An HPSG Account of Relativization in Turkish Using Relational Constraints

Zelal Güngördü[*]   Elisabet Engdahl[†]

July 9, 1998

Abstract

In this paper we propose an HPSG account of the complex phenomenon of relativization in Turkish. Relative clauses in this language are prenominal and headed by a participle whose form depends on the existence of a genitive subject in the clause in the case of bounded dependencies and on two further factors, namely the grammatical function of the gap host and the gap, in the case of long-distance dependencies. Previous accounts have all been transformational. We present an account for this phenomenon in HPSG, making use of lexically specified MOD values, valency lists and non-local feature handling. We outline a comprehensive analysis that exploits relational constraints on lexical entries.

1   Introduction

Relative clauses in Turkish are prenominal and have verbal heads that are morphologically marked with one of a number of participle suffixes. There are two different strategies of relativization in Turkish, distinguished by the morphological marking on the verbal head of the clause (and its subject, if any), as exemplified in (1). (1a) includes a participle derived by the suffix '-yEn', whose subject is relativized and occurs as the head noun of the relative clause, whereas (1b) includes a participle derived by the suffix '-dIk', whose object is relativized. Notice that in the latter case, the subject of the clause is genitive marked and the participle takes a possessive suffix that agrees with the subject.

(1)   a. $[_{S_{[part]}} -_i$ kitab-ı   oku-yan]   çocuk$_i$
                           book-ACC read-PART child

              'the child who is reading the book'

        b. $[_{S_{[part]}}$ çocuğ-un $-_i$ oku-duğ-u]   kitap$_i$
                           child-GEN   read-PART-3sPoss book

              'the book that the child is reading'

Several accounts have been proposed in the literature which try to formulate the distribution of these two relativization strategies, all accounts so far being within the tradition of transformational grammar; for example, [Underhill, 1972], [Hankamer & Knecht, 1976], [Dede, 1978], [Csató, 1985], and [Barker et al., 1990] (see [Knecht, 1979] for an overview of the first three accounts). Here, we propose a purely lexical account of the phenomenon within HPSG, which we claim is empirically more adequate than the previous accounts,

---

[*]Department of Computer Engineering and Information Science, Bilkent University, 06533 Bilkent, Ankara, Turkey (zelal@cs.bilkent.edu.tr).

[†]Department of Linguistics, Göteborg University, Box 200, SE-405 30 Göteborg, Sweden (engdahl@ling.gu.se).

as well as being computationally more attractive.[1] Our analysis exploits the identifying morphology on verbal heads of Turkish relative clauses, and is based on an assumption that such clauses have lexically specified MOD values (encoded in the lexical entry of the verbal head of the clause). In addition, the analysis adopts a mechanism proposed by [Bouma & Nerbonne, 1994] that combines inheritance-based methods and relational constraints in describing (inflectional) morphology.

2   Bounded Relativization

The two relativization strategies in Turkish have traditionally been called *subject participle (SPc)*, with the suffix '-(y)En', and *object participle (OPc)*, with the suffix '-dIk', reflecting the correlation between the grammatical role of the relativized constituent and the choice of the relativization strategy; cf. [Knecht, 1979] and [Sezer, 1986]. This correlation is quite strong and seems to determine the choice of the strategy in cases like (2) (as well as (1) above), with bounded dependency.

(2)   a. $[_{S[part]} -_i$ kadın-ı   gör-en] adam$_i$ 'the man who saw the woman'
               woman-ACC see-SPc man

         b. $[_{S[part]}$ adam-ın $-_i$ gör-düğ-ü]   kadın$_i$ 'the woman that the man saw'
               man-GEN   see-OPc-3sPoss woman

(2a) is a case of subject relativization and the SPc strategy is used, with the corresponding suffix on the verbal head *'gör'*. And (2b) exemplifies object relativization, with an OPc suffix on the verbal head, as well as a possessive suffix which agrees, in person and number, with the genitive marked subject of the clause. This pattern of object relativization in fact applies to relativization of any non-subject constituent, including adjuncts. There are nevertheless cases where non-subject constituents are relativized using the SPc, apparently violating this generalization concerning the correlation between the grammatical function of the relativized constituent and the strategy to be used. Consider, for example, (3), where the locative adjunct NP *'house'* can be relativized using either the OPc, as in (3a), or the SPc, as in (3b).

(3)   a.   [her   gece $-_i$ bir çocuğ-un ağla-dığ-ı]   ev$_i$
               every night   a   child-GEN cry-OPc-3sPoss house
               'the house where a (certain) child cries every night'

         b.   [her   gece $-_i$ bir çocuk ağla-yan] ev$_i$
               every night   a   child cry-SPc house
               'the house where some child cries every night'

Note that the choice of OPc or SPc leads to different interpretations, with specific and nonspecific subject readings, respectively. This is due to the fact that genitive marking on subjects of non-finite Turkish clauses generally correlates with a specific reading of the subject.[2] Thus, one may argue that it is in fact the existence of a genitive marked subject in the clause that determines the particular relativization suffix on its verbal head (rather than the grammatical role of the relativized constituent), and that a genitive subject always induces the use of OPc, whereas the lack of such a subject leads to the SPc. Further evidence supporting this argument comes from Turkish 'impersonal passives', that is, 'subjectless' constructions formed by passivized intransitive predicates, as in (4).

(4)   Bu hava-da   deniz-e gir-il-ir.
         this weather-LOC sea-DAT enter-PASS-AOR

         'This weather is good to swim in the sea.'

---

[1] A shorter discussion of the analysis presented here can also be found in [Güngördü & Engdahl, 1998].

[2] For the interested reader, [Nilsson, 1985] provides a thorough discussion of the function of case marking in Turkish.

[Hankamer & Knecht, 1976] observe that relativization out of such constructions is only possible using the SPc (although it is – naturally – always a non-subject constituent that is relativized). (5), for instance, shows that the dative object NP *'denize'*, and the locative adjunct NP *'bu havada'* in (4) above are both relativized using the SPc.

(5)   a.   [bu hava-da $-_i$ gir-il-en]   deniz$_i$
                this weather-LOC   enter-PASS-SPc sea
                'the sea that this weather is good to swim in'

        b.   [$-_i$ deniz-e gir-il-en]   bu hava$_i$
                sea-DAT enter-PASS-SPc this weather
                'this weather which is good to swim in the sea'

It is clear from the discussion so far that in the case of bounded relativization, the existence/non-existence of a genitive-marked subject does play the main role in the choice of the relativization strategy in a clause. Next, we consider examples of long-distance relativization, before proposing an adequate pattern of relativization in Turkish.

3   Long-distance Relativization

In Turkish relativization is also possible out of embedded phrases of certain kinds such as relative clauses, possessive phrases, postpositional phrases, nominalization clauses, and non-subject infinitive clauses, resulting in structures with long-distance dependencies.

3.1   Relativization out of Relative Clauses

(6b) below is an example of relativization out of a relative clause, where the genitive subject, *'adamın'*, of the clause in (6a) has been relativized out of that clause, appearing as the head noun of a second relative clause surrounding the first one. The inner clause in (6b) consequently has two gaps while the outer one has none. Note that in the outer clause, which has a genitive-marked subject, the OPc is used, and that the inner clause retains the OPc marker and the possessive suffix on its verbal head, although it no longer has a genitive subject.

(6)   a.   Kadın [$_{S[part]}$ adam-ın $-_i$ oku-duğ-u]   kitab-ı$_i$ gör-dü.
             woman   man-GEN   read-OPc-3sPoss book-ACC see-PAST
             'The woman saw the book that the man read.'

        b.   [$_{S[part]}$ kadın-ın   [$_{S[part]}$ $-_j$ $-_i$ oku-duğ-u]   kitab-ı$_i$ gör-düğ-ü]   adam$_j$
                woman-GEN   read-OPc-3sPoss book-ACC see-OPc-3sPoss man
                'the man that the woman saw the book he read'

Consider now (7b), which is another example of relativization out of a relative clause. Note that in this case the accusative object of the clause in (7a) has been relativized, leaving again two gaps in the inner clause and leading to no further gaps in the outer one. The outer clause, as before, has a genitive subject and the OPc has been used.

(7)   a.   Kadın [$-_i$ kitab-ı   oku-yan] adam-ı$_i$ gör-dü.
             woman   book-ACC read-SPc man-ACC see-PAST
             'The woman saw the man who read the book.'

        b.   [kadın-ın   [$-_i$ $-_j$ oku-yan] adam-ı$_i$ gör-düğ-ü]   kitap$_j$
                woman-GEN   read-SPc man-ACC see-OPc-3sPoss book
                'the book such that the woman saw the man who read it'

There are three points to note about these two examples: First, the relativization of a second constituent out of the inner clause hasn't changed the strategy used in that clause before, in either of these examples (leaving it as OPc in (6b) and SPc in (7b)). Second, the choice of the strategy in the outer clause hasn't been affected by the strategy used in the inner clause (resulting in OPc in the outer clause in both cases). And third, neither has it been affected by the grammatical function of the constituent that has been long-distance relativized (i.e. subject in (6b) and object in (7b)).

Let us now consider the two examples of long-distance relativization given in (8b) and (9b). Note that in neither of these examples has the outer clause a genitive subject, and also that the strategy used in the outer clause in both cases is SPc. Note further that all three observations made above for (6) and (7) also hold true for (8) and (9).

(8)   a.   [$\_i$ Bitki-yi   yi-yen] insan-lar-da$_i$ alerji   tespit ed-il-di.
                plant-ACC eat-SPc person-PLU-LOC allergy determine-PASS-PAST
                'Allergy was diagnosed in the people who ate the plant.'

      b.   [[$\_i$ $\_j$ yi-yen] insan-lar-da$_i$ alerji   tespit ed-il-en]   bitki$_j$
                eat-SPc person-PLU-LOC allergy determine-PASS-SPc plant
                'the plant which allergy was diagnosed in the people who ate (it)'

(9)   a.   [İnsan-lar-ın $\_i$ ye-dik-leri]   bitki-de$_i$ zehir   tespit ed-il-di.
                person-PLU-GEN   eat-OPc-3pPoss plant-LOC poison detect-PASS-PAST
                'Poison was detected in the plant that the people ate.'

      b.   [[$\_j$ $\_i$ ye-dik-leri]   bitki-de$_i$ zehir   tespit ed-il-en]   insan-lar$_j$
                eat-OPc-3pPoss plant-LOC poison detect-PASS-SPc person-PLU
                'the people that poison was detected in the plant they ate'

Examples (6)–(9) all seem to support the previous claim on the correlation between the existence of a genitive-marked subject and the choice of the relativization strategy in the (outer) clause. Next, we provide some further examples which suggest that this choice is in fact constrained by an additional factor in certain cases of long-distance relativization.

The first case is exemplified in (10). The genitive subject, *'kadının'*, of the relative clause in (10a) has been relativized in (10b) using the SPc in the outer clause. The point to note about this case is that the genitive marking on the subject in the outer clause and the use of OPc strategy is ruled ungrammatical, as shown in (10c), although the subject (*'child'*) here *does* have a specific reading.

(10)   a.   [Kadın-ın $\_i$ sev-diğ-i]   çocuk$_i$ ağla-ma-ya   başla-dı.
               woman-GEN   cuddle-OPc-3sPoss child   cry-ACT-DAT start-PAST
               'The child that the woman was cuddling started crying.'

     b.   [[$\_j$ $\_i$ sev-diğ-i]   çocuk$_i$ ağla-ma-ya   başla-yan] kadın$_j$
               cuddle-OPc-3sPoss child   cry-ACT-DAT start-SPc woman
               'the woman who the child that she was cuddling started crying'

     c. * [[$\_j$ $\_i$ sev-diğ-i]   çocuğ-un$_i$ ağla-ma-ya   başla-dığ-ı]   kadın$_j$
               cuddle-OPc-3sPoss child-GEN cry-ACT-DAT start-OPc-3sPoss woman

The second case is exemplified in (11b), where the accusative object, *'bitkiyi'*, of (11a) has been relativized using the OPc in the outer clause, together with a genitive marking on the subject of that clause. Observe that (11c), which lacks a genitive marking on the subject and makes use of the SPc in the outer clause, is ungrammatical although the subject in this case is no further specific than the (nominative) one in (10b) above, and hence its obligatory genitive-marking doesn't seem to be due to semantic reasons at all.

4

(11) a. [_$_i$ Bitki-yi   yi-yen] çocuk$_i$ hastalan-dı.
              plant-ACC eat-SPc child   become sick-PAST
          'The child who ate the plant got sick.'

     b. [[_$_i$ _$_j$ yi-yen] çocuğ-un$_i$ hastalan-dığ-ı]   bitki$_j$
              eat-SPc child-GEN become sick-OPc-3sPoss plant
          'the plant which the child who ate it got sick'

     c. * [[_$_i$ _$_j$ yi-yen] çocuk$_i$ hastalan-an]   bitki$_j$
              eat-SPc child   become sick-SPc plant

We claim that the choice of the relativization strategy in the outer clause in these two examples is determined by the grammatical function of the gap in the inner clause which corresponds to the head noun of the outer clause. More specifically, we claim that the strategy used in the outer clause is SPc if that grammatical function is subject, as in (10b), and it is OPc otherwise, as in (11b).

What then is the difference between the (b) examples in (6)–(9) and the ones in (10)–(11) that makes the choice of the relativization strategy in the outer clause rely on different factors? Note that in cases of long-distance relativization, the inner clause is always either a constituent or part of a constituent (modifier in the examples so far) in the outer clause. Hereafter, we refer to that constituent of the outer clause as the 'gap host'.[3] Note further that in all the (b) examples in (6)–(9), the gap host is a non-subject constituent of the outer clause (i.e. an accusative object in (6b) and (7b), and a locative adjunct in (8b) and (9b)), whereas in (10b) and (11b), the gap host is the subject of the outer clause. It is exactly this difference in the grammatical function of the gap host, we claim, that determines which one of the two factors mentioned above plays a role in the choice of the strategy in the outer clause: i) the existence of a genitive-marked subject in the outer clause, as in (6b)–(9b), where the gap host is a non-subject constituent; or ii) the grammatical function of the gap,[4] as in (10b) and (11b), where the gap host is the subject.

One can then formalize the above discussion on the choice of the relativization strategy in long-distance relativization in the following way:[5]

(12)   a) if the gap host is a *non-subject* constituent then i) if there is a *genitive* subject in the clause, the OPc strategy is used, otherwise ii) the SPc strategy is used; or else
          b) if the gap host is the *subject* then i) if the grammatical role of the gap is *subject*, the SPc strategy is used, otherwise ii) the OPc strategy is used.

So, for example, in (6b)–(9b), the gap host is a non-subject constituent of the outer clause, and i) the OPc is used in the outer clause in (6b) and (7b), since there is a genitive subject in that clause (cf. (12ai)), and ii) the SPc is used in (8b) and (9b), since there is no such subject (cf. (12aii)). On the other hand, in both (10b) and (11b) the gap host is the subject of the outer clause, and i) the SPc is used in (10b), since the grammatical function of the gap is subject (cf. (12bi)) – and furthermore the use of OPc is ruled out as shown in (10c) – and ii) the OPc is used in (11b), since the gap is a non-subject constituent of the inner clause, that is, the accusative object (cf. (12bii)) – and the use of SPc is ruled out as shown in (11c).[6]

---

[3]We borrow the term 'gap host' from [Barker et al., 1990]. They define a gap host as the highest *nominal* in the relative clause dominating the gap. However, we use it in a broader sense here, which also includes possessive phrases, postpositional phrases, nominalization and infinitive clauses (as will become clear later in the discussion).

[4]In the rest of the paper, in cases with more than one gap, the word 'gap' always refers to the gap that corresponds to the long-distance relativized constituent (that is, the head noun of the outer clause).

[5] This pattern is based on a compilation of grammaticality judgements of 12 native Turkish speakers on 60 examples of Turkish relative clauses with long-distance dependencies.

[6]One may argue that what renders (11c) ungrammatical is in fact the fact that the dependencies between the gaps and the corresponding head nouns is intersecting in this case (cf. the Nested Dependency Constraint of [Fodor, 1978]). Notice however that both (7b) and (11b) are grammatical although they exhibit exactly the same kind of intersecting dependencies.

Until now, there have been two main (independent) proposals in the literature as to what determines in Turkish the relativization strategy in the outer clause in the case of long-distance relativization: i) the grammatical function of the gap (corresponding to the long-distance relativized constituent, i.e. the head noun of the outer clause), e.g. [Csató, 1985]; and ii) the grammatical function of the gap host, e.g. [Barker et al., 1990]. Notice that (12) takes both these factors into account as well as a third one, namely the existence of a genitive-marked subject in the outer clause. It may prove useful here to make a comparison between (12) and the account suggested by [Barker et al., 1990]. (12a), where the gap host is a non-subject constituent, is quite straightforward and is in line with the account by [Barker et al., 1990], except they analyze clauses with nominative subjects as *subjectless* (just like impersonal passives), claiming that such subjects undergo 'subject incorporation'. As for (12b), where the gap host is subject, we disagree with [Barker et al., 1990] on empirical grounds. They claim that there are two dialects with respect to the distribution of the OPc. In one of the dialects (their Dialect A) the OPc is ruled out in this case, hence the SPc is the only strategy to use, whatever the grammatical role of the gap is. In the other dialect (Dialect B), however, both strategies can be used again independent of the grammatical role of the gap. The grammaticality judgements of our informants (cf. fn. 5 above) have led us to reject the claim that the SPc can be used in this case when the grammatical role of the gap is non-subject (except for the cases in which the gap host is a nominalization phrase as we further discuss in Section 3.3). Turning to the possibility of the OPc when the grammatical role of the gap is subject, we have encountered a number of judgements in favour of this. We do not however see ourselves in the position of claiming the existence of two different dialects with respect to this particular case only, since those judgements are outnumbered by the judgements from the very same speakers on structurally similar examples that rule out the use of OPc in this case.

Note that (12) can further be generalized to cover the cases of bounded relativization as well. The only crucial point then is to assume that the gap and the gap host coincide. The case in (12bii) would then never arise, since the gap/gap host cannot both be the subject and a non-subject constituent at the same time. Thus, if the gap/gap host is the subject then only the SPc can be used (cf. (12bi)); and if the gap/gap host is a non-subject constituent then either the OPc or the SPc can be used, depending on whether there is a genitive subject in the clause or not (cf. (12ai) and (12aii), respectively). In the case of impersonal passives, (12aii) is the only case that arises (since there is no subject in the clause), and hence the SPc is the only possible strategy – in line with the empirical facts (cf. (5) in Section 2).

In this section, we presented several examples of (long-distance) relativization out of relative clauses in Turkish, and proposed a relativization pattern, (12), that covers all the examples of bounded and long-distance relativization considered so far. In the following sections, we turn to the cases of relativization out of possessive NPs, nominalization and infinitive clauses, and show that they are also in line with the predictions made by (12).

3.2   Relativization out of Possessive Phrases

Possessors in Turkish are genitive marked and agree with the possessive suffix on the possessed noun, in person and number; see, for instance, the bracketed NPs in (13a) and (14a) below. (13b) and (14b) show that it is possible in Turkish to relativize possessors out of the possessive phrases they occur in: the genitive possessor, *'adamın'*, of the corresponding (a) example in each case has been relativized, appearing as the head noun of the relative clause surrounding the possessive phrase. Note that in (13b) there is a genitive subject, *'senin'*, in the clause and the OPc is used (cf. (12ai)), and in (14b) the subject is nominative *'arı'* and the SPc is used (cf. (12aii)).

(13)   a.   Sen [NP adam-ın   kız-ı-nı]   gör-dü-n.
                   you   man-GEN daughter-3sPoss-ACC see-PAST-2SG
                   'You saw the man's daughter.'

6

b. [$_{S[part]}$ sen-in [$_{NP}$ —$_i$ kız-ı-nı] gör-düğ-ün] adam$_i$
you-GEN daughter-3sPoss-ACC see-OPc-2sPoss man

'the man whose daughter you saw'

(14) a. [$_{NP}$ Adam-ın bacağ-ı-nı] arı sok-tu.
man-GEN leg-3sPoss-ACC bee sting-PAST

'Some bee/bees stung the man's leg.'

b. [$_{S[part]}$ [$_{NP}$ —$_i$ bacağ-ı-nı] arı sok-an] adam$_i$
leg-3sPoss-ACC bee sting-SPc man

'the man whose leg some bee/bees stung'

[Güngördü, 1997][Chapter 3] argues that possessors in Turkish should be treated as subjects. We rely on that argument here to cover the case of possessor relativization out of subject possessive phrases using the relativization pattern in (12). Thus, for instance, in (15) below (12bi) predicts the use of SPc (and rules out the OPc), which is indeed the case as seen in (15b) (and in (15c)).

(15) a. [Adam-ın kız-ı] sen-i gör-dü.
man-GEN daughter-3sPoss you-ACC see-PAST

'The man's daughter saw you.'

b. [[—$_i$ kız-ı] sen-i gör-en] adam$_i$
daughter-3sPoss you-ACC see-SPc man

'the man whose daughter saw you'

c. * [[—$_i$ kız-ı-nın] sen-i gör-düğ-ü] adam$_i$
daughter-3sPoss-GEN you-ACC see-OPc-3sPoss man

3.3 Relativization out of Nominalization Clauses

All four cases considered in (12) arise in the case of relativization out of nominalization clauses, since relativization of both subject and non-subject constituents is possible out of both subject and non-subject nominalization clauses.

Let us first consider the examples of relativization out of non-subject nominalization clauses given in (16) and (17). Note that independent of the grammatical function of the gap (which is subject in the (b) examples and accusative object in the (c) examples), the relativization strategy used is OPc in (16b,c), where there is a genitive subject in the relative clause, and SPc in (17b,c), where the subject is nominative, as predicted by (12ai) and (12aii), respectively.

(16) a. [$_{S[nomin]}$ Başbakan-ın bu söz-ü söyle-diğ-i-ni] gazete yaz-dı.
prime minister-GEN this word-ACC say-NOMIN-3sPoss-ACC newspaper write-PAST

'The newspaper reported that the prime minister said these words.'

b. [$_{S[part]}$ [$_{S[nomin]}$ —$_i$ bu söz-ü söyle-diğ-i-ni] gazete-nin yaz-dığ-ı]
this word-ACC say-NOMIN-3sPoss-ACC newspaper-GEN write-OPc-3sPoss

başbakan$_i$
prime minister

'the prime minister who the newspaper reported to have said these words'

c. [$_{S[part]}$ [$_{S[nomin]}$ başbakan-ın —$_i$ söyle-diğ-i-ni] gazete-nin yaz-dığ-ı]
prime minister-GEN say-NOMIN-3sPoss-ACC newspaper-GEN write-OPc-3sPoss

bu söz$_i$
this word

'these words which the newspaper reported the prime minister said'

(17)   a.   [$_{\text{S}[nomin]}$ Başbakan-ın   bu   söz-ü   söyle-diğ-i-ni]   gazete   yaz-dı.
                   prime minister-GEN this word-ACC say-NOMIN-3sPoss-ACC newspaper write-PAST

                   'Some newspaper/newspapers reported that the prime minister said these words.'

   b.   [$_{\text{S}[part]}$ [$_{\text{S}[nomin]}$ $-_i$ bu   söz-ü   söyle-diğ-i-ni]   gazete   yaz-an]   başbakan$_i$
                      this word-ACC say-NOMIN-3sPoss-ACC newspaper write-SPc prime minister

                   'the prime minister who some newspaper/newspapers reported to have said these words'

   c.   [$_{\text{S}[part]}$ [$_{\text{S}[nomin]}$ başbakan-ın $-_i$ söyle-diğ-i-ni]   gazete   yaz-an]   bu söz$_i$
                      prime minister-GEN   say-NOMIN-3sPoss-ACC newspaper write-SPc this word

                   'these words which some newspaper/newspapers reported the prime minister said'

Relativization out of subject nominalization clauses is exemplified by (18) and (19) below. (18b,c) reveal that in the case of subject relativization out of a subject nominalization phrase, the strategy to be used is SPc and that the use of OPc is ruled out, as is predicted by (12bi). The case of non-subject relativization out of such clauses, however, constitutes a problem for the relativization pattern in (12). Recall that (12bii) predicts the use of OPc in this case, and rules out the SPc. Yet, only some of our informants have found (19b) (and structurally similar examples), with the OPc, grammatical, whereas all of them have agreed that (19c) (and similar examples), with the SPc, is perfectly grammatical.[7]

(18)   a.   [Adam-ın kadın-ı   tanı-ma-sı]   bekle-n-iyor.
           man-GEN woman-ACC know-ACT-3sPoss expect-PASS-PROG

           'It is expected that the man knows the woman.'

   b.   [[$-_i$ kadın-ı   tanı-ma-sı]   bekle-n-en]   adam$_i$
           woman-ACC know-ACT-3sPoss expect-PASS-SPc man

           'the man who is expected to know the woman'

   c.   * [[$-_i$ kadın-ı   tanı-ma-sı-nın]   bekle-n-diğ-i]   adam$_i$
           woman-ACC know-ACT-3sPoss-GEN expect-PASS-OPc-3sPoss man

(19)   a.   [Bu gösteri-ye   500 kişi-nin   katıl-ma-sı]   bekle-n-iyor.
           this demonstration-DAT   person-GEN participate-ACT-3sPoss expect-PASS-PROG

           'It is expected that 500 people will participate in this demonstration.'

   b.   ? [[$-_i$ 500 kişi-nin   katıl-ma-sı-nın]   bekle-n-diğ-i]   bu gösteri$_i$
              person-GEN participate-ACT-3sPoss-GEN expect-PASS-OPc-3sPoss this demonstration

           'this demonstration in which it is expected that 500 people will participate'

   c.   [[$-_i$ 500 kişi-nin   katıl-ma-sı]   bekle-n-en]   bu gösteri$_i$
              person-GEN participate-ACT-3sPoss expect-PASS-SPc this demonstration

           'this demonstration in which it is expected that 500 people will participate'

4   Restrictions on Relativization in Turkish

Until now we have been concerned with proposing a descriptive account of relativization in Turkish that correctly characterizes the distribution of the two relativization strategies. This section discusses a number of restrictions on relativization in Turkish.

---

[7]Recall from page 6 that according to [Barker et al., 1990], (19c) would be grammatical in both Dialect A and Dialect B, while (19b) would be grammatical only in Dialect B. Hence, their account would make the correct predictions in this particular case.

4.1 Restriction on Relativization out of Subject Infinitive Clauses

[Sezer, 1986] observes that relativization is possible also out of infinitive clauses in Turkish, but only non-subject ones. Thus, for example, it is not possible to relativize the accusative object, '*çocuğu*', of the subject infinitive phrase in (20a) (cf. (20b)), while this is perfectly possible in (21a), where the same infinitive phrase acts as an object of the subject equi verb '*iste*'. Note the genitive subject '*kadının*', and the use of OPc in (21b) (cf. (12ai)).

(20)   a.   [$_{S[inf]}$ Çocuğ-u   gör-mek] kadın-ı   sevin-dir-di.
                   child-ACC see-INF   woman-ACC be happy-CAUS-PAST
                 'To see the child made the woman happy.'

        b.   * [$_{S[part]}$ [$_{S[inf]}$ $-_i$ gör-mek] kadın-ı   sevin-dir-en]   çocuk$_i$
                              see-INF   woman-ACC be happy-CAUS-SPc child

(21)   a.   Kadın [$_{S[inf]}$ çocuğ-u   gör-mek] iste-di.
                woman   child-ACC see-INF   want-PAST
                'The woman wanted to see the child.'

        b.   [$_{S[part]}$ kadın-ın   [$_{S[inf]}$ $-_i$ gör-mek] iste-diğ-i]   çocuk$_i$
                   woman-GEN   see-INF   want-OPc-3sPoss child
                'the child that the woman wanted to see'

4.2 Restriction on Multiple Non-subject Relativization

In Section 3.1, we have considered several examples of relativization in Turkish with two constituents relativized out of the same relative clause. Note that in all those examples, one of the relativized constituents is the subject of the clause, and the other a non-subject constituent. We haven't, in other words, seen any examples with more than one non-subject gap in the same clause, and in fact it turns out that this is not possible in Turkish.[8] Consider, for example, (22) and (23) below, which show that there is such a restriction in the case of relativization out of relative clauses. (The same restriction also holds true for other types of non-finite sentences where object relativization is possible, such as nominalization and infinitive clauses.)

(22)   a.   Ben [çocuğ-un okul-dan $-_i$ git-tiğ-i]   ev-i$_i$ gör-dü-m.
                I   child-GEN school-ABL   go-OPc-3sPoss house-ACC see-PAST-1SG
                'I saw the house where the child went from the school.'

        b.   * [ben-im [çocuğ-un $-_j$ $-_i$ git-tiğ-i]   ev-i$_i$ gör-düğ-üm]   okul$_j$
                 I-GEN   child-GEN   go-OPc-3sPoss house-ACC see-OPc-1sPoss school
                'the school such that I saw the house where the child went from there'

(23)   a.   [Adam-ın kitab-ı $-_i$ oku-duğ-u]   ev$_i$ yan-ıyor.
                man-GEN book-ACC   read-OPc-3sPoss house burn-PROG
                'The house where the man is reading the book is on fire.'

        b.   * [[adam-ın $-_i$ $-_j$ oku-duğ-u]   ev-in$_i$ yan-dığ-ı]   kitap$_j$
                man-GEN   read-OPc-3sPoss house-GEN burn-OPc-3sPoss book
                'the book such that the house where the man is reading it is on fire'

        c.   * [[adam-ın $-_i$ $-_j$ oku-duğ-u]   ev$_i$ yan-an] kitap$_j$
                man-GEN   read-OPc-3sPoss house burn-SPc book
                'the book such that the house where the man is reading it is on fire'

---

[8]Note however that it is in general possible to extract two non-subject constituents out of the same clause in the case of other UDCs, such as topicalization and backgrounding, in Turkish.

The relative clause in (22a) already has a dative object gap, and the relativization of the second object, the ablative NP *'okuldan'*, is blocked as shown in (22b). Similarly, the relativization of the accusative NP *'kitabı'* out of the relative clause in (23a), which has already had its locative adjunct relativized, is blocked, whichever strategy is used (cf. (23b,c)).

4.3   Restriction on Relativization of Nominative Subjects of Non-finite Sentences

In Section 2, we saw that subjects of relative clauses (and nominalization clauses) in Turkish can be genitive marked or unmarked, and that genitive marking usually correlates with a specific reading of the subject. It should be noted that nominative subjects of such clauses cannot be relativized. So, for example, the relativization of the nominative subject, *'arı'*, of the relative clause in (24a) is blocked, whichever strategy is used, as seen in (24b,c).

(24)   a. $[_{S[part]}$ $[_{NP}$ $-_i$ Bacağ-ı-nı]   arı sok-an]   kız$_i$ ağla-dı.
                                 leg-3sPoss-ACC bee sting-SPc girl cry-PAST
             'The girl whose leg was stung by a bee cried.'

       b. * $[_{S[part]}$ $[_{S[part]}$ $[_{NP}$ $-_i$ bacağ-ı-nı] $-_j$ sok-an]   kız$_i$ ağla-yan] arı$_j$
                                           leg-3sPoss-ACC   sting-SPc girl cry-SPc   bee
             'some bee such that the girl whose leg was stung by it cried'

       c. * $[_{S[part]}$ $[_{S[part]}$ $[_{NP}$ $-_i$ bacağ-ı-nı] $-_j$ sok-an]   kız-ın$_i$ ağla-dığ-ı]   arı$_j$
                                           leg-3sPoss-ACC   sting-SPc girl-GEN cry-OPc-3sPoss bee
             'some bee such that the girl whose leg was stung by it cried'

4.4   Restriction on Relativization across Finite Sentences

No relativized constituent in Turkish can cross the boundaries of a *finite* sentence, whereas an extracted (e.g. topicalized or backgrounded) constituent can. In (25a), for example, the S[*fin*] complement of *'sandı'* contains an embedded S[*nomin*] complement, whose accusative object can be long-distance topicalized as seen in (25b), but not be relativized, cf. (25c).

(25)   a.   Ben $[_{S[fin]}$ adam-a   kadın $[_{S[nomin]}$ çocuğ-un kitab-ı   oku-duğ-u-nu]   söyle-di]
             I   man-DAT woman   child-GEN book-ACC read-NOMIN-3sPoss-ACC tell-PAST
             san-dı-m.
             think-PAST-1SG
             'I thought that the woman told the man that the child had read the book.'

       b.   Kitab-ı$_i$ [ben $[_{S[fin]}$ adam-a   kadın $[_{S[nomin]}$ çocuğ-un $-_i$ oku-duğ-u-nu]   söyle-di]
             book-ACC I   man-DAT woman   child-GEN   read-NOMIN-3sPoss-ACC tell-PAST
             san-dı-m.]
             think-PAST-1SG
             'As for the book, I thought that the woman told the man that the child had read it.'

       c. * $[_{S[part]}$ ben-im $[_{S[fin]}$ adam-a   kadın $[_{S[nomin]}$ çocuğ-un $-_i$ oku-duğ-u-nu]   söyle-di]
                           I-GEN   man-DAT woman   child-GEN   read-NOMIN-3sPoss-ACC tell-PAST
             san-dığ-ım]   kitap$_i$
             think-OPc-1sPoss book
             'the book that I thought that the woman told the man that the child had read'

Since we know that relativization is in general possible out of nominalization clauses, the most likely explanation for the contrast between the grammaticality of (25b) and (25c) is that crossing of relativized constituents across the boundaries of finite sentences is blocked in Turkish. To make sure that this is the case, let us also consider (26), where that S[*fin*] complement has been replaced by an S[*nomin*] one. Note that *'kitabı'* in this case can indeed be both topicalized and relativized, as seen in (26b,c), respectively.

(26) a. Ben [_{S[nomin]} adam-a   kadın-ın   [_{S[nomin]} çocuğ-un   kitab-ı   oku-duğ-u-nu]

I   man-DAT woman-GEN   child-GEN book-ACC read-NOMIN-3sPoss-ACC

söyle-diğ-i-ni]   san-dı-m.

tell-NOMIN-3sPoss-ACC think-PAST-1SG

'I thought that the woman told the man that the child had read the book.'

b. Kitab-ı$_i$ [ben [_{S[nomin]} adam-a   kadın-ın   [_{S[nomin]} çocuğ-un $-_i$ oku-duğ-u-nu]

book-ACC I   man-DAT woman-GEN   child-GEN   read-NOMIN-3sPoss-ACC

söyle-diğ-i-ni]   san-dı-m.]

tell-NOMIN-3sPoss-ACC think-PAST-1SG

'As for the book, I thought that the woman told the man that the child had read it.'

c. [_{S[part]} ben-im [_{S[nomin]} adam-a   kadın-ın   [_{S[nomin]} çocuğ-un $-_i$ oku-duğ-u-nu]

I-GEN   man-DAT woman-GEN   child-GEN   read-NOMIN-3sPoss-ACC

söyle-diğ-i-ni]   san-dığ-ım]   kitap$_i$

tell-NOMIN-3sPoss-ACC think-OPc-1sPoss book

'the book that I thought that the woman told the man that the child had read'

5   An Analysis within HPSG

This section is concerned with providing an HPSG analysis of relativization in Turkish, taking into account both the relativization pattern proposed in Section 3, and also the restrictions on relativization discussed in Section 4.[9]

One must first note the following constraint on type *hd-adj-ph*, which guarantees that in any head-adjunct phrase, the non-head daughter's MOD specification is structure-shared with the SYNSEM value of the head daughter:

$$(27) \quad \textit{hd-adj-ph} \Rightarrow \begin{bmatrix} \text{HD-DTR} & \begin{bmatrix} \textit{phrase} \\ \text{SYNSEM} & \boxed{1} \end{bmatrix} \\ \text{NON-HD-DTRS} & \langle [\ \text{HEAD}|\text{MOD} \ \boxed{1}\ ] \rangle \end{bmatrix}$$

Furthermore, following [Sag, 1997], we assume that *hd-adj-ph* has the two subtypes *simp-hd-adj-ph* and *hd-rel-ph*, the latter being constrained in the following way:

$$(28) \quad \textit{hd-rel-ph} \quad \Rightarrow \begin{bmatrix} \text{HEAD} & \textit{noun} \\ \text{CONT} & \begin{bmatrix} \text{INDEX} & \boxed{4} \\ \text{RESTR} & \{\boxed{3}\} \cup \boxed{5} \end{bmatrix} \\ \text{NON-HD-DTRS} & \langle [\ \text{CONT} \quad \boxed{3}\ \textit{proposition}\ ] \rangle \\ \text{HD-DTR} & \begin{bmatrix} \text{CONT} & \begin{bmatrix} \text{INDEX} & \boxed{4} \\ \text{RESTR} & \boxed{5} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

(28) states that the CONT value of a *hd-rel-ph* object is constrained to have a restricted INDEX structure-shared with that of its head daughter (i.e. the NP being modified), and that the restriction set (the RESTR value) is determined by adding the (propositional) CONT value of the non-head daughter (i.e. the modifying clause) to the restrictions imposed by the head daughter.

Let us now consider some important characteristics of Turkish relative clauses that we exploit in our lexical approach. The first point to note is that Turkish relative clauses have verbal heads with identifying

---

[9]The analysis presented here deals with argument relativization only, leaving relativization of adjuncts for further consideration.

morphology. This enables us to specify the MOD value of a relative clause in the lexical entry of its verbal head from where it is passed on to the clause via the Head Feature Principle.[10]

The second point is related to the status of the NONLOCAL feature RELATIVE (REL) in standard HPSG, in the case of Turkish. The function of REL is to encode the relative dependency in a relative clause between the relative word and the head noun with which it shares an index (see [Pollard & Sag, 1994][pages 210–220] for details). Note however, from the examples we have seen so far, that there is no relative pronoun in Turkish. Hence, there doesn't seem to be any need to use the REL feature in the analysis of Turkish relative clauses, since there is no such (relative) dependency.

Third, recall from Section 4.4 that Turkish relativization is in one way more restricted than other kinds of unbounded dependencies: No relativized constituent can cross the boundaries of a *finite* Turkish sentence, while an extracted (topicalized or backgrounded) constituent can. We therefore use two separate NONLOCAL features in the analysis of relativization and of other kinds of unbounded dependencies in Turkish, RELATIVIZED and SLASH, respectively. That enables us to readily formalize the above restriction on relativization as a constraint on only one of these NONLOCAL features (RELATIVIZED) of any *finite* sentence in Turkish grammar, requiring it to be empty.

Another important feature of the analysis comes up in the implementation of the long-distance relativization pattern (12). Note that (12b) requires a mechanism which, at the outer clause level, differentiates between the different grammatical roles of the gap in the inner clause, namely whether the gap is a subject or a non-subject. We therefore assume that subject and non-subject gaps introduced by relativized constituents are passed up in the structure using different RELATIVIZED features. Accordingly, the feature RELATIVIZED is assumed to take values of type *relativized*, a new type with two appropriate features, SUBJ-REL and NON-SUBJ-REL, both of which take values of type *set(local)*. What is essential is then to make sure that a newly introduced subject relative dependency is always stored in the INHER|RELATIVIZED|SUBJ-REL value of the lexical entry introducing it, and similarly that a non-subject relative dependency is always stored in the INHER|RELATIVIZED|NON-SUBJ-REL value.

Note that, with the latest modification to the RELATIVIZED feature, we can deal with the restriction on relativization across *finite* sentences in Turkish by assuming the following parochial constraint for Turkish, which simply states that any *phrase* object with an S[*fin*] SYNSEM value must have empty values for both INHER|RELATIVIZED features:

(29)   Finite Sentence Relativized Constraint:

$$
\begin{bmatrix} phrase \\ \text{SYNSEM} \quad \text{S}[\mathit{fin}] \end{bmatrix} \;\Rightarrow\; \begin{bmatrix} \text{INHER|RELATIVIZED} & \begin{bmatrix} \text{SUBJ-REL} & \{\} \\ \text{NON-SUBJ-REL} & \{\} \end{bmatrix} \end{bmatrix}
$$

5.1 Lexical Entries for Participles

This section presents an introductory discussion on the lexical entries for *part* verbs assumed in the present analysis. Note that in all examples of relative clauses where a *bounded* dependency is bound off, the head noun of the relative clause corresponds to (i.e. is coindexed with) a gap in the clause itself. On the other hand, in clauses where a *long-distance* dependency is bound off, the head noun doesn't correspond to a gap in the clause itself, but rather to one that is embedded somewhere within one of the constituents of the clause (i.e. the gap host). We make a distinction, in the analysis, between *part* verbs that head relative clauses of these two kinds. A generic lexical entry for a *part* verb licensing a clause with bounded dependency – ignoring the details for the time being – can be schematized as follows:

---

[10]Such exploitation of the identifying morphology on verbal heads of relative clauses in languages like Korean is suggested by [Pollard & Sag, 1994][page 57].

$$
(30) \quad
\begin{bmatrix}
\text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} & part \\ \text{MOD} & \text{NP}_{\boxed{2}}\,[\text{TO-BIND}|\text{RELATIVIZED}|\text{Y} \ \{\boxed{1}\,\boxed{2}\}] \end{bmatrix} \\[4ex]
\text{ARG-S} & \langle \ldots , [\text{LOC} \ \boxed{1}] , \ldots \rangle \\[2ex]
\text{F} & \langle \ldots \rangle \\[2ex]
\text{INHER}|\text{RELATIVIZED}|\text{Y} & \{\boxed{1}\}
\end{bmatrix}
$$

where F $\in$ { SUBJ , COMPS } and
       Y $\in$ { SUBJ-REL , NON-SUBJ-REL }

The intended interpretation of (30) is that the argument in the ARG-S list with the LOCAL value tagged as $\boxed{1}$ does not appear in the corresponding valence list (SUBJ or COMPS). Instead, the LOCAL value of the argument appears in either of the INHER|RELATIVIZED feature sets (SUBJ-REL or NON-SUBJ-REL) of the *part* verb, thereby indicating a relative dependency relating to that argument. Furthermore, the MOD value of the verb is constrained as an NP (cf. the paragraph above on lexically specified MOD values), whose corresponding TO-BIND|RELATIVIZED feature set contains a single element structure-shared with the only element in the INHER|RELATIVIZED feature set of the *part* verb itself, to ensure the discharge of this dependency in a head-adjunct phrase with a relative clause headed by this *part* verb. Finally, the coindexation of the modified NP and the element in its TO-BIND|RELATIVIZED set, hence the element in the INHER|RELATIVIZED set of the verb, guarantees that the NP will be assigned the appropriate semantic role (i.e. the one corresponding to the relativized argument) within the CONTENT value of the verb.

Let us now consider a generic lexical entry, as in (31), for a *part* verb licensing a clause with long-distance dependency. Notice that in this case one of the valence lists (SUBJ or COMPS) is constrained to have an element (the one to function as the gap host) with a non-empty INHER|RELATIVIZED feature value, which contains an element structure-shared with the only element in the corresponding TO-BIND|RELATIVIZED feature value of the modified NP (to guarantee the discharge of this long-distance dependency in a head-adjunct phrase with a relative clause headed by this *part* verb). It is important to note that there may well be other long-distance dependencies stored in the same INHER|RELATIVIZED feature value of the gap host, which would then be passed on to the mother NP of the relative clause headed by the *part* verb, via the Nonlocal Feature Principle in the usual way.

$$
(31) \quad
\begin{bmatrix}
\text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} & part \\ \text{MOD} & \text{NP}_{\boxed{2}}\,[\text{TO-BIND}|\text{RELATIVIZED}|\text{Y} \ \{\boxed{1}\,\boxed{2}\}] \end{bmatrix} \\[4ex]
\text{F} & \langle \ldots , \text{XP}\,[\text{INHER}|\text{RELATIVIZED}|\text{Y} \ \{\ldots , \boxed{1} , \ldots\}] , \ldots \rangle
\end{bmatrix}
$$

where F $\in$ { SUBJ , COMPS } ,
       XP $\in$ { NP , PP , S[*nomin*] , VP[*inf*] } , and
       Y $\in$ { SUBJ-REL , NON-SUBJ-REL }

In sum, a *part* verb for bounded relativization introduces in the structure a relative dependency that is bound off immediately by the NP being modified by the very same *part* verb. A *part* verb for long-distance relativization doesn't itself introduce a dependency, but only binds off one inherited from one of its arguments (the gap host).[11] Clearly, one also needs a way of introducing a relative dependency in

---

[11]It would be possible to deal with bounded and long-distance relativization in a more uniform manner if one assumed two empty categories in the lexicon (for the two RELATIVIZED features), one of them having its INHER|RELATIVIZED|SUBJ-REL and LOCAL values structure-shared, and the other having its INHER|RELATIVIZED|NON-SUBJ-REL and LOCAL values structure-shared (cf. the lexical entry for trace proposed by [Pollard & Sag, 1994][page 164]). In that case, the generic participle entry (31) would suffice to handle both bounded and long-distance relativization. However, we prefer the account outlined in the text here to avoid exploiting empty categories in the analysis.

an embedded clause that is then to be bound off as a long-distance dependency in a surrounding relative clause.

Note that many details have been left out in the above-mentioned schematizations of *part* verbs. In the case of (30), one must make sure that the correlation between the existence/non-existence of a *genitive* subject and the strategy to be used is always satisfied. And in the case of (31), it is essential to choose the right strategy to bind off a long-distance relative dependency (reflecting that choice on the PHON value of the lexical entry and the CASE value of its subject, if any), depending on whether the dependency is inherited from a subject or a non-subject gap host (and in the latter case whether the dependency is passed on by the INHER|RELATIVIZED|SUBJ-REL or INHER|RELATIVIZED|NON-SUBJ-REL value of the gap host).

5.2   A Relational Approach

One way to realize the lexical entries for *part* verbs (generically) introduced in Section 5.1 would be to make use of a number of lexical rules that derive *part* verbs from *base* verb entries in the lexicon, also performing certain other changes in their output entries, such as changing the PHON value to the appropriate inflected form (by affixing the appropriate participle suffix, SPc or OPc, to the PHON value of the input *base* verb), and relativizing one of the arguments of the input entry (by removing the argument from either of the valence lists SUBJ and COMPS of the input, and placing its LOCAL value in the corresponding INHER|RELATIVIZED feature value of the output) or constraining one of the arguments (the gap host in long-distance relativization) to have a non-empty INHER|RELATIVIZED feature value. [Güngördü, 1997][Chapter 4] presents such an analysis of relativization in Turkish based on lexical rules.

Recent work within HPSG have proposed several mechanisms as alternatives to lexical rules for expressing generalizations over lexical information (e.g. [Krieger & Nerbonne, 1993], [Kathol, 1994], [Oliva, 1994], and [Bouma & Nerbonne, 1994]). In particular, [Bouma & Nerbonne, 1994] propose a mechanism combining inheritance-based methods and relational constraints in describing (inflectional) morphology. A basic lexeme in the relational approach is an underspecified feature structure that is instantiated by unifying the lexeme with one of the entries in the paradigm of the class to which the lexeme belongs. For example, the various inflected forms of the verb *gör* 'see' can be defined as follows:

$$
(32) \qquad \text{GÖR} \quad \equiv \quad \boxed{1}
\begin{bmatrix}
\text{ROOT} & \langle g\ddot{o}r \rangle \\
\text{HEAD} & verb \\
\text{ARG-S} & \langle \text{NP}_{\boxed{2}},\ \text{NP}_{\boxed{3}}[acc] \rangle \\
\\
\text{CONT} & \begin{bmatrix} see \\ \text{SEER} & \boxed{2} \\ \text{SEEN} & \boxed{3} \end{bmatrix}
\end{bmatrix}
\quad \longleftarrow \quad member(\boxed{1},\ \text{VERB})
$$

(32) states that the underspecified feature structure $\boxed{1}$ must unify with one of the entries in the paradigm VERB; each solution will result in a different inflected form. The paradigm VERB is itself a feature structure specified as a list of entries, each of which specifies the phonological form of a verb as well as the corresponding morphosyntactic features.

Bouma and Nerbonne note that one advantage of the relational approach is its *reversibility*, that is, that it can be used both to instantiate the morphological features of an inflected form and to determine what the form of a lexeme must be given a specification of its morphological features. Moreover, [Oliva, 1994] argues that the use of relational constraints in the organization of lexical information is more in line with the declarative nature of HPSG, rather than the use of lexical rules (because of the procedurality inherent in the description of the latter). One further advantage of the relational approach outlined above is that it is possible to relate any number of entries within the same paradigm (e.g. via structure-sharing), since

14

a paradigm is itself specified as a feature structure. With lexical rules, however, one can only relate two lexical entries, since a lexical rule is basically regarded to map an input lexical entry to an output entry.

We therefore adopt the mechanism proposed by Bouma and Nerbonne in the analysis of relativization in Turkish. One must note however that recursion, which is so naturally handled by lexical rules, is not so easy (if at all possible) to model in the relational mechanism adopted here. It is the lack of recursion in the phenomenon of relativization in Turkish that enables us to propose such an analysis: There is always at most one subject to be relativized out of a single clause. Moreover, it is not possible in Turkish to have more than one non-subject constituent relativized out of the same clause (cf. Section 4.2). Thus, one can have at most two constituents relativized out of a single clause.

The paradigm VERB is assumed to contain entries for (among other inflected verbal forms in Turkish) *part* verbs, specifying the phonological and syntactic features of such verbs that are to license different cases of relative clause constructions. Thus, concerning ourselves for the moment with the entries for *part* verbs only, the paradigm VERB in Turkish grammar can be represented as in (33), where each one of A–D represents a paradigm entry for a class of *part* verbs, as we discuss next in detail.

(33)   VERB   ≡ $\langle \ldots, A, B, C, D, \ldots \rangle$

5.3 Participles for Bounded Relativization

We assume two separate paradigm entries for bounded relativization, licensing *part* verbs for subject or non-subject relativization; that is, two separate versions of (30), where i) F is SUBJ and Y is SUBJ-REL; or ii) F is COMPS and Y is NON-SUBJ-REL.
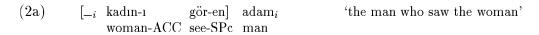
Bounded Subject Relativization

The paradigm entry, A, for subject relativization is given in (34). The main point to note about this entry is that the first element in the ARG-S list, the subject, does not appear in the SUBJ list, but instead its LOCAL value appears in the INHER|RELATIVIZED|SUBJ-REL set, thereby introducing a subject dependency. Consequently, the PHON value consists of the ROOT value followed by the SPc suffix '-(y)En', indicating the choice of the SPc strategy. (Note that • denotes list concatenation.)

$$
(34) \quad A \equiv
\begin{bmatrix}
\text{PHON} & \boxed{1} \bullet \langle yEn \rangle \\
\text{MOR} & [\text{ROOT } \boxed{1}] \\[4pt]
\text{HEAD} &
\begin{bmatrix}
verb \\
\text{VFORM} & part \\
\text{MOD} & \text{NP}_{\boxed{3}} \left[\text{TO-BIND|RELATIVIZED|SUBJ-REL} \quad \left\{ \boxed{2}_{\boxed{3}} \right\} \right]
\end{bmatrix} \\[10pt]
\text{ARG-S} & \langle [\text{LOC } \boxed{2}], \ldots \rangle \\
\text{SUBJ} & \langle \rangle \\
\text{INHER|RELATIVIZED|SUBJ-REL} & \{\boxed{2}\}
\end{bmatrix}
$$

The lexical entry for the *part* verb *gören* will then be as in (35) (once the underspecified lexeme in (32), tagged $\boxed{1}$, is unified with the VERB paradigm entry in (34)).

(35)

$$
\begin{bmatrix}
\text{PHON} & \langle g\ddot{o}ren \rangle \\
\text{MOR} & [\text{ROOT} \quad \langle g\ddot{o}r \rangle] \\
\\
\text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} \quad part \\ \text{MOD} \quad \text{NP}_{\boxed{3}}[\text{TO-BIND}|\text{RELATIVIZED}|\text{SUBJ-REL} \quad \{\boxed{2}\}] \end{bmatrix} \\
\\
\text{ARG-S} & \langle \text{NP}_{\boxed{3}} [\text{LOC} \ \boxed{2}], \boxed{4} \, \text{NP}_{\boxed{5}}[acc] \rangle \\
\text{SUBJ} & \langle \, \rangle \\
\text{COMPS} & \langle \boxed{4} \rangle \\
\text{CONT} & \begin{bmatrix} see \\ \text{SEER} \quad \boxed{3} \\ \text{SEEN} \quad \boxed{5} \end{bmatrix} \\
\text{INHER}|\text{RELATIVIZED}|\text{SUBJ-REL} & \{\boxed{2}\}
\end{bmatrix}
$$

(35) would then license relative clauses as in (2a), repeated below, whose structure is given in (36).

(2a)   [$_{-i}$ kadın-ı   gör-en] adam$_i$ 'the man who saw the woman'
          woman-ACC see-SPc   man

(36)

$$
\begin{bmatrix}
hd\text{-}adj\text{-}ph \\
\text{SYNSEM} \begin{bmatrix} \text{CAT}|\text{HEAD} & \boxed{1} \ noun \ [\text{CASE} \ nom] \\ \text{CONT} & \begin{bmatrix} \text{INDEX} \ \boxed{2} \\ \text{RESTR} \ \left\{ \boxed{3}\begin{bmatrix} see \\ \text{SEER} \ \boxed{2} \\ \text{SEEN} \ \boxed{6} \end{bmatrix}, \boxed{4}\begin{bmatrix} man \\ \text{INST} \ \boxed{2} \end{bmatrix} \right\} \end{bmatrix} \\ \text{INHER}|\text{RELATIVIZED}|\text{SUBJ-REL} \ \{\} \end{bmatrix} \\
\\
\text{NON-HD-DTRS} \left\langle \begin{bmatrix} hd\text{-}comp\text{-}ph \\ \text{SYNSEM} \begin{bmatrix} \text{HEAD} & \boxed{7} \ verb \begin{bmatrix} \text{VFORM} \ part \\ \text{MOD} \ \boxed{10} \end{bmatrix} \\ \text{COMPS} & \langle \, \rangle \\ \text{CONT} & \boxed{3} \\ \text{INHER}|\text{RELATIVIZED}|\text{SUBJ-REL} \ \{\boxed{8}\} \end{bmatrix} \\ \text{NON-HD-DTRS} \ \left\langle \begin{bmatrix} \text{PHON} & \langle kad\imath n\imath \rangle \\ \text{SYNSEM} & \boxed{9} \ \text{NP}_{\boxed{6}}[acc] \end{bmatrix} \right\rangle \\ \text{HEAD-DTR} \begin{bmatrix} \text{PHON} & \langle g\ddot{o}ren \rangle \\ \text{CAT} \begin{bmatrix} \text{HEAD} \ \boxed{7} \\ \text{ARG-S} \ \langle \text{NP}_{\boxed{2}}[\text{LOC} \ \boxed{8}], \boxed{9} \rangle \\ \text{COMPS} \ \langle \boxed{9} \rangle \end{bmatrix} \\ \text{CONT} & \boxed{3} \\ \text{INHER}|\text{RELATIVIZED}|\text{SUBJ-REL} \ \{\boxed{8}\} \end{bmatrix} \end{bmatrix} \right\rangle \\
\\
\text{HD-DTR} \begin{bmatrix} \text{PHON} & \langle adam \rangle \\ \text{SYNSEM} \ \boxed{10} \begin{bmatrix} \text{CAT}|\text{HEAD} & \boxed{1} \\ \text{CONT} \begin{bmatrix} \text{INDEX} \ \boxed{2} \\ \text{RESTR} \ \boxed{4} \end{bmatrix} \end{bmatrix} \\ \text{TO-BIND}|\text{RELATIVIZED}|\text{SUBJ-REL} \ \{\boxed{8}\} \end{bmatrix}
\end{bmatrix}
$$

Bounded Non-subject Relativization

(37) below depicts the paradigm entry, B, for object relativization. Note that in this case one of the non-subject arguments in the ARG-S list, with LOCAL value tagged as $\boxed{4}$, is left out in the COMPS list. The

16

LOCAL value of that argument appears in the INHER|RELATIVIZED|NON-SUBJ-REL set, thereby introducing a non-subject dependency. The relational constraint *strategy-used*, whose definition is given in (38) (in a Prolog-like notation), is responsible for the correlation between the CASE value of the subject (*genitive* or *nominative*) and the suffix(es) to be affixed to the verb root (the OPc suffix followed by a possessive suffix, or the SPc suffix only).

(37) $B \equiv$

$$
\begin{bmatrix}
\text{PHON} & \boxed{1} \bullet \boxed{7} \\
\text{MOR} & [\text{ROOT } \boxed{1}] \\
\text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} \quad part \\ \text{MOD} \quad \text{NP}_{\boxed{5}}[\text{TO-BIND}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} \ \{\boxed{4}\boxed{5}\}] \end{bmatrix} \\
\text{ARG-S} & \langle \boxed{6}, \ldots, [\text{LOC } \boxed{4}], \ldots \rangle \\
\text{SUBJ} & \langle \boxed{6} \text{ NP} \rangle \\
\text{COMPS} & \langle \ldots \rangle \\
\text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\boxed{4}\}
\end{bmatrix}
$$

where *strategy-used* ($\boxed{7}$, $\boxed{6}$)

The first clause of *strategy-used*, (38a), covers the use of the OPc strategy for object relativization: i) the subject constrained to have a *genitive* CASE value; and ii) the OPc suffix '*-dIk*' affixed to the PHON value, together with a possessive suffix that agrees with the subject (via the relational constraint *possess-suffix* assumed to relate the INDEX value of the subject to the possessive suffix affixed to the PHON value of the entry). The second clause of *strategy-used*, (38b), deals with the use of the SPc strategy for object relativization: i) the subject constrained as *nominative* and *nonspecific*; and ii) the SPc suffix '*-yEn*' affixed to the PHON value.

(38)   a.   *strategy-used* ($\langle dIk \rangle \bullet \boxed{1}$, $\text{NP}_{\boxed{2}}[gen]$) :- *possess-suffix* ($\boxed{2}$, $\boxed{1}$).

       b.   *strategy-used* ($\langle yEn \rangle$, $\text{NP}[nom, specific]$).

The lexical entry for the *part* verb '*gördüğü*' (the outcome of the unification between the underspecified lexeme for '*gör*' and the paradigm entry in (37) using (38a)) is as follows:

(39)

$$
\begin{bmatrix}
\text{PHON} & \langle gördüğü \rangle \\
\text{MOR} & [\text{ROOT } \langle gör \rangle] \\
\text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} \quad part \\ \text{MOD} \quad \text{NP}_{\boxed{3}}[\text{TO-BIND}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} \ \{\boxed{2}\}] \end{bmatrix} \\
\text{ARG-S} & \langle \boxed{4} \text{ NP}_{\boxed{5}} [gen], \text{NP}_{\boxed{3}} [\text{LOC } \boxed{2}] \rangle \\
\text{SUBJ} & \langle \boxed{4} \rangle \\
\text{COMPS} & \langle \rangle \\
\text{CONT} & \begin{bmatrix} see \\ \text{SEER} \quad \boxed{5} \\ \text{SEEN} \quad \boxed{3} \end{bmatrix} \\
\text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\boxed{2}\}
\end{bmatrix}
$$

This entry would license relative clauses as in (2b), repeated below.

(2b)   [adam-ın $-_i$ gör-düğ-ü]   kadın$_i$ 'the woman that the man saw'
         man-GEN   see-OPc-3sPoss woman

17

The lexical entry for the *part* verb *'sokan'* in (40), an example of object relativization where the subject is nominative, is given in (41). This entry is the outcome of the unification between the underspecified lexeme for the *base* verb *'sok'* and the paradigm entry in (37) using (38b) this time.

(40)   [—$_i$ arı sok-an]   kız$_i$ 'the girl whom some bee/bees stung'
         bee sting-SPc girl

(41)

$$
\begin{bmatrix}
\text{PHON} & \langle sokan \rangle \\
\text{MOR} & [\text{ROOT} \quad \langle sok \rangle] \\
\\
\text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} \quad part \\ \text{MOD} \quad \text{NP}_{\boxed{3}}[\text{TO-BIND}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} \quad \{\boxed{2}\}] \end{bmatrix} \\
\\
\text{ARG-S} & \langle \boxed{4}\,\text{NP}_{\boxed{5}}\,[nom, nonspecific]\,, \text{NP}_{\boxed{3}}\,[\text{LOC} \quad \boxed{2}] \rangle \\
\text{SUBJ} & \langle \boxed{4} \rangle \\
\text{COMPS} & \langle \rangle \\
\\
\text{CONT} & \begin{bmatrix} see \\ \text{STINGER} \quad \boxed{5} \\ \text{STINGEE} \quad \boxed{3} \end{bmatrix} \\
\\
\text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\boxed{2}\}
\end{bmatrix}
$$

5.4   Participles for Long-distance Relativization

We assume two separate paradigm entries for long-distance relativization, licensing *part* verbs with a subject or a non-subject gap host argument; that is, two separate versions of (31), where the argument constrained to have a non-empty INHER|RELATIVIZED feature value takes place in the SUBJ or COMPS list.

Long-distance Relativization with Non-subject Gap Host

The paradigm entry, C, in (42) deals with long-distance relativization where the gap host is a non-subject constituent (cf. (12a)). Accordingly, one of the arguments in the COMPS list is constrained to have a non-empty value for either of the INHER|RELATIVIZED features. Notice that the relational constraint *strategy-used* in (38) is again used to guarantee the correlation between the CASE value of the subject and the suffix(es) to be affixed to the verb root.

(42) $C \equiv$

$$
\begin{bmatrix}
\text{PHON} & \boxed{1} \bullet \boxed{8} \\
\text{MOR} & [\text{ROOT} \quad \boxed{1}] \\
\\
\text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} \quad part \\ \text{MOD} \quad \text{NP}_{\boxed{13}}\left[\text{TO-BIND}|\text{RELATIVIZED}|\text{Y} \quad \left\{\boxed{9}_{\boxed{13}}\right\}\right] \end{bmatrix} \\
\\
\text{ARG-S} & \boxed{10} \bullet \boxed{11} \\
\text{SUBJ} & \boxed{10} \langle \boxed{12}\text{NP} \rangle \\
\text{COMPS} & \boxed{11} \langle \ldots, \text{XP}\,[\text{INHER}|\text{RELATIVIZED}|\text{Y} \quad \{\ldots, \boxed{9}, \ldots\}] \,, \ldots \rangle
\end{bmatrix}
$$

where   *strategy-used* ($\boxed{8}$, $\boxed{12}$)
        Y $\in$ {SUBJ-REL , NON-SUBJ-REL} and
        XP $\in$ { NP , PP , S[*nomin*] , VP[*inf*] }

The outcome of the unification between the underspecified lexeme *'gör'* and the paradigm entry in (42) via the use of (38a) is given below:

$$
(43) \quad
\begin{bmatrix}
\text{PHON} & \langle \textit{gördü\v{g}ü} \rangle \\
\text{MOR} & [\text{ROOT} \ \langle \textit{gör} \rangle] \\
\text{HEAD} & \begin{bmatrix} \textit{verb} \\ \text{VFORM} \ \textit{part} \\ \text{MOD} \quad \text{NP}_{\boxed{3}} \, [\text{TO-BIND}|\text{RELATIVIZED}|\text{SUBJ-REL} \ \{\boxed{2}\boxed{3}\}] \end{bmatrix} \\
\text{ARG-S} & \langle \boxed{4}, \boxed{6} \rangle \\
\text{SUBJ} & \langle \boxed{4} \, \text{NP}_{\boxed{5}} \, [\textit{gen}] \rangle \\
\text{COMPS} & \langle \boxed{6} \, \text{NP}_{\boxed{7}} \, [\textit{acc}, \text{INHER}|\text{RELATIVIZED}|\text{SUBJ-REL} \ \boxed{2}] \rangle \\
\text{CONT} & \begin{bmatrix} \textit{see} \\ \text{SEER} \quad \boxed{5} \\ \text{SEEN} \quad \boxed{7} \end{bmatrix}
\end{bmatrix}
$$

This entry would then license clauses such as the outer one in (6b), repeated below:

(6b)   [kadın-ın   [_j _i oku-du\v{g}-u]   kitab-ı_i   gör-dü\v{g}-ü]   adam_j
        woman-GEN   read-OPc-3sPoss   book-ACC   see-OPc-3sPoss   man

'the man that the woman saw the book he read'

The lexical entry for the *part* verb '*yazan*' in (17b) (repeated below), the outcome of unifying the underspecified lexeme for the *base* verb '*yaz*' with the paradigm entry in (42) via the use of (38b), is given in (45).

(44)   [[_i bu   söz-ü   söyle-di\v{g}-i-ni]   gazete   yaz-an]   başbakan_i
        this word-ACC   say-FACT-3sPoss-ACC   newspaper   write-SPc   prime minister

'the prime minister who some newspaper/newspapers reported to have said these words'

$$
(45) \quad
\begin{bmatrix}
\text{PHON} & \langle \textit{yazan} \rangle \\
\text{MOR} & [\text{ROOT} \ \langle \textit{yaz} \rangle] \\
\text{HEAD} & \begin{bmatrix} \textit{verb} \\ \text{VFORM} \ \textit{part} \\ \text{MOD} \quad \text{NP}_{\boxed{3}} \, [\text{TO-BIND}|\text{RELATIVIZED}|\text{SUBJ-REL} \ \{\boxed{2}\boxed{3}\}] \end{bmatrix} \\
\text{ARG-S} & \langle \boxed{4}, \boxed{6} \rangle \\
\text{SUBJ} & \langle \boxed{4} \, \text{NP}_{\boxed{5}} \, [\textit{nom}, \textit{nonspecific}] \rangle \\
\text{COMPS} & \langle \boxed{6} \, \text{S} \, [\text{INHER}|\text{RELATIVIZED}|\text{SUBJ-REL} \ \boxed{2} \ : \ \boxed{7}] \rangle \\
\text{CONT} & \begin{bmatrix} \textit{report} \\ \text{REPORTER} \quad \boxed{5} \\ \text{REPORTED} \quad \boxed{7} \end{bmatrix}
\end{bmatrix}
$$

Long-distance Relativization with Subject Gap Host

The paradigm entry, D, in (46) deals with long-distance relativization where the gap host is the subject of the relative clause in question (cf. (12b)). Hence, the subject is constrained to have a non-empty value for either of the INHER|RELATIVIZED features (see below). Notice that VP[*inf*], which appears in the list of possible syntactic categories for the gap host in the paradigm entry (42), is left out in (46), since relativization is not allowed out of subject infinitive clauses in Turkish (cf. Section 4.1). The correlation between the grammatical role of the gap (subject or non-subject) and the strategy to be used (SPc or OPc) is guaranteed by a new relational constraint *strategy-used-pr*, whose definition is given in (47).

$$(46) \qquad D \ \equiv \ \begin{bmatrix} \text{PHON} & \boxed{1} \bullet \boxed{16} \\ \text{MOR} & [\text{ROOT} \ \boxed{1}] \\[2pt] \text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} & part \\ \text{MOD} & \boxed{14}\text{NP} \end{bmatrix} \\[2pt] \text{SUBJ} & \langle \boxed{15}\text{XP} \rangle \end{bmatrix}$$

$$\text{where} \ \ \text{XP} \ \in \ \{ \ \text{NP} \ , \ \text{S}[nomin] \ \}$$
$$\textit{strategy-used-pr} \ (\ \boxed{16} \ , \ \boxed{14} \ , \ \boxed{15} \ )$$

The first clause of *strategy-used-pr*, (47a), covers the use of SPc when the grammatical role of the gap is subject: i) the SPc suffix '*-yEn*' affixed to the root; and ii) the relative dependency inherited from the subject (further constrained as *nominative*) – and to be bound off by the head noun – constrained to be passed on via its INHER|RELATIVIZED|SUBJ-REL value. The second clause of *strategy-used-pr*, (47b), covers the use of OPc when the grammatical role of the gap is non-subject: i) the OPc suffix '*-dIk*' affixed to the root followed by a possessive suffix that agrees with the *genitive* subject; and ii) the relative dependency inherited from the subject – and to be bound off by the head noun – constrained to be passed on via its INHER|RELATIVIZED|NON-SUBJ-REL value.

(47) a. *strategy-used-pr* ($\langle yEn \rangle$, NP$_{\boxed{1}}$ [TO-BIND|RELATIVIZED|SUBJ-REL $\{\boxed{2}_{\boxed{1}}\}$] ,
$\qquad\qquad$ [*nom*, INHER|RELATIVIZED|SUBJ-REL $\{\ldots,\boxed{2},\ldots\}$]).

$\quad$ b. *strategy-used-pr* ($\langle dIk \rangle \bullet \boxed{1}$, NP$_{\boxed{2}}$ [TO-BIND|RELATIVIZED|NON-SUBJ-REL $\{\boxed{3}_{\boxed{2}}\}$] ,
$\qquad\qquad$ [*gen*, INDEX $\boxed{4}$, INHER|RELATIVIZED|NON-SUBJ-REL $\{\ldots,\boxed{3},\ldots\}$])
$\qquad\quad$:- *possess-suffix* ($\boxed{4}$, $\boxed{1}$).

The lexical entry for the *part* verb '*seven*' in (48), the outcome of unifying the underspecified lexeme for the *base* verb '*sev*' with the paradigm entry in (46) via the use of (47a), is given in (49).

(48) [[$\_i$ köpeğ-i] sen-i sev-en] adam$_i$ $\qquad\qquad$ 'the man whose dog loves you'
$\qquad\quad$ dog-3sPoss you-ACC love-SPc man

$$(49) \qquad \begin{bmatrix} \text{PHON} & \langle seven \rangle \\ \text{MOR} & [\text{ROOT} \ \langle sev \rangle] \\[2pt] \text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} & part \\ \text{MOD} & \text{NP}_{\boxed{3}} [\text{TO-BIND|RELATIVIZED|SUBJ-REL} \ \{\boxed{2}_{\boxed{3}}\}] \end{bmatrix} \\[2pt] \text{ARG-S} & \langle \boxed{4}, \boxed{6} \rangle \\ \text{SUBJ} & \langle \boxed{4} \ \text{NP}_{\boxed{5}} \ [nom, \text{INHER|RELATIVIZED|SUBJ-REL} \ \boxed{2}] \rangle \\ \text{COMPS} & \langle \boxed{6} \ \text{NP}_{\boxed{7}} \ [acc] \rangle \\[2pt] \text{CONT} & \begin{bmatrix} love \\ \text{LOVER} & \boxed{5} \\ \text{LOVED} & \boxed{7} \end{bmatrix} \end{bmatrix}$$

The lexical entry for the *part* verb '*hastalandığı*' in (11b) (repeated below), the outcome of unifying the underspecified lexeme for the *base* verb '*hastalan*' with the paradigm entry in (46) using (47b), is given in (50).

(11b) [[$\_i$ $\_j$ yi-yen] çocuğ-un$_i$ hastalan-dığ-ı] $\qquad$ bitki$_j$
$\qquad\quad$ eat-SPc child-GEN become sick-OPc-3sPoss plant

$\qquad\quad$ 'the plant which the child who ate it got sick'

$$(50) \quad \begin{bmatrix} \text{PHON} & \langle hastalandığı \rangle \\ \text{MOR} & [\text{ROOT} \quad \langle hastalan \rangle] \\ \\ \text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} & part \\ \text{MOD} & \text{NP}_{\boxed{3}} [\text{TO-BIND}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} \quad \{\boxed{2}_{\boxed{3}}\}] \end{bmatrix} \\ \\ \text{ARG-S} & \langle \boxed{4} \rangle \\ \text{SUBJ} & \langle \boxed{4} \, \text{NP}_{\boxed{5}} \, [gen, \text{ INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} \quad \boxed{2}] \rangle \\ \text{COMPS} & \langle \rangle \\ \text{CONT} & \begin{bmatrix} get\text{-}sick \\ \text{ARG} & \boxed{5} \end{bmatrix} \end{bmatrix}$$

5.5 Relativization out of Embedded Clauses

We have seen so far two main classes of *part* verbs, one class for bounded and the other for long-distance relativization. Recall that a *part* verb in the former class introduces in the structure a relative dependency that is to be bound off immediately by the NP being modified by the very same *part* verb, and that one in the latter class doesn't itself introduce a dependency, but only binds off one inherited from one of its arguments. This section is concerned with relativization out of embedded clauses, that is, introducing a relative dependency in an embedded clause that is then to be bound off as a long-distance dependency in a surrounding relative clause.

In order to deal with relativization out of embedded clauses, we make use of two further verb paradigms VERB' and VERB'', given in (51) and (52), respectively, both of which are of the same length as the paradigm VERB. The elements in VERB' are specified as $\perp$ except for the elements corresponding to the ones in VERB that may function as heads of embedded clauses out of which subject relativization is possible. Similarly, the elements in VERB'' are specified as $\perp$ except for the elements corresponding to the ones in VERB that may function as heads of embedded clauses out of which non-subject relativization is possible.

$$(51) \quad \text{VERB}' \quad \equiv \quad \left\langle \ldots, \, \perp, B', C', \perp, \ldots \right\rangle$$

$$(52) \quad \text{VERB}'' \quad \equiv \quad \left\langle \ldots, \, A'', \perp, C'', D'', \ldots \right\rangle$$

Two further definitions for GÖR then follow in (53) and (54), which, respectively, state that the under-specified lexeme for 'gör' must unify with one of the entries in the list that is the result of default unifying (see [Lascarides et al., 1996]; denoted here by $\triangle$) the paradigm VERB with VERB', or is the result of default unifying VERB with VERB''.

$$(53) \quad \text{GÖR} \quad \equiv \quad \boxed{1} \begin{bmatrix} \text{ROOT} & \text{GÖR} \\ \text{HEAD} & verb \\ \text{ARG-S} & \langle \text{NP}_{\boxed{2}}, \, \text{NP}_{\boxed{3}}[acc] \rangle \\ \\ \text{CONT} & \begin{bmatrix} see \\ \text{SEER} & \boxed{2} \\ \text{SEEN} & \boxed{3} \end{bmatrix} \end{bmatrix} \quad \longleftarrow \quad member(\boxed{1}, \text{ VERB } \triangle \text{ VERB}')$$

$$(54) \quad \text{GÖR} \quad \equiv \quad \boxed{1} \begin{bmatrix} \text{ROOT} & \text{GÖR} \\ \text{HEAD} & verb \\ \text{ARG-S} & \langle \text{NP}_{\boxed{2}}, \text{NP}_{\boxed{3}}[acc] \rangle \\ & \\ \text{CONT} & \begin{bmatrix} see \\ \text{SEER} & \boxed{2} \\ \text{SEEN} & \boxed{3} \end{bmatrix} \end{bmatrix} \longleftarrow member(\boxed{1}, \text{VERB} \triangle \text{VERB}'')$$

The effect of using default unification here is that certain constraints assumed to be default (defeasible) in the VERB paradigm entries will be overridden by conflicting non-default constraint specifications in the corresponding entries of VERB$'$ or VERB$''$. Accordingly, the VERB paradigm entries that may function as heads of embedded clauses out of which subject (complement) relativization is possible are assumed to have default values for their SUBJ (COMPS) feature, which are then overridden by conflicting non-default SUBJ (COMPS) values in the corresponding entries of VERB$'$ (VERB$''$), thereby relativizing the subject (a complement).

Note that one could instead have additional paradigm entries in VERB for relativization out of embedded clauses (rather than introducing further verb paradigms). However, the approach outlined above helps us to capture certain generalizations over different verb forms out of which relativization is possible, thereby providing us with a more compact and clear solution to the problem.

5.5.1 Relativization out of Relative Clauses

Subject Relativization out of Relative Clauses

Note that among the entries A–D in the paradigm VERB, only B (cf. (37)) and C (cf. (42)) license *part* verbs that may head an embedded relative clause whose subject is long-distance relativized. (One cannot relativize the subject of a clause headed by a *part* verb licensed by either of the VERB paradigm entries A (cf. (34)) and D (cf. (46)), since in the former case the subject is already relativized, and in the latter case the subject is a gap host.)

Consequently, to deal with subject relativization out of embedded relative clauses, we assume that the entries B and C in the paradigm VERB have default values for their SUBJ feature. And in VERB$'$, B$'$ and C$'$ are equivalent and defined as follows:

$$(55) \quad B' \equiv C' \equiv \begin{bmatrix} \text{ARG-S} & \langle \text{NP}\,[\text{LOC} \ \boxed{1} \ [gen]], \ldots \rangle \\ \text{SUBJ} & \langle \rangle \\ \text{INHER}|\text{RELATIVIZED}|\text{SUBJ-REL} & \{\boxed{1}\} \end{bmatrix}$$

Thus, default unifying B with B$'$ (or C with C$'$) will result in the SUBJ value of the outcome being specified as empty (the default non-empty SUBJ value in B/C being overridden by the non-default empty SUBJ value in B$'$/C$'$). Also, the value of the INHER|RELATIVIZED|SUBJ-REL feature (which is constrained as *set(local)* in both B and C) will be further constrained to contain the LOCAL value of the relativized subject. Notice that the CASE value of the relativized subject is constrained as *genitive* to block the relativization of *nominative* subjects of embedded clauses (cf. the restriction on relativization discussed in Section 4.3).

Non-subject Relativization out of Relative Clauses

Again, among the entries A–D in VERB, A, C, and D license *part* verbs that may head relative clauses out of which a non-subject argument is long-distance relativized. (B is excluded in this case, since one cannot have two non-subject constituents relativized out of the same clause in Turkish; see Section 4.2.)

Thus, to deal with object relativization out of embedded relative clauses, we assume that the entries A, C, and, D in the paradigm VERB have default values for their COMPS feature. Furthermore, A'' and D'' are equivalent and defined as in (56), which overrides the COMPS value of the corresponding paradigm entry in VERB, introducing a non-subject relative dependency.

(56)

$$A'' \equiv D'' \equiv \begin{bmatrix} \text{HEAD} & verb \ [\text{VFORM} \ part] \\ \text{ARG-S} & \langle synsem, \ldots, \text{NP} [\text{LOC} \ \boxed{1}], \ldots \rangle \\ \text{COMPS} & \langle \ldots \rangle \\ \text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\boxed{1}\} \end{bmatrix}$$

C'' is very similar to the entry in (56) above, only the relativized non-subject argument here is constrained to have empty values for both INHER|RELATIVIZED features, to make sure that the relativized argument is not a gap host:

(57)

$$C'' \equiv \begin{bmatrix} \text{HEAD} & verb \ [\text{VFORM} \ part] \\ \text{ARG-S} & \left\langle synsem, \ldots, \text{NP} \begin{bmatrix} \text{LOC} & \boxed{2} \\ \text{INHER}|\text{RELATIVIZED}|\text{SUBJ-REL} & \{\} \\ \text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\} \end{bmatrix}, \ldots \right\rangle \\ \text{COMPS} & \langle \ldots \rangle \\ \text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\boxed{2}\} \end{bmatrix}$$

5.5.2 Relativization out of Nominalization Clauses

Recall that subject/non-subject relativization is also possible out of nominalization clauses in Turkish. Thus, the paradigm entry in VERB corresponding to *nomin* verbs, say E, is assumed to have default values for both SUBJ and COMPS features. The corresponding entries E' (subject relativization) and E'' (non-subject relativization) in VERB$'$ and VERB$''$, respectively, follow:

(58)

$$E' \equiv \begin{bmatrix} \text{HEAD} & verb \ [\text{VFORM} \ nomin] \\ \text{ARG-S} & \langle \text{NP} [\text{LOC} \ \boxed{2}[gen]], \ldots \rangle \\ \text{SUBJ} & \langle \rangle \\ \text{INHER}|\text{RELATIVIZED}|\text{SUBJ-REL} & \{\boxed{2}\} \end{bmatrix}$$

(59)

$$E'' \equiv \begin{bmatrix} \text{HEAD} & verb \ [\text{VFORM} \ nomin] \\ \text{ARG-S} & \langle synsem, \ldots, \text{NP} [\text{LOC} \ \boxed{3}], \ldots \rangle \\ \text{COMPS} & \langle \ldots \rangle \\ \text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\boxed{3}\} \end{bmatrix}$$

5.5.3 Relativization out of Infinitive Clauses

Since relativization is also possible out of non-subject infinitive clauses in Turkish, the paradigm entry in VERB corresponding to *inf* verbs, say F, is assumed to have a default value for the COMPS feature. The corresponding entry in VERB″ (for non-subject relativization) is as follows:

$$
(60) \qquad F'' \quad \equiv \quad
\begin{bmatrix}
\text{HEAD} & verb\ [\text{VFORM}\ \ inf] \\
\text{ARG-S} & \langle synsem, \ldots, \text{NP}\,[\text{LOC}\ \boxed{4}], \ldots \rangle \\
\text{COMPS} & \langle \ldots \rangle \\
\text{INHER|RELATIVIZED|NON-SUBJ-REL} & \{\boxed{4}\}
\end{bmatrix}
$$

6   Conclusions

Relative clauses in Turkish provide an interesting test case for linguistic theories of unbounded dependencies. The acceptable pattern of unbounded relativization reflects an interaction between the grammatical function of the gap, the grammatical function of the gap host and the case marking of the highest subject, which in turn reflects interpretational distinctions concerning specificity. In this paper we have outlined an analysis within a constraint-based framework, which captures this interaction through simultaneous constraints on feature values in the lexical signs for participles. Given the usual HPSG inventory of typed feature structures, head feature percolation and nonlocal feature handling, we were able to account for the whole pattern of bounded and unbounded relativization by systematically specifying the constraints that have to be met in order for particular forms of participles to be used in relative clauses. For instance, given a nonlocal feature for type of relativization, we can specify that a given participle is appropriate if one of its complements contains a relativization dependency of e.g. the subject type. In order to capture the systematic paradigm of available verb forms, we applied Bouma and Nerbonne's relational constraints, thereby avoiding redundancy in the lexicon. One question we have not tried to answer in this paper is whether it is just a language particular fact about Turkish that relativization is sensitive to, among other things, the grammatical function of the gap host. Given that the grammatical function of the gap host also appears to be relevant for unbounded relativization in Japanese, another head final language with prenominal relative clauses, it seems plausible that there is a correlation with the branching structure of the language, i.e. whether it is left or right branching, but more research is clearly needed on this topic.

References

[Barker et al., 1990] Chris Barker, Jorge Hankamer, and John Moore, "Wa and ga in Turkish," in D. Katarzyna, P. Farrell, and E. M. Bikandi, eds., *Grammatical Relations*, CSLI Lecture Notes, pp. 21–43. CSLI, Stanford, Ca., 1990.

[Bouma & Nerbonne, 1994] Gosse Bouma and John Nerbonne, "Lexicons for feature-based systems," in *Proceedings of KONVENS'94*. Berlin:Springer, 1994.

[Csató, 1985] Éva A. Csató, "A syntactic analysis of paticiple constructions in modern Turkish," in *Beşinci Milletlerarası Türkoloji Kongresi*, pp. 39–56, İstanbul, 1985.

[Dede, 1978] Müşerref Dede, "Why should Turkish relativization distinguish between subject and non-subject head nouns?," in *Proceedings of the Fourth Annual Meeting of the Berkeley Linguistics Society*, volume 4, Berkeley, Ca., 1978.

[Fodor, 1978]   Janet Dean Fodor, "Parsing strategies and constraints on transformations," *Linguistic Inquiry*, vol. 9, pp. 427–473, 1978.

[Güngördü, 1997]   Zelal Güngördü, *Incremental Constraint-based Parsing: An Efficient Approach for Head-final Languages*. PhD thesis, Centre for Cognitive Science, University of Edinburgh, 1997.

[Güngördü & Engdahl, 1998] Zelal Güngördü and Elisabet Engdahl, "A relational approach to relativization in Turkish," in *Proceedings of the Joint Conference on Formal Grammar, Head-driven Phrase Sturucture Grammar, and Categorial Grammar (FHCG-98)*, Saarbrücken, Germany, August 14–16, 1998.

[Hankamer & Knecht, 1976] Jorge Hankamer and Laura Knecht, "The role of subject/non-subject distinction in determining the choice of relative clause participle in Turkish," in Aissen and Hankamer, eds., *Harvard Studies in Syntax and Semantics*, volume 2, pp. 197–219, Cambridge, 1976.

[Kathol, 1994]   Andreas Kathol, "Passive without lexical rules," in John Nerbonne, Klaus Netter, and Carl Pollard, eds., *German in HPSG*, CSLI Lecture Notes. CSLI, Stanford, Ca., 1994.

[Knecht, 1979]   Laura Knecht, "The role of the genitive suffix in relative clauses in Turkish: A reply to Dede," in *Proceedings of the Fifth Annual Meeting of the Berkeley Linguistics Society*, volume 5, pp. 180–197, 1979.

[Krieger & Nerbonne, 1993] Hans-Ulrich Krieger and John Nerbonne, "Feature-based inheritance networks for computational lexicons," in Ted Briscoe, Valerie de Paiva, and Ann Copestake, eds., *Inheritance, Defaults, and the Lexicon*, pp. 90–136. Cambridge University Press, Cambridge, 1993.

[Lascarides et al., 1996] Alex Lascarides, John Briscoe, Nicholas Asher, and Ann Copestake, "Order independent and persistent typed default unification," *Linguistics and Philosophy*, vol. 19, pp. 1–89, 1996.

[Nilsson, 1985]   Birgit Nilsson, *Case Marking Semantics in Turkish*. PhD thesis, University of Stockholm, 1985.

[Oliva, 1994]   Karel Oliva, "HPSG lexicon without lexical rules," in *Proceedings of the 15th International Conference on Computational Linguistics*, volume 2, pp. 823–826, 1994.

[Pollard & Sag, 1994] Carl Pollard and Ivan Sag, *Head-Driven Phrase Structure Grammar*. CSLI and University of Chicago Press, Stanford, Ca. and Chicago, Ill., 1994.

[Sag, 1997]   Ivan Sag, "English relative clause constructions," *Journal of Linguistics*, vol. 33(2), pp. 431–484, 1997.

[Sezer, 1986]   Engin Sezer, "The unmarked sentential subject constraint in Turkish," in D. Slobin and K. Zimmer, eds., *Studies in Turkish Linguistics*, volume 8 of *Typological Studies in Language*, pp 123–135. John Benjamins Publishing Co., Amsterdam, 1986.

[Underhill, 1972]   Robert Underhill, "Turkish participles," *Linguistic Inquiry*, vol. 3, pp. 87–99, 1972.

A   Verb Paradigms

$$\text{VERB} \quad\equiv\quad \langle\ldots,\, A, B, C, D, \ldots\rangle$$

$$\text{VERB}' \quad\equiv\quad \left\langle\ldots,\, \bot, B', C', \bot, \ldots\right\rangle$$

$$\text{VERB}'' \quad\equiv\quad \left\langle\ldots,\, A'', \bot, C'', D'', \ldots\right\rangle$$

A.1   VERB Paradigm Entries

Bounded Subject Relativization[12]

$$
A \equiv
\begin{bmatrix}
\text{PHON} & \boxed{1} \bullet \langle yEn \rangle \\
\text{MOR} & [\text{ROOT } \boxed{1}] \\[2mm]
\text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} \quad part \\ \text{MOD} \quad \text{NP}_{\boxed{3}}\left[\text{TO-BIND}|\text{RELATIVIZED}|\text{SUBJ-REL} \quad \left\{\boxed{2}\boxed{3}\right\}\right] \end{bmatrix} \\[4mm]
\text{ARG-S} & \langle[\text{LOC } \boxed{2}], \ldots\rangle \\
\text{SUBJ} & \langle\rangle \\
\text{COMPS} & /\ \langle\ldots\rangle \\
\text{INHER}|\text{RELATIVIZED}|\text{SUBJ-REL} & \{\boxed{2}\}
\end{bmatrix}
$$

Bounded Non-subject Relativization

$$
B \equiv
\begin{bmatrix}
\text{PHON} & \boxed{1} \bullet \boxed{7} \\
\text{MOR} & [\text{ROOT } \boxed{1}] \\[2mm]
\text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} \quad part \\ \text{MOD} \quad \text{NP}_{\boxed{5}}\left[\text{TO-BIND}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} \quad \left\{\boxed{4}\boxed{5}\right\}\right] \end{bmatrix} \\[4mm]
\text{ARG-S} & \langle\boxed{6}, \ldots, [\text{LOC } \boxed{4}], \ldots\rangle \\
\text{SUBJ} & /\ \langle\boxed{6}\ \text{NP}\rangle \\
\text{COMPS} & \langle\ldots\rangle \\
\text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\boxed{4}\}
\end{bmatrix}
$$

where   *strategy-used* ($\boxed{7}$, $\boxed{6}$)

Long-distance Relativization with Non-subject Gap Host

$$
C \equiv
\begin{bmatrix}
\text{PHON} & \boxed{1} \bullet \boxed{8} \\
\text{MOR} & [\text{ROOT } \boxed{1}] \\[2mm]
\text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} \quad part \\ \text{MOD} \quad \text{NP}_{\boxed{13}}\left[\text{TO-BIND}|\text{RELATIVIZED}|\text{Y} \quad \left\{\boxed{9}\boxed{13}\right\}\right] \end{bmatrix} \\[4mm]
\text{ARG-S} & \boxed{10} \bullet \boxed{11} \\
\text{SUBJ} & /\ \boxed{10}\ \langle\boxed{12}\text{NP}\rangle \\
\text{COMPS} & /\ \boxed{11}\ \langle\ldots, \text{XP}\,[\text{INHER}|\text{RELATIVIZED}|\text{Y} \ \{\ldots,\boxed{9},\ldots\}]\ ,\ldots\rangle
\end{bmatrix}
$$

where *strategy-used* ($\boxed{8}$, $\boxed{12}$)

Y $\in$ {SUBJ-REL , NON-SUBJ-REL} and   XP $\in$ { NP , PP , S[*nomin*] , VP[*inf*] }

---

[12]Note that '/' is used to denote default values in feature structures (cf. Section 5.5).

Long-distance Relativization with Subject Gap Host

$$D \equiv \begin{bmatrix} \text{PHON} & [1] \bullet [16] \\ \text{MOR} & [\text{ROOT } [1]] \\ \\ \text{HEAD} & \begin{bmatrix} verb \\ \text{VFORM} & part \\ \text{MOD} & [14]\text{NP} \end{bmatrix} \\ \\ \text{SUBJ} & \langle [15]\text{XP} \rangle \\ \\ \text{COMPS} & / \ list\text{-}synsem \end{bmatrix}$$

where XP $\in$ { NP , S[$nomin$] }

$\quad\quad$ *strategy-used-pr* ([16] , [14] , [15])

Relational Constraints Referred to by VERB Paradigm Entries

strategy-used ($\langle dIk \rangle \bullet$ [1] , NP$_{[2]}$[gen]) :- *possess-suffix* ([2] , [1]).

strategy-used ($\langle yEn \rangle$, NP [$nom, specific$]).

strategy-used-pr ($\langle yEn \rangle$, NP$_1$ [TO-BIND|RELATIVIZED|SUBJ-REL $\{[2]_{[1]}\}$] ,
$\quad\quad$ [nom, INHER|RELATIVIZED|SUBJ-REL $\{\dots, [2], \dots\}$]).

strategy-used-pr ($\langle dIk \rangle \bullet$ [1] , NP$_{[2]}$ [TO-BIND|RELATIVIZED|NON-SUBJ-REL $\{[3]_{[2]}\}$] ,
$\quad\quad$ [gen, INDEX [4], INHER|RELATIVIZED|NON-SUBJ-REL $\{\dots, [3], \dots\}$])
$\quad\quad$:- *possess-suffix* ([4] , [1]).

A.2 VERB$'$ Paradigm Entries

Embedded Subject Relativization out of Relative Clauses

$$B' \equiv C' \equiv \begin{bmatrix} \text{ARG-S} & \langle \text{NP} [\text{LOC } [1] [gen]] , \dots \rangle \\ \\ \text{SUBJ} & \langle \rangle \\ \\ \text{INHER|RELATIVIZED|SUBJ-REL} & \{[1]\} \end{bmatrix}$$

Embedded Subject Relativization out of Nominalization Clauses

$$E' \equiv \begin{bmatrix} \text{HEAD} & verb \ [\text{VFORM } nomin] \\ \\ \text{ARG-S} & \langle \text{NP} [\text{LOC } [2][gen]] , \dots \rangle \\ \\ \text{SUBJ} & \langle \rangle \\ \\ \text{INHER|RELATIVIZED|SUBJ-REL} & \{[2]\} \end{bmatrix}$$

A.3 VERB″ Paradigm Entries

Embedded Non-subject Relativization out of Relative Clauses

$$
A'' \equiv D'' \equiv
\begin{bmatrix}
\text{HEAD} & verb\ [\text{VFORM}\ part] \\
\text{ARG-S} & \langle synsem, \dots, \text{NP}\,[\text{LOC}\ \boxed{1}\,], \dots \rangle \\
\text{COMPS} & \langle \dots \rangle \\
\text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\boxed{1}\}
\end{bmatrix}
$$

$$
C'' \equiv
\begin{bmatrix}
\text{HEAD} & verb\ [\text{VFORM}\ part] \\
\text{ARG-S} & \left\langle synsem, \dots, \text{NP}
\begin{bmatrix}
\text{LOC} & \boxed{2} \\
\text{INHER}|\text{RELATIVIZED}|\text{SUBJ-REL} & \{\} \\
\text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\}
\end{bmatrix}, \dots \right\rangle \\
\text{COMPS} & \langle \dots \rangle \\
\text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\boxed{2}\}
\end{bmatrix}
$$

Embedded Non-subject Relativization out of Nominalization Clauses

$$
E'' \equiv
\begin{bmatrix}
\text{HEAD} & verb\ [\text{VFORM}\ nomin] \\
\text{ARG-S} & \langle synsem, \dots, \text{NP}\,[\text{LOC}\ \boxed{3}\,], \dots \rangle \\
\text{COMPS} & \langle \dots \rangle \\
\text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\boxed{3}\}
\end{bmatrix}
$$

Embedded Non-subject Relativization out of Infinitive Clauses

$$
F'' \equiv
\begin{bmatrix}
\text{HEAD} & verb\ [\text{VFORM}\ inf] \\
\text{ARG-S} & \langle synsem, \dots, \text{NP}\,[\text{LOC}\ \boxed{4}\,], \dots \rangle \\
\text{COMPS} & \langle \dots \rangle \\
\text{INHER}|\text{RELATIVIZED}|\text{NON-SUBJ-REL} & \{\boxed{4}\}
\end{bmatrix}
$$