Arabic Relativization Patterns: A Unified HPSG Analysis

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Abstract

Classical Arabic and Modern Standard Arabic have several relativization patterns, including relative clauses with and without relativizers and adjectival modification patterns. Previous generative work has targeted several phenomena, but there is no analysis which covers all relativization patterns in any generative framework. We present an HPSG analysis that covers these phenomena in a uniform manner. Based on Doron and Reintges (2005), we show that the crosslinguistically unusual syntax of adjectival modifiers is a language-internally expected variant of participial modifiers as found in English. We also present the first HPSG analysis of Arabic broad subjects and argue that they are selected as specifiers, accounting for the similarities between broad subjects and ordinary subjects.

1 Introduction

Classical Arabic (CA) and Modern Standard Arabic (MSA) (henceforth together 'Arabic')[1] have several relativization patterns, including relative clauses with and without relativizers and adjectival modification patterns. Previous generative work has targeted several areas, but there is no analysis which covers all relativization patterns in any generative framework. Previous work includes Suaieh (1980), Ouhalla (2004), and Aoun et al. (2010) in transformational frameworks and HPSG analyses by Melnik (2006), Haddar et al. (2009), Alqurashi and Borsley (2012), and Alqurashi (2012). The goal of this paper is to provide a unified analysis covering all relativization patterns. The analysis will include an HPSG account of the broad-subject construction (Doron and Heycock, 1999).

1.1 Relative Clauses

Arabic relative clauses can be classified into *marked clauses* introduced by special relative marker and *unmarked clauses* without such a marker. Unmarked relative clauses always modify an indefinite NP:

(1) risaalat-u-n$_i$ [ḥammala=nii=haa$_i$ Maḥmuud-un]
     letter.SG.F-NOM-INDEF gave=me=it.SG.F   Mahmud-NOM

     'a letter Mahmud gave me'

[1] Classical Arabic (CA) in the narrow sense was the spoken and written language of the Arab tribes roughly from the seventh to the ninth century. It forms the basis for Modern Standard Arabic (MSA), which is the (mainly) written language of the Arab world today. Especially in morphology and syntax, these two languages are extremely similar, and they are often treated as having the same syntax in generative work. This paper follows this approach and attempts to develop a syntactic analysis for both languages.

Relative clauses may employ resumptives or gaps, with different but overlapping distributions. Nominal and adjectival predicates in verbless relative clauses show nominative case marking, as in independent clauses:

(2) ra'aytu mra'at-a-n   [Zayd-un   'abuu=haa]
    I.saw   woman-ACC-INDEF Zayd-NOM father-NOM=her
    'I saw a woman whose father is Zayd'

For marked relative clauses, two sets of markers have to be distinguished. As demonstrated by Alqurashi and Borsley (2012), they are relativizers, not relative pronouns. The Inflected Relativizers (singular masculine *lladhii*, feminine *llatii*, etc.) mark definite relative clauses which may be free or modifying. They agree with the antecent in case, number and gender (3a). The Uninflected Relativizers *man* 'who' and *maa* 'what' mark free relative clauses and do not show case marking, nor agreement in any feature other than animacy (3b).

(3)   a. l-mar'at-ayni$_i$ [llatayni   ra'ayta=(humaa)$_i$]
       DEF-woman-DU.ACC RELTV.FDU.ACC you.saw=them
       'the two women that you saw'

   b. [maa   ra'ayta=(hu)$_i$ fii l-bayti]$_i$
      RELTVZR.INANIM you.saw=(it) in the-house
      'what you saw in the house'

1.2   Adjectival Modifiers

The second type of relativization patterns is adjectival modification. The simpler pattern, the *Direct Attribute* (*na't ḥaqiiqiyy*), is similar to ordinary adjectival modification in English, but the adjective agrees with the modified NP in number, gender, animacy, case and definiteness (4). Adjectival phrases can also be used as independent NPs:

(4)   a. ra'aytu (buyuut-a-n)   [jadiid-at-a-n]
       I.saw   house.PL-ACC-INDEF new-PL.INANIM-ACC-INDEF
       'I saw new (houses)'

   b. ra'aytu (l-buyuut-a)   [l-jadiid-at-a]
       I.saw   DEF-house.PL-ACC DEF-new-PL.INANIM-ACC
       'I saw the new (houses)'

In the *Indirect Attribute* (term from Polotsky (1978), traditional term: *na't sababiyy*) construction, the adjective has a subject that may be distinct from the modified NP, which is linked to a resumptive pronoun inside the adjectival phrase. The adjective agrees with the head only in the morphosyntactic features case and definiteness, while agreeing with its subject with respect to the index features number, animacy, and gender. The phrase may be attributive (5a) or free (5b).

(5) a. fii l-buyuut-i$_i$ [l-ḥaaṣil-i   fii=haa$_i$ l-ḥariiq-u]
      in DEF-houses.GEN DEF-starting.SG-GEN in=them DEF-fire
      'in the houses in which the fire broke out'

     b. ma'a [l-munkasirat-i   quluub-u=hum$_i$]$_i$
      with DEF-broken-GEN hearts-NOM=their.ANIM
      'with those whose hearts are broken'

The adjective always stands at the beginning:

(6) a. ra'aytu rajul-an   [kariim-an   'abuu=hu]
      I.saw   man-ACC.INDEF kind-ACC.INDEF father=his

     b. * ra'aytu rajul-an   ['abuu=hu kariim-an]
       I.saw   man-ACC.INDEF father=his kind-ACC.INDEF

   'I saw a man (acc.) whose father is kind'

The resumptive can be embedded in arbitrary depth, hence, the structure presumably involves a genuine UDC:

(7) l-baraamij-u$_i$ t-talafizyuuniyyat-u [l-mumkin-u
    DEF-programmes.PL-NOM DEF-television-nom DEF-possible.M.SG-NOM
    li=l-mushaahid-i   ['an   yaxtaara   bayna=haa$_i$]]
    for=DEF-viewer-GEN COMP.M.SG he.chooses between=them

    'the television programmes the viewer can choose between, lit 'the television programs such that it is possible for the viewer to choose between them' (Fischer, 1987)'

2   The Structure of Adjectival Modifiers

The question that arises is what the structure of these four relativization patterns is and whether they can be reduced to more general patterns. In traditional and modern Arabic linguistics, the two adjectival modification patterns are usually discussed as distinct and apparently unrelated structures. The HPSG analysis by Melnik (2006) introduces two phrasal types for the two structures, but expresses some properties that both types share on a more general level. In the direct attribute, represented by *subject-non-fin-rel-cl*, the modified NP controls the unrealized subject argument of the adjective. The type of the indirect attribute, *non-subject-non-fin-rel-cl*, establishes the coindexation of the modified NP and a resumptive pronoun via the nonlocal feature RESUMP(TIVE), which is similar to SLASH. The first type coresponds to the analysis of English reduced relatives by Sag (1997) (*red-rel-cl*), while the second type corresponds to Sag's analysis of English non-wh relative clauses (*non-wh-rel-cl*).

Doron and Reintges (2005) argue that the indirect attribute is a language-specific variant of the direct attribute whose presence is explained by the notion of *broad subjects*, introduced by Doron and Heycock (1999). In Arabic, broad

subjects are NPs which are extracted and appear in a subject-like position, often in a higher clause, leaving a resumptive pronoun. This construction can result in simple preposing (8) similar to English topicalization, but the broad subject can also participate in raising and equi. In (9), *Hind* is the broad subject of the clause *ra'aa=haa 'Amrun* and is coreferent with the resumptive pronoun =*haa* contained in it. The subject-to-object raising verb *ẓananta* takes *Hind* and the clause as its complements. (10) show examples of subject-to-subject raising. While subject-to-subject raising of broad subjects is rare[2] and considered ungrammatical by many MSA speakers, subject-to-object raising of broad subjects is more common.

(8) a. Hindun$_i$ ra'aa=haa$_i$ 'Amr-u-n
    Hind-NOM he.saw=her Amr-NOM

    'Hind (f), Amr (m) saw'

  b. Hind-un$_i$ [yaẓunnu 'Amr-un ['anna=ka ra'ayta=haa$_i$]]
    Hind(f)   thinks   Amr(m) that=you saw=her

    'Hind$_i$ (f), Amr (m) thinks that you saw t_i'

(9) ẓananta   Hind-an   [ra'aa=haa$_i$ 'Amr-un]
   you.thought Hind(f)-ACC he.saw=her Amr(m)-NOM

   'You thought that Amr (m) saw Hind (f)'

(10) a. kaan-at   l-mar'atu$_i$ [yu-qaalu   la-haa$_i$ Ḥanḍalatu]
     used.to-3FS DEF-woman 3MS-is.said to-her Ḥanḍala

     'They used to say 'Ḥanḍala' to the woman. (more literally: the woman used to be said to 'Handala') (Reckendorf, 1921, 368)'

   b. kid-tu   [ta-qṭa'u nafs-ii]
     was.almost-1S 3FS-break soul.F-my

     'my heart almost broke (Reckendorf, 1921, 369)'

Doron and Reintges (2005) argue that, given this phenomenon, the direct attribute, and an analysis which assimilates broad subjects to normal (narrow) subjects, the existence of the indirect attribute is expected: While the modified NP is coindexed with the lexically required ('narrow') subject in the direct attribute, it is coindexed with a broad subject in the indirect attribute. In (5a), for instance, *buyuut* and *haa* are coreferent with an (unrealized) broad subject of *ḥaaṣil-i-n fii-haa*. This treatment is supported by the distribution of resumptives and gaps: Like the indirect attribute, broad subjects do not leave gaps[3], and their resumptives are not subject to island constraints.

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[2]Corpus data from CA is given by Reckendorf (1895-1898, 789), Reckendorf (1921, 368–369).

[3]Arabic as a pro-drop language has zero resumptives. The distribution of zero elements in the canonical position of a broad subject is the same as the distribution of pro-drop, i.e. they can always be analyzed as empty resumptives.

Thus, we analyze the indirect attribute using the broad subject construction, following Doron and Reintges (2005).

One might go one step further and derive all relative clauses with resumptives using the broad subject construction. However, extraction of the highest subject is not possible in unmarked nonfinite relative clauses without a resumptive:

(11) buyuut-a-n   [*(hiya) jadiid-at-u-n]
     house.PL-ACC-INDEF they   new-F.SG-NOM-INDEF

     'houses that are new'

We therefore only analyze adjectival modifiers using the broad subject construction, while marked and unmarked relative clauses are analyzed as unbounded dependency constructions.

3 An HPSG Analysis

In this section, we present an HPSG analysis of Arabic relative clauses and adjectival modifiers. Since the analysis of adjectival modifiers is based on the broad subject phenomenon, we will first discuss how this phenomenon can be accounted for.

3.1 Broad Subjects

UDCs in Arabic   We follow Taghvaipour (2005) in assuming a uniform treatment of resumptives and gaps using the SLASH list, whose elements are objects of type *ud-object* with the features LOCAL and UD-TYPE, for which the type *ud-type* with subtypes *resumptive* and *gap* is appropriate. Broad subjects are connected to the resumptive by a nonlocal dependency with UD-TYPE *resumptive*. The advantage over using separate features SLASH and RESUMPTIVE (Vaillette, 2001, Vaillette, 2002) is that constructions allowing gaps also allow resumptives in Arabic. Analyses under which resumptives cannot be distinguished non-locally from gaps (Taghvaipour, 2004; Borsley, 2010) face the problem that island constraints only apply to gaps in Arabic. Another approach, under which island constraints only apply to slashed non-pronouns, suggested by an anonymous reviewer, faces the problem that accusative interrogative pronouns can leave gaps, to which island constraints apply. However, it seems plausible that the approach of Crysmann (2012), which simplifies the analysis of ATB extraction and eliminates spurious ambiguities between resumptive and gap analyses, can be applied to Arabic. We leave this to future research.

Valence   In examples like (8a), the broad subjects could be analyzed using the *filler-head-construction*. However, the participation in control would be unexpected under such a treatment. This can be accounted for more naturally by selecting broad subjects using valence lists similar to the selection of narrow subjects.

The question arises which valence lists are appropriate for Arabic and where the place of broad subjects is.

Borsley (1995) proposes that subjects are always selected via SUBJ, while complements are selected via COMPS. It seems straightforward to use SUBJ also for broad subjects and controlled subjects. However, this leads to some complications.

There has to be some way of indicating whether a member of SUBJ will be realized pre- or postverbally to account for a well-known agreement asymmetry: there is no number agreement with postverbal nominal subjects. One possibility is to have such a head feature on the verb, such as INV, but this causes problems if there is both a postverbal narrow subject and one or more (preverbal) broad subjects. An alternative is to indicate the position by a feature of the subject, but then raised subjects must be marked somehow, as their position feature will be relevant only for the verb with which they are realized, while embedded verbs will necessarily show full agreement.

These problems could be solved by introducing additional machinery such as the RAISED feature introduced by Meurers (2000), but there is little, if any, independent motivation for such features in Arabic. Thus, we will use SUBJ only for postverbal subjects, while preverbal subjects, broad subjects, and controlled subjects are selected via SPR.

Another possibility is to realize postverbal arguments via COMPS, as suggested by Beller (2007). However, postverbal subjects differ from postverbal complements with respect to a second CLLD-like pattern which we will refer to as *accusative fronting*, found only in Classical Arabic (Siibawayh, 1988, I 80, Reckendorf, 1895-1898, 791, Ayoub, 1981, 219). Here, the verb is preceded by an accusative NP which is coindexed with a genitive or accusative resumptive pronoun (12a). While the resumptive can be embedded inside a complement (12b), it is never embedded inside a subject (12c).

(12) a. wa=l-qamar-a   qaddarnaa=hu manaazil-a
       and=DEF-moon-ACC we.defined=it phases-ACC

       'and we have determined phases for the moon (Qur'an 36:39)'

    b. 'amr-an$_i$ laqiitu 'ax-aa=hu$_i$
       Amr-ACC I.met brother-ACC-his

       'Amr$_i$, I met his$_i$ brother (Al-Zamakhshari, 1879, 24)'

    c. * 'abda-llaahi$_i$ ḍaraba 'ax-uu=hu$_i$ zaydan
        Abdullah.ACC hit   brother-NOM-his Zayd-ACC

        'Abdullah$_i$, his$_i$ brother hit Zayd (Ayoub, 1981, 220)'

Another problem that occurs if postverbal subjects are treated as complements while preverbal subjects are treated as specifiers is that it is hard to prohibit subjects on COMPS from appearing in a preverbal position, while allowing this for other members of COMPS. Unless additional mechanisms for controlling raising

are used, it is not possible to put preverbal complements into the same valence list as preverbal subjects, as complements cannot be controlled.

Therefore, we use SUBJ for postverbal subjects, SPR for preverbal subjects, broad subjects, and controlled subjects, and COMPS for complements. We adopt Borsley (1995)'s proposal that all arguments of a verb, except for preverbal subjects, are realized in a *head-subj-comp-phrase*. Our constraint differs from Borsley's in that the relative order of subjects and complements is not fixed; the only constraint being that the subject be realized postverbally. This accounts for the possibility of VSO, OVS, and VOS:

(13) *head-subj-comp-phrase* →

$$
\begin{bmatrix}
\text{SS}|\text{L}|\text{C} & \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{COMPS} & \langle\rangle \\ \text{SUBJ} & \langle\rangle \end{bmatrix} \\[4ex]
\text{HD-DTR} & \boxed{1}\begin{bmatrix} \text{COMPS} & \boxed{3} \\ \text{SUBJ} & \boxed{2} \oplus \text{list}(\textit{non-canonical-ss}) \end{bmatrix} \\[3ex]
\text{DTRS} & \texttt{ss-to-sign}(\boxed{3}) \circ \left(\langle\boxed{1}\rangle \oplus \texttt{ss-to-sign}(\boxed{2}) \right)
\end{bmatrix}
$$

where `ss-to-sign` is defined as follows:

(14) $\texttt{ss-to-sign}(\langle\rangle) = \langle\rangle$

$\texttt{ss-to-sign}(\langle \boxed{1} | \boxed{2} \rangle) = \langle\, [\,\text{SYNSEM}\ \boxed{1}\,]\, | \texttt{ss-to-sign}(\boxed{2})\rangle$

Note that the constraint also accounts for verbs without subjects and verbs with empty subjects. Without an additional mechanism for adjuncts, such a treatment requires an Adjuncts-as-Complements approach, as adjuncts can occupy essentially any position after the verb. As an alternative, one could define a binary branching structure or use discontinuous constituents.

Members of SPR are realized in a *spr-head-phrase*:

(15) *spr-head-phrase* →

$$
\begin{bmatrix}
\textit{clause} \ \& \ \textit{head-final-phrase} \\
\text{SS}|\text{L}|\text{C}|\text{SPR} \quad\quad\quad \boxed{1} \\[2ex]
\text{HD-DTR}|\text{SS}|\text{L}|\text{C} \quad \begin{bmatrix} \text{SPR} & \langle\boxed{2}\rangle \oplus \boxed{1} \\ \text{COMPS} & \langle\rangle \\ \text{SUBJ} & \text{list}(\textit{noncanical-ss}) \end{bmatrix} \\[3ex]
\text{NON-HEAD-DTRS} \quad \langle\text{SYNSEM} \quad \boxed{2}\rangle
\end{bmatrix}
$$

We now define the linking between ARG(UMENT)-ST(RUCTURE) and the valence lists (Manning and Sag, 1998). We assume that preverbal subjects correspond to a *pro* on SUBJ. This allows a very simple analysis of the agreement asymmetry:

a verb always agrees with the (single) element of SUBJ, which is also the first element of ARG-ST. Agreement is complete if and only if this element is pronominal or a gap. Following Manning and Sag, we state the following principle:

(16) Argument Realization Principle (adapted)

$$
word \rightarrow \left[SS|L|C \left[\begin{array}{ll} \text{SUBJ} & \boxed{1} \\ \text{SPR} & \texttt{to-specifier}(\boxed{1}) \\ \text{COMPS} & \boxed{2} \ominus \text{list(non-canonical-ss)} \\ \text{DEPS} & \boxed{1} \oplus \boxed{2} \end{array} \right] \right]
$$

The non-deterministic function `to-specifier` is defined in Prolog notation as follows (the first argument denotes the input, the second one the output):

(17) `to-specifier`(*list*, $\langle \rangle$).
   `to-specifier`($\langle$ *non-canonical-ss$_i$* $\rangle$, $\langle$ *synsem$_i$* $\rangle$).

The first clause accounts for empty subjects and for postverbal subjects. The second clause accounts for overt preverbal and for controlled subjects, including controlled empty subjects.

This analysis is similar to the traditional account, according to which a preverbal subject (at least in clauses headed by a finite verb) is actually a *mubtada'*, i.e. a broad subjects linked to an empty resumptive subject pronoun (Wright, 1896-98, II 255). A direct implementation of this approach would make it possible to eliminate the reference to SPR from the Argument Realization Principle entirely, but there is evidence that the position of preverbal subjects is ambiguous and that they can be either broad subjects or genuine preverbal narrow subjects (Doron, 1996, 16).

Broad Subjects One possibility to introduce the broad subject to SPR is to introduce all broad subjects into SPR lexically. For every broad subject introduced to SPR, a corresponding requirement is added to TO-BIND (Pollard and Sag, 1994, Bouma et al., 2001). Under this account, the SPR list, which is usually assumed to contain at most one element, can contain an unbounded number of elements. This account, which is similar to the analysis of English missing object constructions by Grover (1995), the analysis of the Korean double nominative construction by Choi (2012) and the analysis of Danish object shift by Müller and Ørsnes (2012), explains why broad subjects behave very much like ordinary, lexically required subjects and allows a straightforward analysis of the data in (8–9).

It also correctly predicts that the resumptive belonging to a broad subject may be located inside any of the verb's dependents, even another broad subject (18a; corpus examples are given in Reckendorf, 1895-1898, 784). However, the analysis fails to predict that a broad subject always precedes (and c-commands) the coreferent resumptive (18b).

(18) a. Hindun$_i$ ṣadiiqu ’abii$_j$-haa$_i$ ra’ay-tu=hu$_j$
Hind-NOM friend-NOM father-GEN-her I.saw-him

'Hind$_i$, the friend$_j$ of her$_i$ father, I saw him$_j$'

   b. * ṣadiiqu ’abii$_j$-haa$_i$ Hindun$_i$ ra’ay-tu=hu$_j$
friend-NOM father-GEN-her Hind-NOM I.saw-him

'The friend$_j$ of her$_i$ father, Hind$_i$, I saw him$_j$'

In fact, the analysis does not even ensure that a pronominal broad subject cannot be its own resumptive. This is not trivial to rule out under the Pollard and Sag (1994) mechanism.[4] However, these cases can be ruled out by modifying the SLASH Amalgamation Principle (Bouma et al., 2001) so that for each broad subject, an element of the SLASH value of a preceding element of DEPS is removed. Apart from the problem that it seems hard to formalize this constraint without relations or quantifiers, there is the more general issue that lexical introduction of the broad subject does not readily extend to predicative NP, which should probably be introduced phrasally (Müller, 2009), and which can head clauses including broad subjects without a copula. Unless an empty copula head is used[5], it is necessary to also stipulate the possibility of broad subjects for phrasally introduced predicates.

An alternative that avoids this drawback and that predicts that broad subjects c-command their resumptive uses a unary projection that takes an element from SLASH and adds a broad subject to SPR:

(19) *broad-subj-intro-phrase* →

$$
\begin{bmatrix}
\textit{headed-phrase} \\[2pt]
\text{SYNSEM}\ \begin{bmatrix}
\text{L}|\text{C}\ \begin{bmatrix}
\text{HEAD} & \textit{verb} \\
\text{COMPS} & \boxed{1}\langle\rangle \\
\text{SPR} & \left\langle\begin{bmatrix}\text{LOC} & \boxed{2}\end{bmatrix}\right\rangle
\end{bmatrix} \\[18pt]
\text{N}|\text{SLASH}\ \boxed{3}
\end{bmatrix} \\[30pt]
\text{HEAD-DTR}|\text{SYNSEM}\ \begin{bmatrix}
\text{L}|\text{C}\ \begin{bmatrix}
\text{COMPS} & \boxed{1} \\
\text{SPR} & \langle\rangle
\end{bmatrix} \\[12pt]
\text{N}|\text{SLASH}\ \left\langle\begin{bmatrix}\text{UD-T} & \textit{resu} \\ \text{LOC} & \boxed{2}\end{bmatrix}\right\rangle \circ \boxed{3}
\end{bmatrix}
\end{bmatrix}
$$

To avoid spurious ambiguities, it only applies to saturated projections. We will adopt this account. Note that, unlike a DEPS-based analysis, it does not rely on

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[4]Stipulating that no coreferential element is on SLASH when a broad subject is realized is insufficient, as there might be several coreferential broad subjects, as in (?) *Zaydun huwa ra’aytu=hu* 'Zayd, he, I saw him'.

[5]For arguments against empty copulas in Arabic, cf. Al-Horais (2006) and Benmamoun (2008). The arguments by Bender (2001) for a copula head in an HPSG analysis of verbless clauses in AAVE apparently do not apply to Arabic.

an adjuncts-as-complement analysis. It is also independent of the particular choice of the theory of extraction; it is compatible with both Pollard and Sag (1994)'s analysis and head-driven lexicalized analyses (Bouma et al., 2001, Ginzburg and Sag, 2001).

Figure 1 shows an analysis of (8b).

Another possibility is to introduce only controlled broad subjects to SPR and to realize other broad subjects immediately. Clearly, this analysis leads to smaller syntactic trees for sentences with a broad subject that is not controlled, but it requires an additional construction and controlled elements of SPR must somehow be marked.
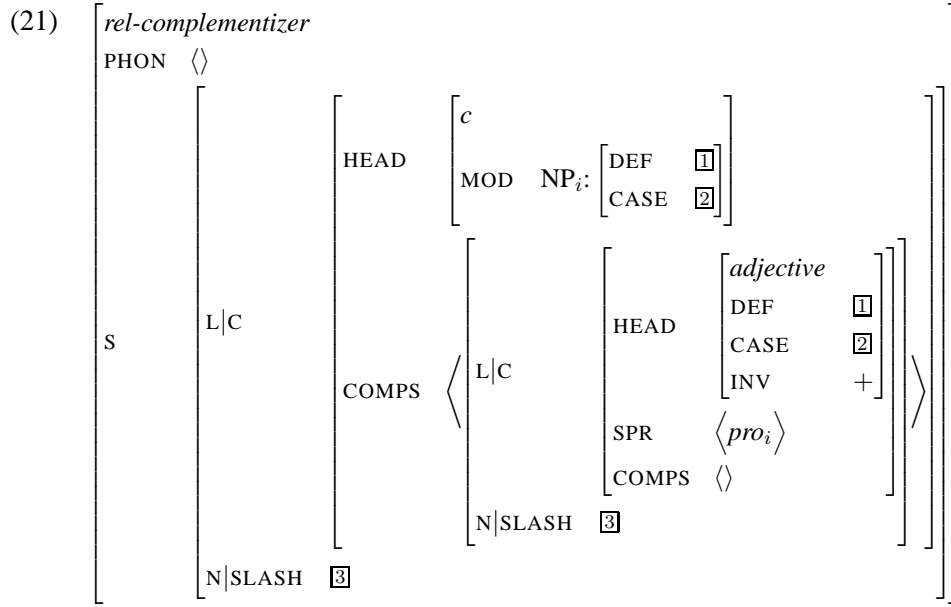
A second alternative is to treat all raising constructions as UDC constructions. Hence, ordinary raising of (narrow) subjects would be treated as extraction leaving an empty resumptive. However, nonfinite predicates do not allow empty subject pronouns, as can be seen in unmarked relative clauses (20a). Thus, it is unexpected under such an analysis that the subject of a nonfinite predicate can be raised, as in (20b).

(20) a. ra'aytu rajul-a-n   yaquumu/*qaa'im-u-n
        I.saw   man-ACC-INDEF he.stands/standing-NOM-ACC

        'I saw a man who was standing'

     b. Zayd-un   kaana   qaa'im-a-n
        Zayd-NOM was.3MS standing-ACC-INDEF

        'Zayd was standing'

3.2   Previous Work on Arabic Relative Clauses

Haddar et al. (2009) present an HPSG analysis of Arabic marked relative clauses under which the relativizer is a marker in the sense of Pollard and Sag (1994) which selects a VP. While the analysis accounts for marked relative clauses where the extracted element is the highest subject, it is not obvious how it can be extended to cover cases like (3), where the extracted element is not the highest subject. Unmarked relative clauses and free marked clauses are not included in the analysis.

Alqurashi and Borsley (2012) and Alqurashi (2012) argue for a uniform analysis of marked and unmarked relative clauses under which they are headed by a (potentially empty) relativizer. It selects a saturated clause and establishes coindexation between an element of the clause's SLASH list with its own MOD value. Free relatives are accounted for by a unary projection. This analysis can be extended to cover adjectival modifiers by adding another empty element (the feature geometry is the same as in Alqurashi and Borsley, 2012):

(21)
$$
\begin{bmatrix}
\textit{rel-complementizer} \\
\text{PHON} \quad \langle\rangle \\
\text{S} \quad
\begin{bmatrix}
\text{L}|\text{C} \quad
\begin{bmatrix}
\text{HEAD} \quad
\begin{bmatrix}
c \\
\text{MOD} \quad \text{NP}_i:
\begin{bmatrix}
\text{DEF} & \boxed{1} \\
\text{CASE} & \boxed{2}
\end{bmatrix}
\end{bmatrix} \\
\text{COMPS} \quad
\left\langle
\begin{bmatrix}
\text{L}|\text{C} \quad
\begin{bmatrix}
\text{HEAD} \quad
\begin{bmatrix}
\textit{adjective} \\
\text{DEF} & \boxed{1} \\
\text{CASE} & \boxed{2} \\
\text{INV} & +
\end{bmatrix} \\
\text{SPR} \quad \langle pro_i \rangle \\
\text{COMPS} \quad \langle\rangle
\end{bmatrix} \\
\text{N}|\text{SLASH} \quad \boxed{3}
\end{bmatrix}
\right\rangle
\end{bmatrix} \\
\text{N}|\text{SLASH} \quad \boxed{3}
\end{bmatrix}
\end{bmatrix}
$$

The relativizer selects a head-initial projection of an adjective with an unrealized *pro* element on SPR, which is coindexed with the relativizer's MOD value. The element on SPR is a broad or narrow subject of the adjective. Furthermore, the relativizer establishes concord in DEFINITENESS and CASE between the adjective and the modified NP. The SLASH value of the adjective is taken over unchanged, since adjectival modifiers are not UDC constructions.

Alqurashi and Borsley (2012) also consider surface-oriented constructional analyses and reject these. Their main argument is based on the fact that Sag (1997)'s constructional analysis requires a new type *head-relative-phrase* to account for the correct semantic composition. Whether this argument is convincing depends on whether an additional type in a completely surface-oriented account is seen as more 'expensive' than the stipulation of an empty word. Different researchers will presumably differ on this issue. We will therefore present a different, surface-oriented account that uses both constructional and lexical elements in the next section. In section 3.4, we will outline a second constructional analysis, which does not require a special rule for the semantic composition of NPs containing a modifying relative clause.

3.3 A Surface-Oriented Account

In this section, we present a surface-oriented analysis of relative clauses and adjectival modifiers. We assume that the head of an Arabic relative clause is the relativizer in marked clauses and the highest predicate in unmarked clauses and adjectival modifiers. Both assumptions are justified by the case-marking of the putative heads visible on case-marked relativizers and adjectival predicates.

In the surface-oriented account of Sag (1997), English relatives are analyzed as clauses with a nominal synsem object as MOD value. Following Sag (1997), we

get the following constraint for *relative-clause*:

(22) $rel\text{-}cl \rightarrow$ $\begin{bmatrix} \text{MOD}|...|\text{HEAD} & noun \\ \text{CONT} & proposition \end{bmatrix}$

This analysis faces the difficulty that in the semantic architecture of Pollard and Sag (1994), the semantics of a relative clause is of type *proposition*, while an NP composed of a noun and a relative clause has a restricted index as its CONT value. The standard HPSG principles for semantic composition (Pollard and Sag, 1994) assume that the CONT value of the NP should be token-identical with the CONT value of the adjunct, i.e. the relative clause. Sag solves this problem by defining a special constraint for the semantic composition of phrases composed of a head and a relative clause. We will adopt this solution.

Alqurashi and Borsley (2012) view the necessity of assuming a different rule for semantic compositionality as a major argument against a constructional analysis. Whether this argument is convincing depends on whether an additional type in a completely surface-oriented account is seen as more 'expensive' than the stipulation of an empty word. In section (3.4), we will outline a constructional analysis that avoids this drawback of Sag's analysis.

For relative clauses involving a UDC, Sag (1997) establishes a link between SLASH and MOD on the level of the *relative-clause* by removing an element from the SLASH list of its head. In a surface-oriented analysis, this does not work for Arabic, as relative clauses can consist of finite verb without any overt dependents, i.e. there is not even always a head-daughter. We will establish the link between MOD and SLASH on the lexical level using the feature TO-BIND (Pollard and Sag, 1994, Bouma et al., 2001). Heads of relative clauses involving a UDC satisfy the following description:

(23) $\begin{bmatrix} \text{S} & \begin{bmatrix} \text{L}|\text{C} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} reltvzr\text{-}or\text{-}verb \\ \text{MOD} & \text{NP}_i \end{bmatrix} \end{bmatrix} \\ \text{NONLOC} & \begin{bmatrix} \text{TO-BIND} & \left\langle \begin{bmatrix} \text{L} & local_i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$

We then have the following two subtypes of *rel-cl*:

(24) $ordinary\text{-}rel\text{-}clause \rightarrow$ $\begin{bmatrix} \text{S} & \begin{bmatrix} \text{L}|\text{C} & \begin{bmatrix} \text{HD} & \begin{bmatrix} reltvzr\text{-}or\text{-}verb \\ \text{MOD} & \text{NP} \end{bmatrix} \\ \text{SPR} & \langle \rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$

(25) *adjective-rel-clause* →
$$\left[\begin{array}{l} S \quad \left[L|C \quad \left[\begin{array}{ll} \text{HD} & \left[\begin{array}{ll} \textit{adjective} \\ \text{PRED} & + \\ \text{MOD} & \text{NP}_i \end{array}\right] \\ \text{SPR} & \left\langle \textit{pro-ss}_i \right\rangle \end{array}\right] \right] \end{array}\right]$$

The second constraint is only slightly more specific than the constraint on *red-rel-cl* in Sag (1997) and stipulates none of the specific properties of the Arabic indirect attribute, all of which are accounted for by independently needed machinery for broad subjects and subject-predicate agreement.

An analysis for (4a), an instance of the direct attribute, is shown in figure 2. Figure 3 shows an analysis of (5a), an instance of the indirect attribute.

The apparent possibility of pro-drop with adjectival modifiers (Polotsky, 1978, 162–168), which is not attested in CA and not accepted by all MSA speakers, can be stipulated on the lexical level for adjectives with MOD *synsem*.

Free relatives are introduced via a unary projection, as suggested by Müller (1999) for German. Whether a relative clause can or has to be free can be stipulated by restricting the MOD value. Following Müller (1999), free relative clauses are specified as modifying an element with a *synsem* object that intuitively represents an empty head and which cannot be realized in any sign. The free-relative clause projection construction takes as its daughters only relative clauses with such a requirement. This ensures that the head of the relative clause, which is the highest predicate or the relativizer, can control whether the clause is free or modifying.

Restrictions on Marked Clauses and Adjectival Modifiers   Marked relative clauses and adjectival modifiers require agreement with the modified NP in case and definiteness. Furthermore, they are always head-initial (6).[6] These facts are captured by the following constraint:

(26)
$$\left[\begin{array}{ll} \dots\text{HD} & \left[\begin{array}{ll} \textit{reltvzr} \vee \textit{adjective} \\ \text{MOD} & \text{NP} \end{array}\right] \end{array}\right] \rightarrow \left[\begin{array}{ll} \dots\text{HD} & \left[\begin{array}{ll} \text{INI} & + \\ \text{CASE} & \boxed{1} \\ \text{DEF} & \boxed{2} \\ \text{MOD} & \left[\begin{array}{ll} \dots\text{CASE} & \boxed{1} \\ \dots\text{DEF} & \boxed{2} \end{array}\right] \end{array}\right] \end{array}\right]$$

Sharing DEF is compatible with cases where definiteness agreement with adjectival modifiers fails. In general, nouns with a genitive dependent are not marked for definiteness. This rule may prohibit the use of definiteness marker on adjectives with a genitive dependent. This depends on several factors, all of which are accessible on the level of the adjective: In 'unreal annexation' (*l-mar'atu l-jamiilatu*

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[6]It is not clear how examples like *la=ka maa 'amilnaa baaṭil-un* for=you RELTVZR we.have.done void-NOM 'what we have done for you is void' (Reckendorf, 1921, 447, with similar examples), where the relativizer is preceded by material belonging to the relative clause, should be analyzed.

l-wajhi DEF-woman-NOM DEF-beautiful-NOM DEF-face-GEN 'the woman whose face is beautiful'), the definiteness marker is obligatory. If the adjective is a participle and the genitive dependent an argument, the presence of the definiteness marker is influenced by tense/aspect (Reckendorf, 1895-1898, 155–156, 185–188, Reckendorf, 1921, 186). With certain words like *ghayr* 'other than', the definiteness marker was forbidden in CA and is optional in MSA. Such a treatment allows a simple account of the fact that the definiteness of the genitive complement is identical with that of the head if it is also an adjective (Badawi et al., 2004, 234–235).

The agreement of adjectival modifiers with their subject in number and gender can be accounted for by a general agreement mechanism, which is independently required in order to account for subject-predicate agreement in independent clauses and which is similar to Melnik's constraint 22. This is confirmed by the fact that adjectives seem to show the same agreement patterns in the indirect attribute as in independent clauses in which the subject follows the predicate; in particular, number may be neutralized in both cases (Hasan, 1968-1971, III 453; Reckendorf, 1921, 29). An additional constraint enforcing total agreement in the direct attribute, as constraint 24 in Melnik (2006), is not needed, since adjectives used as direct attribute have a nonempty SUBJ list under our analysis, as shown in Figure 2.

Thus, while we follow Melnik (2006) in basing our analysis on the general approach of Sag (1997), our analysis of adjectival modifiers is significantly simpler, since it capitalizes on independently required mechanisms for broad subjects and subject-predicate agreement.

Restrictions on Unmarked Clauses Unmarked relative clauses always modify in indefinite NP. This is captured by the following constraint:

$$(27) \quad \begin{bmatrix} \ldots\text{HD} & \begin{bmatrix} verb \\ \text{MOD} & \text{NP} \end{bmatrix} \end{bmatrix} \rightarrow \begin{bmatrix} \ldots\text{HD} & \begin{bmatrix} \begin{pmatrix} not\text{-}case\text{-}marked\text{-}head \\ \vee \text{ CASE} \quad nom \end{pmatrix} \\ \text{MOD} \quad \begin{bmatrix} \ldots\text{DEF} & - \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Not-case-marked-head subsumes finite verbs, prepositions and other heads without morphological case marking. Other heads, i.e. nominal and adjectival predicates, are constrained to show nominative case marking, which accounts for (2). The restriction on definiteness was not valid for all CA speakers, as definite unmarked relative clauses are attested. An account of this obsolete and rare phenomenon is given in Hahn (2012).

3.4 A (Second) Constructional Alternative

Alqurashi and Borsley (2012) see the necessity of assuming a different type of semantic compositionality as an argument against a constructional analysis. In this section, we outline a constructional analysis that does not require a separate

head-relative-phrase type to account for the correct composition of the semantics. The basic ingredient is a unary projection which introduces an NP with a restricted index as its CONT value over a clause:

$$
(28) \quad \textit{rel-phrase} \rightarrow
\begin{bmatrix}
\text{N-HD-DTRS} & \left\langle \begin{bmatrix} \textit{clause} \vee \textit{relativizer-with-clause} \\ \text{CONT} \quad \boxed{1}\ \textit{proposition} \end{bmatrix} \right\rangle \\[3em]
\text{SYNSEM|LOC} &
\begin{bmatrix}
\text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{noun} \\ \text{COMPS} & \langle\rangle \\ \text{SUBJ} & \langle\rangle \end{bmatrix} \\[2em]
\text{CONT} & \begin{bmatrix} \text{RESTR} & \left\{ \boxed{1} \right\} \cup \textit{set} \end{bmatrix}
\end{bmatrix}
\end{bmatrix}
$$

Modifying relative clauses are instances of *relative-phrase* with MOD value of type *synsem*, while free relatives specify MOD as *none*. A constraint enforcing coindexation and agreement of modifying relative clauses with the modified NP value can be stated easily. Thus, both free and modifying relatives are analyzed as NPs.

By defining a hierarchy of subtypes and expressing some of the properties expressed on the lexical level there by constraints on these phrasal types, the analysis presented in the previous section can be reconstruced. The analysis is described in more detail in Hahn (2012).

While leading to more complex syntactic structures for modifying relative clauses, this treatment simplifies the analysis of free relative clauses. More importantly, since the phrasally introduced NP has a restricted index as its CONT value, there are no difficulties with the semantic composition. This shows that the priniciples of semantic compositionality stated in Pollard and Sag (1994) are compatible with a constructional surface-oriented analysis of Arabic relative clauses. In principle, similar analyses are also possible in other semantic frameworks formalized in HPSG that allow semantic material to be introduced phrasally.

4   Conclusion

We have presented an HPSG analysis of NP relativization in Arabic that covers significantly more phenomena than previous analyses. Based on Doron and Reintges (2005), we showed that the crosslinguistically unusual syntax of adjectival modifiers is a language-internally expected variant of reduced relatives as found in English and requires no additional stipulations or phrasal types. Its syntactic peculiarities follow from independently established properties of Arabic syntax, in particular the existence of *broad subjects*, clause-initial NPs that bind off a UDC and that can be controlled (Doron and Heycock, 1999). We showed that their syntactic behaviour suggests that they are selected via SPR and that this requirement is
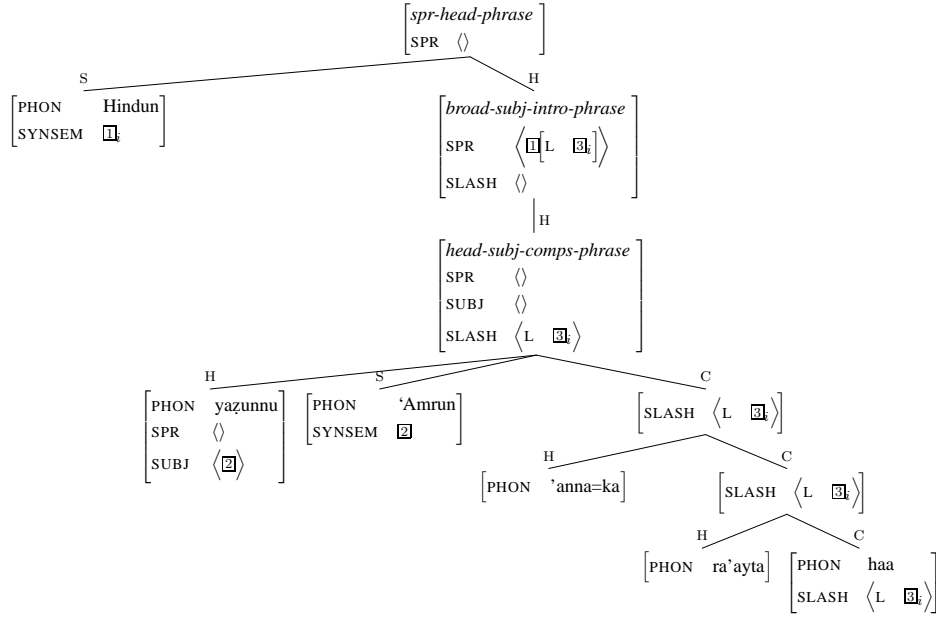
Figure 1: Analysis of (8b)

introduced phrasally by a unary projection. We then presented an analysis of relative clauses and adjectival modifiers that combines constructional with lexicalist elements and does not require empty elements. Because of the use of independently required mechanisms, the analysis of adjectival modifiers is significantly simpler than the previous analysis by Melnik (2006).

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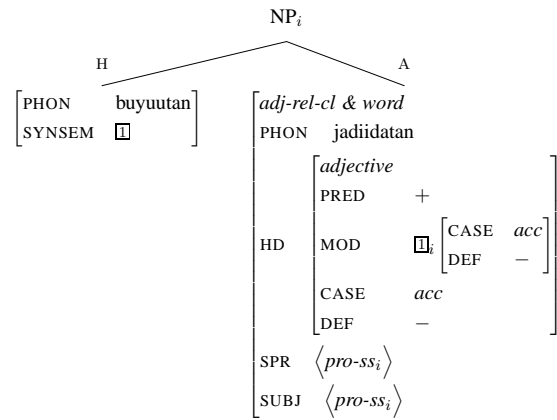
NP$_i$

   H   A

$$
\begin{bmatrix} \text{PHON} & \text{buyuutan} \\ \text{SYNSEM} & \boxed{1} \end{bmatrix}
\quad
\begin{bmatrix} \textit{adj-rel-cl \& word} \\ \text{PHON} \quad \text{jadiidatan} \\[4pt]
\text{HD} \begin{bmatrix} \textit{adjective} \\ \text{PRED} \quad + \\ \text{MOD} \quad \boxed{1}_i \begin{bmatrix} \text{CASE} & acc \\ \text{DEF} & - \end{bmatrix} \\ \text{CASE} \quad acc \\ \text{DEF} \quad - \end{bmatrix} \\[6pt]
\text{SPR} \quad \left\langle \textit{pro-ss}_i \right\rangle \\
\text{SUBJ} \quad \left\langle \textit{pro-ss}_i \right\rangle
\end{bmatrix}
$$

Figure 2: Analysis of example (4a) (Direct Attribute)

NP$_i$

  H   A

$$
\begin{bmatrix} \text{PHON} & \text{buyuutin} \\ \text{SYNSEM} & \boxed{1} \end{bmatrix}
\quad
\begin{bmatrix} \textit{adj-rel-cl \& broad-subj-intro-phrase} \\[4pt]
\text{HD} \quad \boxed{3} \begin{bmatrix} \textit{adjective} \\ \text{PRED} \quad + \\ \text{MOD} \quad \boxed{1}_i \end{bmatrix} \\[6pt]
\text{SPR} \quad \left\langle \begin{bmatrix} \textit{pro-ss} \\ \text{L} \quad \boxed{4}_i \end{bmatrix} \right\rangle \\[6pt]
\text{SLASH} \quad \langle \rangle
\end{bmatrix}
$$

        H

$$
\begin{bmatrix} \textit{head-subj-comps-phrase} \\ \text{SPR} \quad \langle \rangle \\ \text{SUBJ} \quad \langle \rangle \\ \text{SLASH} \quad \left\langle \text{L} \ \boxed{4}_i \right\rangle \end{bmatrix}
$$

  H   C   C

$$
\begin{bmatrix} \text{PHON} & \text{ḥaaṣilin} \\ \text{SPR} & \langle \rangle \\ \text{SUBJ} & \langle \boxed{2} \rangle \\ \text{HD} & \boxed{3} \end{bmatrix}
\quad
\begin{bmatrix} \text{SLASH} \quad \left\langle \text{L} \ \boxed{4}_i \right\rangle \end{bmatrix}
\quad
\begin{bmatrix} \text{PHON} & \text{lḥariiqu} \\ \text{SYNSEM} & \boxed{2} \end{bmatrix}
$$

    H   C

$$
\begin{bmatrix} \text{PHON} \quad \text{fii} \end{bmatrix}
\quad
\begin{bmatrix} \text{PHON} & \text{haa} \\ \text{SLASH} & \left\langle \text{L} \ \boxed{4}_i \right\rangle \end{bmatrix}
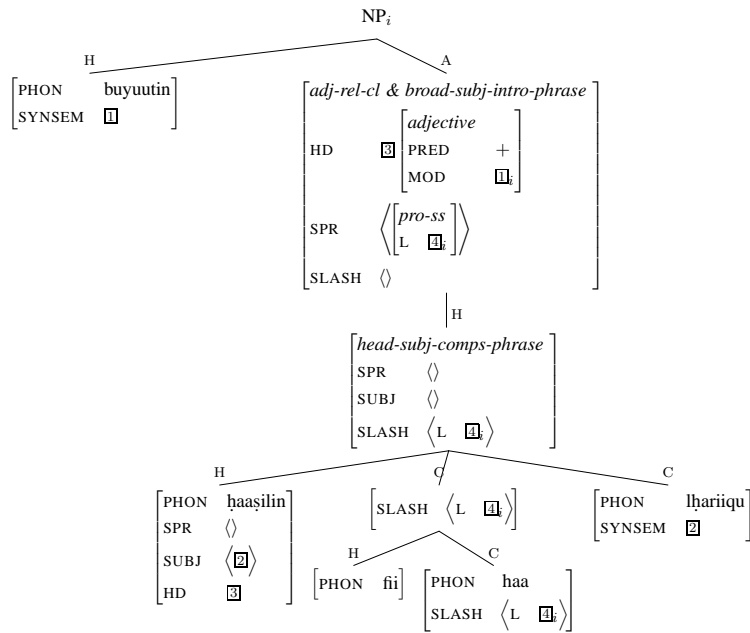$$

Figure 3: Analysis of example (5a) (Indirect Attribute)

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