PRONOMINAL COREFERENCE
IN OSSETIC CORRELATIVES
AND THE SYNTAX-SEMANTICS INTERFACE

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Abstract

Correlatives are a subtype of relative constructions where the subordinate clause precedes the main clause, contains a relative pronoun or DP, and is resumed in the main clause by a full DP containing a personal or demonstrative pronoun (the correlate). Crucially, the subordinate clause does not usually form a constituent with the correlate. Most explicit treatments of the semantics of correlatives adopt, with some variations, the standard set-intersective analysis of relative clauses. In this paper, we demonstrate that the data of Ossetic shows that the relative DP and the correlate are instead linked through pronominal anaphora, such that the relative DP acts as the antecedent and the correlate, as the bound pronominal or definite description. This explains certain effects that are unexpected under the standard analysis of relative clauses, such as the possibility of bridging. The analysis is given a full formalization in terms of LFG, Glue semantics and PCDRT as the semantic metalanguage.

1 Introduction

The correlative construction is generally understood as a relative clause where "a left-peripheral relative clause is linked to a (possibly phonetically unrealized) nominal correlate in the clause that follows the relative clause" (Lipták 2009, 1). A classic example of a language with correlatives is Hindi:

(1) $\left[\,\left[\,\textbf{jo}\;\;\textbf{laṛkii}\,\right]_{\text{DP}_{\text{rel}}}\text{khaṛii}\quad\text{hai}\,\right]\;\left[\,\textbf{vo}\,\right]_{\text{DP}_{\text{mat}}}\text{lambii hai}$
     REL girl   standing is   she   tall   is
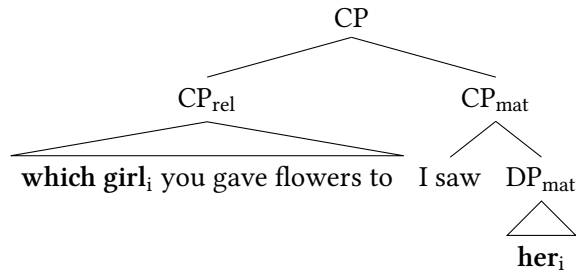 'The girl who is standing is tall'

(Srivastav 1991)

Here, the subordinate clause precedes the main clause, contains a left-dislocated relativized DP with an internal head (DP_{rel}), which is linked to a demonstrative pronoun (DP_{mat}) in the main clause.[1]

Broadly speaking, there are two syntactic analyses of correlatives that dominate the contemporary literature. In one of them, originally proposed in Srivastav (1991), the subordinate clause is said to be base-generated in the left peripheral
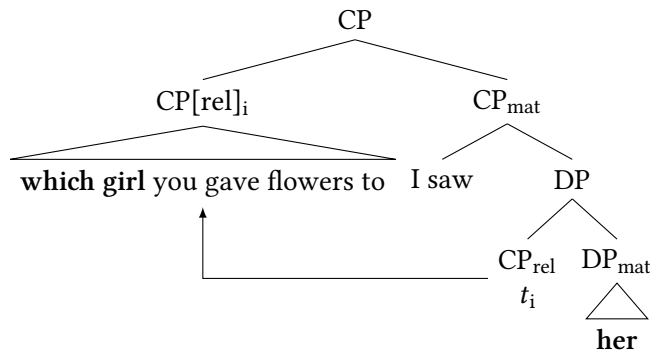
[1]The abbreviations DP_{rel} and DP_{mat} are adopted from Andrews (2007).

position, and non-locally linked with DP_{mat}:

```
                        CP
              ┌─────────┴─────────┐
          CP_rel                CP_mat
      ┌──────┴──────┐          ┌──┴──┐
which girl_i you gave flowers to  I saw  DP_mat
                                         △
                                        her_i
```

The second analysis has been most explicitly articulated in Bhatt (2003). In this analysis, the subordinate clause is base-generated adjoined to DP_{mat} and afterwards (optionally) undergoes movement to the left periphery:

```
                        CP
              ┌─────────┴─────────┐
          CP[rel]_i              CP_mat
      ┌──────┴──────┐          ┌──┴──┐
which girl you gave flowers to  I saw  DP
                                    ┌──┴──┐
                                CP_rel  DP_mat
                                  t_i     △
                                         her
```

Even though these analyses differ considerably in terms of syntax, the semantics they assume is always some variant of the standard semantics of relative clauses. This is true even of the former analysis: although the binding is non-local, it does not involve any special anaphoric mechanisms. Thus, in Srivastav's original version, the relative clause is assigned the following meaning:

(2) $\lambda P.P(\iota x(\text{girl}'(x) \wedge \text{stand}'(x)))$

The correlate is interpreted as a "phonetically realized trace" (and so is treated in a very different way from the external head in a canonical relative clause). This means the main clause is an open proposition, in this case $\lambda x.\,\text{tall}'(x)$. When substituted into (2), this gives:

(3) $\lambda P.P(\iota x.\,\text{girl}'(x) \wedge \text{stand}'(x))(\lambda x.\,\text{tall}'(x)) \Rightarrow$
     $\text{tall}(\iota x.\,\text{girl}'(x) \wedge \text{stand}'(x))$

The standard semantics for relative clauses, i.e. set intersection (Quine 1960; Partee 1975, 229; Larson and Segal 1995, 256), gives, if combined with a definite article, exactly the same result:

(4) $[\![\text{girl who is standing}]\!] = \lambda x.\,\text{girl}(x) \wedge \text{stand}(x)$

(5) a. $[\![\text{the}]\!] = \lambda P.\iota x.P(x)$
     b. $[\![\text{the girl who is standing}]\!] = \iota x.\,\text{girl}(x) \wedge \text{stand}(x)$
     c. $[\![\text{the girl who is standing is tall}]\!] = \text{tall}(\iota x.\,\text{girl}'(x) \wedge \text{stand}'(x))$

Therefore, Srivastav's analysis essentially treats correlatives as definite relative clauses.[2] The approaches provided in Dayal (1995) and Grosu and Landman (1998) involve an additional maximalization operation applied to (2), but do not otherwise differ from the conventional approach to relative clauses. In Brasoveanu (2008), the matrix correlate is taken to refer anaphorically to DP_{rel}, with maximalization following from anaphora. But again, the anaphora is assumed to always involve full coreference.

In what follows we will demonstrate that for Ossetic and a few other languages an analysis that appeals to the conventional semantics of relative clauses meets with considerable difficulties, and we must rather analyze the linking between DP_{rel} and DP_{mat} as an anaphoric relation between two separate referents which does *not* necessary involve full coreference.

2   The syntax of simple correlatives in Ossetic

Ossetic[3] is an Iranian language spoken by around 700 000 people worldwide, with about 450 000 living in the Republic of North Ossetia in the Caucasus, part of the Russian Federation, where the language enjoys official status. Other areas with considerable numbers of Ossetic speakers include the disputed region of South Ossetia, certain areas of Georgia and some settlements in Turkey. Ossetic consists of two dialects, Iron and Digor, both of which have standard varieties, but Iron is by far the dominant idiom. This study is based on the standard variety of the Iron dialect.

The basic structure of the correlative clause in Ossetic is illustrated in (6), with the very schematic structural representation in (7).

(6)   [didinǯ-ətɜ **sə**   **čəžg-ɜn** ba-lɜvar   kotː-aj],   fetː-on
        flower-PL what girl-DAT PV-present do-PST.2SG see.PFV-PST.1SG
      wəj   fəd-ə
      that[GEN] father-GEN
      'I saw the father[4] of **the girl that** you gave flowers to.'

(7)   CP
              ⟋‾‾‾‾‾‾‾⟍
          CP_{rel} C′
         ⟋‾‾⟍   ⟋‾‾⟍
      …DP_{rel} V …   ….DP_{mat} …
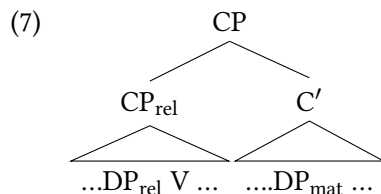
That is, CP_{rel} is left-peripheral and contains DP_{rel} (obligatorily preceding the verb of its clause), which is "resumed" in the main clause by DP_{mat} which must contain

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[2]Correlatives also tend to have a universal interpretation, which we mostly ignore for the purposes of this article; but see the end of section 4 for a brief discussion.

[3]All sourced examples marked as "ONC" are from the Ossetic National Corpus (`http://corpus.ossetic-studies.org/en`). Unsourced examples are elicited from native speakers. There is a list of glosses at the end of the paper.

[4]Direct objects in Ossetic are marked by either nominative or genitive. The rules determining this are complex, mostly involving animacy, cf. Kulaev (1961).

a distal demonstrative. We assume that CP_{rel} is attached in the specifier position of CP_{mat}; the motivation for the adoption of this structure instead of adjunction will be provided below.

From the syntactic point of view, both DP_{rel} and DP_{mat} are full-fledged DPs, that can have their own modifiers such as numerals, adjectives, and even certain quantifiers:

(8)   ... [sə   **birɜ**   **čing**ʷ**ə-tɜ** ba-kašt   aχɜšton-ə], **wədon-ə**
         what many book-PL PV-look[PST.3SG] prison-IN   those-GEN
         midiš   =dɜr =zə nɜ roχ   kot:-a.
         content ADD it.IN NEG oblivion do-PST.3SG
         'He didn't forget the content of **the many books that** he read in prison.'
                                          (ONC: Gusalty Baris, *Tugdar æmæ tugagur*, 2003)

(9)   [jekup-ə   kɜrt-ə   **sə**   **ɜrtɜ fɜtk**ʷ**ə-jə** žaj-ə],   **wədon-ə**
         Ekup-GEN courtyard-IN what three apple-GEN grow-PRS.3SG those-GEN
         dərʁ-tɜ ražə   ɜfšnajd   ɜr-səd-əštə...
         fruit-PL long_ago gather.PTCP PV-go-PST.3PL
         'The fruits **from the three apple trees that** grow in Ekup's courtyard have been gathered long ago.'
                                                (ONC: *Max dug* 4, 2008)

As an alternative, the subordinate clause may be located immediately preceding the correlate as in (10), a variant of (6) with the simplified structure in (11).

(10)   fet:on, [didinžətɜ **sə čəžgɜn** balɜvar kodtaj], **wəj** fədə

(11)
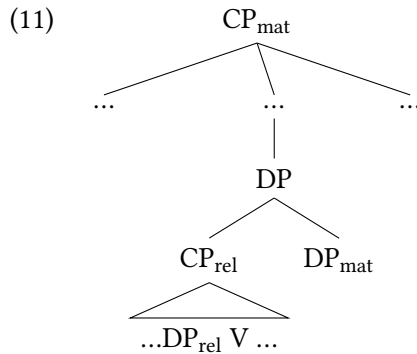
In the latter case, the relative clause and DP_{mat} form a constituent, since the relative clause must immediately precede DP_{mat}, and two groups of relative clause + DP_{mat} can be coordinated:

(12)   alan kɜš-ə,   [[[**sə**   **činəg**ᵢ =ən   ba-lɜvar   kot:-a
         Alan read-PRS.3SG   what book he.DAT PV-present do-PST.3SG
         aslan], **wəj**ᵢ]_DP, **ɜmɜ** [[**sə**   **stat**ʲ**ja**ⱼ nə-ffəšt-a   žawər],
         Aslan   that.DEM and   what article PV-write-PST.3SG Zaur
         wəjⱼ]_DP]_CoP
         that.DEM
         'Alan is reading **the book that** Aslan gave him **and the article that** Zaur wrote.'

Furthermore, the CP$_{rel}$+DP$_{mat}$ combination can be modified by the adverb *ɜrmɜšt* 'only' (which generally precedes the focused element, and which can associate with DPs but not CPs):

(13) χɜzar-ə =ma ba-žžad-iš **ɜrmɜšt**, [ɜnɜmɜng **či** qɜw-ə],
  house-IN more PV-remain-PST.3SG only certainly who need-PRS.3SG
  aχɜm zawma-tɜ
  such thing-PL
  'In the house there were left **only the things which** were certainly needed.'
  (ONC: Mamsyraty Dæbe, *Cardy k'æpxæntyl*, 1937)

We will see that correlative clauses have exactly the same semantics irrespective of whether they are in SpecCP or adjoined to DP. This gives some motivation for adopting an analysis of the kind proposed in Bhatt (2003), formulated in terms of LFG by Butt, King, and Roth (2007). On this analysis, the fronted correlative clause is an f-structure TOPIC structure-shared with the ADJ feature of the correlate's f-structure.

A demonstrative DP$_{mat}$ is obligatory; it is generally impossible not to have a correlate (14), or for the correlate to be expressed by a null pronoun (15), an enclitic pronoun (16b) or a possessive proclitic (for exceptions see Belyaev 2014a).

(14) * [**či** rba-sɜw-a], dwar ba-jgom kɜn
  who PV-go-SBJV.3SG door PV-open do[IMP.2SG]
  ('(If) **who** comes, open the door.')

(15) [**sə** lɜp:u$_i$ ɜrba-səd-i], **wəj**$_i$ / *∅$_i$ me= fšəmɜr u
  what boy PV-go-PST.3SG that.DEM my brother be.PRS.3SG
  '**The boy who** came is my brother.'

(16) a. [**sə** lɜp:u$_i$ ɜrba-səd-i], **wəm-ɜn**$_i$ činəg rat:-on
  what boy PV-go-PST.3SG that-DAT book give.PFV-PST.1SG

  b. * [**sə** lɜp:u$_i$ ɜrba-səd-i], činəg =ən$_i$ rat:-on
  what boy PV-go-PST.3SG book he.DAT give.PFV-PST.1SG
  'I gave the book **to the boy who** came.'

The treatment of correlatives crucially depends on the phrase structure that one assumes at the clause level. Ossetic word order is free in the sense that the linear position of constituents does not depend on their grammatical function. However, specific linear positions, especially in the preverbal area (on which see Erschler 2012), are rigidly associated with particular discourse functions or word classes, such that the language can be characterized as discourse-configurational. Informally and schematically, the purely linear structure of the clause can be presented as follows:

(17) LPeriph − PreC − C − PostC − $\overbrace{\underbrace{\text{Foc} - \text{Wh} - \text{Neg} - \text{V}}_{\text{enclitic placement area}} - \text{PostV}}^{\text{verb complex}}$ − RPeriph

A detailed discussion of each of these positions is beyond the scope of this paper, but the most important ones can be briefly described as follows:

LPeriph The position for left-dislocated elements, whose defining feature is the inability to host second-position enclitics.

C The position for the five non-preverbal subordinators (*sɜmɜj* 'in order to', *kɜd* 'if', *salənmɜ* 'while', *səma* 'as if', *jugɜr* 'if') which may be optionally preceded by one, rarely two or more, left-peripheral but clause-internal elements.

Foc The position for focused constituents.

Wh The position for interrogatives and **DP$_{rel}$**[5].

Neg The position for negative particles or negative pronouns.

V The finite verb or complex predicate.

PostV The postverbal area, which may contain both topical and focal DPs.

RPeriph The position for right-dislocated clitic-doubled DPs.[6]

The clause structure thus revolves around the verbal complex, which is tightly integrated both syntactically and prosodically, and can be regarded as a VP constituent. We also assume that non-preverbal subordinators go into C^0, and the peripheral elements are either specifiers or adjuncts of CP. Between the CP and the VP level we situate the S level, which contains elements not explicitly designated as topical or focal. This can be summed up in the following scheme:

(18)

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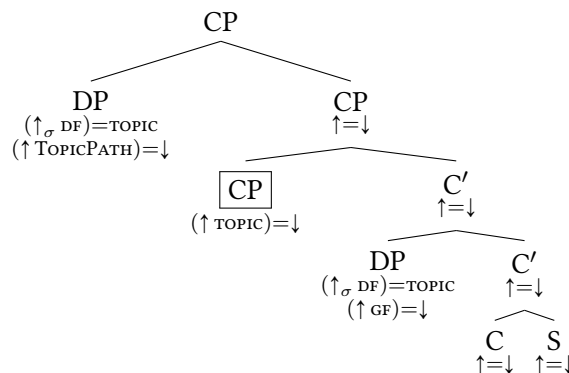
[5]An anonymous reviewer observes that there can also be multiple subordinators here, as shown in Erschler (2012, 680). The example that this refers to concerns multiple correlatives, which, as argued in Belyaev (2014a), must be treated as a separate construction. In particular, multiple correlatives use "true" interrogatives instead of relative markers or subordinators. Furthermore, as argued in Belyaev (2014c), only the last of the interrogatives occupies the Wh position and is required to have a correlate; the rest are ordinary focal items.

[6]An anonymous reviewer observes that these can be treated as separate fragments rather than genuine clitic-doubled items. This is indeed a possiblity; in fact, such an analysis of clitic right dislocation has been proposed in Ott and Vries (2013). If this is the correct analysis, RPeriph should not be treated as a special structural position within the clause. Note, however, that there are certain locality constraints on right dislocation (Belyaev 2014b).

The tree diagram:

```
                                          S
                    ┌─────────────────────┼─────────────────────────────┐
                  DP*                      VP                            DP*
                (↑ GF)=↓                   ↑=↓                         (↑ GF)=↓
                              ┌────────────┴───────┐
                             DP                    VP
                         (↑_σ DF)=FOCUS      ┌──────┴──────┐
                         (↑ GF)=↓           ┌─┐            V′
                                           │DP│      ┌──────┴──────┐
                                           └─┘      DP             V′
                                        (↑ FOCUS)=↓  (↓ DET) =_c NEG   ┌───┬──┬────┐
                                        (↑ GF)=↓    (↑ GF)=↓        Neg Adv V    CP
                                                                    ↑=↓ ↑=↓ ↑=↓ (↑ COMP)=↓
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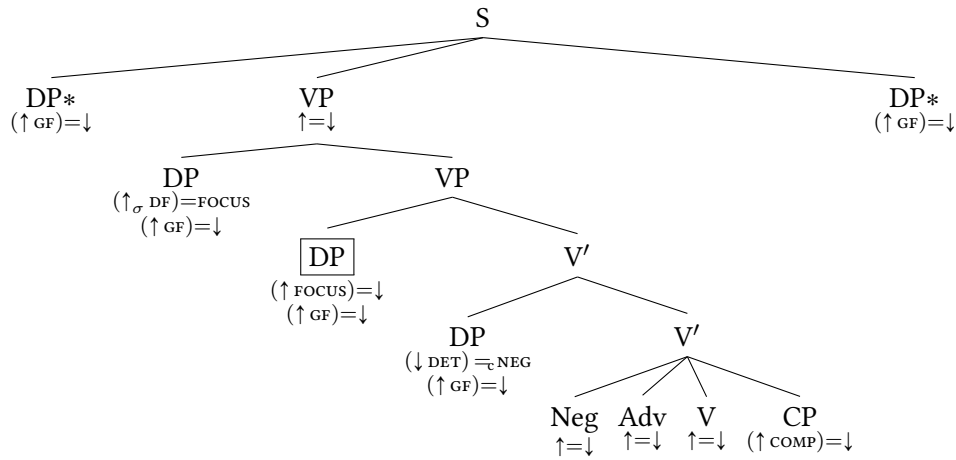
It must be stressed that this structure is preliminary and should be elaborated and motivated in more detail. For the purposes of this article, it merely serves as a basis for the full syntactic formalization of correlatives. The crucial point is that we distinguish between f-structure and i-structure DFs; only the former are relevant for establishing long-distance dependencies and are involved in the correlative construction. They are boxed in the tree above. DP_{rel} is, just like wh-words occupying the same position, a FOCUS structure shared with some GF in the relative clause:

(19)   VP → { DP   } V′
              (↑ FOC)=↓   ↑=↓

The fronted correlative clause is in SpecCP and occupies the TOPIC position, structure shared with some ADJ function in the matrix clause:

(20)   CP →   CP   C′
                (↑ TOPIC)=↓   ↑=↓
            ↓ ∈ (↑ GF POSS* ADJ)
            (↓ STYPE) =_c CORREL

For (21), this yields the f-structure in (22):

(21)   [didinǯ-ətɜ **sə**   **čəžg-ɜn** ba-lɜvar   kotː-aj],   **wəj**
         flower-PL what girl-DAT PV-present do-PST.2SG that[GEN]
       fetː-on
       see.PFV-PST.1SG
       'I saw **the girl which** you gave flowers to.'

(22)

$$
\begin{bmatrix}
\text{PRED} & \text{`see}\langle\text{SUBJ OBJ}\rangle\text{'} \\[4pt]
\text{TOPIC} & \begin{bmatrix}
\text{PRED} & \text{`give}\langle\text{SUBJ OBJ OBJ}_{\text{GOAL}}\rangle\text{'} \\
\text{STYPE} & \text{CORREL} \\
\text{FOCUS} & \begin{bmatrix} \text{PRED} & \text{`girl'} \\ \text{DET} & \text{REL} \end{bmatrix} \\
\text{OBJ}_{\text{GOAL}} & [\quad] \\
\text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`you'} \end{bmatrix} \\
\text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`flowers'} \end{bmatrix}
\end{bmatrix} \\[4pt]
\text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`I'} \end{bmatrix} \\[4pt]
\text{OBJ} & \begin{bmatrix}
\text{PRED} & \text{`PRO'} \\
\text{DET} & \text{DIST} \\
\text{ADJ} & \left\{ [\quad] \right\}
\end{bmatrix}
\end{bmatrix}
$$
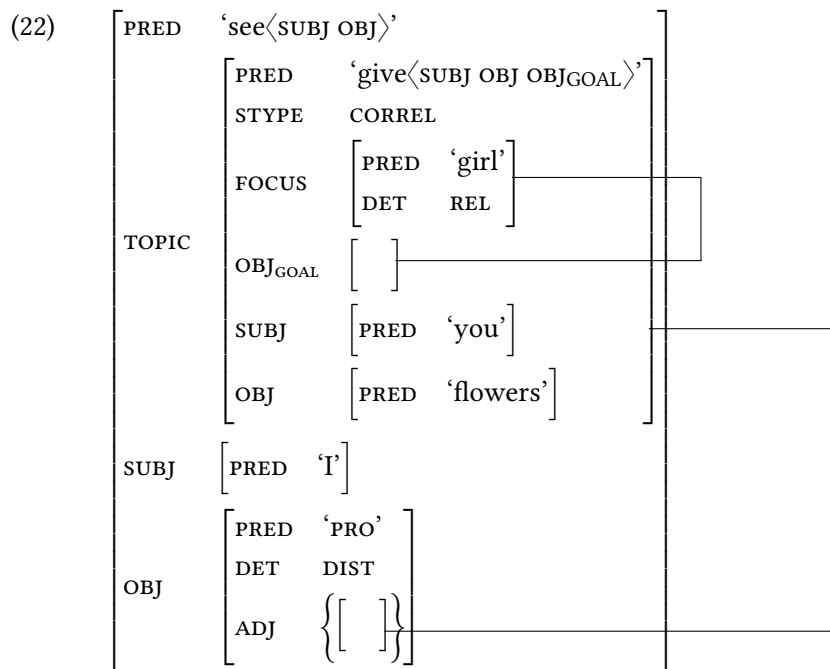
Alternatively, the correlative clause attaches to DP_{mat} and thus only occupies the ADJ function of the correlate:

(23) DP $\rightarrow$ $\underset{\substack{\downarrow\in(\uparrow\text{ADJ}) \\ (\downarrow\text{STYPE})=_{\text{c}}\text{CORREL}}}{\text{CP}}$ $\underset{\uparrow=\downarrow}{\text{DP}}$

(24)

$$
\begin{bmatrix}
\text{PRED} & \text{`see}\langle\text{SUBJ OBJ}\rangle\text{'} \\[4pt]
\text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`I'} \end{bmatrix} \\[4pt]
\text{OBJ} & \begin{bmatrix}
\text{PRED} & \text{`PRO'} \\
\text{DET} & \text{DIST} \\
\text{ADJ} & \left\{ \begin{bmatrix}
\text{PRED} & \text{`give}\langle\text{SUBJ OBJ OBJ}_{\text{GOAL}}\rangle\text{'} \\
\text{STYPE} & \text{CORREL} \\
\text{FOCUS} & \begin{bmatrix} \text{PRED} & \text{`girl'} \\ \text{DET} & \text{REL} \end{bmatrix} \\
\text{OBJ}_{\text{GOAL}} & [\quad] \\
\text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`you'} \end{bmatrix} \\
\text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`flowers'} \end{bmatrix}
\end{bmatrix} \right\}
\end{bmatrix}
\end{bmatrix}
$$
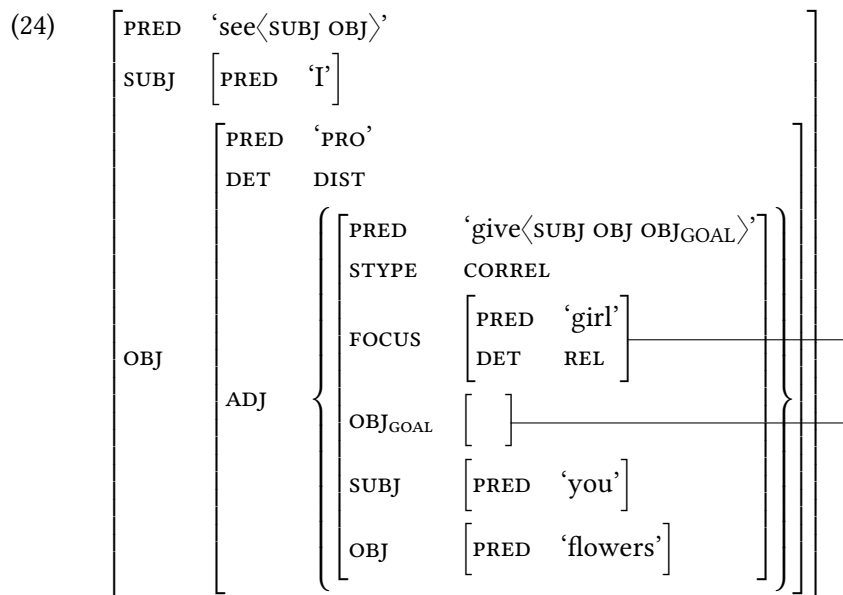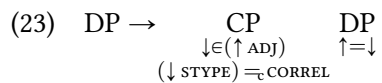
That said, it must be stressed that the syntactic approach one adopts does not in

any way influence the semantic part of our analysis, which is logically independent from the issue of movement/structure sharing.

3 Semantics

3.1 Why the linking is anaphoric

Intuitively, relative clauses link two positions, one in the matrix clause and one in the relative clause. Some analyses, e.g. Falk (2010), assume that these two positions are structure shared in the syntax. For correlatives, however, that would yield a clash of PRED-values. In any case, most analyses link the two positions semantically instead. Typically this is done by binding the two positions to the same variable as in (25).

(25) $\lambda P.\lambda Q.\lambda x.P(x) \wedge Q(x)$

The formula in (25) may be the meaning of a relative pronoun, or be associated with the relative clause construction itself (if there is no pronoun). Essentially, the combination of a head with a relative clause denotes the intersection of the individuals in their denotations. The matrix determiner applies to this meaning. There are several reasons why this does not work for Ossetic correlatives.

Bridging   Correlatives can have both an internal and an external "head". In most cases the subordinator and the correlate are fully coreferent, but indirect coreferentiality ('bridging') is also possible.

(26) $\big[$ afɜz-ɜj   afɜz-mɜ =šɜ   **sə**   **kɜnd-tɜ**$_i$ qɜw-ə $\big]$,
           year-ABL year-ALL those.GEN what commemoration-PL need-PRS.3SG
           wə-sə   **χɜrz-tɜ**$_{j\sim i}$ mɜ= χi-mɜ   iš-ən.
           that-ATTR expense-PL my   self-ALL take-PRS.1SG
           'I take **the expenses** needed for **the commemorations** that they need every year on myself.'
           (lit. '**What remembrances**$_i$ they need every year, I take **these expenses**$_{j\sim i}$ on myself.')
                                    (ONC: Gaglojty Vladimir, *Ġe, marʒæ, isči!..*, 2009)

(27) $\big[$ adɜjmag χʷəždɜr **sə**   **vžag-əl**$_i$ zur-a $\big]$,   **wə-sə**
           person   better   what language-SUPER speak-SBJV.3SG that-ATTR
           adɜməχat:-ɜj$_{j\sim i}$ u.
           nation-ABL   be.PRS.3SG
           'A person belongs **to the nation** whose **language** s/he speaks better.'
           (lit. '**What language**$_i$ a person speaks better, from **that nation**$_{j\sim i}$ he is.')
           (ONC: Ajlarty Izmail, Gæʒẏnaty Rimæ, Kcojty Rimæ, *Iron dissægtæ æmæ æmbisændtæ* [Ossetic proverbs], 2006)

Interestingly, we find such indirect linking even when the relative clause is DP-adjoined:

(28) ɜž χorž žət:-on, ⌈ de= šťol-əl **sə k'am** iš ⌉, **wə-sə**
I well know-PST.1SG your table-SUPER what photo is that-ATTR

lɜp:u-jə
boy-GEN

'I knew well **the boy whose** photo is on your table.'

(lit. 'I knew well, **what photo** is on your table, **that boy**.')

(ONC: *Max dug* 5, 1998)

This could perhaps be explained by some implicit variable acting as the correlate (boy [in it], language [of the nation], etc.), see e.g. Higginbotham (1997). But this explanation is implausible, as Ossetic generally imposes a very strict requirement that the correlate must contain a distal demonstrative. Furthermore, this analysis does not capture the semantics of the Ossetic construction, which can involve relations that do not imply any direct link between the two referents that may be expressed by a null variable, e.g.:

(29) ⌈ wədon **sə šɜrd** ɜr-ləʁd-əštə ⌉, **wə-sə fɜžžɜӡ-ə** sə-dɜr
those what summer PV-run-PST.3PL that-ATTR autumn-IN what-INDEF

raӡə ɜr-səd-əštə wərəš-ɜj ibəri-i-tɜ
early PV-go-PST.3PL Russia-ABL Ibiri-ASC-PL

'**In the autumn** after **the summer** when they moved, Ibiri's family came to Russia somewhat early.'

(lit. '**Which summer** they moved, in **that autumn** ...')

(ONC: *Max dug* 12, 1999)

Clearly, no direct link can be postulated between 'summer' and 'autumn', and, to our knowledge, there is no language which marks such a relation by genitive, i.e. **summer of autumn*. The connection here is rather through both summer and autumn being associated with the same year; an implicit variable approach would require postulating, in essence, a covert noun 'year', which is obviously an *ad hoc* solution.

Split antecedents Unlike in Hindi etc., Ossetic correlatives may stack, i.e. there may be several subordinate clauses at the left periphery corresponding to a single correlate.[7] In this case we may have split antecedents, i.e. one correlate corresponding to a *sum* of all the DP_{rel}s:

(30) ⌈ sard-ɜj **sə konflikt-tɜ$_i$** išt-a ⌉, ⌈ **sə χarakter-tɜ$_j$**
life-ABL what conflict-PL take-PST.3SG what character-PL

ɜvdəšt-a ⌉, **wədon$_{i+j}$** wəd-əštə kadɜž-ə ɜrmɜg.
demonstrate-PST.3SG those be-PST.3PL legend-GEN material

'**What conflicts$_i$** he took from life, **what characters$_j$** he demonstrated, **they$_{i+j}$** were legendary material.'

(ONC: Gædiaty Sek'a, *Wacmystæ*, 1991)

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[7]While stacking is allowed, there may be only one correlate in the main clause, regardless of the number of stacked relatives. This suggests analyzing such cases as asyndetic coordination.

(31) $\left[\text{kalač-ə } \mathbf{sə} \quad \mathbf{səl}_i, \quad \mathbf{sə} \quad \mathbf{bon}_j \quad \text{wəd-i}\right], \quad \left[\mathbf{sə} \quad \mathbf{\chi_3\check{z}na}_k \quad \text{wəd-i}\right],$
city-IN what goods what force be-PST.3SG   what richness be-PST.3SG
$\mathbf{wədon}_{i+j+k}$ ra-χašt-oj   ɜfsɜd-tɜ.
them   PV-carry-PST.3PL army-PL
'**What goods**$_i$, **what force**$_j$, **what riches**$_k$ there were in the city, the armies
took **them**$_{i+j+k}$ away.'

<div align="right">(ONC: Max dug 8, 1996)</div>

Once again, split antecedence is not predicted for "normal" relative clauses: *_the boys$_{i+j}$ who$_i$ was standing (and) who$_j$ was sitting_ is clearly bad. But under some circumstances, split antecedence seems possible, e.g. ?*people who he knew (and) who he didn't know*. In any case, the possibility of such split antecedence cannot in itself serve as a valid argument in favour of anaphora, because similar phenomena are found with adjectives, elements that are not usually assumed to be anaphorically linked. E.g., the English NP *red and white flags* has two interpretations: a purely intersective one, where the meaning is a set of flags each of which is of two colours, red and white, and a second, non-intersective interpretation, where some of the flags are red and some are white. The latter interpretation is similar to the split antecedence effects observed above for Ossetic. The data of Russian is even more relevant in this regard, cf. *krasnyj i belyj flagi* (red.SG and white.SG flag.PL), where singular morphology on each of the adjectives leads to the unambiguous interpretation of there being exactly one red flag and exactly one white flag.

Such examples demonstrate that there must be an explanation of such effects that does not appeal to anaphoric mechanisms. Still, an anaphoric treatment of Ossetic correlatives predicts this behaviour without any additional elaboration, and therefore, the possibility of split antecedence indirectly confirms our analysis.

"Intermediate" anaphoric indexation   When two subordinate clauses are attached, the second of them may reference the DP$_\text{rel}$ of the first one, while the DP$_\text{rel}$'s of both clauses are split antecedents of the correlate in the main clause:

(32) $\left[\mathbf{sə} \quad \mathbf{lɜg}_i \quad =\text{mɜm } \chi\text{əl} \quad \text{kot:-a}\right] \quad \text{ɜmɜ} \left[\mathbf{jemɜ}_i \quad \mathbf{sə} \quad \mathbf{lɜp:u}_j\right.$
what man me.ALL scold do-PST.3SG and   he.COM what boy
$\text{fɜ-bəsɜw}\left.\right], \quad \mathbf{wədon}_{i+j} \text{ šɜ= } \text{dəwwɜ =dɜr rašt } \text{štə}$
PV-argument those   their two   ADD right be.PRS.3PL
'**The man who**$_i$ scolded me and **the lad who**$_j$ argued with **him**$_i$, both of
them$_{i+j}$ are right.'

In other words, each DP$_\text{rel}$ has independent reference, otherwise it would be impossible to refer to the DP$_\text{rel}$ of the first clause without using a correlate first.

3.2   Anecdotal evidence from other languages

The possibility of bridging in correlatives has apparently never been explicitly discussed, but there is anecdotal evidence that it was allowed in old Indo-European languages, specifically Hittite:

(33) **PÍŠ ga-pár-ta=na=kán ku-in** *A-NA* DÙ EME ši-pa-an-ta-aš nu
animal:ACC=CONJ=PTCL REL.ACC to made tongue sacrifice CONJ
^{UZU}NÍG.GUG ^{UZU}ZAG.UDU ḫa-ap-pí-ni-it za-nu-zi
intestines.ACC shoulder.ACC flame.INS burn.PRS.3SG
'He roasts the intestines and the shoulders of **the animal**[8] **which** he had
sacrified to the artificial tongue.' (lit. '**What animal** he had sacrificed to
the artificial tongue, he roasts **intestines** and **shoulder** with the flame.')
(Probert 2006, 63)

Bridging is also observed in Ashti Dargwa, where correlatives exist as a marginal
strategy:[9]

(34) ⌈ **si** **luʁat-li-ži-w** ʁaj
what language-OBL-SUPER-M[ESS] speech
ka:k'-ul=il ⌋, **te:** **ummat-la** w-i:χʷ-a:
DOWN:M:speak.IPFV-PRS[3]=IQ that nation-GEN M-be.IPFV-HAB.3
har-il insan
every-RESTR person
'Every person belongs to **that nation** whose **language** they speak.'
(lit. '**Which language** (they) speak, **of that nation** every person is')

(field data, 2014)

Finally, Creissels and Sambou (2013, 470) provide examples of non-coreferentiality
in Mandinka (Mande > Niger-Congo) correlatives.

By contrast, in Hindi, it is only possible to use synonyms and hyponyms in
DP_{rel} and DP_{mat} (McCawley 2004). According to some authors, even more radi-
cally, one can only repeat the same noun or use an epithet in DP_{mat} (Potts 2005). If
so, the variable binding analysis works for Hindi, and consequently, this language
has a different type of correlatives than Ossetic, Hittite or Ashti.

4 Analyzing correlatives in LFG + Glue + PCDRT

4.1 Guiding intuitions

We observed above that Ossetic correlatives can involve bridging and split an-
tecedents. In this they are closely parallel to ordinary discourse anaphora involv-
ing pronouns and definite DPs, as illustrated in (35) and (36).

(35) When I go to a bar$_i$, the bartender$_{j\sim i}$ always throws me out.

(36) Peter$_i$ met Harold$_j$ in Utrecht. They$_{i+j}$ loved the town.

Moreover, cross-linguistically correlates are always demonstratives, personal pro-
nouns, or definite descriptions, or, at least, historically derived from these ele-
ments — the same kind of items that are used in pronominal / discourse anaphora.

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[8]*PÍŠ ga-pár-t* is really the name of an unknown animal rather than a generic term for animals.

[9]Interestingly, Ashti also allows postposing the correlative clause with an internal head, which
seems to contradict the idea that correlatives are always left-adjoined, and that right-adjoined rel-
ative clauses are actually displaced adnominal clauses.

There seems to be no language where there is a special set of correlative pronouns. It is therefore tempting to analyze correlatives as truth-conditionally more or less equivalent to a juxtaposition of two clauses with an anaphoric link between them.

(37)   a.   Which girl$_i$ came, I saw her$_i$.

      b.   A girl$_i$ came. I saw her$_i$.

There are some differences relating to the fact that the subordinate clause is used to identify a referent, rather than making an assertion. For simplicity, we ignore this aspect and use simple juxtaposition of the meanings, just like the traditional analysis of relative clauses use predicate conjunction to achieve set intersection. In DRT terms we get (38).

(38)

$x\ y$
came(x)
girl(x)
saw$(\text{speaker}, y)$
$y = x$

Crucially, we have **two separate discourse referents**, and not two occurences of the same variable. This means that instead of equality as in (38), we can use some other, more general relation, compatible with bridging, split antecedence, etc. In the next section we will see how this can be made formally explicit.

4.2   Coreference in PCDRT

Partial CDRT (Haug 2013) aims at providing a clear separation of monotonic (semantic) and non-monotonic (pragmatic) content. It provides a model-theoretic semantics for unresolved anaphors (including accessibility constraints) but treats coreference resolution post-semantically in the pragmatics. Consider the mini-discourse in (39).

(39)   John$_1$ hid Bill's$_2$ key$_3$. He$_4$ was drunk.

After processing (39) we may entertain the resolution that $x_4 = x_1$. In PCDRT this is modelled through a function $\mathcal{A}$ taking anaphoric discourse referents to their antecedents.

(40)

$x_1\ x_2\ x_3\ x_4$
john(x_1)
bill(x_2)
key(x_3)
poss(x_2, x_3)
hide(x_1, x_3)
drunk(x_4)

$, \mathcal{A} = \{x_4 \mapsto x_1\}$

Notice that the interpretation of the discourse is split: the DRS on the left side of the comma tracks the monotonic content of the discourse, whereas the right-hand part of the representation tracks pragmatic enrichments of the discourse – in (40) we only show the anaphoric resolution, but this is also where e.g. Gricean

inferences and other non-monotonic content would be represented. When the discourse is updated, the set of pragmatic inferences can be recomputed and destructively updated. For example, if we update (39) with (41), the resolution of x_4 may be non-monotonically changed to x_2.

(41) So he$_5$ shouldn't drive.

(42)

$$\begin{array}{|c|}
\hline
x_1\ x_2\ x_3\ x_4\ x_5 \\
\hline
\text{john}(x_1) \\
\text{bill}(x_2) \\
\text{key}(x_3) \\
\text{poss}(x_2, x_3) \\
\text{hide}(x_1, x_3) \\
\text{drunk}(x_4) \\
\text{shouldn't. drive}(x_5) \\
\hline
\end{array}, \mathcal{A} = \{x_5 \mapsto x_4, x_4 \mapsto x_2\}$$

As presented in Haug (2013), PCDRT assumes that antecedence implies equality. But this is a simplification that must be given up when dealing with bridging. Haug (2014) proposes to enrich the framework by assuming that the non-monotonic content not only supplies a function $\mathcal{A}$ taking anaphoric discourse referents to their antecedents, but also a function $\mathcal{B}$ taking anaphoric discourse referents to a relation between individuals, namely their coreference relation. $\mathcal{B}$ defaults to identity but other relations are possible, similarly to the analysis of bridging in Asher and Lascarides (1998):[10]

(43) John entered the room. The chandelier sparked brightly.

$$\begin{array}{|c|}
\hline
x_1\ \bar{x_2}\ \bar{x_3} \\
\hline
\text{john}(x_1) \\
\partial(\text{room}(x_2)) \\
\text{enter}(x_1, x_2) \\
\text{spark. brightly}(x_3) \\
\partial(\text{chandelier}(x_3)) \\
\hline
\end{array}, \mathcal{A} = \{x_3 \mapsto x_2\}, \mathcal{B} = \{x_3 \mapsto \lambda x.\lambda y.\, \text{in}(x, y)\}$$

A truly predictive theory of bridging will have to constrain $\mathcal{B}$ in a principled way. We make no attempt to do that here, but we do assume that such a theory can be developed, and that the constraints on bridging in Ossetic correlatives are not different from bridging in ordinary discourse anaphora. We also abstract from split antecedence: these could be captured by taking $\mathcal{A}$ to be a function to a set of antecedents and allowing $\mathcal{B}$ to be a sum operation on this set, but the details would depend on the particular theory of plurals one adopts.

4.3   Attaching the subordinate clause

We augment the rules given in (20) and (23) above with the template @CORREL. Beyond requiring the adjoined clause to be marked as a correlative (by having an

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[10]In the DRS we use ∂, the presupposition operator of Beaver 1992.

appropriate subordinator, see below), the template turns it into a modifier of the main clause.

(44) $\text{CP} \rightarrow$ CP   C′
         $(\uparrow \text{TOPIC})=\downarrow$ $\uparrow=\downarrow$
         $\downarrow\in(\uparrow \text{GF POSS}* \text{ADJ})$
            @CORREL

(45) $\text{DP} \rightarrow$ CP   DP
        $\downarrow \in(\uparrow \text{ADJ})$ $\uparrow=\downarrow$
         @CORREL

(46)   @CORREL $=$ $(\downarrow \text{STYPE}) =_c \text{CORREL}$
               $\%M = ((\text{GF} - \text{POSS})\, \text{POSS}* \text{ADJ} \in \downarrow)$
               $\lambda P.\lambda Q.P; Q : \downarrow_\sigma \multimap \%M_\sigma \multimap \%M_\sigma$

In the CP-adjunction case we could easily identify the matrix clause as $\uparrow$, the f-structure of the CP node dominating the correlative CP. But this will not work for DP-adjoined correlatives. For uniformity we therefore use an inside-out functional uncertainty to identify the matrix clause. The idea is that we start from the f-structure where the correlative clause has an ADJ function and move up any number of nominal embeddings (POSS) until we reach a function which is not adnominal (GF – POSS).[11] We use a local name, $\%M$, to make sure the functional uncertainty is instantiated to the same f-structure in both occurrences, but in practice, there is no room for ambiguity here: we are basically just reversing the outside-in functional uncertainty that is used to attach the correlative CP in (44) and there is only one way to do this, by moving along a (possibly empty) path of POSS-functions until we find a non-POSS-function.[12]

4.4 The subordinators

In (47) and (48) we give lexical entries for *sə*, which has a generalized quantifier type and must combine with a noun to form a DP_{rel}, and *či* 'who',[13] which forms a DP_{rel} alone.

(47)   *sə* D^0 $(\uparrow \text{DET}) = \text{REL}$
       relativizer   @INDEF
                  @RELPRO

(48)   *či* D^0 $(\uparrow \text{PRED}) = \text{'PRO'}$
       'who' $(\uparrow \text{DET}) = \text{REL}$
                 $\lambda x.\, \text{person}(x) : (\uparrow_\sigma \text{VAR}) \multimap (\uparrow_\sigma \text{RESTR})$
                 @INDEF
                 @RELPRO

---

[11]For simplicity we assume that POSS is the only adnominal function; another candidate would be SPEC.

[12]Notice that it is not necessary to say explicitly in (44) that GF must be instantiated to something other than POSS since (we assume) POSS is not licensed outside adnominal contexts.

[13]The meaning provided below assumes that *či* can only refer to humans. This is not entirely correct: as an anonymous reviewer observes, this pronoun can also refer to inanimate entities (in relative clauses, but not in questions), as in (13). Since the distribution of 'who' vs. 'what' in relative clauses is not yet completely clear and bears nothing on the problems discussed in this paper, we assume an animate vs. inanimate distinction for simplicity.

Both subordinators introduce a new discourse referent. This is taken care of by the @INDEF template in (49), which produces a semantic resource with a generalized quantifier type.

(49) @INDEF = $\lambda R.\lambda P.[x_1|\,]\,;R(x_1)\,;P(x_1):$
$((\uparrow_\sigma \text{VAR}) \multimap (\uparrow_\sigma \text{RESTR})) \multimap \forall\alpha.(\uparrow_\sigma \multimap \alpha) \multimap \alpha$

For *sə* the restrictor of the generalized quantifier is supplied by the noun phrase it attaches to; we assume that *sə* and the NP are co-heads of the DP. *či*, on the other hand, does not need an NP co-head, since it provides its own restriction (to persons).

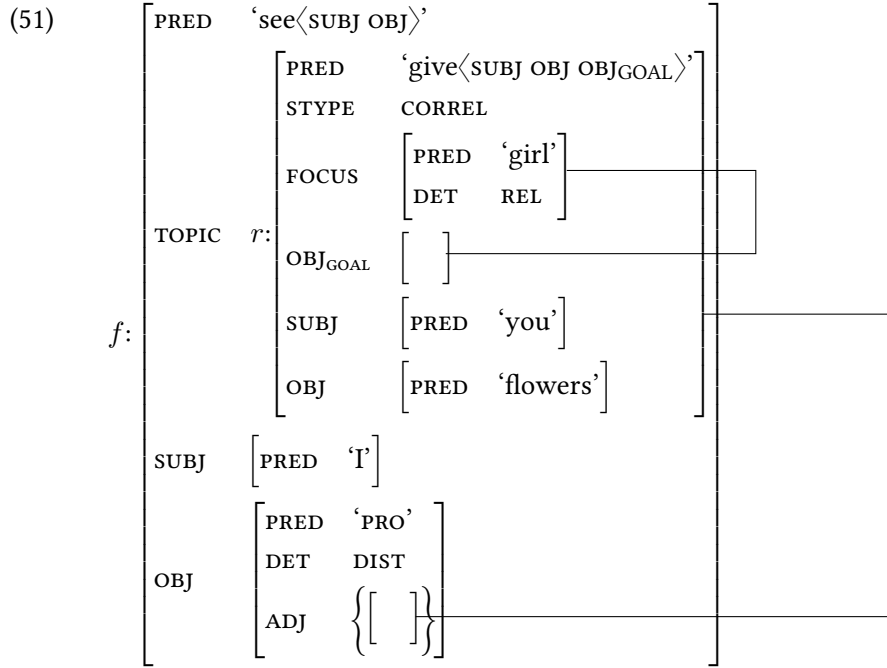The more interesting part of the semantics of the subordinator is provided by the @RELPRO-template in (50).

(50) @RELPRO = $((\text{FOCUS}\downarrow)\,\text{STYPE}) = \text{CORREL}$
$\%C = (\text{ADJ FOCUS}\downarrow)$
$(\%C\,\text{DET}) =_c \text{DIST}$
$\lambda P.\lambda x.\lambda y.P(x)(y);[\,|\mathcal{A}(y) = x\,]:$
$\forall\alpha.(\%C_\sigma \multimap \downarrow_\sigma \multimap \alpha) \multimap (\%C_\sigma \multimap \downarrow_\sigma \multimap \alpha)$

The first line of @RELPRO marks the clause in whose FOCUS function the DP$_\text{rel}$ appears as a correlative clause. This is what licenses the adjuctions in (44)–(45). The next line identifies the matrix correlate and binds it to a local name, %C. Since we know that DP$_\text{rel}$ has a FOCUS function in the correlative clause, which again is the ADJUNCT of the correlate, we can identify the correlate with a functional uncertainty. Next, we require the correlate to have a distal demonstrative. And finally, @RELPRO offers a semantic resource that requires the correlate to take DP$_\text{rel}$ as its antecedent.

The lexical entries above ignore the possibility of pied-piping, which is allowed in Ossetic. However, we could capture that by using the standard solution of having a separate f-structure function OPER which is structure-shared with some constituent of FOCUS.

4.5 A worked example

We are now ready to see how we can analyze (21), whose f-structure is repeated here as (51).

(51)

$$f: \begin{bmatrix} \text{PRED} & \text{`see}\langle\text{SUBJ OBJ}\rangle\text{'} \\[4pt] \text{TOPIC} \quad r: & \begin{bmatrix} \text{PRED} & \text{`give}\langle\text{SUBJ OBJ OBJ}_{\text{GOAL}}\rangle\text{'} \\ \text{STYPE} & \text{CORREL} \\ \text{FOCUS} & \begin{bmatrix} \text{PRED} & \text{`girl'} \\ \text{DET} & \text{REL} \end{bmatrix} \\ \text{OBJ}_{\text{GOAL}} & [\quad] \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`you'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`flowers'} \end{bmatrix} \end{bmatrix} \\[4pt] \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`I'} \end{bmatrix} \\[4pt] \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{DET} & \text{DIST} \\ \text{ADJ} & \left\{ [\quad] \right\} \end{bmatrix} \end{bmatrix}$$

In the semantic composition, we must first construct the meanings of the matrix clause without DP_{mat} and the correlative clause without DP_{rel} in the normal fashion. This gives us

(52) $\quad \lambda x.[\,|\,\text{saw}(\text{speaker}, x)] : (f\;\text{OBJ})_\sigma \multimap f_\sigma$

(53) $\quad \lambda y.[x_1\,|\,\text{flowers}(x_1), \text{gave}(\text{hearer}, x_1, y)] : (r\;\text{OBJ}_{\text{GOAL}})_\sigma \multimap r_\sigma$

We now combine these two meanings using the meaning constructor provided by @CORREL-template, which turns the correlative clause into a modifier of the matrix. @CORREL requires clausal meanings, so we provide hypothetical fillers $(\mathbf{x}, \mathbf{y})$ for the missing slots in the two clauses. The result is as in (54).

(54) $\quad \lambda P.\lambda Q.P; Q([\,|\,\text{saw}(\text{speaker}), \mathbf{x}])([x_1\,|\,\text{flowers}(x_1), \text{gave}(\text{hearer}, x_1, \mathbf{y})])$

When we reduce this and discard the hypothetical fillers, we get (55):

(55) $\quad \lambda x.\lambda y.[x_1\,|\,\text{saw}(\text{speaker}, x), \text{flowers}(x_1), \text{gave}(\text{hearer}, x_1, y)] :$
$\qquad (f\;\text{OBJ})_\sigma \multimap (r\;\text{OBL}_{\text{GOAL}})_\sigma \multimap f_\sigma$

Now we have a dependency on the meanings of both DP_{rel} and DP_{mat}. The binder resource provided by @RELPRO can apply to this as in (56), which reduces to (57).

(56) $\quad \lambda P.\lambda x.\lambda y.P(x)(y); [\,|\,\mathcal{A}(y) = x]$
$\qquad (\lambda x.\lambda y.[x_1\,|\,\text{saw}(\text{speaker}, x), \text{flowers}(x_1), \text{gave}(\text{hearer}, x_1, y)])$

(57) $\quad \lambda x.\lambda y.[x_1\,|\,\text{saw}(\text{speaker}, x), \text{flowers}(x_1), \text{gave}(\text{hearer}, x_1, y), \mathcal{A}(y) = x] :$
$\qquad (f\;\text{OBJ})_\sigma \multimap (r\;\text{OBL}_{\text{GOAL}})_\sigma \multimap f_\sigma$

And finally, when we saturate the slots of DP_{rel} and DP_{mat}, we get (58)

(58) $\quad [x_1\;x_2\;x_3\,|\,\text{girl}(x_3), \text{saw}(\text{speaker}, x_1), \text{flowers}(x_2), \text{gave}(\text{hearer}, x_2, x_3),$
$\qquad \mathcal{A}(x_1) = x_3] : f_\sigma$

This is the desired result. We see that the grammar imposes an anaphoric relation between DP_{rel} and DP_{mat}. In the case of examples such as (6) above, there is no reason to assume anything else than identity between the two discourse referents: this is the default in an anaphoric relation. But the semantics is compatible with other referential relationships, and the analysis therefore extends to cases of bridging such as (26)–(28).

The semantics we have developed here only deals with definite readings of correlative clauses. Ossetic correlatives also have universal readings. One possibility is to treat these as simply generic uses of the definite reading. Another option, which is seen more often in the literature on correlatives, is to treat universal correlatives as genuinely quantifying structures. This would entail a very different semantic analysis of such correlatives. We can leave the issue open here, as we focus on the manner in which the connection between DP_{rel} and DP_{mat} is established: and this connection must be anaphoric both in definite readings and in universal ones, because the same phenomena (bridging, split antecedence) occur in both types, as seen in (27) above.

5 Conclusions

From the syntactic point of view, Ossetic correlatives are not significantly different from other similar constructions that have been analyzed in the literature. They can be readily accounted for on an LFG-version of Bhatt's approach to correlatives (Bhatt 2003), following Butt, King, and Roth (2007) who recast Bhatt's movement analysis in terms of functional control. It is not unlikely that the analysis of Srivastav (1991), which would translate into LFG as anaphoric control, would also work. However, since Ossetic correlatives can appear both adjoined both to the matrix CP and to the correlate DP with no distinction in meaning, the functional control analysis offers a convenient way of unifying the two constructions.

However, regardless of the syntactic analysis chosen, the semantic behaviour of Ossetic correlatives does not conform to any of the treatments proposed in the literature. Specifically, DP_{rel} and DP_{mat} need not be fully coreferent: they can be in a part-whole relation, or there may even be no coreference in the strict sense, the relation between the referents being only associative (similar to bridging in anaphora). We have seen that this means that the standard property denotation of relative clauses, leading to set intersection with the head noun, does not work. Instead, a proper solution must take the anaphoric connection between DP_{rel} and DP_{mat} seriously. Our analysis captures this by representing the two DPs as two different discourse referents, unlike all previous analyses of correlative clauses, which assume that the two positions are represented by the same variable (just like in canonical headed relative clauses). In other words, the relation between DP_{rel} and DP_{mat} is akin to pronominal anaphora rather than variable binding. Informally, Ossetic correlatives may thus be characterized as juxtaposition of two clauses with obligatory coreference between their elements imposed by the grammar.

The distinction between separate discourse referents and a single bound variable could not be modelled in standard versions of DRT, where anaphors and antecedents are represented by the same variable. But it is easily incorporated into PCDRT if we allow relations other than full coreference to hold between anaphoric expressions and their antecedents.

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