince-little-N.Sg.Rel	live-Epst-doing-N.Sg.3SgPoss-Trm	proof-Future-N.Pl.Abs
	@POSS>	@i-ADVL>	@SUBJ>
	tassaa-ppu-t	inequnar-luinnar-ner-a,	
	that.is-V.Ind.3Pl	charming-wholly-doing-N.Sg.3SgPoss.Abs	
	@PRED	@i-N<	
	illar-tar-ner-a		
	laugh-Iterative-doing-N.Sg.3SgPoss.Abs		
	@i-N<		
	sava-ati-taar-usun-ner-a-lu		
	sheep-UTE-get-want-doing-N.Sg.3SgPoss.Abs-and		
	@i-N<		

> "The proof that the Little Prince existed was his charm, his laughter and that he wanted a sheep (...)"

In example 21, "charm, laughter and sheep-wanting" are all paratactically coordinated and thus have the same possessor. This possessor is not explicit, and none of the possessives are unambiguous. Therefore, the information about the possessor must be extracted from the further context by looking at the noun phrase filling the slot as subject of the verb, *ataqqinartuaqqap inuusimaneranut uppernarsaatissat*. Here, *ataqqinartuaqqap* is possessor of the noun *inuusimaneranut*, and this word is adverbial to the verbal base in the next word, *uppernarsar-*. From this we can see that identifying which noun gives the information for the possessive is not always an easy task.

One must also be careful to select the correct boundaries for the paratactic constructions and to take into account occurrences of dependents which might be possessed by other possessors. The second, third and fourth word in example 22 are paratactic, but the fifth word is adnominal to the fourth word and is also possessed, but not by the same possessor:

22T)	Oqaluttuartu-p	nipaa,
	narrator-N.Sg.Rel	voice-N.Sg.3SgPoss.Abs
	@POSS>	@OBJ>
	anertikkar-palun-ner-a	sumiorpalun-ner-a-lu
	gasp-sound-doing-N.Sg.3SgPoss.Abs	dialect-sound-doing-N.Sg.3SgPoss.Abs-and
	@OBJ>	@OBJ>
	tusa-qqi-nngisaanna-ga-ssar-a	
	hear-again-never-done-Future-N.Sg.1SgPoss.Abs	
	@N<	
	tusaa-sutut	i-ler-pa-ra
	hear-as.though.Comp	be-begin-V.Ind-1Sg.3SgO
	@V>	@PRED

> "It is as though I begin to hear the narrator's voice, his breath and his dialect which I shall never hear again, (...)"

Here, *anertikkarpalunnera* and *sumiorpalunneralu* must have the same possessor as *nipaa*, whose possessor is explicit and thus not ambiguous, but *tusaqqinngisaannagassara* is possessed by an implicit 1st singular possessor. This must be deduced from the context, again the subject of the verb.

NIQ is a special case

Nouns of the *aallarnerami* type are often special cases. Most of them are derived with NIQ which forms what can often be translated as a gerund, such as *atuarneq*, "reading". In my corpus, only three lexemes are not derived with NIQ, *ernera*, "my/his son", *sinnera*, "my/his left-over", and *qanera*, "my/his mouth", in total seven occurrences.

This derivational morpheme NIQ inderives a verbal stem.[20] Inderivation with this derivative is personal if the noun is possessed, but impersonal if the noun is not possessed. When possessed, the subject information of the inderived verbal stem is referred to by the possessor marking in the inflection (Langgård 2002:85-88). Therefore, it should be possible to guess who is the possessor on the basis of the semantics of the sentence. In this way, nouns derived with NIQ can be easier to disambiguate if it can be extracted from the sentence or further context who is the possessor, but this extraction is much harder to do with a machine only knowing limited context, than it would be for a real human being.

Summary of part I

As we have seen, many factors come into play when two homographs are to be disambiguated, or when a concept is to be translated from one language into another. My hypothesis is that it is possible to establish rules for disambiguation on the basis of the theories discussed.

The possessor is marked both on the possessum and on the possessor if it is explicit. An explicit possessor will be in the relative case and placed to the left of the possessum. Unfortunately, the

[20] I follow the terminology and theories of inderivation developed by Karen Langgård (1993, 2002).

relative case is also used for marking subjects of dicongruent verbs, so one cannot be sure whether the relative marks the subject or the possessor. One way to investigate the matter is to look at the semantics. Words which paradigmatically are semantically close often establish a possessor-possessum construction, as in example 4. This is often found in descriptions of nature, weather and time, according to appendix VI.

An important thing to be aware of is whether the word in question is part of a speech act. 1st and 2nd persons are the only real participants in speech acts and therefore much more frequent there than outside speech acts. A marking in the text of when the possessive occurs in a speech act would therefore be useful.

When a noun derived with NIQ is possessed, the agent of the inderived verbal stem corresponds to the possessor of the noun. This knowledge makes it easier for at human being to disambiguate possessives derived with NIQ, but it might be hard to extract this knowledge from the text for the machine. However, if the possessives are coordinated, their implicit or explicit possessors often refer to the same and can therefore be predicted if just one of the possessors are unambiguous; but often the context must be investigated in order to find out who the possessor is – and sometimes surprisingly much context must be considered. It is therefore not always possible to disambiguate correctly.

On the basis of these observations, I have marked in my corpus when the possessive is part of a speech act and when the explicit possessor includes semantics of time or weather, or is coordinated with another possessive. This can be found in appendix VI.

Part II: Disambiguation in practice

In this part, rules for disambiguating words of the *aallarnerami* type are written on the basis of the theories outlined in part I. The rules are optimized by being added to the GCG, and by being tested iteratively. They will be proof checked in part III. The CG formalism is documented in Didriksen 2018 and well illustrated in Bick 2000, and the operators special for the GCG are briefly explained in appendix III. The LISTs and SETs used can be found in appendix IV, and the rules for disambiguation are found in appendix V.

Disambiguation will be made on two levels: the local, context-free level, and the global level, where the context is taken into consideration. Karlsson only looks at one period at a time, and defines "local" ambiguities as concerning only one or a few adjacent words, and "global" ones as using a wider context, but still within the same sentence (Karlsson 1995:19-20). In my rules I will use "local" for rules concerning one period, while "global" rules may extract information from other clauses as well. Rules based on semantics are typically local, while rules based on stochastics tend to be more global. Rules based on both morphological and syntactic tagging tend to be local. The grammar is run twice, the rules based on syntactic mapping only in the second run. The rules are non-commutative, so the safest rules must be written higher in the grammar, and the less safe rules lower.

It can be discussed how far the disambiguation should go. Unsafe rules may give incorrect answers. This is the case for the disambiguation rules in the GCG version of January 2nd 2018, with an error rate of 21%. Instead, writing safer and less broad rules postponing the disambiguation until later in the translation chain may yield more reliable results; but even later, disambiguation can be impossible, as real ambiguities exist (Bick 2000:124-128).

Local level rules for the GCG based on the morphological tagging

The safe rules should be written first, or at least be placed in the upper part of the GCG. These rules can be semantic or purely syntactic, but based on the morphological tagging. They are local rules, working context-free, within either a phrase, a clause or a period. This kind of rules can be

used for solving many morphological ambiguities, including inflectional ambiguities (Bick 2000:100).

Earlier in the grammar, most PoS disambiguation has been done. The next level is the semantic level (Bick 2000:105). Semantic rules are written on the basis of the semantics which is either tagged directly in the output from the GFST, or written in a LIST or SET in the GCG.

Here, observations about which words can be possessed by which can be used. E.g. words with semantics of time are not possessed by 1st and 2nd persons, unless they are derived. A safe rule can forbid all derivatives turning a noun into a verb:

```
R1)     REMOVE TIME + POSSESSUM12 IF
                (NEGATE 0 Der/nv) ;
```

Using a REMOVE and not a SELECT rule here not only wards off wrong possessives, but also hinders the interpretation of non-possessed words as being possessives, and selection of these on that basis.

Rule 1 selects the correct possessive in *sapaatip-akunnera*, where *sapaatip-akunnera*, “week” (“sunday’s space”), is a compound where the relative case is marked on *sapaatip*, but not analyzed by the FST as a separate word, and thus cannot be referred to by the rule. Therefore, a rule such as the following ones wouldn’t work for this.

```
R2)     SELECT POSSESSUM3 OR iPOSSESSUM3 IF
                (0 WEATHERVERB)
                (*-1 WEATHER + Rel BARRIER KOMMA OR VERB-NOTCONT) ;

R3)     SELECT POSSESSUM3 OR iPOSSESSUM3 IF
                (0 TIMEVERB)
                (*-1 TIME + Rel BARRIER KOMMA OR VERB-NOTCONT) ;
```

These rules select a 3rd person possessum if the word in question is part of the LISTs WEATHERVERB or TIMEVERB, and is preceded by a noun in the relative case LISTed in

WEATHER or TIME, respectively.[21] The rules thus work on the basis of a combination of different semantic SETs or LISTs.

To make sure the rule doesn't hit a relative in another clause, a BARRIER has been added.[22] In this way, the rule won't work if the relative is placed to the left of a comma or a verb, which is in another mood than the contemporative mood. Rules 2 and 3 could be written as one rule, but keeping them apart makes it easier to adjust them separately if it turns out that weather semantics should be treated differently from time semantics. Referring to Karlsson, "[i]t is not a mandatory goal to express the syntactic regularities of a language in the form of very general or few rules" (Karlsson 1995:27). On the other hand, fewer rules are easier to overlook and keep updated. The rules above are used for sentences such as example 4, *Seqernup tarrinnera takorusoqaa*, "he really wanted to see the sunset", i.e. the disappearing of the sun.

Contrary to the rules above, the rules below only require one argument of WEATHER or TIME. The rules are nevertheless safe because they have a strict BARRIER only allowing adverbials between the possessor and the possessum, as in example 23:

23T)	sila-p	qanoq	in-ner-a
	weather.N-Sg.Rel	how.Part	be-doing-3SgPoss.Sg.Abs
	@POSS>	@i->N	@HNOUN

"How the weather is"

```
R4)  SELECT POSSESSUM3 OR iPOSSESSUM3 IF
         (*-1 WEATHER + Rel BARRIER (*) - Adv) ;

R5)  SELECT POSSESSUM3 OR iPOSSESSUM3 IF
         (*-1 TIME + Rel BARRIER (*) - Adv) ;
```

[21] The WEATHERVERB or TIMERVERB must of course be externally or internally nominal in order to be possessed.
[22] The templates "NexusHøjre" and "NexusVenstre" have been used for this in GCG earlier, but they don't take all possibilities into account. In the autumn 2018 we have experimented with a more safe tagging of the conjunctional versus adverbial use of the particles and enclitics, but this has not yet been implemented. This will be done during the first months of 2019.

Purely syntactic rules are rules where only syntax has been taken into account and where the word is disambiguated on the basis of what can or cannot be true for a grammatically correct sentence. Still, the rules must be true disregarding the further context of other periods. The syntactic tagging has not yet been added at this point in the grammar and thus cannot be used for the disambiguation yet.

R6) SELECT 1SgPoss OR i1SgPoss IF
(*-1 Gram/Pers + 1Sg + Rel BARRIER VERB-NOTCONT OR Pron - 1Sg OR POSSESSUM - POSSESSUM1 OR iPOSSESSUM - iPOSSESSUM1) ;

In the rule above an internal or external 1st person singular possessive is selected if there is a 1st person singular personal pronoun to the left of it, but limited by the BARRIER.

24A) Uanga teriannia-mik
Pron.1Sg fox.Sg.Ins
@SUBJ> @i->N

kamma-qar-sima-ner-a nuannaarutige-qa-a-ra
friend-have-Perf-doing-1SgPoss.Sg.Abs appreciate-much-Ind-1Sg.3SgO
@OBJ> @PRED

"I really appreciate my having a friend who is a fox…", i.e. "to have a fox as friend".

Another safe syntactic rule can be used for possessives with explicit possessors which cannot be possessors for other nouns or subjects for transitive verbs. This rule has a Careful (C) relative to the left, meaning that a word meeting all conditions of the rule must also only have relative case readings left in the cohort. Also the possibility of transitive verbs to the right has been taken into account. The rule must not hit if there is a transitive verb for which the relative might be subject:

R7) SELECT 3SgPoss IF
(-*1C Rel + Sg BARRIER (*) - CONT - Adv[23] - Pali - OBLIQUE)

[23] In the GFST and GCG there are 9 main word classes, namely noun, verb, "particle-like", conjunction, adverb, interjection, pronoun, proper noun and numeral. The word classes can be found in the root file for the GFST and are used in the GCG. Traditionally, they have been divided into only 3 (Langgård and Langgård 1988: 24) with "particle-like", conjunction, adverb, interjection counted together as "particles" and noun, pronoun, proper noun and

(NEGATE 0 V - iPOSSESSUM)
(NEGATE *1 VERB-NOTCONT + TRANSVERB + 3Sg BARRIER VFIN)
(NEGATE *-1 OBLIQUE + POSSESSUM BARRIER (*) - (Rel Sg)) ;

The first NEGATE context is normally not needed, but is necessary when verbs and possessives occasionally share word form.

The OBLIQUEs is added to the first BARRIER in order to hit a clause like the following, where *gigtimik* is placed between the possessor and the possessum:

25U)	fru	Jensen-ip	gigti-mi-nik
	mrs.N.Sg	Jensen.Prop.Sg.Rel	arthritis-4SgPoss-Sg.Ins
	@PROP>	@POSS>	@i-ADVL>

ippigusun-ner-a	aasiit	sakkortusi-galuttuinnar-po-q
suffer-doing-3SgPoss.Sg.Abs	Part.as.usual	increase-gradually-Ind.3Sg
@SUBJ>	@ADVL>	@PRED

"Mrs. Jensen's suffering from arthritis was steadily increasing."

However, the omission of OBLIQUE in the BARRIER causes a wrong selection of *ikkunneqarsimaneranut* in example 26, because the rule ignores the OBLIQUE and looks at the possessor of the OBLIQUE, *taassuma*:

26T)	(...) taassuma	ikkunneqarsimaneranut
	its.Pron.Sg.Rel	put-Pass-Perf-being-3SgPoss.Sg.Trm
	@POSS>	@i-ADVL>

pisooqataa-nngin-ner-a	paasi-tin-niar-lu-gu.
accomplice-Neg-being-1SgPoss.Sg.Abs	know-Caus-want-Cont-3SgO
@OBJ>	@<ADVL

numeral grouped as "nouns", or 4 (Kleinschmidt 1851; Nielsen 2019) main word classes, with the pronouns being the fourth word class.

> "(...) in order to make them aware of that I am an accomplice of its [the memorial's] being raised."

Therefore, the BARRIER should not include 3rd person possessives. As it is not possible to write something like (OBLIQUE - POSSESSUM3) in a BARRIER, this condition is written in the last NEGATE instead. An alternative to the last NEGATE would therefore have been to add (OBLIQUE POSSESSUM12), (OBLIQUE POSSESSUM4) and (OBLIQUE NOTPOSSESSUM) in the first BARRIER.

Despite the many NEGATE conditions, the rule seems to be safe, thanks to the Careful mode.

Another safe syntactic rule looks for a 4th person possessor. If this is in the relative case and placed left of the possessive of the *aallarnerami* type, this must be 3rd and not 1st person.

```
R8)   SELECT 3SgPoss IF
      (-*1C Rel + Sg + 4SgPoss BARRIER (*) - CONT - Adv - Pali - OBLIQUE)
      (NOT 0 Adv) ;
```

It is also possible to write rules that remove less probable combinations of morphemes. These might be less safe than the rules above. For this, a new feature which requires a strict order of morphemes can be used, marked with an "l":

```
R9)   REMOVE POSSESSUM12 IF
            (0 (/TUQ\ Der\/vn\ QAR\ Der\/nv\(\ Gram\/.V\)?
            \(\(\ TAR\ Der\/vv\)\(\ Gram\/.V\)?\)?\ \([A-Z]*\ \Der\/vn\)\ N\ /l)) ;
```

The combination TUQ and QAR can make the subject impersonal ("there are"). If the word is derived further, it can be possessed by other persons as well. Therefore, only one derivative is accepted after QAR, except for the morphemes like TAR which are verb-modifying affixes (Fortescue 1980). A more general way to do this would be to accept a LIST of right hand side non-frame evoking derivational morphemes, such as TAR. To make the rule more safe, a NEGATE context of instrumentals on the left side could be added, in order to make sure that the QAR is not used for inderivation, which could take an oblique adnominal in the instrumental or terminative case to the incorporated object. Also personal structures exist and should be taken

into account, so the rule is not safe, but I have not so far found examples where it does anything wrong.

The 9 rules above disambiguate correctly on the basis of the semantics, the syntax, and the morphology. In clauses containing both a possessum and a dicongruent verb, more context is needed in order to select the correct semantic role of a noun in the relative case.

Global level rules for the GCG based on the morphological tagging

Global rules look outside the period. In the standard setting a total of 5 periods are stored and can be used for reference, 2-3 on each side of the period in question.

Because 1st and 2nd persons occur in speech acts, it is possible to write a rule removing 1st persons if there is no speech act. For this, a LIST of verbs often connected with speech and thought is LISTed in DIRTALE, and initiating quotation marks are mapped by DIRTALESTART.

```
R10)    REMOVE 1SgPoss IF
                (NEGATE *0W 1Sg OR 1SgO OR DIRTALE OR DIRTALESTART) ;
```

In principle, direct speech markers could be searched for at the left side only, but 2-3 sentences are not always sufficient to reach a direct speech marker. Therefore, the rule is made more safe by looking to both sides, using W. I have tried to encounter this problem by adding the tags DIRTALEMIDDLE and DIRTALEEND inside direct speech, but are still not precise enough to mark direct speech every time. This is why “?” and “!” is added to the BARRIER in the rule.

In my corpus, all occurences of 1st person in first position occur in direct speech, which is the basis for rule 11:

```
R11)    REMOVE 3SgPoss IF
                (-1 BOS)
                (0 1SgPoss)
                (*-1< DIRTALESTART OR DIRTALEMIDDLE
```

```
        BARRIER DIRTALESLUT OR ("\?") OR ("\!"))
        (NEGATE *1 DIRTALESTART) ;
```

The following rules supplement the previous ones because of the inadequate marking of direct speech. The later the rule is placed in the grammar, the less strict the BARRIER must be.

```
R12)    REMOVE 3SgPoss IF
            (-1 BOS)
            (0 1SgPoss)
            (*1> DIRTALESLUT OR ("\?") OR ("\!") BARRIER DIRTALESTART) ;

R13)    REMOVE 1SgPoss IF
            (NEGATE *-1< DIRTALEMIDDLE OR DIRTALESTART OR
            ORATIOOBLVERB BARRIER DIRTALESLUT)
            (NEGATE *-1< 1Sg OR 1SgO OR 1SgPoss)
            (NEGATE *1 1Sg) ;

R14)    REMOVE NOT-REL + 1SgPoss IF
            (NEGATE *0 V + 1Sg)
            (NEGATE *0W 1Sg OR 1SgPoss OR DIRTALESLUT) ;
```

If direct speech was marked more consistently, rules 10-14 could be reduced and would probably be more effective. A bigger window span could also make a difference, but would make global rules less safe.

A rule could also be written for a series of occurrences of same possessor and case.

```
    SELECT $$POSSESSUM + $$KASUS IF
        (*-1C $$POSSESSUM + $$KASUS BARRIER (*) - CONJ-C) ;
```

However, even though most coordinated possessives are possessed by the same possessor, this is not always the case.

27T) ukiu-p qanoq ili-ner-a
year-N.Sg.Rel how.Part develop-doing-N.3SgPoss.Sg.Abs
@POSS> @i-ADVL> @OBJ>

su-mi-lu najugaqar-ner-a akornutigi-na-git
where-N.Abs.Sg-and live-doing-N.1SgPoss.Sg.Abs is.hindered-V.ContNeg.3PlO
@i-ADVL> @OBJ> @PRED2

"and it doesn't hinder how the year goes on and where I live"

Writing the rule later and taking the syntactic functions into account wouldn't help either. Therefore, I cannot use the rule.

Rules for the GCG based on the syntactic roles

The syntactic mapping, marked with @, can be used for disambiguating homographs. This can be used for selecting the right possessive when there is an explicit possessor that has not been taken into account earlier because it could have been confused with a subject.

R15) SELECT POSSESSUM3 IF
(*-1 @POSS> + Sg BARRIER POSSESSUM) ;

The syntactic mapping can also be useful for disambiguating indirect speech or thought. This is however hard to deal with: the 1st person possessor is relatively frequent, but one cannot be sure that the possessive in the oratio obliqua is possessed by the same as the subject of the inquit.

The main verb of the oratio obliqua is tagged @CL-CIT and may be used as a point of reference in the rules, just as below:

R16) SELECT POSSESSUM1 IF
(0 @OBJ>)
(*1 @CL-<CIT + 1Sg + TRANSVERB BARRIER V) ;

R17) SELECT POSSESSUM1 IF
(0 @SUBJ>)

```
        (*1 @CL-<CIT
        BARRIER V LINK *-1 _TARGET_ LINK *-1 ORATIOOBLVERB) ;
```

In the same way, also other function tags can be selected or removed taking the context into account. Because they are only used in the second run of the grammar, after the mapping has been done, they apparently work well, at least for my corpus. However, their reliability should still be checked against a larger corpus.

```
R18)    SELECT POSSESSUM1 IF
            (0 @OBJ>)
            (*1 1Sg - Cau - Con - @N<
            BARRIER VFIN OR NIAR OR QQU OR Cau OR V + CONJ-C) ;

R19)    REMOVE 1SgPoss IF
            (0 3SgPoss + @FUNC)
            (NEGATE *0 1Sg OR 1SgPoss OR 2Sg) ;

R20)    REMOVE 1SgPoss IF (0 3SgPoss)
            (0 @FUNC)
            (NEGATE *0 VFIN + 1Sg OR VFIN + 1SgO)
            (NEGATE *-1 1Sg OR 1SgO BARRIER V) ;
```

Summary of part II

Above, we see the 20 rules selecting and removing correct and incorrect readings of possessives. All rules have quite strict barriers or are restricted in another way in order to prevent them disambiguating wrongly.

The rules are based on the theories of part I, and they replace the old rules of the GCG. How big influence the rules have on the disambiguation depends on where in the grammar they are placed. The safest rules must always be placed higher than less safe rules. The new rules are added to the GCG in the same order as above. Rule 1 is placed near the beginning of the grammar, and rules 2-14 a bit lower. Near the bottom of the grammar are the rules based on the

syntactic roles. The rules are grouped together in order to establish a structure in the grammar which adds to the user-friendliness and overview. They could have been placed farther from each other.

The main corpus has been used for developing the rules, analysing the corpus iteratively while changing the rules. How the rules work on other corpora will be tested in part III.

Liv Molich
Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

Part III: Proof checking and discussion

Once the rules are deduced, they can be applied to texts outside the main corpus for validation. In this way, the rules will not only be founded on theory, but also shown to be working in practice. Extending the corpus will also be a method for adjusting the rules. The corpora can be found in appendix VI.

Proof checking the rules on regression corpus

The rules developed from my investigation of the main corpus are tested on the regression corpus. This corpus is small, but the test will give an impression of whether the rules work on other kinds of text than fictional literature. Examples from this corpus might be real ambiguities because they appear without context, but not for the sentences of the *aallarnerami* type. Furthermore, the rules cannot be run globally.

In the corpus there are 21 occurrences of ambiguous possessives of the *aallarnerami* type. When run through the old grammar of January 2nd 2018, there are three incorrect disambiguations. A wrong selection or removement cannot be undone, so even though three mistakes don't seem to be many, the error rate is still 14%, a number that cannot be reduced. The new grammar doesn't do anything wrong, but two possessives are not disambiguated. This corresponds to an error rate of 10%. Disambiguation is still possible later in the process, so the error rate will probably decrease as the grammar or translation machine is refined further, or possibly already if the context is added.

Proof checking on extended corpus

I have run the rules on the first 44 occurrences of the *aallarnerami* type nouns in *Inuillisimasup ikioqqunera* ([The wanderer's cry for help], Steenholdt 2001) from the extended corpus. Here, 14 possessives are wrongly disambiguated using the old grammar, and 7 using the new grammar. Another 21 occurrences in the new grammar are not disambiguated at all, and 2 don't get an analysis from the GFST and can therefore be disambiguated in neither of the grammars, according to appendix VI. However, taking a closer look on the sentences wrongly

disambiguated by the new rules, most of them can become correct if a few adjustments are made in the rules.

Rule 9 can be adjusted so the base *soqar* is included, because the detailed analysis with *su* and QAR is missing in the output from the GFST. The rule made from the main corpus did not include verb-modifying SIMA either:

```
R9C)   REMOVE POSSESSUM12 IF
            (0 (/TUQ\ Der\/vn\ QAR\ Der\/nv(\ Gram\/.V\)?
            ((\ SIMA\ Der\/vv\)(\ Gram\/.V\)?\)?
            ((\ TAR\ Der\/vv\)(\ Gram\/.V\)?\)?\ \([A-Z]*\ \Der\/vn\)\ N\ /l) OR
            (/\"susoq\"\ QAR\ Der\/nv(\ Gram\/.V\)?
            ((\ SIMA\ Der\/vv\)(\ Gram\/.V\)?\)?
            ((\ TAR\ Der\/vv\)(\ Gram\/.V\)?\)?\ \([A-Z]*\ \Der\/vn\)\ N\ /l)) ;
```

A LIST of the verb-modifying morphemes would have made the syntax of the rule much simpler. With this addition, words 6 and 7 in the extended corpus were disambiguated correctly.

Also, rule 12 could have been more effective, had it not only been referring to the beginning of a period, but the beginning of a clause in general. However, still missing a method for marking boundaries of clauses, this cannot be done yet. If it worked, it would have solved the problem of example 15.

Example 25 would have been disambiguated correctly by rule 12 if rule 12 had taken into account that the possessive could be preceded by an adverb:

```
R12C) REMOVE 3SgPoss IF
            (*-1 BOS BARRIER (*) - Adv)
            (0 1SgPoss)
            (*1> DIRTALESLUT OR ("\?") OR ("\!") BARRIER DIRTALESTART) ;
```

In order to hinder rule 19 from disambiguating wrongly in example 38, an additional line could be included in the rule:

R19C) (NEGATE *-1 @POSS> - TIME BARRIER POSSESSUM - TIME)

Naggat should then have been included in SET TIME.

For example 22, the following addition to rule 7 would solve the problem:

R7C) (NEGATE *1> POSSESSUM1
CBARRIER V - CONT OR POSSESSUM - POSSESSUM1) ;

Only one wrong disambiguation would then be left, namely example 20. With an investigation of a bigger corpus, this could probably be dealt with, too.

Discussion

Every time there are ambiguities, disambiguation is needed. Constraint grammar aims at disambiguating readings of a word on the morphological and syntactic levels by using local or global constraints (Karlsson 1995:18-25) with reference to the morphological and/or syntactic tagging. However, as we have seen, this is not sufficient for unraveling every ambiguity. The remaining ambiguities must be taken care of by other actions. This will be discussed here.

In appendix VI we can see that the old set of rules and the new set of rules (Oqaasileriffik 2018d and 2018e, respectively) often leave the same possessives wrongly disambiguated or undisambiguated. The main difference lies in the safeness of the rules; the old rules occasionally select or remove wrongly. I have been careful to write safer rules that add to the total number of rules, but also yield both stable and reliable selections. However, there are still ambiguities which are solved by the old rules but not by the new rules. Some of the old rules could therefore be reactivated and placed later in the grammar than the new rules in order to hit some of my undisambiguated sentences. In that case they would, however, interfere with my rules based on the syntactic mapping because those rules are only used in the second run of the grammar. Any rule that is not based on syntactic roles should therefore be placed either in a later section only run once or in a subsequent grammar.

Another option would be to write rules on the basis of the specific text or genre such as news articles, fiction or blogs, or the grammar could be adjusted to fit different kinds of texts. Indirect

speech is normal in fictional literature, direct speech in the form of citations are normal in newspapers, and speech acts are unusual in laws, etc. Each text type requires different handling, just like rule 12, which is written with fictional literature in mind.

As mentioned earlier, a better marking of direct and indirect speech as well as a tagging on the particles and enclitics marking if they are used adverbially or coordinating. This will make the rules and barriers more safe, and may also open the possibility for new, safe rules.

Rule driven and stochastic driven machines have different forces and can be combined (Bick 2009a, 2009b), and in the bottom sections of the GCG there are a few stochastic rules. Eckhard Bick recommends such rules to be written with C-contexts to make them as safe as possible (Bick 2000:127). In any case, if more stochastic rules are added, they must not overwrite the rules based on syntactic roles.

Disambiguation could also be built on probabilities. That would, however, require a properly tagged and a sufficiently comprehensive corpus (Bick 2000:133-139), and such a corpus doesn't exist for Greenlandic. In addition, the rich morphology of the Greenlandic language calls for rule based technology, and not probabilistic (Oqaasileriffik 2012:13).

There are several possibilities for increasing the number of disambiguated possessives, but for now, the remaining ambiguities will be left for later work.

Conclusion

My thesis has resulted in 20 rules for disambiguating possessives of the *aallarnerami* type, based on an investigation of how and when possession is marked in Greenlandic.[24]

There are rules based on morphological tagging, semantics, overt marking of possessors, the occurrences of 1st persons in the same, antesequent or subsequent clauses, as well as knowledge of if and how the possessive is part of direct or indirect speech. I have shown that theories about these topics can form a basis for selecting the right possessives to a high level of precision.

The mappings make the rules safer, e.g. by enabling the machine to interpret the syntactic roles of words in the relative correctly. However, correct mapping presupposes correct disambiguation, which is why not all rules can be based on the syntactic mappings.

The rules could have been combined into fewer rules, but keeping them apart makes it easier to trace for what reason a specific reading is chosen and to write similar rules for other kinds of possessives. It may look like some of the rules are only written for the sake of very few words; but most of the rules are not only used for possessives of the *aallarnerami* type, but also for other types and cases, such as syncretic 1st and 2nd person in oblique cases, or 4th person relative syncretic with non-possessed locative. Therefore, they have a wider use than shown in my thesis.

The rules take into account occurrences of speech act indicators in the period or search for lexicographically or semantically close words; but based on my corpus and my current knowledge it does not seem to be feasible to write additional rules that either do not affect more than a specific sentence or do not select wrongly. The minor adjustments have almost eradicated the wrong disambiguations in the corpora; but still, many possessives are left undisambiguated.

The use of the extended corpus was effective and clearly showed where the rules could be adjusted in order to disambiguate more precisely and correctly. It also showed what

[24] The GFST and GCG are dynamic and steadily undergo changes. The rules written for this thesis may therefore be changed or rearranged, and the actual analyses of the sentences may at some points differ from the analyses used in my thesis.

consequences the more precise and less broad rules of disambiguation have: against my expectations, only half of the possessives in this corpus were disambiguated, which is less than the old rules accomplished.

The new rules do not disambiguate more possessives than the old ones, but they do disambiguate more correctly. A more precise marking of clause boundaries and conjunctions, as well as speech acts, could improve the rules. However, not all problems can be solved in this way, and some must be left to disambiguation in later grammars, or stay undisambiguated.

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Liv Molich
Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

Appendix I: The tag set

Word class tags

Adv	Adverb. Morphologically not distinguishable from nouns, but has a different distribution.
Conj	Conjunction. Only sole words are included, and thus not the enclitic conjunctions.
i	"i" marks that the word class tag is internal.
Interj	Interjection. This word class is sometimes included in the particles.
N	Noun. This main word class includes adjectives, substantive, adjective, pronoun, proper noun, and numeral. Nouns are inflected for person, number and case.
Num	Numeral. Morphologically not distinguishable from nouns, but has a different distribution.
Pali	"Particle-like". Includes verbs and nouns not following the normal morphology and/or syntax. It is not fully decided which words are included in this word class.
Part	Particle. Includes "particle-like", conjunction, adverb, and interjection. Particles are not inflected.
Pron	Pronoun. Interrogative, personal, coreferential or indefinit. Are often included in the nouns.
Prop	Proper noun. Morphologically not distinguishable from nouns, but is written with capitalized initial letter.
V	Verb. Verbs are inflected for mood. Monocongruent verbs also for person and number of the subject, and dicongruent verbs also for person and number of both subject and object.

Liv Molich
Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

Derivation tags (including enclitics)

Caus	The derivational morpheme TIP, making the verb causative.
Epst	The derivational morpheme SIMA, sometimes expressing epistemic modality.
Intense	The enclitic morpheme MI, often used as intensifier.
Iterative	The derivational morpheme TAR. Marks that something is done more than once.
MI	Enclitic morpheme, often used as intensifier.
MIUQ	Derivational morpheme, meaning “inhabitant of”.
Neg	Negation. The derivational morpheme NNGIT. Negates verbs.
NIAR	Derivational morpheme, meaning “intend to do something”.
NIQ	Derivational morpheme, often translated as a gerund.
NIR	Derivational morpheme, meaning “whether” or “if”.
Past	The derivational morpheme SIMA, sometimes used for expressing past.
Perf	The derivational morpheme SIMA, sometimes used for expressing perfective.
QAR	Derivational morpheme, meaning “have” or, impersonally, “there is”.
QQU	Derivational morpheme, meaning “asking someone to do something”.
TUQ	Derivational morpheme, meaning “one who does something”.
UTE	Derivational morpheme, used for making alienable nouns possessable.
Vbr	Verbalizing morpheme after inflection.

Liv Molich
Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

Inflection tags

Abs	Absolutive case.
Adv	Adverbium.
Cau	Causative mood.
Comp	First part of compositum.
Con	Conditional mood.
Cont	Contemporative mood.
ContNeg	Negated contemporative mood.
i	“i” marks that the inflexion tag is internal.
Ind	Indicative mood.
Ins	Instrumental case.
Lok	Locative case.
O	Object.
Pass	Passive.
Pl	Plural.
Poss	Possessor.
Pron	Pronoun.
Rel	Relative case.
Sg	Singular.

Trm	Terminative case.

Secondary tags

Der/nv	Marks that the previous derivational morpheme is verbalizing.
Gram/Pers	Marks that the previous pronoun is personal.
Sem/Unit	Marks that the semantics of the noun designates a unit.

Liv Molich
Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

Appendix II: Syntactic tags

<	Marks that the head is to the left.
>	Marks that the head is to the right.
i	Marks that head is inderived or a noun verbalized after inflection.
@ADVL	Adverbial.
@CL-ADVL	Clause adverbial.
@CL-CIT	Dependent clause, often indirect speech or thought.
@FUNC	All function tags for clause level arguments.
@HNOUN	Noun without predicat.
@N	Post-nominal.
@OBJ	Object.
@POSS	Possessor.
@PRED	Predicat.
@PRED2	Alternative predicat.
@PROP	Determiner for proper noun.
@REFL-POSS	4. person possessor.
@REFL-SUBJ	4. person subject.
@SUBJ	Subject.
@V	First part of a compositum.

Liv Molich
Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

Appendix III: The GCG formalism

Below is a list of special operators used in the GCG for rules 1-20. Other tags used can be found in appendices I, II and IV, as well as in the documentation (Didriksen 2018). The formalism is exemplified in Didriksen's documentation.

i	"i" marks that the tag is internal.
BOS	Beginning of sentence, also written >>>.
CONJ-C	Coordinating conjunction.
CONT	Contemporative mood, including negated contemporative.
DIRTALESTART	Beginning of direct speech.
DIRTALEMIDDLE	Direct speech.
DIRTALESLUT	End of direct speech.
KOMMA	Comma.
NOT-REL	All cases, except relative case.
NOTPOSSESSUM	Noun which is not possessed.
OBLIQUE	Oblique case, i.e. locative, terminative, ablative, instrumental, equative or vialis.
POSSESSUM	Possessum, possessed by 1st, 2nd, 3rd and/or 4th person.
TRANSVERB	Dicongruent verb.
VERB-NOTCONT	All moods, except contemporative mood.
VFIN	Verb in indicative, imperative, optative or interrogative mood.

Liv Molich
Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

Appendix IV: Semantic LISTs and SETs

SET DIRTALE	Verbs which often initiate direct speech or thought, such as “say”.
LIST NUMHOVED	Nouns which often have numerals as dependents, such as “Euro”.
SET ORATIOOBLVERB	Verbs which are often inquit, such as “think”.
SET TIME	Verbs, nouns and particles with semantics connected with time, such as “pass”, “winter” and “yesterday”.
LIST TIMEVERB	Verbs which often have a subject with semantics of time, such as “end”.
LIST WEATHER	Nouns which are often used for description of weather, such as “wind”.
LIST WEATHERVERB	Verbs which are often used for description of weather, such as “blow”.

Liv Molich
Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

Appendix V: Rules for disambiguation and mapping

Local rules

R1) REMOVE TIME + POSSESSUM12 IF
(NEGATE 0 Der/nv) ;

R2) SELECT POSSESSUM3 OR iPOSSESSUM3 IF
(0 WEATHERVERB)
(*-1 WEATHER + Rel BARRIER KOMMA OR VERB-NOTCONT) ;

R3) SELECT POSSESSUM3 OR iPOSSESSUM3 IF
(0 TIMEVERB)
(*-1 TIME + Rel BARRIER KOMMA OR VERB-NOTCONT) ;

R4) SELECT POSSESSUM3 OR iPOSSESSUM3 IF
(*-1 WEATHER + Rel BARRIER (*) - Adv) ;

R5) SELECT POSSESSUM3 OR iPOSSESSUM3 IF
(*-1 TIME + Rel BARRIER (*) - Adv) ;

R6) SELECT 1SgPoss OR i1SgPoss IF
(*-1 Gram/Pers + 1Sg + Rel BARRIER VERB-NOTCONT OR Pron - 1Sg OR
POSSESSUM - POSSESSUM1 OR iPOSSESSUM - iPOSSESSUM1) ;

R7) SELECT 3SgPoss IF
(-*1C Rel + Sg BARRIER (*) - CONT - Adv - Pali - OBLIQUE)
(NEGATE 0 V - iPOSSESSUM)
(NEGATE *1 VERB-NOTCONT + TRANSVERB + 3Sg BARRIER VFIN)
(NEGATE *-1 OBLIQUE + POSSESSUM BARRIER (*) - (Rel Sg)) ;

R8) SELECT 3SgPoss IF
(-*1C Rel + Sg + 4SgPoss BARRIER (*) - CONT - Adv - Pali - OBLIQUE)
(NOT 0 Adv) ;

R9) REMOVE POSSESSUM12 IF
(0 (/TUQ\ Der\/vn\ QAR\ Der\/nv\(\ Gram\/.V\)?
\(\(\ TAR\ Der\/vv\)\(\ Gram\/.V\)?\)?\ \([A-Z]*\ \Der\/vn\)\ N\ /l)) ;

Global rules

R10) REMOVE 1SgPoss IF
(NEGATE *0W 1Sg OR 1SgO OR DIRTALE OR DIRTALESTART) ;

R11) REMOVE 3SgPoss IF
(-1 BOS)
(0 1SgPoss)
(*-1< DIRTALESTART OR DIRTALEMIDDLE
BARRIER DIRTALESLUT OR ("\?") OR ("\!"))
(NEGATE *1 DIRTALESTART) ;

R12) REMOVE 3SgPoss IF
(-1 BOS)
(0 1SgPoss)
(*1> DIRTALESLUT OR ("\?") OR ("\!") BARRIER DIRTALESTART) ;

R13) REMOVE 1SgPoss IF
(NEGATE *-1< DIRTALEMIDDLE OR DIRTALESTART OR
ORATIOOBLVERB BARRIER DIRTALESLUT)
(NEGATE *-1< 1Sg OR 1SgO OR 1SgPoss)
(NEGATE *1 1Sg) ;

R14) REMOVE NOT-REL + 1SgPoss IF
(NEGATE *0 V + 1Sg)
(NEGATE *0W 1Sg OR 1SgPoss OR DIRTALESLUT) ;

Syntactic rules

R15) SELECT POSSESSUM3 IF
(*-1 @POSS> + Sg BARRIER POSSESSUM) ;

R16) SELECT POSSESSUM1 IF
(0 @OBJ>)
(*1 @CL-<CIT + 1Sg + TRANSVERB BARRIER V) ;

R17) SELECT POSSESSUM1 IF
(0 @SUBJ>)
(*1 @CL-<CIT
BARRIER V LINK *-1 _TARGET_ LINK *-1 ORATIOOBLVERB) ;

R18) SELECT POSSESSUM1 IF
(0 @OBJ>)
(*1 1Sg - Cau - Con - @N<
BARRIER VFIN OR NIAR OR QQU OR Cau OR V + CONJ-C) ;

R19) REMOVE 1SgPoss IF
(0 3SgPoss + @FUNC)
(NEGATE *0 1Sg OR 1SgPoss OR 2Sg) ;

R20) SELECT 1SgPoss IF
(0 @SUBJ> LINK *1 V + 1Sg BARRIER V - CONT) ;

Liv Molich
Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

Appendix VI: Corpora

Main corpus

The main corpus consists of all sentences containing a possessive of the *aallarnerami* type in *Ataqqinartuaraq* (Kleist et al. 2007), *Ukiut Trettenit Qaangiummata* (Vebæk 1992) and *Tarrarsuummi Tarraq* (Korneliussen 1999).

Column 1 is the possessive. In column 2 the correct possessor is marked. Columns 3 and 4 show which rule is disambiguating the possessive, in the old version of January 2nd 2018 and the new version of January 2nd 2019, respectively. How the rules disambiguate after implementation of the adjustments suggested is not shown. Columns 5, 9, 10 and 11 show when the possessive is coordinated with another possessive, when it is part of direct speech, when it is part of direct speech, and what the syntactic function is, respectively. Columns 6-8 show when the possessor is explicit. Column 12 is the example sentence. The sentences are run with context not shown in the corpus below. The corpus sentences must be run in context in order to obtain the same results as in my thesis.

Color codes for the chart:	
Cyan	Correct disambiguation by the new rules, local rules.
Magenta	Correct disambiguation by the new rules, global rules.
Green	Correct disambiguation by the new rules, syntactic rules.
Orange	Not disambiguated by the new rules.
Yellow	Correct disambiguation by the old rules.
Red	Wrongly disambiguated by the old rules.
Grey	Corpus

Word form	Possessor	New rule	Earlier rule	conjunct	time possessor	weather possessor	other possessor	direct speech	Indirect speech	Syntactic function	Sentence

ATAQQINARTUARAQ											
titartaasarnera	1	R16	1680						x	@OBJ>	Inersimasut siunnersorpaannga pulateriaarsunnik ipititsisartunik titartaasarnera unitsissagiga, ammasunik matoqqasunilluunniit, taarsiulluguli aalluteqquaat nunalerutit, oqaluttuarisaaneq, kisitsisilerineq oqaasilerinerlu.
Inuunera	1		1680		x					@CL-ADVL>	Inuunera tamaat inuit ilumoorsaartut susassaqarfigisimaqaakka.
Takkuteriasaarnera	3		9939A							@OBJ>	Takkuteriasaarnera tupinnartoq paasiniassallugu periarfissarseriasaarpunga, aperigasuarparalu:
inequnarluinnarnera	3		123					x		@i-N<	"Ataqqinartuaqqap inuusimaneranut uppernarsaatissat tassaapput inequnarluinnarnera, illartarnera savaatitaarusunneralu; savaatitaarusunnermi uppernarsaataavoq inuusimanermut"
illartarnera	3		123	x				x		@i-N<	
savaatitaarusunneralu	3		123	x				x		@i-N<	
aallalernera	3		9939A							@OBJ>	Ullut tamaasa ulloriaaraq angalasoq pillugu tusagaqartarpunga, tassanngaanniit aallalernera angalaneralu pillugit.
angalaneralu	3		9939A	x						@OBJ>	
naanera	3	R10	123							@SUBJ>	Taava tasitsaartarpoq, aallaqqaammullu qunusunnguamik naanera ataasinnguaq inequnavissoq ajoqutaanngivilluni seqernup tungaanut siaartarpoq.
pinaasernera	1	R18	1680							@OBJ>	Baobabinulli tunngatillugu tammartajaarluni ulloriaaqqamut pigaanni, tamatuma kingunissai ajortut ilisimanngisat annertoqimmata, tamatumuuna pinaasernera akiorpara.
tarrikkiartuaarnera	3	R2	65			x				@OBJ>	Sunaaffami sivisuumik seqernup tarrikkiartuaarnera pinnersoq kisiat aliikkutarisarsimavat.
tarrikkiartuaarnera	3	R2	65			x		x		@OBJ>	- Seqernup tarrikkiartuaarnera nuannareqaara.
tarrikkiartornera	3	R2	65			x		x		@OBJ>	Seqernup tarrikkiartornera alakkassavarput...

tarrinnera	3	R2	65			x				@SUBJ>	Minutsip ataatsip ingerlanerani Frankrigimut angalapallassinnaasuugaanni seqernup tarrinnera takusarneqarsinnaagaluarpoq.
aappillernera	3	R2	123			x				@OBJ>	Illilli ulloriamineeqqanni issiavik nikisilaaginnarlugu seqernup unnukkut aappillernera takusinnaasarpat...
ajutoornera	3	R7	123				x			@SUBJ>	Motoorima ajutoornera ajorsigaluttuinnartutut isikkoqarpoq imissaralu nungulerluni, ajornerpaamik annilaanngatigilikkannik.
iluarinninnera	3		1680					x		@N<	Nakutitseriarnerisa nallinnaannartut tunuanniittoq iluarinninnera takusinnaasimasariaqaraluarpara.
asanninnera	1		9939A					x		@OBJ>	Naasut imminnut assortortaqigamik, uangali inuusuppallaarsimavunga asanninnera paasissallugu.
silaannarinnera	3	R5	65		x			x		@OBJ>	- Taamak aamma nuatsiginngilanga ... unnuap silaannarinnera iluaqutigissavara.
tarrinnera	3	R2	65			x		x		@OBJ>	- Seqernup tarrinnera takorusoqaara ... Nuannarissagaluarpara ... seqineq tarreqqusinnaasuugukku...
tarrinnera	3	R2	65			x		x		@HNOUN	- Seqernummi tarrinnera takorusutara? ataqqinartuaqqap eqqaasippaa.
tarrinnera	3	R2	65			x		x		@OBJ>	- Seqernup tarrinnera takujumaarpat.
tarrinnera	3	R2	123			x				@OBJ>	Seqernup tarrinnera takorusoqaa.
Kanngusunnera	1	R11	9939A					x		@OBJ>	- Kanngusunnera puigorumallugu, imerajuttoq nassuerpoq sikillunilu.
Imernera	1	R11	123					x		@HNOUN	- Imernera, imerajuttoq naggasiivoq nipaarutivillunilu.
piginnittuunera	1		9939A					x		@SUBJ>	Taamaalillunga taakkuninnga piginnittuunera innermik anitsisartuutinnut naasuutinnullu iluaqutaavoq.
kaavinnera	3	R7	65			x		x		@SUBJ>	Ukiut tamaasa ullorissap kaavinnera sukkatsikkaluttuinnarami, malittarisassallu allanngornatik.
innera	3	R7	123					x	x	@OBJ>	Nunalerutilerisorlu isumaqaruni ilisimasassarsiortut arlaata eqqaamasai soqutiginartuusut, taava taassuma ileqqorissutsikkut qanoq innera pillugu paasissutissanik pissarsiniartarpoq.
Inuunera	1	R11	9939A					x		@SUBJ>	- Inuunera assigiiaaginnarpoq.
inuunera	1		123					x		@SUBJ>	Nujuillisarsinnaagummali inuunera qaamanerulissagaluarpoq.

siorsunnera	3	R2	1680			x		x		@OBJ>	Uangalu anorip karrit aqqusaarlugit siorsunnera nuannaringaalissagaluarpara...
kammaqarsimanera	1	R6	1680					x		@OBJ>	Uanga terianniamik kammaqarsimanera nuannaarutigeqaara...
kusanarnera	3	R7	65				x	x		@SUBJ>	- Inoqajuitsup kusanarnera peqquteqarpoq tamaani arlaanni puilasumik toqqortaqarneranik ... ataqqinartuaraq oqarpoq.
aalajaatsuunera	3		9939A							@i-N<	Sigguilu aatsalaarmata qungujunniarlunilusooq kingumut eqqarsalerpunga "Ataqqinartuaraq sinittoq una pillugu killitsissutiga tassaavoq naasunnguamut aalajaatsuunera. Naasup taassuma assinga qullertulli qaamanerivaa sinikkaluarluniluunniit ..."
akisunnera	3	R7	65							@SUBJ>	Mikisuullunga aamma juullip orpiliaata akisunnera, unnuaqeqqanut naalagiarnermi pattagiarsuup erinaa asasamalu qungujunnerisa saamanerat juullimi tunissutisiannik qaamaneqalersitsisut ittarput.
sapaatip-akunnera	3	R1						x		@N<	- Taavami nalaatsornerusimanngilaq ulloq taanna sapaatip-akunnera qaangiummat ilisarisimalerakkit maani kiserrappit pisorujoortutit, miilit tuusintilippassuit nunaqarfinninngaanniit ungasitsigisumi.
ilungersuanera	1	R17	9939A						x	@SUBJ>	Tassami oqarfigileraluarpara ilimaginngisannik ilungersuanera kinguneqarluarsimasoq.
aallarnera	3		1680							@N<	Unnuk taanna aallarnera maluginngilaraluunniit.
Aqullaarneraluunniit	3	R10	123							@OBJ>	Aqullaarneraluunniit tusaaneqarsinnaanngilaq, sioraqarallartillugu.

UKIUT TRETTENIT QAANGIUMMATA											
oqalunnera	3	R7	65				x			@OBJ>	Emilie Anettep oqalunnera tusarnaajutigalugu isumaliorpoq:
similaarnera	3	R7	65				x			@OBJ>	Nujaasa qernernerat amiatalu similaarnera eqqaassanngikkaanni qallunaajusorineqarsinnaavoq, timaa nioqqortulluni qallunaarpalukkami.
oqallorissiaarnera	3	R10	123							@SUBJ>	Aamma oqallorissiaarnera nuannequtinut ilaavoq.

qiarpalunnera	3	R14	123							@OBJ>	Saniliisali qiarpalunnera tusaalerlugu, imminnut eqqussimavaat, aanani utaqqikatalerlugu qiangiilersoq.
ippigusunnera	3	R14	123				x			@SUBJ>	Uninngajuarsimanermit aasaq imaasigaluartoq, fru Jensenip gigtiminik ippigusunnera aasiit sakkortusigaluttuinnarpoq.
napinera	3	R7	123				x			@OBJ>	Ukiartoq pitsorluttorujussuanngorpoq, niumi napinera annertuumik gigteqarfigisalerlugu.
paarisaqarnera	3	R10	123							@SUBJ>	Meeqqamik paarisaqarnera pisortanit ippigineqalerpoq.
ikiortigilluarnera	3	R13	123				x			@OBJ>	Emilieli tigujumanngikkuniuk Eriup qimaqinammani annilaangagaa, maannalu nassangaatsialerami Eriup ikiortigilluarnera miserratigisinnaanngilaa.
ernera	3	R7	65				x			@SUBJ>	Eriup ernera qassinimmitaava ukioqassava?
meeraanera	3	R7	65				x			@SUBJ>	Emiliep meeraanera Danmarkimi meeqqanit allaaneruvoq imaluunniit illuatungeriinnik angajoqqaaqanngitsut assigai.
toqunera	3	R8	123				x			@OBJ>	Angunni upperisimagamiuk kingorna anaanagigaluami toqunera eqqaaqqinngilaa.
toqusimanera	3	R8	123				x			@OBJ>	Ilimaginngilluinnakkaminilli arnami qanoq toqusimanera tusarpaa.
toqusimanera	3	R8	123				x			@OBJ>	Qimaannarusukkaluarpaa, kisianni anaanami qanoq toqusimanera tusassallugu annilaarnartikkaluarlugu tusarusuppaa.
Taamaannera	3	R10	123							@SUBJ>	Taamaannera soorlu Hans Møllerimut kajumissaariinnartoq.
naalannera	3	R10	123							@OBJ>	Ilinniartitsisuisali naalannera unneqqarinneralu pissutigalugit niviarsiaraq taanna nuannarisarilluarpaat, naammassimmallu siunnersorlugu Aasianni juumuussatut ilinniartunngoqqullugu.
unneqqarinneralu	3	R10	123	x						@OBJ>	
piginnaaneqarnera	3	R10	123							@SUBJ>	Angut oqaaseqartorsuunngitsoq aamma qallunaatut piginnaaneqarnera killeqarami, qanga kalaallit ilinniagaqarpallaanngikkallarmata peroriartorsimagami.
angerlajaartarnera	3	R10	123							@OBJ>	Qitigiaraangami angerlajaartarnera mersernartutut isigisarpaat, kalaaleqatiminullu angutinut qaninniarnerusutut pissuseqarnera

											arnaqataanut naleqqiukkaangamikku maluginiartarlugu.
pissuseqarnera	3	R10	123							@OBJ>	
sullerinnera	3	R7	65				x			@OBJ>	Maannalu Margrethep sullerinnera iluaqutigilerpaat.
oqarnera	3	R8	123				x		x	@OBJ>	Aamma paasisoraa Eriup aleqami taamatut oqarnera nuannarinngikkaa.
eqqarsaatigeqqajaanera	3	R7	65				x			@SUBJ>	Tassa apersortinnissap eqqarsaatigeqqajaanera pissutaalluni, ilaquttat ilaginissaat apersortinnissamut ilaammat.
naalagiartoqarnera	3	R9	123							@OBJ>	Kalaallimik naalagiartoqarnera pingaartiinnarpaa.
nakkakattarnera	3	R7	123				x			@OBJ>	Ilami taamani Hansenip annaassiniaraluarluni nakkakattarnera isinneralu takorloorlugit, naamik kingornagut ajorani panertunik atisereermat illarnarnera assissaqanngilaq.
isinneralu	3	R20	123	x						@OBJ>	
illarnarnera	3	R20	123							@SUBJ>	
maniinnera	3	R15	123				x			@OBJ>	Asumiaa Norgep nunataata maniinnera sungiusimanngikkaa.
illaqataalernera	3	R7	65				x	x		@OBJ>	Kingornagut Hansenip illaqataalernera quianartut ilagaat, Eskild nangippoq.
akunnera	3	R1	65		x			x		@ADVL>	Sapaatip akunnera utaqqigaluarussi aallarnitta nalaani aallassagaluarpusi!
sumiinnera	3	R10	123							@OBJ>	Qanormita ililluni angaavata Olep sumiinnera paasisimavaa?
oqarnera	3	R7	65				x			@OBJ>	Margrethep oqarnera 'angaavit Olep takorusuppaatit' eqqarsaatigaa.
inuunera	3	R8	123				x			@OBJ>	Paasivaa anaanagigaluami inuunera qanorlu toqusimanera Emiliemut paaseqqunagu kalaallinut ungasitsinniartarsimagaluaraani.
toqusimanera	3	R10	123	x						@OBJ>	
oqarnera	3	R7	65				x			@OBJ>	Annap oqarnera, 'EF-imit anisimanngikkaluarutta marluussagaluarput' puiguikkiutivippaa.
oqarnera	3	R14	65				x			@<OBJ	Aamma eqqaavaa angummi ullut ilaanni isumalulluinnarluni oqarnera:
tunisisarnera	3	R14	123							@NIQ-OBJ>	Taamaattumik quiagikujuttaraluarlugu assut kiffartuukkusuttarpaat, immikkut tunisisarnera iluarinermik.

ernera	1	R18	1680					x		@OBJ>	Utileruma ernera Esbjergimiittoq ilagissavara, ukua ilaquttani ilagilaarniassammagit.
inuunera	3	R7	65				x	x		@OBJ>	Uangaana paniga, uanga taassuma inuunera aalajangigassaraara ...
inuunera	3	R7	65				x	x		@OBJ>	- Anaanaata inuunera aserorakku, taassuma inuunera aserussanngilat!
inuunera	3	R7	65				x			@OBJ>	
inuunera	3	R10	123					x		@OBJ>	Panini namminermisut inuunermik taamaattumik atugaqaqqunagu silattunnginnerani toqoqatigalugu inuunera kipiniaraluarpaa ...!
kamannera	3	R7	123				x			@SUBJ>	Olep taxanut ikillunilu kamannera sakkortusiartuinnarpoq.
aggersinnaasimannginnera	3	R7	65							@OBJ>	Emiliep aggersinnaasimannginnera eqqarsaatigeriaramiuk imaassinnaavoq imminut tuppallersarniarluni qiimmassarniarlunilu imernerusimasoq, taamaassimanerpaa?
iiuminarnera	3	R4	65				x			@OBJ>	Aqaguagunnguaq umiarsuaamminik umiartorniarpoq, mallit qaffiaartitsinerat anorillu silaannaata iiuminarnera misigissallugit.
Sumiuunera	1	R12	9939 A					x		@OBJ>	„Inuit sianiitsut. Sussa! Sumiuunera puigorlugu uangaaginnarlanga."
oqarnera	3	R7	9939 A				x			@<OBJ	Nalunngilara sangiakujulluni qinngasaaraluni taamatut oqaluttoq, Eskild oqarpoq, eqqaalerpaalu ippassaq imminnut attuutivillutik karakteeritik isiginnaajutigalugit atuarfimmiit aniartornerminni Frank nukappiararlu alla naapikkamikkit Frankip illakululluni oqarnera:
oqarnera	3	R15	9939 A				x			@OBJ>	- Piuminaatsuuniarama, Emiliep taamatut oqarnera aappaata quiagaa.
toqunera	3	R8	123				x			@OBJ>	Taamanikkut anaanami toqunera, namminerminillu toqutseriaraluarnera upperisinnaanngorlugu paasilluarpaa.
toqutseriaraluarnera	3	R10	9966	x						@OBJ>	
Napparsimaruloorsimanera	3	R12	123							@SUBJ>	Napparsimaruloorsimanera pissutaasimanerpa?
toqunera	3	R7	123				x	x		@SUBJ>	„Eskildip paasisinnaagunanngilaa anaanama toqunera uannut qanoq sunniuteqarsimanersoq."
toqusimanera	3	R8	123				x			@OBJ>	Unnuk manna anaanami qanoq toqusimanera Eskildimut oqaluttuarisussaanngikkaluarpaa.
unnussiornera	3	R14	99				x			@OBJ>	Eskildip unnussiornera aserorpaa, namminerlumi aamma.

imminorsimanera	3	R7	123				x			@OBJ>	Ikinngutitaarnerit tamaasa anaanami imminorsimanera oqaluttuarisariaqassallugu?
soqutigisaqarnera	3	R10	123						x	@SUBJ>	Nalunngilaa nukappiaqqat arlallit qaninniartarsimagaluaraat, soorluli aalajangersimasumik soqutigisaqarnera malunnarsimanani.
nuannernera	3	R5	65		x			x		@SUBJ>	- Unnuup nuannernera assissaqanngilaq, oqartoqarpaluppoq.
suunerali	3	R19	123							@SUBJ>	Mikisuaraaqqamik uummataasaliorpoq, suunerali ersarippoq.
toqusimanera	3	R8	123				x			@OBJ>	Eskildimummi unnuk manna anaanagigaluami qanoq toqusimanera oqaluttuarereerpaa, taamaattumillu taamak oqarsinnaasoraaq:
Inuunera	1	R11	1680					x		@CL-ADVL>	- Inuunera tamaat anaanama imminornerata malersussanerlunga?
Perpalunnera	3	R10	123							@HNOUN	Perpalunnera suami tassa.
oqarpallannera	3	R8	123				x			@OBJ>	Angunni Anettelu qimaguppaluttut tusaavai, angummilu oqarpallannera ersarissumik tusaavaa:
toqunera	3	R8	123				x			@OBJ>	Taamani angutip aalakoortup anaanagigaluami toqunera oqaluttuarimmagu, angussuullu taassuma anaanagigaluamisut inuuneqaqqunani oqaluummani Gitte oqaluttuuppaa.
inuunera	3	R8	123				x		x	@SUBJ>	Taamani angaami qarnganit anaanami inuunera alianartoq, qanorlu naasimanersoq tusaramigit aalajangersimavoq nammineq ajunngitsumik inuuniarsarissalluni, ajutoorumananilu aatsaat uinikkuni angummik ilaqarumaarluni.
Sialualaarnerali	3	R10	123			x				@SUBJ>	Sialualaarnerali qinngarnaq sakkortusiartorpoq, Emilielu masalerpoq.
oqaluttuarnera	3	R14	123				x			@OBJ>	Maanna ullaaralaannguami Utterslev Mosekkut ingerlatilluni Emiliep kalaallit ilaquttani eqqarsaatigalugit Margrethep angaaminik ajoqiusumik oqaluttuarnera eqqarsaatigilerpaa.
Nuannaanngeqqajaanera	3	R10	123							@SUBJ>	Nuannaanngeqqajaanera soorlu anillaqqajaasoq.
ikinnguteqarnera	3	R10	123							@OBJ>	Qallunaavinnik ikinnguteqarnera takussavaa.
anerneralu	3	R10	123							@SUBJ>	Emiliep issanngungaalerluni assassua qiseriarlugu peernialerpaa, ipermit tupasunnimillu tipeqimmat, anerneralu imigassarsunneriarmat Emilie inuunilulerluni misigaaq, iluaallilerasugalunilu.

peeriaraluartarnera	3	R13	123							@OBJ>	Angutilli Emiliep taliata aappaa imminut tulleq assammi illuanik nukersorluni tigummivaa peeriaraluartarnera ajornarsitillugu.
ersiornera	3	R7	65				x			@SUBJ>	Emiliep ersiornera sakkortusigaluttuinnalerpoq qitimigut eqissimaneqalerami.
arnaateqalersimanera	3	R15	123				x	x		@OBJ>	- Katrine imilerpoq ataatavit Kalaallit Nunaannukaqqikkami arnaateqalersimanera tusaramiuk, uffalu aappariikkaluarlutik.
inuuneqarsimanera	3	R7	1680				x	x		@OBJ>	„Ataatama qanga qanoq inuuneqarsimanera uanga susassarinngilara, eqqarsaatigerusunngilara, ilisimarusunngilara, immaqa inuit tamarmik ilumioqarput inunnut allanut tusartikkusunngisaminnik.
pissuseqarsimanera	3	R14	123						x	@OBJ>	Anaanaminummi ajortumik pissuseqarsimanera naluaa.
inuusimanera	3	R8	123				x			@OBJ>	Anaanami inuusimanera toqusimaneralu pissutigalugit angunni asalivinneq sapissavaa, isumaqaramimi pisimasupalaanut pisooqataasoq.
toqusimaneralu	3	R13	123	x						@OBJ>	

TARRARSUUMMI TARRAQ											
aalajangernikuuneralu	1	R18	9939A							@OBJ>	Tikikkiartorlunga malugilerpara ulinneq naammatsilersoq, aalajangernikuuneralu malillugu eqqaaviup tungaanut ingerlavunga tassani ikuallassagakku.
Aalajangernerami	1	R18	60							@OBJ>	Aalajangernerami allanngortissinnaagaluarpara, nalunngilaralu umiatsiatut nuannaarluni ernumassuteqarnanilu angallataasartutut pisinnaajunnaartoq, ukiut atugassani naammatsippai naggatissanilu tikillugu.
sumiinnera	1		1680							@OBJ>	Uunnaaviup qaava paavialeraluarlugu sumiinnera eqqaalerakku imaq maajunnaqimmat tamanna unitsiinnarpara.
ikumanera	3		9939A							@SUBJ>	Inneq sakkortoqaaq, umiatsiallu naqqa putulluni silaannaqarlualeriarmat ikumanera suli sakkortunerulerpoq, attuiniartutut tigusiniartutullu illuni tunginnut naarallattalermat kajungilerpunga pulaffiginiarlugu.

ilinera	3	R3	9939 A		x					@OBJ>	Qisuup masattup saviminertarasaartullu ikumanermini nipit assigiinngitsut pilersittalermagit isumaqartilerpakka innermut ikummarissumut pulaqqusisut pulagumalu ukiut ingerlanerini ataatsimoorluta misigisarsimasavut nuannersut uterfigissagikka, qimaqqinngisaannassallugillu ukiup qanoq ilinera sumilu najugaqarnera akornutiginagit.
najugaqarnera	1		9939 A	x						@OBJ>	
isigisimanera	1		9939 A							@SUBJ>	Ikumasumut isigisimanera sivisusimaqimmat eqqara taarsisimasutut ippoq, tunuartiteramalu aatsaat iluamik isigisaqarsinnaalerpunga.
seqqulunnera	3	R7	65				x			@SUBJ>	Ikuallattup seqqulunnera kisimi nipaavoq, tununnilu qiarpaluttumik tusaasaqalerama qiviarakku takuara naajaaq umiatsiamut igiinnakkamut missimalluni nipituumik qarlortoq.
qarlornera	3	R7	1680				x			@OBJ>	Timmissap qiasutut nipeqarluni ilaminit qimataalerluni naalliuppalulluni qarlornera uannut tutsippara, sanileriilluta qummut isigivugut, timmiaq inullu, aapparma qunugiunnaarlunga qiviartalerpaanga, paasigunarpaa aamma uanga qummut isigisunga, marluullutami qimataasimavugut ingerlaqqinnerlu sapilerluta.
sinnera	3	R7	65				x			@SUBJ>	Umiatsiap sinnera ikumasoq uligutitilivippoq, eqqaalu kissaqimmat imaq takkuttoq aalannguulluni qalattutut pujulerpoq.
titartarnera	3	R7	1641				x			@OBJ>	Maanga nuukkama soorunami inigisassama titartarnera pivara, tassanilu takusinnaavara tarrap nalerisartagaa igalaaqarnikuunanilu matoqarnikuunngitsoq.
kinaanerami	1	R18	60							@OBJ>	Aallartilluartinnangalu ilisaritilaaqqaartariaqarpunga, kinaanerami saqqummiuteqqaartinnagu oqaluinnaraluaruma ingallunga soqutigineqarnavianngginnama.
kinaanera	3	R7	65				x		x	@SUBJ>	Isumaqarpungami inuup ataatsip kinaanera pisimasunut pingaaruteqanngitsoq, ullumili ulloq taama pingaaruteqartigimmat isumaqarpunga kinaanera oqaatigeqqaarukku pitsaanerussasoq.
kinaanera	1		1680						x	@OBJ>	

Kinaanera	1	R12	1680							@OBJ>	Kinaanera isertuunnianngilara, ilumoortumilli ilisaritissaguma ilimagisariaqarpoq oqaatigisakka tamarmik ilumoorluinnartutut tamanillu ersersitsisutut naatsorsuutigineqartariaqanngimmata, ajunnginnerussagaluarpormi inuup allap ilisarititttuuppanga, taassumami kinaassagaluarnersup tamakkiinerusumik kinaanera oqaatigisinnaassagaluarmagu.
kinaanera	3		9939 A						x	@OBJ>	
kajungisaarinera	3	R7	65				x			@OBJ>	Kinguaariippassuillu inuuneranni unissanatik ingerlajuarsimapput, ungasissup ersiaqqalaartup kajungisaarinera malillugu tikissanagulu.
kinarpiaanera	3	R7	65				x			@SUBJ>	Inuup kinarpiaanera aatsaat paasinarsisarpa siulini kinguaanilu ilanngullugit ilisaritikkuni?
sinnera	3	R7	1641				x			@OBJ>	Kaffiliama sinnera nungoriarlugu aninialerpunga.
sorsunneqakulannginnera	3	R10	123							@OBJ>	Qatserisartoq politiiorusuttaraluarpoq, taannami imminermit pisinnaaffeqarnerummat, politeeq sakkutuunut naalagarsoorusukkaluarpoq, taakku atortorinnerummata, sakkutuullu naalagaata sorsunneqakulannginnera avaanngugisaraa, sorsulertuuppatami toqqorfissiamut nunap iluaniittumut qaartartumeerneqarsinnaanngitsumut periarluni naammattorsuarmik sapiitsuliortaqqajarami.
eqqissinarneralu	3		9939 A							@OBJ>	Taamaattumik ileragalugu eqqissinarneralu akornuserusunnagu mingutsikkusunnagulu nipaatsumik arriitsumillu ingerlalerpunga.
isumagissaarnera	1	R18	1680							@OBJ>	Ullumikkut isumagissaarnera nammineq aalajangigarinngilara, nammineerluni takkussimagami aamma nammineerluni peeruteriaannaammat atorluarniartariaqarpara, ullummi tamaasa takkunneq ajormat takkutillatuarmat ajattortariaqanngilaq.
qiviarnera	3	R7	9939 A				x			@<SUBJ	Allaanngivippoq taamani tikaagulliup killinnguatsigut puilluni qiviarnera, umiatsiamiittut aallaasiminnik piareeqqasut qiviaramigit isai.
sajukulanera	3	R15	65				x			@SUBJ>	Ungasilliartornerani nunap sajukulanera milliartorpoq, sulili anertikkarpalunnersua tusarsaavoq nipikilliartortutullu inngilaq.
sajukulanera	3	R7	65				x			@SUBJ>	Taannarsuaq imminut naalliutsinnermik kajungerisalik suli pangalilluni tatsip

											illua'tungaani orpiit akornannut pulasorlu tatsip tasertaa patsisaasimanerluni nunap sajukulanera malunnarunnaarpoq.
nuannertigineria	3	R7	1641				x			@<OBJ	Naapillatuaraangakku nipangiunneq ajorpai tappavani ilaquttani pitsassuit, siuaasani piniartorsuit sapigaqanngitsut, nunaqarfiup meeraaffimmi nuannertiginera, uigisimasami qanoq inupalaajutiginera, ernermi nalusami qanoq pikkoritsiginera, inutsialaatiginera, suliffigissaarluni aningaasarsiorluartiginera, ernuttamilu takusimanngisami pakkutaarsimanngisamilu qanoq inequnarluinnartigineri.
inupalaajutiginera	3	R7	9939A				x			@<OBJ	
pikkoritsiginera	3	R7	9939A				x			@<OBJ	
inutsialaatiginera	3	R20	9939A							@<OBJ	
aningaasarsiorluartiginera	3	R20	9939A							@<OBJ	
Danmarkiliarnera	3	R13	123							@OBJ>	Nunaminut uterusussimagaluarpoq, namminerlu Danmarkiliarnera akilersimagamiuk oqarfigisimavaa uterniaruni nammineq akilertariaqaraa.
Sumunnarsimanerami	3	R10	1690							@SUBJ>	Sumunnarsimanerami tatsip illua'tungaani ingerlavoq.
Inuunera	3	R10	123							@SUBJ>	Inuunera ajunngitsumik ingerlavoq.
sinnera	3	R7						x		@OBJ>	“Uunga killippunga, ilissi sinnera isumannaarniarsiuk!”
ilitsersuinera	3	R7	65				x			@OBJ>	Soorunami ilaannikkut inuk kukkusarpoq, pinngortitsisup ilitsersuinera paatsoortaramiuk, aperisassaqannginnamimi imminullu tatigivallaarluni pinngortitsisup pinngortitaa ilaatigut naammaginanngitsumik kingunilimmik ingerlateqqinniartaramiuk.
kusanartuarnera	3	R10	123				x			@OBJ>	Isigisallu kusanartuarnera isigiuminartuarneralu isigisup malugisimajunnaaraluarpaguluunniit atajuassaaq isiginnittussaq alla kusanassutsimik takunnissinnaasoq isigisaminillu kusaginnilluni nuannaaruteqarluni qujamasussinnaasoq utaqqisutut illugu.
isigiuminartuarneralu	3	R10	123	x						@OBJ>	

sanaajunera	3	R10	123							@OBJ>	Taseq tasiviunngikkaluarluni isigiuminarpoq isikkumigut tasivimmut eqqaanarami, inunnit sanaajunera ilisimanngikkaanni tuaviinnavillu saneqqukkaanni tasivimmut naatsorsuunneqarsinnaagaluarpoq.
suunera	3	R7	123				x			@OBJ>	Tuaviungaarami unilluni eqqissilluni nerinissaminut piffissaqanngilaq, nerisami suunera susunninneralu soqutiginngitsutut illugit ingerlavoq, eqqani qiviassanagu siumuinnarlu isigaluni.
susunninneralu	3	R19	123	x						@OBJ>	
Tasiviunnginnera	3	R19	123							@OBJ>	Tasiviunnginnera soqutigerpasinngilaat sungiussisimarpasillutillu.
qaaqqusinera	3	R7	65				x			@SUBJ>	Suluppalaarnerup qaaqqusinera pinngitsaaliiniarpaluttutut inngilaq.
innera	3	R4	9939 A			x				@OBJ>	Nappaatit, silap qanoq innera naalakkersuisullu pillugit tusagaqarusunngilanga.
susunninnera	3	R10	123							@OBJ>	Tusarnaaginnarnagu susunninnera qanorlu akisuanera maluginiariaruk.
akisuanera	3	R10	123	x						@OBJ>	
navianartiginera	3	R19	123							@OBJ>	Akianut apuukkami tunummut saappoq, ikaarfimmilu navianartiginera uppernarsiniarlugu isigeqqaarpaa.
suunera	3	R7	65				x			@SUBJ>	Akoorneqartaqaat, isumagalu malillugu nerisassap suunera apeqqutaalluni mamassuseqassaaq, assigiinngitsunillu akoorneqarunik mamaat ilisarnarunnaassaaq.
isersimasoqarnera	3	R9	1680							@OBJ>	Kaffisukkama tiitorfiit aappassaat ingerlatilerlugulu allanik isersimasoqarnera aatsaat malugilerpara.
pisimasoqarnera	3	R9	1680							@OBJ>	Qanoq pisimasoqarnera soqutiginngilara, piumaartussat soqutigineruakka.
suunera	3		9939 A						x	@OBJ>	Niaquinnannik angerama suunera puulukilli neqerinngikkaa oqaatigaa.
Sumunnarniarnera	1	R18	1680							@OBJ>	Sumunnarniarnera oqaatigissanngilara.
nipilersornera	3	R20	123							@OBJ>	Radio ammagaluarpoq, nipilersorpalorusaarpoq uannullu pingaarutilinnik pisoqarsimagaluarpat nipilersornera kipitiinnarlugu tuaviinnavik nalunaarutigeqqajarpaat.

naalliunnartiginera	3		9939A							@OBJ>	Taama ittut toqqarlugit qiviarusunnginnakkit tuavioqalutik saneqqutilermannga allamut qiviarpunga, oqaloqatigiinnerallu tusarnaarnianngikkaluarlugu nipitoqimmata tusaavara suliamik naalliunnartiginera akissarsialutsiginertillu eqqartoraat.
pillarneqarnerali	3	R19	123							@SUBJ>	Pilersaarusioqataasutut eqqartuunneqarpoq, pillarneqarnerali sakkukinneroqaaq.
qanera	1	R17	123						x	@SUBJ>	Seqineq tappavunga pisareerluni kissatsillualermat malunnarsivoq qanera aqajaroralu arlaannik nillertumik najoqqaarusuttut.
anertikkarpalunnera	3		1680	x						@OBJ>	Oqaluttuartup nipaa, anertikkarpalunnera sumiorpalunneralu tusaqqinngisaannagassara tusaasutut ilerpara, isigilersutullu ippara oqaatsit taakku oqaatigigaangamigit toqqarlunga qiviartaraanga, isaalu asannippaluttut isarussat sakkortuut tunuini qungujulasartut.
sumiorpalunneralu	3		1680	x						@OBJ>	
imaalinera	3	R3	65		x					@OBJ>	Utertulilerlunga sila nuannernerarmagu oqaloqateqarnissannik sillimannginnermik akueriinnaleraluarlugu piaaralunga akivara ukiup imaalinera eqqarsaatigalugu naammaginanngivissoq.
ittuunera	3	R7	1680				x			@OBJ>	Uteriartornermini isersimasut allat qanoq qiviarsimaneramigit alapernaappasillutik qiviarpaannga, arnarlu iseramali aatsaat tunginnut saammat kiinaata qanoq ittuunera paasivara.
najugaqarnera	1		9939A						x	@OBJ>	Akivakka sumi najugaqarnera oqaatigerusunnagu susassarinngimmassuk.
Nikuinnera	1	R18	9939A							@OBJ>	Nikuinnera iluatsillugu ataatsimik piseqqippunga aalajangerlungalu nungoriarlugu aniniarlunga.
ilaanera	3	R14	123							@SUBJ>	Sulisoq illaarluarsimatigaluni tarrarsorluni nutsaminik iluarsaassiutigaluni akuliuteriaraluarmat ilaata nipangeqquaa ikiuiumatuunut ilaanera ilimanaqimmat.
nererusunnera	1		9939A							@SUBJ>	Aqajarora nerisassaanngikkaluamik immerneqariarmat nererusunnera malunnarunnaarpoq, silamilu quineq nuannarinnginnakku quisarfimmukarpunga querusunngikkaluarlunga siumoorsillunga quiniassagama.

Umiatsiaqannginnera	1		9939A							@OBJ>	Umiatsiaqannginnera misissorluarniarlugu issiavimmut ingippunga taseq tasiliaq tamaat alakkarlugu.
Sianerpalunneralu	3		9939A							@SUBJ>	Sianerpalunneralu imatut taallartaqartoq tusaavara: Maydaymayday, Mandalaymandalaymaydaymayday.
akisuanera	3	R7	65				x			@SUBJ>	Kasuttarnerup akisuanera arriitsumik angallatitut kiviartortutut aanngariartorpoq malunnarunnaarlunilu.
ilinera	3	R3	1680		x					@OBJ>	Ullup qanoq ilinera soqutigineq ajorpara, arlaannut iserusuleraangama isertarpunga.
Paasinninnera	1	R18	9939A							@OBJ>	Paasinninnera malugitinnaveersaarlugu nikuippunga ilasseriarlugulu aggerfimma tungaanut aallarlunga.
suialaarnera	3	R2	65			x				@N<	Taamaalisorlu suialaarneq nillertoq alanngup suialaarnera aqqusinermi suialaalerpoq, pappialakujuillu aputip teqqalasarneratut teqqalalerput, allagartat ussassaarutit upperarput.
allanngoriasaarnera	3	R4	65			x				@NIQ_OBJ>	Silap allanngoriasaarnera eqqumiiginermik ingerlaqqipallalerama niviarsissap tarrarsuummiittup isigaasa qanoq ittuuneri qiviannginsoorpakka.
sumiinnera	3	R4	65			x				@OBJ>	Allakkut aqqutissaqannginnama seqernup sumiinnera paasiniarluaqqaarlugu alanngut alanngiumaartullu, tarrat tarranngorumaartullu misissorluaqqaarpakka.
inuusimanera	3	R10	123			x				@OBJ>	Atuakkat atuarfinni ilinniarfinnilu ilinniutit atuakkiarineqarsimapput, meeqqallu ilinniartullu pinngitsaalisamik inuup taassuma qanoq inuusimanera kikkullu kinguaarinerai ilinniartalerpaat, sooraarummeerutigisalerlugillu.
pisooqataanginnera	1		9939A							@OBJ>	Ataasiakkaat qiviariarlunga eqqaassutissaq qiviaraangassuk nipaatsumik ilassisarpakka taassuma ikkunneqarsimaneranut pisooqataannginnera paasitinniarlugu.
oqalunnera	3	R7	123						x	@OBJ>	Malunnarpoq arlamik oqalunnera qanorlu isumaqarnera soqutiginagu oqaluttut.
isumaqarnera	3	R19	123	x					x	@OBJ>	
illuariartornera	3	R4	65			x				@OBJ>	Qiviallattaarlugit seqernullu illuariartornera najoqqutaralugu malugilerpara angutit taakku malunnartumik eqqaassutissamut qanilliartuinnarlutik arriitsumik milugukkiartortutut ittut.

sakkoqanngin nera	1		9939 A							@<OBJ	Itummakka takutippakka sakkoqannginnera isumapiloqannginneralu paasiniassammagu.
isumapiloqann ginneralu	1		9939 A	x					x	@OBJ>	
sinnera	3	R5	123		x					@SUBJ >	Taamaattumik ullaakkut iteraanni ullormut siunertarisaq suna anguniarneqassanersoq nalunartarpoq, ullullu sinnera taamaaginnassanersoq naatsorsuutigineqarsinnaanani.
Kinaanera	1	R18	1680							@OBJ>	Kinaanera sulerineralu oqaatigissanngilara.
sulerineralu	1	R18	1680	x						@OBJ>	
najugaqarnera	1		9939 A						x	@OBJ>	Nej, nej, sumi najugaqarnera oqaatiginiarnagu oqarfigereerpakkit.
qinngornera	3	R2	65			x				@OBJ>	Qangarsuarlimi toqu takkuteqqaarmat kinaanersoq paaseqqunagu tipigissaammik akisuumik tarnummillu pitsaasumik innersuullugu tuniniaaffigisimagamiuk pillarneqarpoq anissanani naassaanngitsumik taqqamani pisiniarfiup iluaniittuassasoq, alanngumi tarratut illuni, seqernup qinngornera ullullu qaamanera takunngisaannassallugit, tipigissaatisunni naamajuassallugu napparsimasullu nungukkiartornerini isigiuassallugit kiffartuuttuusaarlugillu aningaasannanniarfigiuassallugit.
qaamanera	3	R2	123	x	x					@OBJ>	
tunniutassaqaj uinnera	1		9939 A							@OBJ>	Naluara tunniutassaqajuinnera namminerluunniit nerisassaminnik ujaasinatik tuneqqusaarlutik naakkinarsaarlutillu qinnuuloornerat kamassutigisarnerlugu.
pisoqartarnera	3	R10	123							@SUBJ >	Taamatut pisoqartarnera akuttungaarmat pisimasut allassimaffiini annertuumik eqqartorneqartarpoq atuarfinnilu ilinniutinut ilanngunneqarluni aningaasaateqanngitsut qitornaannut allaat pinngitsaaliissummik ilinniartitsissutigineqartarluni.
Ammanera	3		123							@CL-A DVL>	Ammanera tamaat tassani nikorfarusaartuartarput suliatuaralugu isertunik isikkorluineq.
sulinera	3		9939 A				x		x	@OBJ>	Tarrilerlunga ilummut itsuarama takusoorpara qarasaasiap arnat sulisut ilaata sulinera naammagisimanagu iperartoraa, paarsisussaagaluarlu nuannisaapilulluni kiaguppasillunilu iperaatap arnap timaanut

											tuttarnera akuttoqatigalugu uppammigut sajuallattarluni isiginnaartoq.
tuttarnera	3		9939 A				x			@OBJ>	
innera	3	R7	123		x					@OBJ>	Inuup misilittagartuup qaammaasaqarluarsimanerakkallu naatsorsuutigiuminaanneranit akornusersorneqarnatik silap nunallu qanoq innera ukiullu kaavinnera allanngorarneralu kisiisa malillugillu naajorarput.
kaavinnera	3	R5	123	x	x					@OBJ>	
allanngorarneralu	3	R10	123	x						@OBJ>	
Tassaniinnera	3		9939 A							@SUBJ>	Tassaniinnera sivitsulersoq suialaaq saqisimariarmat ikumaartitap pujuata tikka naamalerpara, qisugineqartullu minguippaseqalutik pitsaarpaseqimmata tipigigalugit eqqara qineraluarpara ikumaartitsisoqarsoralugu.
nuannernera	3		9939 A							@SUBJ>	Najugaq nuannersoq qimalerpara, najorsimasarmi nuannarisaq qimakkaanni nuannernera, unganarnera najoruminarneralu aatsaat malunnarsisarpoq.
unganarnera	3		9939 A	x						@SUBJ>	
najoruminarneralu	3		9939 A	x						@SUBJ>	
taarsiaartalernerulernera	3		9939 A							@SUBJ>	Ulloq imaalereermat, aasarissilluni taarsiaartalernerulernera malunnarsimmat ukiullu inuusuffigisakka qaangiussimalermata, eqqara aqqutissaralu misissorlugit paasivara tarrat alanngullu alliartorlualersut.
suminngaanneernera	3	R7	65				x			@OBJ>	Illu angisoorujussuaq uiarlugulu ikumatitarsunnitsumik naamasaqaqqilerpunga, suialaarnerullu suminngaanneernera misissoraluarakku iluamik paasisaqanngilanga illut portusuut akornanni anori piumasaannarminik sammiveqartarmat.
nippattaartarnera	3	R7	123				x			@<OBJ	Aammami naluaat qorlortup upernaami aputip aalernerani aasarimmilu sialleqqammersumi kuulluarluni nipaata suialaamit tingitaalluni nippattaartarnera.
isikkoqarnera	3	R19	123							@SUBJ>	Qanorli isikkoqarnera soqutaanani.

pisuppalunnera	1		9939A							@SUBJ>	Tuaviunngikkaluarlunga pisuppalunnera nipituumik akisuavoq, sullormi annertunnginnami meterip aappaa missiliuinnarlugu silitsigigami portunanilu.
angitiginera	3	R7	123				x			@OBJ>	Ilaat kamassimaarpalullutik allattarsimapput ilaallu nuannaarlutik, quianartuliorlutik asasamillu aqqi allattarsimallugit asanninnerullu qanoq angitiginera isertuutinngivillugu allattarsimallugu.
akisuanera	3	R7	1641				x			@SUBJ>	Tummartarnerma akisuanera nuannarinermik uinngiarsoraluarpunga, nipikeqimmallu nipitoorsuarmik qatituumik suaarama "kiap ikaartarfiutiga aqqutigaa", qoqernaannarmik akisuavoq.
Suaarneralu	3	R19	9939A							@SUBJ>	Suaarneralu akineqanngilaq.
soqarpalunnera	3	R20	1680							@OBJ>	Aamma siutikka tutsillugit taqqamani soqarpalunnera naalaaraluarakku nipeqanngivippoq.
Ammanera	3	R19	9939A							@SUBJ>	Ammanera qanillilersimammat suialaarneq malunnarsilerpoq, silallu qaamanera sunniutilerluni.
qaamanera	3	R2	1641			x				@SUBJ>	
maanaqquunnerami	1		60							@SUBJ>	Anillattariaqalerpunga, sulluliaq sajukulaaginnalerpoq, maanaqquunnerami sivitsorpoq.
innera	3	R7	9939A				x			@OBJ>	Tassuunaqquutikulannginnermik anisariaata qanoq innera puigorsimallugu tuaviutsariarama arpasukaaginnaq anillaatilerlunga tummeraarakasiit maluginngitsoorlugit pangallangajavippunga.

Regression corpus

The regression corpus consists of all sentences containing a possessive of the *aallarnerami* type in Oqaasileriffik 2018b. The sentences from the main corpus are excluded from the regression corpus. The columns and color codes are identical to the ones explained and used in the main corpus above.

REGRESSION CORPUS

tikinnera	3	R7	65							@SUBJ>	Ulloq taanna Aqqaluartaannguup tikinnera puigunaatsoq nunaqarfinnguami nalliussineqarpoq
ukiorluunera	3	R10	123							@OBJ>	Kommunit paasiniaaqquneqalerput ilaqutariinnik aalisartukkormiunik ukiorluunera pissutigalugu aningaasatigut ima ajornartorsiortigisunik, allaat meeqqaminnut iluamik isumaginnissinnaajunnaartunik, soorlu nerisassaqartitsinatik.
aallarnera	3	R8	123							@OBJ>	Ilaanni nuliami ilaquttaminut pulaarluni aallarnera iluatsillugu Ortup ikinngutitoqqami ilaat Joorsi tikeraarsimavaa unnuiffigisimallugulu.
ataqqinninnera	3	R7	123							@SUBJ>	Ulloq taanna aallarnerfigalugu Juulup Kaaleeqqamut ataqqinninnera suli annerulerpoq.
kingunera	3	R1	65							@i-N<	Kuisittoq tassaavoq niviarsiannguup asimioqarfimmiup nappajakkunnut kiffaajartorluni niuertoqarfiliarnerata kingunera.
kinarpiaanera	3	R7	65							@OBJ>	Margrethep kinarpiaanera maanna oqaluttuarilaassavarput.
piginnaaneqqortusinera	3		9939 A							@<OBJ	Tamatumuuna eqqarsaatigaakka landsrådip nammineq qinikkaminik siulittaasoqalernermigut suliffeqalernermigullu piginnaaneqqortusinera, kiisalu – minnerunngitsumik – inuusuttut pingaartumik ilinniagallit tunuarsimaannarunnaarlutik sassartilernerat.
nassataqarsimanera	1	R18	1680							@<OBJ	Aquttup nammattagaq angisooq taxanut ikigaa takugakku nassataqarsimanera paasivara.
akunnera	3	R1	65		x					@SUBJ>	Sapaatip akunnera qaangiuttoq Jaaku tikippoq assut qungujulaarluni iluarusuttoq nalunarani.
allanngoriartornera	3	R7	65			x				@SUBJ>	- Silap pissusaata allanngoriartornera nunarsuarmioqatigiinnit oqallisaaqaaq, inuppassuillu nassuerutigaat Kalaallit Nunaat tassaasoq silap pissusaata allanngoriartorneranik erseqqinnerpaamik takunniffiusinnaasoq.
nakkarnera	3	R7	123				x			@SUBJ>	Filmimi Idealisten-imi timmisartup Thule airbasemi 1968-imi nakkarnera oqaluttuarineqarpoq,

nalunaarnera	3	R7	65				x			@SUBJ>	- Timooq Mølgaardip nalunaarnera, allaanngilaq Nunatsinni Atassutip immikkoortortaqarfii tamaasa sinnerlugit oqaluttoq.
eqqunngitsuunera	3	R7	123				x			@OBJ>	Tassalu eqqunngitsumik issuarneqarnini Johan Lund naammagittaalliuutigaa. Naammagittaalliumminut ilanngullugu oqaatigaa allaaserisaq naqinneqartinnagu issuarneqarnermi eqqunngitsuunera aviisimut erseqqissaatigisimagaluarlugu.
qinngornera	3	R2	123			x				@OBJ>	Silaannarmik mingutsitsisup gassip, kuldioxid-ip seqernup qinngornerata kissassusaa tigummisarpaa, soorlu illup naatitsiviusup seqernup qinngornera tigummisaraa.
ernera	3	R7	65				x			@SUBJ>	tassa Anna, taassuma ernera angusimasoq.
nipeqarnera	3	R7	1680				x			@OBJ>	maskiinap qanoq nipeqarnera eqqaamavara.
ernera	1		123							@i-N<	"illit tassaavutit ernera asasara."
ineriartornera	3	R15	123				x			@OBJ>	allattariaatsip ineriartornera Hans Egedep 1721-mi nunatsinnukarnerata kingunerivaa.
kaajallannera	3	R7	65				x			@SUBJ>	nigallip kaajallannera 6 centimeteriuvoq.
sajunnera	3	R7	65			x				@SUBJ>	nunap sajunnera richterskalamik uuttorlugu 6-iuvoq.
sapaatip-akunnera	3	R1	123							@SUBJ>	sapaatip-akunnera 26-mi feeriarpoq.

Extended corpus

The extended corpus consists of all sentences containing the first 44 occurrences of possessives of the *aallarnerami* type in Steenholdt 2001. Other parts of the extended corpus (Oqaasileriffik 2018f) are not listed here.

Column 1 shows the number of the possessive referred to in the discussion about how to adjust the rules. Columns 2 and 3 show the period and word in question. Columns 4 and 7 show the correct possessor and mapping, respectively. Columns 5 shows which rule is disambiguating the

possessive in the new grammar, before the adjustments are implemented. Column 6 shows which possessive is chosen by the old grammer.

Color codes for the chart:	
red	wrong disambiguation
yellow	correct disambiguation after adjustment of rule
orange	no disambiguation
cyan	no disambiguation after adjustment of rule

number	sentence	word	possessor	new rule	old rule	mapping
1	Oqaluttuassama qanoq ingerlasimanera tamaat ataatsimut takorluuleraangakku paasisorilersarpara angutip taassuma kinaanersumit suliassinneqarluni Jamesimik naapitsinissara suleqataaffigisimagaa.	ingerlasimanera	3	R7	1	@OBJ>
2	Nunani allani kiattuniikkaangama pisarnera malillugu kiagulaaqaanga.	pisarnera	3		1	@OBJ>
3	Illorsuit portusoorsuummata alanngortarissaarlutillu, nillataarnersiugaralugit aqqusaartarpakka, seqerngulli tamakku akornisigut saqqersimasai tikikkaangakkit tuaviusukaaginnaq inuppassuit akornisigut ingerlalertarnera ingammik kiakkiutigisarlugu.	ingerlalertarnera	1		1	@OBJ>
4	Taamaasiornera tupaallaatigigunarlugu ileqimisaariarluni nilliallariarlunilu nerisassat allattorsimaffiat tigusinnarlugu qimappaanga.	Taamaasiornera	1		1	@OBJ>
5	Viinnisugara nungullannguarnagu tuaviusukaaginnaq neriniartarfimmit aniartorpunga, akuttunngitsunnguanillu kingumut qiviartarpunga, isit uannik malersuisut inuttaata sumukarnera arajutsinaveersaarlugu nakkutinnguatsiarmanga.	sumukarnera	3	R15	3	@OBJ>
6	Taama sivisuatsiaamik ingerlareerlunga takusassarpassuillu akornisigut ingerlalerama kingorna tupigilluinnakkannik susoqarsimanera puigorluinnarpara, tassalu ulloq manna tikillugu eqqumiigilluinnartagara.	susoqarsimanera	3	R9	1	@OBJ>
7	Qimaallungaana ersinermillu kingumut qiviallaallunga “ersinartoqarfik” qimarratigigiga, soorliuna tassanngaannaq	susoqarnera	3	R9	1	@OBJ>

	susoqarnera puigorluinnarsimagiga?					
8	Ataatsimeeqataanera puigorluinnarpara.	Ataatsimeeqataanera	1	R12	1	@OBJ>
9	Soqutiginngitsuusaarluguli aniartornera unitsiinnarlugu allamut sangoriataarpunga allakkanillu nakkartitsisarfiup tungaanut aallarlunga, una tunuinnagu sanimukannerli isima teqeqquisigut isigalugu.	aniartornera	1	R18	1	@OBJ>
10	Soorunami arnap kialluunniit soqutiginnilluni qiviarnera akinngitsuugassaanngilaq, inussiarnersumillu kiinnerlunga toqqarluni qiviaranni inussiarnersumik akinngilaanga, kiinnili soorlu alaamisikkaa arnap angummit ilisarisimanngisaminik qaninniarfigineqartup pissusilersuutigisartagaa malillugu.	qiviarnera	3	R7	1	@SUBJ>
11	Matup silataaniippoq angut siornatigut takusimanngisara, suliannulli tunngasunik inuppassuarnit taamatut orninneqartarama pisarnera malillugu ilassivara, oqaaseqaranili uninngaannalermat inussiarnersumik qungujuffigalugu iseqquara.	pisarnera	1	R18	1	@OBJ>
12	Atuakkamik matuminnga atuartussanut ajuusaarutigivallaarnagu nalunaarutigeriissavara, soorunami neriorsuisimanera malillugu qanoq iliuuseqartussaagaluarnera unioqqutikkakku, taamaattumik allagaarannguit imarisaat tamakkerlugit kimillu allagaanersut isertugaalluinnarmata atuakkami uani atia allanngortippara.	neriorsuisimanera	1		1	@OBJ>
13		iliuuseqartussaagaluarnera	1		1	@OBJ>
14	Allakkat atuareerlugillu takornartamik ilaqarnera puigorluinnarpara, misigaanga annilaarnermik silaannarmut isigilersimallunga, tupatsitaanerali nuannaarninngulerpoq, Japhet suli inuuvoq!	ilaqarnera	1	R18	1	@OBJ>
15		tupatsitaanerali	1	R12	1	@SUBJ>
16	Tuparujussuarnerup kingorna nuannaarpalulernera angutip takornartap malugisimagunarlugu silaannarmut nakkussinera, ilami takorluuillunga paatsiveerutileraluarnera kipitippaa, assakkut tigullunga issiaviup tungaanut nusukarlunga aallarussimagaminga, takusinnaavaralu kiinni nuannaarpalunnerulersimasoq uannut paatsuugassaajunnaarlugu nittaraa.	nuannaarpalulernera	1		1	@OBJ>
17		nakkussinera	1	R15	1	@CL-<CIT

18		paatsiveerutileraluarnera	1		1	@OBJ>
19	Sumi naapissinnaavakkit, piareersarnerami naammasseriarukku kalerrittariaqassagakkit?”	piareersarnerami	1		CAU	@OBJ>
20	Nikuikkaluarama suli iluamik „silattunngilanga”, ilami tupatsitaanera ima angitigaaq allaat tusagara taama nutaatigisoq upperilersinnaanagu.	tupatsitaanera	1		1	@SUBJ>
21	Kisiannili apeqqut akisinnaanngisara, tassa siullermik pilersaarutigiligara angutip ikiorniakkama akuersaarsinnaanera.	akuersaarsinnaanera	3	R7	3	@i-N<
22	Taama eqqarsarujoortillunga eqqaariasaalerpara Nunatta napparsimavissuani nakorsamik ilisarisimasaqarnera.	ilisarisimasaqarnera	1	R7	1	@<OBJ
23	Illuatunginni quinartussarsiorluniaasiit oqaluppalutsillugu sumik siunertaqarlunga sianernerma aserulernera maluginialerpara, taavali eqqaariasaarpara angummik ataatsimik marluulluta ilisarisimasaqaqatigiilluta.	aserulernera	3	R7	3	@OBJ>
24	Saninnummi pigaluarmat qivianngilara, nakkutaralu nakkuttuarpara aapparma nakkutama tungaanut nakkussilernera tikillugu.	nakkussilernera	3		1	@OBJ>
25	Taamali neriullualernera allarluinnarmut sanguteriataarlugu qanoruna oqalersoq?	neriullualernera	1	R13	3	@OBJ>
26	Tarnip pissuusiinik ilisimasaqartorsuunngikkarluarlunga, taamaattoq naatsorsuutigereersinnaasoraara inuup kialluunniit angutitut issumatut misigisaqarsimasup pissutsit taamaaleratarsinnaasut naatsorsuutigeriikkani uterfigeqqissinnaajunnaarluinnarsimassagai allatullu iliorluni qimatserisariaqalissalluni, uangalu tamanna kissaatiginngilluinnarpara, allaat nammineerluni inuunerminik kipititsisinnaanera inuilleqqissinnaaneralu eqqarsaatigalugit.	kipititsisinnaanera	3		1	@OBJ>
27		inuilleqqissinnaaneralu	3		1	@OBJ>
28	„Ulluni qaninnerpaani orneqqissavakkit, ajornanngippat, nassuiaanera aallaavigalugu paasinngutsiarpat ineeraq avissaaqqusimasoq sivikitsumik atugassaq maani pisariaqartikkipput, tamannalu illit pisinnaasat naapertorlugu isumagisinnaagit naatsorsuutigissavara”, anilerlunga kingumut saallugu oqarfigaara, tassalu anillunga.	nassuiaanera	1		1	@OBJ>
29	Taamaasiorsimanera eqqaalerakku tuaviinnaq puussiamit qallulerpakka nillataartitsivimmilu inigisimasaannut	Taamaasiorsimanera	1		1	@OBJ>

	peqqissaarutivillugit ilioqqalerlugit.					
30	Angerlamut apuukkama pisarnera malillugu angalassagaangama siulliullugit isumaginiartakkakka isumaginiarpakka.	pisarnera	1	R18	1	@OBJ>
31	Ilami ilaanneeriarlunga nuliannullu nalunaarutimininnguamik allannissannulluunniit piffissaarukkaangama, Kangerlussuarmiinneralu sivikippallaaraangat nuliara nalunaarfigisinnaaneq ajorpara, aatsaallu København nimi hotellissannut inissereeraangama sianerfigisarpara sumiinnera nalunaarutigalugu.	Kangerlussuarmiinneralu	1		1	@SUBJ>
32		sumiinnera	1		1	@OBJ>
33	Taxartuma pisarnera malillugu timmisartoqarfimmut aallarullungalu aperaanga aamma ualikkut timmisartoqartalersimanersoq.	pisarnera	3	R15	3	@OBJ>
34	Apeqqarinnersua qinnguummiuteqaara, qinnguummernerali paasitikkumanagu inussiarnersumik oqarfigaara angallateeqqamik Qeqertarsuatsiaanukaatsinniarama, unnukkullu silaginnerusarmat aatsaat aallariartorlunga.	qinnguummernerali	1		1	@OBJ>
35	Qujanartumik ulinngammat umiarsuaarakorsuarmut aqqarniarnera imannarsuaq ilungersuanartoqartinnagu aqqareerama aappara malillugu aallarpunga, sivitsulaartorlu tikillugu.	aqqarniarnera	1		1	@OBJ>
36	Taava uanga paarlaannarlugu aqup tungaanut ingerlapallappunga, orsualu milleriarlugu maskiinap gearimiinnera peerpara unitsillugulu.	gearimiinnera	3	not disambiguated		
37	„Aasipalaarsuarmiaasiit", nipituumik oqarpunga, tassamiaasinuna plastikkersuaq qernertoq sarpimmissimagipput, taassumalu motoorip nillusaasuata immamik milluaanera milikartilluinnarsimagaa nipiliorterujussualerlugulu.	milluaanera	3		1	@OBJ>
38	Motoorip taamatut unikkiartuaarluni naggataagut univinnera siornagut misigisaqarfigereersimavara.	univinnera	3	R18	1	@OBJ>
39	Nalunngilara kangerluup taassuma piumalleraangami „kigutiminik" takutitsisarnera, tassa tinimuumik ulimuumilluunniit aallartitsilluarsimalluni avannermik akornusersorneqaleraangami mallerluni atoruminaalluinnalersartoq, massa imartat kujatiminiittut avannaminiittulluunniit qatsungaarlutik	takutitsisarnera	3		1	@CL-<CIT

	atoruminarluinnaraluartut.					
40	Taamatulli eqqarsaraluarnera nammineerlunga naqqippara ima isumaliulerama, inuup nallinnartup allanit ikiorneqarani inuillu ilaannaannilluunniit takuneqarani inuunermi sinnerata qanoq ingerlasariaqarneranik aaqqissuussilersimasup, kangerluk kikkunnit tamanit angallavigineqartuartoq uninngaarfissamitut, immaqalu toqquvissamitut qinersimanavianngikkaa.	eqqarsaraluarnera	1	R18	1	@OBJ>
41	„Unnummut naapillugu qanoq isikkoqalersimanera takussanerpara? Takunngitsuuginnassanerpara? Qimaasoorutigiinnassanerpara?”	isikkoqalersimanera	3		1	@OBJ>
42	Aquuteralaap ingerlarpalunnerata ilaanni erinarsuutaasinnaasunut sunulluunniit taktilersuisutut tusarnersumik siutinnut aallartitsisaraluarnerata eqqarsaatikka nuannernerulersinniartaraluarai, taamaattoq kipitinneqartuarput, angutip maanna ujarniakkama nalunngisamalu oqaluttuartarnera eqqarsaatinni nipitunerujussuanngortarmat.	oqaluttuartarnera	3	R7	3	@SUBJ>
43	„Naamik, tassa uanga ullumikkut suliassara tamaanga killeqarallarpoq, suliassap sinnera illit kisimiillutit isumaginiarukku ajunnginnerussaaq.	sinnera	3	R7	3	@SUBJ>
44	Motoorini aallartippaa immalli ikkaliallappallaarsimanera pissutigalugu uteriartorsinnaannginnamili iputimi aappaa tiguaa immallu naqqa toortarlugu umiatsiani kinguporsortilerlugu.	ikkaliallappallaarsimanera	3	not disambiguated		@OBJ>

Liv Molich
Department of Language, Literature & Media
Institute of Culture, Language & History
Ilisimatusarfik, University of Greenland

Appendix VII: Abbreviations

CG Constraint Grammar, refers to CG-3.

DM Derivational Morpheme. See appendix I.

FST Finite State Transducer.

GCG Greenlandic Constraint Grammar. See appendices I, II, III, IV and V.

GFST Greenlandic Finite State Transducer.

PoS Part of Speech. See appendix I.

A) Example taken from *Ataqqinartuaraq* (Kleist et al. 2007).

C) Corrections to the rule.

R) New rule written for the GCG.

T) Example taken from *Tarrarsuummi Tarraq* (Korneliussen 1999).

U) Example taken from *Ukiut Trettenit Qaangiummata* (Vebæk 1992).

X) Real life examples or examples from the extended corpus.