Distributive Possessors in Swedish and Norwegian: Binding, Agreement, and Quantification

Helge Lødrup
University of Oslo

Raj Singh
Carleton University

Ida Toivonen
Carleton University

Abstract

The Scandinavian languages employ an unusual device for expressing distance distributivity: they make use of prenominal distributive possessors. These distributive elements appear, at least historically, to be composed of a distributive quantifier and a reflexive possessor. All Scandinavian languages have distributive possessors, but they display some interesting differences across language varieties. Two varieties from Norwegian and Swedish are specifically considered here. We outline similarities and differences between the distributive possessors having to do with agreement, (in-)definiteness, binding, and other linguistically significant properties. We suggest that their interpretive similarities follow from the assumption that they both have the semantics of Skolemized Choice Functions; this assumption makes sense of the fact that they are interpreted as indefinites and as bound variables. We furthermore argue that their main morphosyntactic differences boil down to whether the distributive expression consists of two lexical items or one, following an idea in Vangsnes (2002a,b). Specifically, we propose that the differences follow from the assumption that the Norwegian distributive possessor is a syntactically more complex DP than the Swedish one (the Norwegian variant contains an additional QP that hosts the distributive element).

1 Introduction

The Scandinavian languages have two options for expressing *distance distributivity*: they can use a numeral/indefinite followed by a common noun followed by a distributive element, as illustrated in the Swedish example in (1), or they can use a prenominal distributive possessor (Przepiórkowski & Patejuk 2013; Dotlačil 2012; Zimmermann 2002, a.o.), as illustrated in the Swedish example in (2). Throughout the paper, we mark each Swedish example with an (S) and each Norwegian example with an (N) at the end of the translation line.

(1) Pojkarna har ätit **ett** äpple **var**.
boys.DEF have eaten one apple each
'The boys have eaten one apple each.' (S)

(2) Pojkarna har ätit **varsitt** äpple.
boys.DEF have eaten each.3REFLPOSS.NEUT apple
'The boys have eaten one apple each.' (S)

These constructions are said to express 'distance distributivity' because the sentences are interpreted as something like 'each of the boys has eaten an apple' even though the distributive elements *var* and *varsitt* are far away from the subject *pojkarna* 'boys.DEF'. The strategy in (1) is far more common cross-linguistically (witness the English *a book each*). The focus of our paper is distributive possessors, which are typologically uncommon (but see Dubert & Galves 2016, 422 on Galician).

According to standard criteria for constituency, *varsitt äpple* (containing the distributive possessor *varsitt*) is a syntactic constituent. For example, it can be topicalized as in (3):

(3) Varsin   bok har de läst.
    each.3REFLPOSS.COM book have they read
    'One book each, they have read.' (S)

Examples that include distributive possessors involve matching the so-called *sorting key* (the boys) and the *distributed share* (apple) at a distance, similar to binominal *var* 'each' in (1). This explicit matching differentiates distributive possessor phrases from other similar expressions that also include distributive quantifiers:

(4) Varje pojke har läst en bok.
    each boy   has read a   book
    'Each boy has read a book.' (S)

(5) Hon läste varje bok   noggrant.
    she   read each book carefully
    'She read every book carefully.' (S)

Sentences with distributive possessors are very similar in meaning to examples such as *Each boy read their book*, where the second NP has a possessor that is bound by the quantified first NP.

Even though distributive possessors are cross-linguistically rare, they occur in all the Scandinavian languages, where they display interesting morphological and syntactic variation. See Faarlund et al. 1997, 207-8, Vangsnes 2002a,b on Norwegian, Teleman et al. 1999, 387-89, Hultman 2003, 120-21 on Swedish, Thráinsson 2001, Sigurðsson et al. Forthcoming on Icelandic, Thráinsson et al. 2004, 129 on Faroese, and Allan et al. 1995 on Danish.

In this paper, we describe and compare distributive possessors in two of the Scandinavian varieties, which we call Standard Swedish and Eastern Norwegian. Norwegian splits into two major dialects that differ in several ways when it comes to distributive possessors (Vangsnes 2002a,b). The Norwegian dialects that we do not discuss are more similar - but not identical - to Swedish in relevant respects. We make sporadic reference to variation that reaches beyond Standard Swedish and Eastern Norwegian, but we wish to stress that this paper is not intended to be a full dialectal survey of distance distributivity in Swedish and Norwegian.

2   The distributive possessor

The distributive possessor consists of a distributive quantifier *hver/var* 'each' and a possessive pronoun. In Norwegian, its first part *hver* is the regular distributive quantifier that translates to *each* in examples such as *hver gutt* 'each boy'. Swedish is different in this respect. In modern Swedish, the regular form for the prenominal

distributive quantifier is the uninflected *varje*. Prenominal *var* occurs as well, but only rarely. It can be found dialectally, in older texts, and in certain expressions (e.g. *var sak på sin plats* 'each thing in its place').

In Norwegian, the quantifier *hver* and the possessor are written separately, whereas they can be written separately (*var sin*) or together (*varsin*) in Swedish. We write the Swedish distributive possessor as one word throughout the paper, except we follow the authors in attested examples.

In example (2) above, the sorting key is a subject and the distributed share is an object. However, the NPs can also occur in other positions. The sentences in (6–7) below illustrate the sorting key and the distributed share in various clausal positions.[1] The sorting key phrases are in boldface, and the the distributed share phrases are in small caps. The sorting key phrase is usually a plural NP or pronoun, but it can also be a group-denoting noun, as in (6b):

(6)   a.   **Elevene**   presenterte fakta om   HVER   SIN
            students.DEF presented   facts about each.COM 3REFLPOSS.COM
            PLANET.
            planet
            'The students presented facts about one planet each.' (N)

      b.   **Samboerpar**   ble pålagt   å ligge i HVERT
            cohabitant.couple was instructed to lie   in each.NEUT
            SITT   ROM.
            3REFLPOSS.NEUT room
            'A cohabitant couple was instructed to have separate rooms.' (N)

      c.   Du bør   gi   **dem** HVERT   SITT   BUR.
            you ought.to give them each.NEUT 3REFLPOSS.NEUT cage
            'You should give them one cage each.' (N)

(7)   a.   **Tre   lyckliga vinnare** får i   veckan   nycklarna till
            three happy   winners get in week.DEF keys.DEF to
            VARSIN   FORD THUNDERBIRD 1955.
            each.3REFLPOSS.COM Ford   Thunderbird   1955
            'Three lucky winners will this week get the keys to one 1955 Ford Thunderbird each.' (S)

      b.   Efter denna kanonad   stannar matchen   av och avslutas med
            after this   bombardment stops   game.DEF off and finishes with
            ytterligare VARSITT   MÅL för **de båda lagen**.
            additional each.3REFLPOSS.NEUT goal for the both   teams.DEF
            'After this bombardment, the game finishes with one additional goal each for both teams.' (S)

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[1]Almost all of the examples in this paper are attested examples retrieved from the world wide web, either directly with Google, or indirectly through corpora of web texts. Some examples have been shortened or modified slightly, but not in a way that is relevant to the points we make.

   c. Jag gav **dom** VARSIN   MOROT.
       I   gave them each.3REFLPOSS.COM carrot
       'I gave them one carrot each.' (S)

The examples above show that neither the sorting key nor the distributed share is tied to a particular phrase structural position or grammatical function. The distribution is not unrestricted, however; we will return to this in Section 2.5 below.

2.1 Agreement

The distributive possessor displays richer agreement in Eastern Norwegian than in Swedish. In Eastern Norwegian, both the quantifier and the possessor agree, but only the possessor agrees in Swedish.

In Eastern Norwegian, the quantifier agrees with the distributed share. The possessor agrees both with the sorting key and with the distributed share. These facts are illustrated in 8–9 and discussed immediately below:

(8)   Guttene fikk **hver**   **sin**   sykkel.
       boys.DEF got each.COM 3REFLPOSS.COM bike(COM)
       'The boys got one bike each.' (N)

(9)   Vi fikk **hvert**   **vårt**   bord.
       we got each.NEUT our.NEUT table(NEUT)
       'We got one table each.' (N)

The possessor agrees with the sorting key in person and number, a case of index agreement (Wechsler & Zlatić, 2000). In (8), it agrees with the third person *guttene* 'boys.DEF', and in (9) with the first person plural *vi*. Note that the Scandinavian languages have separate reflexive forms in the third person only; the first and second person forms are used both reflexively and non-reflexively.

The possessor also agrees with the distributed share in gender and number, a case of concord agreement (Wechsler & Zlatić, 2000). It agrees with the common gender noun *sykkel* 'bike' in (8) and with the neuter *bord* 'table' in (9). The quantifier also agrees with *sykkel* and *bord* in gender. When the distributed share is plural, as in (21) below, the morphologically unmarked common gender form is used.

Compare Eastern Norwegian (8–9) to the parallel Swedish in (10–11):

(10)   Pojkarna fick **varsin**   cykel.
        boys.DEF got each.3REFLPOSS.COM bike(COM)
        'The boys got one bike each.' (S)

(11)   Vi fick **varsitt**   bord.
        we got each.3REFLPOSS.NEUT table(NEUT)
        'We got one table each.' (S)

In (10–11), the Swedish possessor agrees with *cykel* 'bike' and *bord* 'table', but the quantifier *var* does not.[2]

Outside the distributive possessor construction, both Eastern Norwegian and Swedish possessive pronouns show index agreement with the possessor. Similarly, the prenominal quantifier *hver/var* agrees with the noun it quantifies outside the distributive possessor construction (in Swedish this is the case only when the quantifier is *var*; the distributive quantifier is usually the non-inflecting *varje*, as in (4)–(5) above).

2.2 Definiteness

Possessive NPs are in general definite (Lyons 1999, 1.2.4, Barker 2000; Peters & Westerståhl 2013), but distributive possessor phrases seem to not be: they can occur in contexts normally restricted to indefinites. One example is the object position in presentational sentences, as in Eastern Norwegian (12) and Swedish (13):

(12) Det ble overrakt dem **hver   sin   medalje**.
     it was given   them each.COM 3REFLPOSS.COM medal
     'They were given one medal each.' (N)

(13) Det ligger **var sin   skattkarta** till barnen   redo
     there lies   each 3REFLPOSS.COM treasure.map to children.DEF ready
     hemma.
     home
     'There is one treasure map each for the children at home.' (S)

The distributive possessor phrases cannot felicitously be exchanged for possessive or other definite NPs in (12–13). The indefinite nature of Scandinavian distributive possessor phrases is unsurprising in light of the fact that distance distributivity marking cross-linguistically appears on indefinite NPs (Safir & Stowell, 1988; see also Milačić et al., 2015 as well as Section 3.2 below for an attempt to explain this generalization).

In Swedish, some dialects allow the indefinite article, homophonous with the numeral 'one', to precede the distributive possessor: *en varsin* and *ett varsitt*.

(14) Alla barn   får ett paket   med **en varsin**   bok i.
     all children get a   package with one each.3REFLPOSS.COM book in
     'All children receive a package with one book each in it.' (S)

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[2]Examples of quantifier agreement in Swedish occur but are infrequent (i). Hultman (2003, 120) refers to quantifier agreement in distributive possessors as hypercorrection.

(i) Sedan gav brudgummen oss vartsitt   kuvert   med pengar i!
    then gave groom.DEF   us each.NEUT.3REFLPOSS.NEUT envelope with money in

    'Then the groom gave us one envelope each with money!' (S)

Regardless of whether *en/ett* is interpreted as an indefinite article or the number 'one', *en/ett* phrases are indefinite. Examples similar to (14) but with the definite article *den/det* instead of *en/ett* do not occur: **den varsin bok*.

Other Swedish dialects have reanalyzed *varsin* and *varsitt* as *vars* plus the indefinite article (or the numeral 'one'): *vars en* and *vars ett*. An example is (15):

(15) Alla elever ska ha **vars**   **en bok**.
      all   pupils shall have each.GEN one book
      'All pupils must have one book each.' (S)

These dialects, which seem to be spoken mainly in Scania, also have *vars två* 'each.POSS two', *vars tre* 'each.POSS three', etc.:

(16) Till sist gick vi till Andrahandsbokhandeln   där vi båda hittade
      to   last walked we to Second.hand.bookstore.DEF there we both found
      vars   två böcker.
      each.GEN two books
      'Finally, we went to the second hand book store, where we both found two books each.' (S)

The fact that the dialectal forms include *en/ett* and (other) numerals further indicates that the distributed share is indefinite in Swedish.

2.3 Attributive adjectives

Both Norwegian and Swedish have a distinction between what is traditionally called 'weak' and 'strong' adjective declension. The former is used in definite NPs, and the latter in indefinite NPs, as shown in Norwegian (17) and Swedish (18). This is typically considered to be definiteness agreement. We will use the terms definite and indefinite about these adjective forms. Definite adjectives do not agree in number or gender.

(17) a. den   **lange**   boken
         the.COM long.DEF book.DEF
         'the long book' (N)

      b. min   /sin   **lange**   bok
         my.COM /3REFLPOSS.COM long.DEF book
         'my long book' (N)

      c. en   **lang**   bok
         a.COM long.INDEF.COM book
         'a long book' (N)

(18) a. den   **långa**   boken
         the.COM long.DEF book.DEF
         'the long book' (S)

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b. min /sin **långa** bok
my.COM /3REFLPOSS.COM long.DEF book
'my long book' (S)

c. en **lång** bok
a.COM long.INDEF.COM book
'a long book' (S)

In Norwegian, adjectives display definite forms in distributive possessor phrases (19), but in Swedish, adjectives display indefinite forms in distributive possessor phrases (20):[3]

(19) a. Vi leste hver vår **lange** bok.
we read each.COM our.COM long.DEF book
'We read one long book each.' (N)

b. Elevene lager hver sin **lille** skulptur.
studentsDEF make each.COM 3REFLPOSS.COM little.DEF sculpture
'The students made one little sculpture each.' (N)

(20) a. Vi läste varsin **lång** bok.
we read.PAST each.3REFLPOSS.COM long.INDEF.COM book
'We read one long book each'. (S)

b. De bär på varsin **liten** sändare
they carry on each.3REFLPOSS.COM little.INDEF.COM transmitter
och mottagare.
and receiver
'They carry one little transmitter and receiver each.' (S)

We will argue in Section 3.2 that *hver* is the source of indefiniteness in Norwegian distributive possessor phrases. Furthermore, we will argue in Section 3.1 that *hver* is the specifier of the DP containing the adjective and *vår* is the D head: $[_{DP}$ $[_{QP}$ *hver*$]$ $[_{D'}$ *vår lange bok*$]]$. Hence the adjective can be definite (because possessives are definite) even though the entire distributive possessive phrase is indefinite (once the contribution of "hver" is factored in). In Swedish *varsin* is the head of the DP containing the adjective, $[_{DP}$ *varsin lång bok*$]$, and is also the source of indefiniteness (again, see Section 3.2). Hence, the distinction between Swedish and

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[3]None of the Swedish speakers we have consulted accept definite adjectives in distributive possessor phrases. However, some attested examples do occur: the example below is from Ivar Lo-Johansson's (1985) *Frihet*, the fourth volume of his memoirs. Definite forms after *varsin* in Swedish are unusual, and we do not know what governs the variation.

(1) Vi drack varsin lilla kopp espresso.
we drank each.3REFLPOSS.COM little.DEF cup espresso
'We drank one small cup of espresso each.' (S)

Norwegian declensions follows from whether the source of indefiniteness heads the DP that hosts the adjective.

2.4 Number

Prototypically, a sentence with a distributive possessor has a singular distributed share. Teleman et al. (1999, 388) say that the distributed share is "normally" singular in Swedish. Searches in the Norwegian web-corpus NoWaC show that plural *hver sine* make up only 6.6% of the total number of 'hver lemma' + 'sin lemma'. Some speakers allow a plural noun preceded by a numeral as the distributed share. In this case, the numeral decides *how many Xs each* are intended.

(21) De har tenkt å male hver sine   to rom
they have thought to paint each 3REFLPOSS.PL two rooms

'They intend to paint two rooms each.' (N)

(22) Efter det kommer Italien och Tyskland med varsina   fyra
after it come Italy and Germany with each.3REFLPOSS.PL four
vinster.
wins

'After that come Italy and Germany with four wins each.' (S)

However, many speakers do not accept such sentences. In a query, the Norwegian (21) got an average acceptability score of about 2.5 out of 5, and its Swedish counterpart about 2.1. By comparison, all examples included in the survey that contained the singular *hver sin/varsin* received scores higher than 4.8.

Both Swedish and Norwegian allow sentences with the *one X each* interpretation to have a plural distributed share, as an alternative to a singular distributed share. Consider the Swedish example (23):

(23) Pojkarna gick till varsina   rum.
boys.DEF went to each.3REFLPOSS.PL rooms

'The boys went to one room each.' (S)

In example (23), the plural could be replaced by the singular without any change in interpretation. Even if a plural is possible, it is clear that the singular is the unmarked choice. In the query mentioned above, (23) had an average acceptability score of about 2.5 out of 5, and the corresponding Norwegian sentence about 3.

There is an interesting difference in interpretation between the Norwegian and the Swedish plural distributed share. In Swedish, the natural interpretation of *varsina X-pl* is 'one X each', even though the phrase is in the plural. In fact, the Swedish speakers we have consulted seem to think this is the only possible interpretation.[4] However, Norwegian speakers find the phrase ambiguous between 'one

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[4]There does, however, seem to be variation in Swedish concerning the interpretation of *varsina X-pl*. Hultman (2003, 120) gives the impression that Swedish is like Norwegian.

X each' and 'some Xs each'. There is no preference for the singular; if anything, the plural interpretation is preferred, unless context dictates otherwise.

2.5 Binding

A striking difference between Eastern Norwegian and Swedish concerns binding. Eastern Norwegian *hver sin* must be syntactically bound in the same way as the regular reflexive possessive *sin* (see Faarlund et al. 1997, 1154, Vangsnes 2002a), while this is not necessarily the case in Swedish. The question is then how the regular reflexive possessive is bound. Binding conditions are basically the same in the Mainland Scandinavian languages (but see Lundquist 2014 for some nuances). The regular reflexive possessive *sin* is the possessive of both the simple reflexive *seg/sig* and the complex reflexive *seg selv/sig själv*. The distribution of the regular reflexive possessive *sin* is therefore the union of the distribution of the simple and the complex reflexive. Its binding domain is the minimal finite domain (Hellan 1988, 59-79, Dalrymple 1993, 32-33). Somewhat more controversial is the question of possible binders. In our view, the Scandinavian literature on binding tends to be too restrictive concerning the options that actually exist. Without going into details, we would like to point out that not only subjects, but also objects are to some extent possible binders of regular reflexives (see e.g., Platzack 1998, 222-23 on Swedish, Lødrup 2008 on Norwegian); an example is (24). It is also true of Swedish and Norwegian *varsin* and *hver sin*; see examples (7c) and (6c) above.

(24) Jeg ga dem maten   sin.
       I   gave them food.DEF 3REFLPOSS.COM
      'I gave them their food.' (N)

In Eastern Norwegian, *hver sin* has the same binding domain as the regular reflexive possessive *sin*, namely the finite domain. Swedish *varsin* differs from its Eastern Norwegian counterpart in that it sometimes allows a binder that does not satisfy regular binding conditions. In some cases, the binder does not outrank *varsin*, as in (7b) and (13) above, and (25) and (26) (the latter from Teleman et al. 1999, 388). In other cases, the binder is not syntactically realized, as in (27).[5]

(25) **Var sin**   **kopp kaffe** lockade två lyssnare till Hasses
      each 3REFLPOSS.COM cup   coffee tempted two listeners to Hasse's
      lilla trädgårdshörna.
      little garden.corner
      'One cup of coffee each tempted two listeners to Hasse's little garden cor-
      ner.' (S)

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[5]By 'syntactically realized' we here mean *overtly* syntactically realized. The word *frukost* 'break-fast' in (27) presumably introduces (implicit) event participants, and the sentence asserts that there was a cup of coffee for each of them. Clearly, more would need to be said about what notion of "syntactic realization" this is, and how it relates to the binding theory in general.

(26) Jag gav **var sin**   **båt** åt mina bröder.
      I   gave each 3REFLPOSS.COM boat to my   brothers

      'I gave my brothers one boat each.' (S)

(27) Till frukost idag blev   det smörgås, och så klart
      to   breakfast today became it   sandwich and of course

      varsin   **kopp kaffe**.
      each.3REFLPOSS.COM cup   coffee

      'For breakfast today, there were sandwiches, and of course one cup of cof-
      fee each.' (S)

It is noteworthy that (26) is given as a regular example in the reference grammar of the Swedish Academy (Teleman et al. 1999, 388). The Norwegian variants of the Swedish sentences that do not satisfy standard binding requirements give the impression of being degraded. (Scattered Norwegian examples that violate binding conditions can be found in texts, but corpus searches indicate a real difference between Norwegian and Swedish.[6])

2.6 Diachrony

The diachrony of the distributive possessor construction has not been investigated. However, it seems plausible that its origin is sentences with 'each' as a floating quantifier (Faarlund et al. 1997, 207, Askedal et al. 2013, 102-3). Consider the Norwegian (28) - (29). Example (28) has *hver* as a floating quantifier, while example (29) is structurally ambiguous between an analysis with *hver* as a floating quantifier and *hver* as a part of a distributive possessor.

(28) Sjåførene   har hver   fått sin   rute.
      drivers.DEF have each.COM got 3REFLPOSS.COM route

      'Each driver has got his/her route.' (N)

(29) Sjåførene   har hver   sin   rute.
      drivers.DEF have each.COM 3REFLPOSS.COM route

      'Each driver has his/her route.' (N)

Sentences in which the floating quantifier precedes the object have likely been reanalyzed to yield the complex distributive possessor. Originally, the floating quantifier must have been the binder of the reflexive possessive, and triggered its agreement in person. The quantifier *hver* 'each' can only be third person. This means that the invariable use of third person *sin* as in Modern Swedish reflects the original situation while Eastern Norwegian person agreement with the sorting key

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[6]We searched for *hver sin* in the Norwegian web-corpus NoWaC. The first 200 hits contained one sentence with a clear violation of standard Scandinavan binding conditions. We then searched for *varsin* in the social media corpora at the Swedish Korp corpus collection. The first 200 hits contained twelve sentences with clear violations of binding conditions.

is an innovation. Other Norwegian dialects only use *sin*, see Vangsnes (2002a,b), and this is also the main rule in Danish, see Allan et al. (1995, §5.3.1.8). (Old Norse used the third person reflexive in related constructions with 'each', see Faarlund 2004, 283-84.) When the floating quantifier was the binder, it could not agree with the distributed share. Again, Eastern Norwegian shows an innovation, letting 'each' agree with the distributed share. Other Norwegian dialects only use the morphologically unmarked form (Vangsnes 2002a,b).

3 Analysis

3.1 Syntax

There are a number of reasons to consider Swedish *varsin* as one word and Eastern Norwegian *hver sin* as two. As mentioned above, Swedish *varsin* is often written as one word, while Eastern Norwegian *hver sin* is not. In addition, *varsin* lacks the direct connection to the regular distributive quantifier that Norwegian *hver sin* has: the regular prenominal quantifier is *varje*, not *var*, in Swedish. Dialectal pronunciations such as 'vassin' also indicate the word status of Swedish *varsin*.

The second part of Eastern Norwegian *hver sin* shares important properties with the reflexive possessive: (1) It agrees with the sorting key in person and number. (2) It triggers the definite form of the adjective. (3) It follows binding theory.

The *sin* in Swedish *varsin* lacks these properties. According to Teleman et al. (1999, 387), Swedish *varsin* is lexicalized. Vangsnes (2002b) similarly argues that *hver* and *sin* constitute one "lexical combination" in Norwegian dialects that show the Swedish agreement pattern, while Eastern Norwegian has the quantifier and the possessive as two distinct lexical items.

The assumption that Swedish *varsin* is lexicalized explains why 'sin' does not agree with the sorting key and why 'var' does not agree with the distributed share. This assumption also sheds light on the reanalyses in Swedish dialects that have reanalyzed *varsin* as shown in examples (14) and (15) above (with *en varsin* and *vars en* respectively) - this kind of reanalysis seems to presuppose a lexical unit as its point of departure.

Based on the morphological, syntactic, and semantic characteristics presented above, we assume that the Swedish distributive possessor is a single lexical unit where *sin* no longer functions as a possessor. In Eastern Norwegian, the quantifier and the possessor are two separate lexical items. Our analysis is inspired by Vangsnes's (2002a,b) analysis of distributive possessors in Norwegian dialects.

We follow a suggestion by Vangsnes (2002b) that the words in the separable *hvert sitt* occupy a QP in specifier position and a D^o head respectively, whereas the single lexical unit occupies a head position. We further draw upon the syntax for *every* proposed in Dalrymple (2001, section 8.2) and the analysis of pronominal possessors in Strunk (2004). Following Dipper (2005) and Spector (2008), we assume that quantifiers can be of different categories — Spector (2008) specifically proposes that they can be of the category D or Q. The lexical entries and c-structure

that we assume are given in (30–31). The subscript DD (for *Distance Distributivity*) in (31a) marks the entry for *hver* 'each' that is used together with a reflexive pronoun and associated with the relevant semantics.
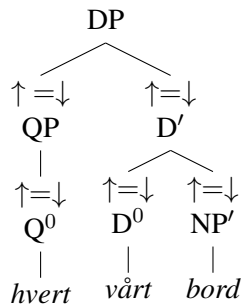
(30)   SWEDISH

varsitt	D	(↑ SPEC PRED)	=	'EACH'
		(↑ DISTRIBUTIVE)	=	+
		(↑ CONCORD NUMBER)	=	SG
		(↑ CONCORD GENDER)	=	NEUTER
		(↑ DEFINITE)	=	−

DP
|
↑=↓
D′

↑=↓　　↑=↓
D⁰　　NP
|　　　|
varsitt　*bord*
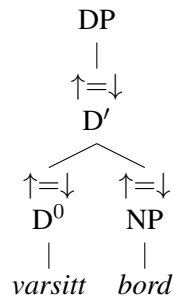
(31)   EASTERN NORWEGIAN

a.
hvert$_{DD}$	Q	(↑ SPEC PRED)	=	'EACH'
		(↑ DISTRIBUTIVE)	=	+
		(↑ CONCORD NUMBER)	=	SG
		(↑ CONCORD GENDER)	=	NEUTER
		(↑ DEFINITE)	=	−
		(↑ POSS REFL)	=	+

b.
vårt	D	(↑ POSS PRED)	=	'pro'
		(↑ POSS INDEX NUMBER)	=	PL
		(↑ POSS INDEX PERSON)	=	1
		(↑ CONCORD NUMBER)	=	SG
		(↑ CONCORD GENDER)	=	NEUTER
		(↑ CONCORD DEFINITE)	=	+

$$
\begin{array}{c}
\text{DP} \\
\diagup \qquad \diagdown \\
\uparrow = \downarrow \qquad \uparrow = \downarrow \\
\text{QP} \qquad \text{D}' \\
| \qquad \diagup \ \diagdown \\
\uparrow = \downarrow \qquad \uparrow = \downarrow \quad \uparrow = \downarrow \\
\text{Q}^0 \qquad \text{D}^0 \quad \text{NP}' \\
| \qquad\quad | \qquad | \\
hvert \quad v\mathring{a}rt \quad bord
\end{array}
$$

The Eastern Norwegian lexical entries contain more agreement information than the Swedish entry, reflecting the richer agreement marking in Eastern Norwegian. Distributive possessor phrases are indefinite in both Eastern Norwegian and Swedish. The Eastern Norwegian distributive possessor also contributes definite concord agreement, since it includes a possessive pronoun, and Norwegian possessive pronouns require definite concord on adjectives.

In Swedish, the semantics associated with distance distributivity is associated with a specialized lexical entry for *varsitt* (or *varsin*). Eastern Norwegian is more straightforward, since it makes use of words that exist independently – *hver/hvert* and possessive pronouns. However, the specific interpretation associated with distance distributivity only occurs when the *hver/hvert* co-occurs with a reflexive pronoun that is co-indexed with the sorting key. In our semantic proposal in Section 3.2, the distributed share is interpreted as a so-called 'Skolemized Choice Function'. This function is associated with *hver/hvert* precisely when it co-occurs with a possessive pronoun. We capture this formally by assuming that the relevant use of *hver/hvert* (31a) includes the specification ($\uparrow$ POSS REFL) = +. This equation adds a POSS grammatical function which needs to receive its PRED feature from some other lexical entry. The possessor is reflexive, which only allows *sin/sitt* in third person, assuming that other third person pronouns are marked ($\uparrow$ REFL) = −. Our analysis adds a [REFLEXIVE +] feature also to first and second person possessive pronouns which do not have morphologically distinct reflexive forms.

3.2 Toward a semantic analysis

Our discussion above imposes several demands on a semantic analysis of distributive possessor phrases like *varsin bok* and *hver sin bok*:

(32) a. They are indefinite noun phrases (even though there do not appear to be any $\exists$-denoting elements in them).

 b. They behave anaphorically (we need to find antecedents in order to interpret them).

 c. The antecedent is typically a universal quantifier denoted by a plural definite noun phrase (giving rise to a $\forall > \exists$ scope configuration).

We suggest that these demands can be naturally satisfied if we follow Milačić et al. (2015) in assuming that markers of distance distributivity denote Skolemized Choice Functions (SCFs). Roughly speaking, SCFs provide a formal means to 'pair' elements from one set with elements from another. For example, consider a sentence like *the boys ate an apple each*. Intuitively, the sentence is true if there is a way to pair each boy with an apple such that each boy ate the apple he is paired with. Milačić et al. (2015) argued that these truth-conditions (among other relevant facts) could be derived if *an apple each* denotes a pairing function of this kind. We propose that the requirements in (32) can be captured if we assume that distributive possessor phrases – like related phrases like the English *an apple each* or the Swedish *ett äpple var* – also denote SCFs.

Choice functions – Skolemized or not (see below for the distinction) – have been argued to play an essential role in the syntax and semantics of natural language indefinite noun phrases (Reinhart, 1997; Winter, 1997; Matthewson, 1999; Schlenker, 2006; Steedman, 2011, a.o.). We do not discuss their motivation here. What is important for our purposes is that SCFs simultaneously provide variables – and hence the possibility for anaphora (cf. (32b)) – as well as existential meanings without the use of existential quantifiers (cf. (32a)). Together, these formal tools combine in a phrase like *varsin bok* to take each element from some domain (usually given by a plural definite subject) and pair it with a book (cf. (32c)).

We now say a bit more about Choice Functions, just enough to illustrate their application to the semantics of distributive possessives. A *Choice Function* f is a way of picking elements from a set: given a non-empty set P, $f(P) \in P$. Letting f be a choice function variable, a formula like $read(Sara, f(book))$ is true if there is a way f of choosing from the set of books, $f(book)$, such that Sara read $f(book)$.[7] This is just a roundabout way of saying that the sentence is true if there is a book that Sara read. A *Skolemized Choice Function* is a way of mapping individuals to choices from a set. Specifically, given a sequence of individuals $d_1, \ldots, d_k$, and a non-empty set P, a SCF maps these inputs to an element of P: $f(d_1, \ldots, d_k, P) \in P$. Here we say the *arity* of the SCF is k (and hence a 'pure' Choice Function is a nullary SFC).

With this as background, consider a sentence like the Swedish *flickorna läste varsin bok* ('the girls read *varsin* book', i.e., 'the girls read a book each'). Recall from (32) that we need a semantic analysis under which (i) the sentence receives a $\forall\exists$ interpretation (i.e., a quantifier alternation with a universal quantifier outscoping an existential quantifier) and (ii) *varsin bok* behaves like a variable bound by the higher universal quantifier. The classic first-order logic representation for capturing

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[7]It is sometimes assumed that choice function variables are closed off by an existential closure operator at matrix level, such that the above formula would actually be a sentence $\exists f(read(Sara, f(book)))$. Note that by the definition of satisfiability, there is 'implicit' existential quantification over the choice function variable when the $\exists f$ is left off. Partly for this reason, and partly to reduce clutter, we omit the existential closure in our representations. Note also that *book* in our representation is really the characteristic set of the function $\lambda x.book(x)$, and so on for other aspects of our representation. We hope our abuse of notation does not lead to any material difficulties.

(i) does not readily give us the means to also capture (ii):

(33) $[\forall x : girl(x)][\exists y : book(y)](read(x, y))$

This representation does not explicitly indicate that the choice of book y depends on the choice of girl x. Furthermore, in thinking about the semantics of phrases like *varsin bok*, it is not clear which element(s) in this phrase might plausibly denote $\exists y : book(y)$ (or a generalized quantifier variant like $\lambda P.\ \mathbf{book} \cap P \neq \emptyset$, where **book** is the set of books).

   In contrast to this, consider an alternative representation like in (34):

(34) $[\forall x : girl(x)](read(x, f(x, book)))$

Here, unlike (33), there is no explicit existential quantifier (cf. (32a)). Instead, there is a SCF in the second argument of *read* that pairs each girl x with a book $f(x, book)$ (we can think of this, roughly, as *x's book*; cf. (32b) and (32c)).We can think of (34) as a 'Skolemized' variant of (33): one is satisfiable if and only if the other one is, but Skolemization eliminates explicit existential quantification and replaces it with the use of SCFs that explicitly mark the dependence of choices of books on choices of girls.[8] In this way, the representation in (34) acts like a function that 'pairs' elements of one set (the girls) with elements of another set (the books). The formula in (34) is true if there is a unary SCF f that pairs girls and books such that each girl x is paired by f with a book $f(x, book)$ that x read. For now, we assume no constraints on the function f. However, Milačić et al. (2015) suggest that the most natural reading is that it is a one-to-one function, and they note that Swedish arguably requires that it be one-to-one (Teleman et al., 1999).

   Our proposal is that Scandinavian distributive possessor phrases *hver sin N* and *varsin N* denote SCFs that pair each element of an antecedent set with some element in the set denoted by *N*. That is:

(35)   The denotation of *hver sin N* and of *varsin N* is $f(x, N)$.

With this assumption, let's see how the demands in (32) above can be met and how a representation like (34) can be compositionally derived for a sentence like the Swedish *flickorna läste varsin bok*. First, the existential quantificational force of distributive possessors comes from the assumption that these phrases introduce a SCF variable f which, recall, are undersood as existentials (either implicitly or explicitly – see Note 7). Second, there is a variable x inside the Skolem term $f(x, book)$. We assume that this variable is lexically specified as a bound variable (with possibly different binding domains in different languages). Furthermore, this variable is bound by the higher universal quantifier. For now, we have no way to *derive* the fact that the binder must be a higher universal quantifier that furthermore

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[8]Incidentally, one of the main motivations for Skolemization in the mathematical logic literature was to eliminate existential quantifiers (and hence reduce quantifier alternations) while retaining relevant semantic notions like satisfiability. See Buss (1998) for discussion.

is canonically given by a plural definite. This might be the place for a further lexical stipulation that x somehow associates with a covert distributive operator that turns plural definites into universal quantifiers (Note 9). We leave this matter unresolved for now and hope to return to it in future work (see also Section 4).

Consider now the compositional derivation of (34) for *flickorna läste varsin bok* ('the girls read varsin book'). The plural definite subject *flickorna* denotes a universal generalized quantifier over girls: $\lambda P_{et}.[\forall x : girl(x)]P(x)$.[9] The object *varsin bok* denotes a SCF $f(x, book)$; the fact that the Skolem variable x ends up being bound by the higher universal quantifier follows from the lexical assumption associated with *varsin* that its variable is an anaphoric element. Our discussion in Section 2.5 would suggest that the binding domain is the finite domain in Eastern Norwegian, and at least for the simplest cases in Swedish. Thus, assuming a standard lexical entry for *läste* (e.g., $\lambda y.\lambda z.read(z, y)$), the entire sentence composes to yield $[\forall x : girl(x)](read(x, f(x, book)))$, as desired (= (34) above).[10]

4   Discussion

We have presented a series of generalizations about the syntax/semantics of distributive possessors in Eastern Norwegian and Swedish. We have proposed that the syntax of these phrases is different in the two languages, and that Skolemized Choice Functions play an essential role in their interpretation. Here we end by highlighting some challenges that remain for our proposal.

It follows from our semantic analysis that the distributed share needs a sorting key. We noted earlier that the *canonical* sorting key tends to be the denotation of a plural definite noun phrase, but there are other possibilities (see examples (6b) and (7a) above, as well as Milačić et al., 2015). There are two challenges here: what makes plural definites canonical, and which non-canonical sorting keys are

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[9]In Milačić et al. (2015), we assumed with Heim et al. (1991) that a covert distributive operator D could apply to the Link (1983) style referential output of plural definites (the maximal object). In place of $\forall x : girl(x)$, then, we assumed the meaning was $\forall x \sqsubseteq MAX(Girl)$, where $\sqsubseteq$ is 'atomic-part-of' and $MAX(Girl)$ is the maximal element in the set $Girl$ ordered by the 'part-of' relation (following Link). One could alternatively assume an ambiguity in the definite itself: either it is referential, or it is a universal quantifier (something would need to be said about presuppositions). Another option is to leave the definite as a purely referential element, and pack the distributivity into the choice functional element instead. For example, a lexical entry like the following – along with suitably type-shifted variants for occurrences in non-canonical positions – would go quite far in capturing the data: $[[varsin]] = \lambda P_{et}.\lambda R_{<e,et>}.\lambda X_e.\exists f \forall x \sqsubseteq X(R(x, f(x, P)))$. This move is undesirable in part because plural definites can receive a distributive quantificational interpretation without *varsin*. There are other choice points as well, such as the actual type of the quantifier. In some treatments, quantificational noun phrases do not denote generalized quantifiers but instead take a variable and two open formulas as input (e.g., Heim, 1982; Dalrymple, 2001; see Heim, 1997 for relevant discussion). Here we simply note that there are many viable approaches for turning a plural definite into a universal quantifier, and we do not commit to any particular way of doing it.

[10]The verb and object combine to give $\lambda z.read(z, f(x, book))$, and these combine with the subject universal quantifier $\lambda P_{et}.[\forall x : girl(x)]P(x)$ to give the final result $[\forall x : girl(x)](read(x, f(x, book)))$.

allowed? Furthermore, there is cross-linguistic variation in exactly what a possible sorting key is. In Eastern Norwegian, for example, the relationship between the distributed share and the sorting key mirrors that of anaphors and their antecedent: the sorting key must outrank the distributed share. Specifically, the binding domain of *hver sin* appears to be identical to that of *sin*. The constraints on the Swedish sorting key are less strict, and the sorting key does not necessarily outrank the distributed share. The Swedish example in (36) is ambiguous: the gifts can distribute over the guest or the children. In other words, if there are three guests and four children, either three or four gifts were given. In the Eastern Norwegian equivalent, the gifts distribute over the guests, not the children.

(36)   Gästerna   gav   **varsitt**   **paket** åt barnen.
        guest.DEF gave each.3REFLPOSS.NEUT gift   to children.DEF
        'The guests gave the children one gift each.' (S)

Thus, as noted earlier, one might say that the binding domain of Swedish *varsin* is the finite domain in the simplest cases. However, in Swedish the sorting key is not necessarily included in the sentence at all; it can also be a referent retrieved from the context, as in (27) above. Here, just like when the sorting key is explicit, the implied sorting key is understood as a universal quantifier (for each person at breakfast today x), and the Skolem term pairs each such x with a cup of coffee ($f(x, C)$, where C is a (salient) set of coffee cups). Example (27) is ungrammatical if *varsin kopp kaffe* is replaced by a noun phrase with a regular reflexive possessor. Similarly, if *varsitt paket* in (36) is replaced by a noun phrase with a reflexive possessor (e.g., *sitt paket* 'REFL.POSS gift'), it is unambiguously bound by the subject in both Swedish and Eastern Norwegian.

We hope to put these facts into order and to relate them to our general assumption that *hver sin* is composed of two units while *varsin* is a single unit, as well as the assumption that Skolem term variables might be subject to different anaphoric constraints across languages. Having made assumptions about both indefinites and anaphora, we hope to connect the ideas sketched here to related work on the connection between indefinites and pronouns (e.g., Kamp, 1981; Heim, 1982; Groenendijk & Stokhof, 1991; Crouch & van Genabith, 1999; Dalrymple, 2001), and to embed choice-functional treatments of indefinites within glue-theoretic approaches to semantics (e.g., Dalrymple, 2001).

As but one step in this direction, consider the following proposal for the meaning constructor for Norwegian *hver* as it occurs in *hver sin bok*. Based on our earlier discussion, *hver* might plausibly denote $\lambda x_e.\lambda P_{et}.f(x, P)$ (the fact that the Skolem variable ends up bound would follow from the assumption that *sin* is co-indexed with the subject universal quantifier in the syntax, and that an anaphor that is co-indexed with a quantificational noun phrase that outranks it is interpreted as a variable bound by the quantifier). The glue side would seek a resource of the type supplied by *sin*, and would return an implication that seeks a resource of the type supplied by *bok* to return a resource y_σ (where y is the label for the F-structure for

the entire object DP *hver sin bok*). The rest of the composition would follow from standard assumptions (e.g., Dalrymple, 2001).

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