Chapter 8

Coordination

Agnieszka Patejuk
Polish Academy of Sciences and University of Oxford

Coordination is a rich and complex topic. To avoid repeating what has been written in many excellent textbooks and reference guides, this chapter takes a non-standard approach. It starts by presenting the very basics of coordination in LFG, it provides pointers to agreement phenomena related to coordination, and then it proceeds to discuss selected less well-known coordination phenomena and their treatment in LFG, including: non-constituent coordination, coordination of unlike categories, coordination of unlike grammatical functions and coordination involving ellipsis.

1 Introduction

This section starts by introducing two key concepts of coordination in LFG: sets and hybrid objects. Next, it briefly introduces distributivity, a key concept of coordination, on the basis of feature resolution (for non-distributive attributes) and dependent sharing (for grammatical functions, which belong to distributive attributes). Finally, it presents single conjunct agreement as an alternative to resolved agreement (under feature resolution).

Over time, different conventions have been used in f-structures. To avoid potential confusion, the f-structures presented in this chapter have been normalized: as a result, while f-structures in this chapter consistently use the same conventions, they may look different than in original papers. Furthermore, to save space, some f-structures have been simplified by removing attributes which are not relevant in a given context (such as SPEC, for instance).

The following convention is used in c-structure rules in this chapter: if a category on the right-hand side has no annotation, it is assumed to have the (co-)head annotation (↓=↑).

Agnieszka Patejuk. 2023. Coordination. In Mary Dalrymple (ed.), *Handbook of Lexical Functional Grammar*, 309–374. Berlin: Language Science Press.
DOI: 10.5281/zenodo.10185948

Except for (189), all examples used in this chapter are either English or Polish.

1.1 Coordination basics: sets and hybrid objects

A basic LFG coordination rule is given in (1), where XP is a variable over categories: every instance of XP in (1) must be replaced by the same category (for example NP).

(1) $\text{XP} \longrightarrow \underset{\downarrow\in\uparrow}{\text{XP}}\ \text{Conj}\ \underset{\downarrow\in\uparrow}{\text{XP}}$

While the rule in (1) can only join two conjuncts, its slightly modified version in (2) can join more than two conjuncts: XP^+ corresponds to one or more occurrences of XP.[1] Furthermore, the rule in (2) includes an optional preconjunction (such as BOTH in *both… and…* or EITHER in *either… or…*):[2]

(2) $\text{XP} \longrightarrow (\text{PreConj})\ \underset{\downarrow\in\uparrow}{\text{XP}^+}\ \text{Conj}\ \underset{\downarrow\in\uparrow}{\text{XP}}$

While there are various patterns of coordination (one conjunction, as many conjunctions as conjuncts, one fewer conjunction than the number of conjuncts, etc.), the basic annotations are the same: any (pre)conjunctions are co-heads ($\downarrow{=}\uparrow$, omitted above following the convention that lack of annotation is equivalent to having $\downarrow{=}\uparrow$ annotation), while conjuncts are members of the set ($\downarrow\in\uparrow$) corresponding to the coordinate structure.

Let us consider structures created by these rules, using the simplified lexical entries below:

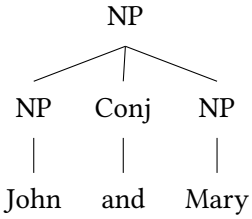
(3)	*John*	N	(↑ PRED)='JOHN'
	Mary	N	(↑ PRED)='MARY'
	and	Conj	(↑ CONJ)=AND
	both	PreConj	(↑ PRECONJ)=BOTH
			$(\uparrow \text{CONJ})=_c$ AND

The structures in (4)–(5) can be generated by both rules in (1) and (2), while the structures with the preconjunction in (6)–(7) can only be generated by the rule in (2).

[1] Punctuation between non-final conjuncts is ignored in (2).

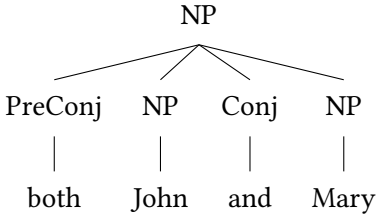
[2] While (2) overgenerates (*both… and…* can only be used with two conjuncts), some speakers can use *either… or…* with more than two conjuncts (e.g. *either X, Y or Z*).

(4)



(5)
$$\begin{bmatrix} \left\{ \left[\textsc{pred} \text{ `John'} \right], \left[ \textsc{pred} \text{ `Mary'} \right] \right\} \\ \textsc{conj} \quad \textsc{and} \end{bmatrix}$$

(6)



(7)
$$\begin{bmatrix} \left\{ \left[\textsc{pred} \text{ `John'} \right], \left[ \textsc{pred} \text{ `Mary'} \right] \right\} \\ \textsc{preconj} \quad \textsc{both} \\ \textsc{conj} \quad \textsc{and} \end{bmatrix}$$

The f-structures representing coordination are hybrid objects. This is because they contain two types of objects: a set containing the individual conjuncts (sets are represented using curly brackets; set elements may be typeset horizontally or vertically) as well as attributes pertaining to the coordinate structure as a whole (these include the attributes CONJ and PRECONJ[3] representing the conjunction and the preconjunction, respectively).

1.2 Non-distributivity and feature resolution

As mentioned above, the lexical entries in (3) are simplified. The importance of hybrid objects is clearer when more features are represented in the f-structure, so let us extend the lexical entries in (8) by adding the NUM(ber) feature (while still ignoring other features):

(8)

	John	N	(↑ PRED)='JOHN'
			(↑ NUM)=SG
	Mary	N	(↑ PRED)='MARY'
			(↑ NUM)=SG

[3]Some works use different attribute names, for instance COORD-FORM and PRECOORD-FORM.

As shown in (9),[4] even though both conjuncts are singular, the coordinate subject as a whole is plural – as a consequence, the verb requires plural agreement:

(9) [[John] and [Mary]] sing/*sings.

(10)
sing	V	(↑ PRED)=‘SING⟨(↑ SUBJ)⟩’	
		(↑ SUBJ NUM) $=_c$ PL	
sings	V	(↑ PRED)=‘SING⟨(↑ SUBJ)⟩’	
		(↑ SUBJ NUM) $=_c$ SG	

(11) shows how this is reflected in the f-structure: while individual conjuncts are singular (their value of NUM is SG), the entire coordination is plural (its NUM is PL):

(11)
$$\begin{bmatrix} \left\{ \begin{bmatrix} \text{PRED} & \text{‘JOHN’} \\ \text{NUM} & \text{SG} \end{bmatrix}, \begin{bmatrix} \text{PRED} & \text{‘MARY’} \\ \text{NUM} & \text{SG} \end{bmatrix} \right\} \\ \text{NUM} \quad \text{PL} \\ \text{CONJ} \quad \text{AND} \end{bmatrix}$$

To obtain such a representation, the equation (↑ NUM)=PL must be placed somewhere in the grammar. While normally it would be part of more complex feature resolution rules for number,[5] it is put below in the simplified rule handling NP coordination, see (12).

(12)
NP	⟶	(PreConj)	NP$^+$	Conj		NP
			↓∈↑	↓=↑		↓∈↑
				(↑ NUM)=PL		

The prerequisite for this equation to work as desired is that the NUM attribute must be non-distributive. This means that such an equation does not distribute to individual conjuncts (which would clash with (↑ NUM)=SG in their lexical entries), but instead it applies to the topmost f-structure corresponding to the entire coordinate phrase, see (11).

Apart from NUM(ber), some typical non-distributive attributes (or features) include GEND(er) and PERS(on). As mentioned above for NUM(ber), such non-distributive attributes are subject to feature resolution: rules specifying which value of these attributes is appropriate for the entire coordinate phrase, given the values of these attributes of particular conjuncts. Feature resolution rules are different for various attributes and may differ across languages. See Haug 2023 [this volume] for more discussion and references.

[4] Square brackets in examples indicate the boundaries of coordination and individual conjuncts.

[5] Such rules should consider the type of the conjunction (*and* vs. *or*). Even with *and*, it is not always the case that the number should be plural: *my doctor and best friend* can refer to one or two individuals.

1.3 Distributivity and dependent sharing

The rules in (1)–(2) can also be used to join categories other than NPs. For instance, (13) involves coordination of two sentences, while (14) involves two instances of coordination, at two different levels: NP coordination (*John and Mary*) described above (with the more specialised rule in (12)), and coordination of verbal phrases (*sing and walk*).

(13) [[John sings] and [Mary walks]].

(14) [[John] and [Mary]] [[sing] and [walk]].

In (14) the coordinated nominal subject (*John and Mary*, see its partial f-structure in (11)) is a shared dependent of the coordinated verbal phrases (*sing and walk*, see (15)).

(15)
$$\begin{bmatrix} \left\{ \left[\text{PRED } \text{`SING}\langle \text{SUBJ} \rangle\text{'} \right], \left[ \text{PRED } \text{`WALK}\langle \text{SUBJ} \rangle\text{'} \right] \right\} \\ \text{CONJ} \quad \text{AND} \end{bmatrix}$$

Since grammatical functions are distributive, no special rules are required to handle examples with a shared dependent such as (14). The equation (↑ SUBJ)=↓ assigning the SUBJ grammatical function to the NP in (16) distributes to each element of the set corresponding to the VP.[6] As a result, (11) becomes the subject of both conjuncts in (15), yielding (17) which involves structure sharing, indicated using boxed indices (1).

(16) S ⟶ NP VP
(↑ SUBJ)=↓

(17)
$$\begin{bmatrix} \left\{ \left(\begin{bmatrix} \text{PRED} & \text{`SING}\langle \boxed{1} \rangle\text{'} \\ \text{SUBJ } \boxed{1} & \begin{bmatrix} \left\{ \left( \begin{bmatrix} \text{PRED} & \text{`JOHN'} \\ \text{NUM} & \text{SG} \end{bmatrix}, \begin{bmatrix} \text{PRED} & \text{`MARY'} \\ \text{NUM} & \text{SG} \end{bmatrix} \right\} \right) \\ \text{NUM} \quad \text{PL} \\ \text{CONJ} \quad \text{AND} \end{bmatrix} \end{bmatrix} \right), \begin{bmatrix} \text{PRED} & \text{`WALK}\langle \boxed{1} \rangle\text{'} \\ \text{SUBJ} & \boxed{1} \end{bmatrix} \right\} \\ \text{CONJ} \quad \text{AND} \end{bmatrix}$$

[6] Most recent analyses would use IP instead of S and I′ instead of VP. However, since these distinctions are not the main focus of this chapter, the rules and c-structures from the literature are not normalised.

1.4 Single conjunct agreement

Single conjunct agreement (SCA) is an alternative agreement strategy available under coordination in some languages. Instead of agreeing with the entire coordinate phrase under feature resolution, under SCA the agreement target (for example: the verb) agrees with one of the conjuncts of its agreement controller (for verbs, typically the subject), usually the closest conjunct – this is known as closest conjunct agreement (CCA). Though furthest conjunct agreement (FCA) is also attested, it is rather rare (compared to CCA).

(18) is a Polish example showing resolved agreement (*szli* 'walked' is plural masculine) as opposed to agreement with the closest conjunct (*szła* 'walked' is singular and feminine):

(18) Polish
Szli/szła [[Marysia] i [Janek]].
walked.3.PL.M1/3.SG.F Marysia.SG.F and Janek.SG.M1
'Janek and Marysia walked.'

See Haug 2023 [this volume] for more discussion of SCA and references.

2 Non-constitutent coordination

When discussing coordination, typically what is discussed is coordination of constituents (typically of the same category and corresponding to the same grammatical function). Kaplan & Maxwell (1988) is the first published LFG analysis of such coordination.

Maxwell & Manning (1996) is a seminal LFG work discussing non-constituent coordination (NCC) where conjuncts do not correspond to constituents. Instead, each conjunct corresponds to a sequence of constituents (or possibly their parts), with no strict requirement of parallelism between conjuncts. Maxwell & Manning (1996: 1) provide the following "grab-bag of other cases of coordination commonly negatively classified as non-constituent coordination" which are outside of the scope of Kaplan & Maxwell (1988), labelling (19) as "conjunction reduction" (CR), (20) as "Right-Node Raising" (RNR), (21) as "Gapping", (22) as "Ellipsis" and (23) as "non-symmetric coordination":

(19) Bill gave [[the girls spades] and [the boys recorders]].
(Maxwell & Manning 1996: (2a))

(20) [[Bill likes], and [Joe is thought to like]] cigars from Cuba.
(Maxwell & Manning 1996: (2b))

(21) [[Bill gave a rhino to Fred], and [Sue a camera to Marjorie]].
(Maxwell & Manning 1996: (2c))

(22) [[Bill likes big cars], and [Sally does too]].
(Maxwell & Manning 1996: (2d))

(23) Bill [[went] and [took the test]]. (Maxwell & Manning 1996: (2e))

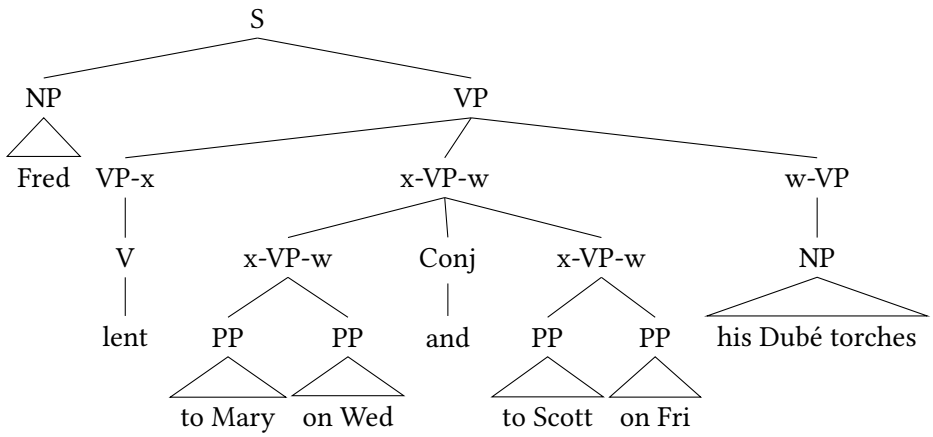
In order to account for instances of CR and RNR, Maxwell & Manning (1996: 3) propose to extend the analysis of coordination by allowing "the coordination of partial expansions of c-structure rules", namely partial expansions of VP rules (such as (26) discussed below), pointing out that this solution makes it possible to "maintain the simple and classic rule for coordination that only identical things are allowed to coordinate".[7]

2.1 Basics of the Maxwell & Manning (1996) analysis

Let us consider (24), where the NCC (*to Mary on Wednesday and to Scott on Friday*)[8] is surrounded by shared material: the subject (*Fred*) and the main verb (*lent*) on the left and the object on the right (*his Dubé torches*). (25) is the tree corresponding to (24).

(24) Fred lent [[to Mary on Wednesday] and [to Scott on Friday]] his Dubé torches.

(25)



(Maxwell & Manning 1996: (15))

[7] It can also be used to reanalyse unlike category coordination as same category coordination, see Section 3.1.

[8] *Wednesday* and *Friday* are abbreviated in trees and f-structures to *Wed* and *Fri*, respectively.

The following modified rules can be read off the tree in (25):[9]

(26) VP ⟶ VP-x x-VP-w w-VP

(27) VP-x ⟶ V

(28) x-VP-w ⟶ x-VP-w Conj x-VP-w

(29) x-VP-w ⟶ PP PP

(30) w-VP ⟶ NP

However, the rules above are not complete because f-descriptions are missing. While the rule in (31) could normally be used, in order to handle the NCC in (24), the rules in (28)–(30) must be annotated with f-descriptions as shown in (32)–(34):

(31) VP ⟶ V PP PP* NP
(↑ OBL)=↓ ↓∈(↑ ADJ) (↑ OBJ)=↓

(32) x-VP-w ⟶ x-VP-w Conj x-VP-w
↓∈↑ ↓∈↑

(33) x-VP-w ⟶ PP PP
(↑ OBL)=↓ ↓∈(↑ ADJ)

(34) w-VP ⟶ NP
(↑ OBJ)=↓

There is an important difference between "standard" rules such as (31) and modified rules aimed at handling NCC. While in (31) subsequent dependents have appropriate grammatical function annotations ((↑ OBL)=↓ for the oblique PP, ↓∈(↑ ADJ) for the modifier PP and (↑ OBJ)=↓ for the NP object), the corresponding NCC partial categories in (26), x-VP-w and w-VP, have no annotation, which is interpreted by default as the co-head annotation (↓=↑). As a consequence, the annotations assigning appropriate grammatical functions are instead equivalently placed in (33) (for x-VP-w which rewrites to an oblique PP followed by a modifier PP) and in (34) (for w-VP which rewrites to an NP object). Thanks to the different placement of f-descriptions,[10] such modified rules can account for NCC, unlike the "standard" VP rule in (31).

[9]While Maxwell & Manning (1996) use "and" in their rules, it was replaced with "Conj" for consistency.

[10]Moving f-descriptions in this way is crucial in some analyses of other phenomena, including coordination of different grammatical functions (Section 4) and gapping (Section 5.3).

To better understand the analysis of Maxwell & Manning (1996), let us consider its procedural intuition by inspecting partial f-structures created by these rules.

Each conjunct of NCC builds its partial f-structure using the rule in (33): (35) corresponds to the first conjunct (*to Mary on Wednesday*), (36) to the second (*to Scott on Friday*).

(35) $\begin{bmatrix} \textsc{obl} & \left[\textsc{pred} \ \text{`Mary'}\right] \\ \textsc{adj} & \left\{\left[\begin{array}{ll}\textsc{pred} & \text{`on}\langle\boxed{4}\rangle\text{'} \\ \textsc{obj} & \boxed{4}\left[\textsc{pred} \ \text{`Wed'}\right]\end{array}\right]\right\} \end{bmatrix}$

(36) $\begin{bmatrix} \textsc{obl} & \left[\textsc{pred} \ \text{`Scott'}\right] \\ \textsc{adj} & \left\{\left[\begin{array}{ll}\textsc{pred} & \text{`on}\langle\boxed{6}\rangle\text{'} \\ \textsc{obj} & \boxed{6}\left[\textsc{pred} \ \text{`Fri'}\right]\end{array}\right]\right\} \end{bmatrix}$

Next, (35) and (36) are added as set elements using the coordination rule in (32).[11]

(37) $\left[\left\{\left[\begin{array}{ll}\textsc{obl} & \left[\textsc{pred} \ \text{`Mary'}\right] \\ \textsc{adj} & \left\{\left[\begin{array}{ll}\textsc{pred} & \text{`on}\langle\boxed{4}\rangle\text{'} \\ \textsc{obj} & \boxed{4}\left[\textsc{pred} \ \text{`Wed'}\right]\end{array}\right]\right\}\end{array}\right], \left[\begin{array}{ll}\textsc{obl} & \left[\textsc{pred} \ \text{`Scott'}\right] \\ \textsc{adj} & \left\{\left[\begin{array}{ll}\textsc{pred} & \text{`on}\langle\boxed{6}\rangle\text{'} \\ \textsc{obj} & \boxed{6}\left[\textsc{pred} \ \text{`Fri'}\right]\end{array}\right]\right\}\end{array}\right]\right\} \\ \textsc{conj} \quad \textsc{and} \end{bmatrix}$

Next, the VP rule in (26) unifies the partial f-structures of 3 co-heads: (38) corresponds to VP-x; (37) is the set corresponding to NCC in x-VP-w; (39) is created by the w-VP rule in (34). As mentioned in Section 1.3 when discussing (14), grammatical functions are distributive; so is PRED. Note that being a distributive feature is consistent with being an instantiated feature: when PRED is distributed, it is uniquely instantiated in each conjunct.[12] As a result, (38) and (39) distribute over (37), yielding the f-structure in (40).

(38) $\left[\textsc{pred} \ \text{`lend}\langle\textsc{subj},\textsc{obj},\textsc{obl}\rangle\text{'}\right]$

(39) $\left[\textsc{obj} \ \left[\textsc{pred} \ \text{`Dubé torches'}\right]\right]$

(40) $\left[\left\{\left[\begin{array}{ll}\textsc{pred} & \text{`lend}\langle\textsc{subj},\boxed{2},\boxed{3}\rangle\text{'} \\ \textsc{obj} & \boxed{2}\left[\textsc{pred} \ \text{`Dubé torches'}\right] \\ \textsc{obl} & \boxed{3}\left[\textsc{pred} \ \text{`Mary'}\right] \\ \textsc{adj} & \left\{\left[\begin{array}{ll}\textsc{pred} & \text{`on}\langle\boxed{4}\rangle\text{'} \\ \textsc{obj} & \boxed{4}\left[\textsc{pred} \ \text{`Wed'}\right]\end{array}\right]\right\}\end{array}\right], \left[\begin{array}{ll}\textsc{pred} & \text{`lend}\langle\textsc{subj},\boxed{2},\boxed{5}\rangle\text{'} \\ \textsc{obj} & \boxed{2} \\ \textsc{obl} & \boxed{5}\left[\textsc{pred} \ \text{`Scott'}\right] \\ \textsc{adj} & \left\{\left[\begin{array}{ll}\textsc{pred} & \text{`on}\langle\boxed{6}\rangle\text{'} \\ \textsc{obj} & \boxed{6}\left[\textsc{pred} \ \text{`Fri'}\right]\end{array}\right]\right\}\end{array}\right]\right\} \\ \textsc{conj} \quad \textsc{and} \end{bmatrix}$

[11] Coordination of partial expansions such as in (32) is handled by the general coordination rule in (1).

[12] This makes it possible to account for multiclausal coordination phenomena such as NCC, coordination of different grammatical functions (Section 4.4), SGF (Section 5.1) and gapping (Section 5.3).

One element is missing in (40): the shared subject (*Fred*), see the tree in (25). Assuming a rule for S such as in (16), the annotation (↑ SUBJ)=↓ distributes the NP subject over the partial f-structure in (40), yielding the complete f-structure in (41).

(41)
$$\left[\begin{array}{l}\left\{\left[\begin{array}{ll}\text{PRED} & \text{`LEND}\langle\boxed{1},\boxed{2},\boxed{3}\rangle\text{'}\\ \text{SUBJ} & \boxed{1}\left[\text{PRED `FRED'}\right]\\ \text{OBJ} & \boxed{2}\left[\text{PRED `DUBÉ TORCHES'}\right]\\ \text{OBL} & \boxed{3}\left[\text{PRED `MARY'}\right]\\ \text{ADJ} & \left\{\left[\begin{array}{ll}\text{PRED} & \text{`ON}\langle\boxed{4}\rangle\text{'}\\ \text{OBJ} & \boxed{4}\left[\text{PRED `WED'}\right]\end{array}\right]\right\}\end{array}\right], \left[\begin{array}{ll}\text{PRED} & \text{`LEND}\langle\boxed{1},\boxed{2},\boxed{5}\rangle\text{'}\\ \text{SUBJ} & \boxed{1}\\ \text{OBJ} & \boxed{2}\\ \text{OBL} & \boxed{5}\left[\text{PRED `SCOTT'}\right]\\ \text{ADJ} & \left\{\left[\begin{array}{ll}\text{PRED} & \text{`ON}\langle\boxed{6}\rangle\text{'}\\ \text{OBJ} & \boxed{6}\left[\text{PRED `FRI'}\right]\end{array}\right]\right\}\end{array}\right]\right\}\\ \text{CONJ}\quad \text{AND}\end{array}\right]$$

An important thing to note about the Maxwell & Manning (1996) analysis of NCC is that it creates multiclausal structures.[13] This means that it is equivalent to a coordination of two VPs, with two instances of a given verb – it is clear in (41), where the set corresponding to coordination contains two clauses with different instantiations of LEND as the main verb.

2.2 Interaction with verbal coordination

(42) demonstrates an interesting issue arising when NCC (*to Mary on Wednesday and to Sue on Friday*) co-occurs with verbal coordination, which is also represented as a set:

(42) John [[gave a book] or [lent a record]] [[to Mary on Wednesday] and [to Sue on Friday]]. (Maxwell & Manning 1996: (43))

Strictly speaking, (42) is more complex than necessary to show the issue at hand:[14] *[[gave a book] or [lent a record]]* is another instance of NCC, which means that more complex c-structure rules are needed to handle this example. (43) is the "standard" VP rule which is split into partial VP rules in (44)–(48) in order to handle NCC in (42).

(43) VP ⟶ V NP PP PP*
(↑ OBJ)=↓ (↑ OBL)=↓ ↓∈(↑ ADJ)

[13] Multiclausal structures also arise under gapping (Section 5.3), in some instances of coordination of different grammatical functions (Section 4.4) and when unlike category coordination is reanalysed as NCC (Section 3.1).

[14] The same issue arises in a modified version of (24) with simple coordination of verbs (*gave or lent*):

(i) Fred [[gave] or [lent]] [[to Mary on Wednesday] and [to Scott on Friday]] his Dubé torches.

(44) VP ⟶ VP-x x-VP

(45) VP-x ⟶ VP-x Conj VP-x
↓∈↑ ↓∈↑

(46) VP-x ⟶ V NP
(↑ OBJ)=↓

(47) x-VP ⟶ x-VP Conj x-VP
↓∈↑ ↓∈↑

(48) x-VP ⟶ PP PP*
(↑ OBL)=↓ ↓∈(↑ ADJ)

The procedural intuition of the analysis of (42) involves unifying two partial f-structures in the VP rule in (44), both of which happen to be sets: (49) corresponds to VP-x (*gave a book or lent a record*) built using the rules in (45)–(46), while (50) corresponds to x-VP (*to Mary on Wednesday and to Sue on Friday*) built using (47)–(48).

(49)
$$\left[\left\{\begin{bmatrix}\textsc{pred} & \text{`GIVE}\langle\textsc{subj},\boxed{2},\textsc{obl}\rangle\text{'}\\ \textsc{obj} & \boxed{2}\begin{bmatrix}\textsc{pred} & \text{`BOOK'}\end{bmatrix}\end{bmatrix},\begin{bmatrix}\textsc{pred} & \text{`LEND}\langle\textsc{subj},\boxed{3},\textsc{obl}\rangle\text{'}\\ \textsc{obj} & \boxed{3}\begin{bmatrix}\textsc{pred} & \text{`RECORD'}\end{bmatrix}\end{bmatrix}\right\}\right.$$
$$\left.\textsc{conj}\quad \textsc{or}\right]$$

(50)
$$\left[\left\{\left\{\begin{bmatrix}\textsc{obl} & \begin{bmatrix}\textsc{pred} & \text{`MARY'}\end{bmatrix}\\ \textsc{adj} & \left\{\begin{bmatrix}\textsc{pred} & \text{`ON}\langle\boxed{4}\rangle\text{'}\\ \textsc{obj} & \boxed{4}\begin{bmatrix}\textsc{pred} & \text{`WED'}\end{bmatrix}\end{bmatrix}\right\}\end{bmatrix}\right\},\left\{\begin{bmatrix}\textsc{obl} & \begin{bmatrix}\textsc{pred} & \text{`SUE'}\end{bmatrix}\\ \textsc{adj} & \left\{\begin{bmatrix}\textsc{pred} & \text{`ON}\langle\boxed{5}\rangle\text{'}\\ \textsc{obj} & \boxed{5}\begin{bmatrix}\textsc{pred} & \text{`FRI'}\end{bmatrix}\end{bmatrix}\right\}\end{bmatrix}\right\}\right.$$
$$\left.\textsc{conj}\quad \textsc{and}\right]$$

As discussed in Section 2.1, when a set is unified with a non-set f-structure, the non-set f-structure is distributed over the set. Maxwell & Manning (1996) discuss the issue of unifying two sets[15] on the basis of example (42), where the first set contains elements labelled as f_1 (*gave a book*) and f_2 (*lent a record*), see the f-structure in (49), while the second set contains f_3 (*to Mary on Wednesday*) and f_4 (*to Sue on Friday*), see (50).

Maxwell & Manning (1996) point out that a possible but undesired result of unifying (49) and (50) is set union, yielding an f-structure containing a set with 4 elements. This is schematically shown in (51), while the corresponding partial f-structure is given in (52).

(51) $\uparrow\{f_1,f_2,f_3,f_4\}$

[15]The issue of unifying two sets also surfaces in other coordination phenomena, including multi-clausal coordination of different grammatical functions (Section 4.4) and gapping (Section 5.3).

(52)
$$\left[\begin{array}{l}\left\{\left[\begin{array}{l}\textsc{pred}\ \text{`}\textsc{give}\langle\textsc{subj},\boxed{2},\textsc{obl}\rangle\text{'}\\ \textsc{obj}\quad \boxed{2}\left[\textsc{pred}\ \text{`}\textsc{book}\text{'}\right]\end{array}\right], \left[\begin{array}{l}\textsc{pred}\ \text{`}\textsc{lend}\langle\textsc{subj},\boxed{3},\textsc{obl}\rangle\text{'}\\ \textsc{obj}\quad \boxed{3}\left[\textsc{pred}\ \text{`}\textsc{record}\text{'}\right]\end{array}\right],\right.\\ \left.\left[\begin{array}{l}\textsc{obl}\ \left[\textsc{pred}\ \text{`}\textsc{Mary}\text{'}\right]\\ \textsc{adj}\ \left\{\left[\begin{array}{l}\textsc{pred}\ \text{`}\textsc{on}\langle\boxed{4}\rangle\text{'}\\ \textsc{obj}\quad \boxed{4}\left[\textsc{pred}\ \text{`}\textsc{Wed}\text{'}\right]\end{array}\right]\right\}\end{array}\right]\right\}, \left\{\left[\begin{array}{l}\textsc{obl}\ \left[\textsc{pred}\ \text{`}\textsc{Sue}\text{'}\right]\\ \textsc{adj}\ \left\{\left[\begin{array}{l}\textsc{pred}\ \text{`}\textsc{on}\langle\boxed{5}\rangle\text{'}\\ \textsc{obj}\quad \boxed{5}\left[\textsc{pred}\ \text{`}\textsc{Fri}\text{'}\right]\end{array}\right]\right\}\end{array}\right]\right\}\\ \textsc{conj}\quad \textsc{or}{\neq}\textsc{and}\end{array}\right]$$

(52) is ill-formed for three reasons.[16] First, it is incomplete: f_1 and f_2 have a missing OBL(ique) argument. Secondly, it is incoherent: f_3 and f_4 have no PRED subcategorising for their OBL arguments. Finally, it is inconsistent due to conflicting values of the CONJ attribute: f_1 and f_2 are conjoined with *or* ((↑ CONJ)=OR), while f_3 and f_4 are conjoined with *and* ((↑ CONJ)=AND). Unifying these f-descriptions results in a clash (≠), see (52).

Maxwell & Manning (1996) explain that the desired result is to distribute one set over the other, which yields a set containing 2 elements, each of which also contains 2 elements. There are two ways in which this can be done.

The result of distributing the first set (containing f_1, f_2) over the second (containing f_3, f_4) is schematically shown in (53). This yields the partial f-structure in (54), where the top-level conjunction is AND (it joins f_3 and f_4), while the conjunction in embedded sets is OR (it joins f_1 and f_2). The sentence in (55) provides a natural language intuition of the f-structure in (54) (with the subject added in brackets, since its contribution is not present in (54)).

(53) $\uparrow\{f_3\{f_1',f_2'\},f_4\{f_1'',f_2''\}\}$

(54)
$$\left[\begin{array}{l}\left\{\left[\begin{array}{l}\left\{\left[\begin{array}{l}\textsc{pred}\ \text{`}\textsc{give}\langle\textsc{subj},\boxed{2},\boxed{3}\rangle\text{'}\\ \textsc{obj}\quad \boxed{2}\left[\textsc{pred}\ \text{`}\textsc{book}\text{'}\right]\\ \textsc{obl}\quad \boxed{3}\left[\textsc{pred}\ \text{`}\textsc{Mary}\text{'}\right]\\ \textsc{adj}\quad \left\{\boxed{4}\left[\begin{array}{l}\textsc{pred}\ \text{`}\textsc{on}\langle\boxed{5}\rangle\text{'}\\ \textsc{obj}\quad \boxed{5}\left[\textsc{pred}\ \text{`}\textsc{Wed}\text{'}\right]\end{array}\right]\right\}\end{array}\right]\right\}, \left[\begin{array}{l}\textsc{pred}\ \text{`}\textsc{lend}\langle\textsc{subj},\boxed{9},\boxed{3}\rangle\text{'}\\ \textsc{obj}\quad \boxed{9}\left[\textsc{pred}\ \text{`}\textsc{record}\text{'}\right]\\ \textsc{obl}\quad \boxed{3}\\ \textsc{adj}\quad \{\boxed{4}\}\end{array}\right]\right\}\\ \textsc{conj}\quad \textsc{or}\end{array}\right], \left\{\left[\begin{array}{l}\left\{\left[\begin{array}{l}\textsc{pred}\ \text{`}\textsc{give}\langle\textsc{subj},\boxed{2},\boxed{6}\rangle\text{'}\\ \textsc{obj}\quad \boxed{2}\\ \textsc{obl}\quad \boxed{6}\left[\textsc{pred}\ \text{`}\textsc{Sue}\text{'}\right]\\ \textsc{adj}\quad \left\{\boxed{7}\left[\begin{array}{l}\textsc{pred}\ \text{`}\textsc{on}\langle\boxed{8}\rangle\text{'}\\ \textsc{obj}\quad \boxed{8}\left[\textsc{pred}\ \text{`}\textsc{Fri}\text{'}\right]\end{array}\right]\right\}\end{array}\right]\right\}, \left[\begin{array}{l}\textsc{pred}\ \text{`}\textsc{lend}\langle\textsc{subj},\boxed{9},\boxed{6}\rangle\text{'}\\ \textsc{obj}\quad \boxed{9}\\ \textsc{obl}\quad \boxed{6}\\ \textsc{adj}\quad \{\boxed{7}\}\end{array}\right]\right\}\\ \textsc{conj}\quad \textsc{or}\end{array}\right]\right\}\\ \textsc{conj}\quad \textsc{and}\end{array}\right]$$

[16]These problems persist after the f-structure of the subject (*John*) is distributed over all set elements.

(55) (John) [[gave a book or lent a record] to Mary on Wednesday] and [[gave a book or lent a record] to Sue on Friday].

By contrast, (56) schematically shows the opposite situation, where the second set (containing f_3, f_4) is distributed over the first set (containing f_1, f_2). This yields the partial f-structure in (57), where the top-level conjunction is OR (it joins f_1 and f_2), while the conjunction in embedded sets is AND (it joins f_3 and f_4). (58) provides the natural language intuition of (57).

(56) $\uparrow\{f_1\{f_3', f_4'\}, f_2\{f_3'', f_4''\}\}$

(57)
$$\left[\left\{\left[\left\{\left[\begin{array}{ll}\text{PRED} & \text{`GIVE}\langle\text{SUBJ},\boxed{2},\boxed{3}\rangle\text{'}\\ \text{OBJ} & \boxed{2}\left[\text{PRED `BOOK'}\right]\\ \text{OBL} & \boxed{3}\left[\text{PRED `MARY'}\right]\\ \text{ADJ} & \left\{\boxed{4}\left[\begin{array}{ll}\text{PRED} & \text{`ON}\langle\boxed{5}\rangle\text{'}\\ \text{OBJ} & \boxed{5}\left[\text{PRED `WED'}\right]\end{array}\right]\right\}\end{array}\right], \left[\begin{array}{ll}\text{PRED} & \text{`GIVE}\langle\text{SUBJ},\boxed{2},\boxed{6}\rangle\text{'}\\ \text{OBJ} & \boxed{2}\\ \text{OBL} & \boxed{6}\left[\text{PRED `SUE'}\right]\\ \text{ADJ} & \left\{\boxed{7}\left[\begin{array}{ll}\text{PRED} & \text{`ON}\langle\boxed{8}\rangle\text{'}\\ \text{OBJ} & \boxed{8}\left[\text{PRED `FRI'}\right]\end{array}\right]\right\}\end{array}\right]\right\}\right], \left\{\left[\left\{\left[\begin{array}{ll}\text{PRED} & \text{`LEND}\langle\text{SUBJ},\boxed{9},\boxed{3}\rangle\text{'}\\ \text{OBJ} & \boxed{9}\left[\text{PRED `RECORD'}\right]\\ \text{OBL} & \boxed{3}\\ \text{ADJ} & \{\boxed{4}\}\end{array}\right], \left[\begin{array}{ll}\text{PRED} & \text{`LEND}\langle\text{SUBJ},\boxed{9},\boxed{6}\rangle\text{'}\\ \text{OBJ} & \boxed{9}\\ \text{OBL} & \boxed{6}\\ \text{ADJ} & \{\boxed{7}\}\end{array}\right]\right\}\right]\right\}\right]$$
$$\text{CONJ AND}$$
$$\text{CONJ OR}$$

(58) (John) [gave a book [to Mary on Wednesday and to Sue on Friday]] or [lent a record [to Mary on Wednesday and to Sue on Friday]].

As shown above, due to the fact that there are two ways of distributing one set over the other, (42) has two possible interpretations, depending on whether the scope of disjunction is narrow ((53)–(54)) or wide ((56)–(57)). While this may not be immediately obvious, there is a significant difference in truth conditions between these two interpretations.

In (54) where disjunction has narrow scope, each woman (Mary, Sue) is given a book or lent a record, while in (57) where disjunction has wide scope, both women (Mary and Sue) are given a book or lent a record. This is why (57) could be referred to as the symmetric reading – if Mary is given a book, Sue is also given a book (and vice versa); the same applies to being lent a record. By contrast, (54) does not require such symmetry: this reading is true when Mary (but not Sue) is given a book and Sue (but not Mary) is lent a record (or the other way round). While (54) is true in all situations when (57) is true, the opposite does not hold: there are scenarios when (54) is true but (57) is not.

While the grammar produces both solutions discussed above for (42), there are different views on which of these is more natural. As reported in Maxwell & Manning (1996: 13): "Blevins (1994) argues that the wide scope reading for the disjunction is the most natural interpretation, but we tend to think the opposite".

3 Coordination of unlike categories

While it has been claimed that coordination can only join identical categories (Chomsky (1957: 36), Williams (1981); more recently Bruening & Al Khalaf (2020)), many works have challenged such claims, showing that there is no such requirement (Peterson (1981), Sag et al. (1985), Bayer (1996); more recently Patejuk & Przepiórkowski (2023)).

When discussing unlike category coordination, the following examples are often used:

(59) Pat is [[a Republican] and [proud of it]]. (Sag et al. 1985: 117, (2b))

(60) Pat is [either [stupid] or [a liar]]. (Sag et al. 1985: 117, (2a))

(61) Pat has become [[a banker] and [very conservative]]. (Sag et al. 1985: 118, (3a))

(62) I consider John [[stupid] and [a fool]]. (Peterson 1981: (35))

(63) I consider that [[a rude remark] and [in very bad taste]]. (Sag et al. 1985: 118, (3b))

(64) We walked [[slowly] and [with great care]]. (Sag et al. 1985: 140, (57))

Except (64), which is an example of coordination of modifiers, all examples above involve predicative complements. Modifiers and predicative complements are the two most popular example types discussed in the literature on unlike category coordination.

There are also examples where unlike category coordination corresponds to a non-predicative argument. As discussed in Patejuk & Przepiórkowski (2023) on the basis of examples below, some predicates require an argument defined in terms of semantics rather than syntactic categories: expressing location (RESIDE), manner (TREAT), duration (LAST) etc. Such phrases may also act as modifiers: (64) is an example of a manner modifier.

(65) [[That place] and [behind these shops]] are where many families reside.

(66) Do you treat the four museums [[individually] or [as a collective]]?

(67) Immunity may last [[10 years] or [longer]]

There are also non-predicative arguments which are not defined semantically. (68) is a famous example often used in the context of unlike category coordination.

(68) You can depend on [[my assistant] and [that he will be on time]].
(Sag et al. 1985: 165, (124b))

However, (68) is controversial/problematic because it involves a subcategorisation violation. While the conjunct closer to the head obeys its subcategorisation requirements, (69), the other conjunct does not, see (70) – neither as a complement of the preposition ON, nor as a direct complement of the verb:

(69) You can depend on my assistant.

(70) *You can depend (on) that he will be on time.

Normally each conjunct is expected to satisfy the subcategorisation requirements of the verb it depends on – this is the case in two other famous examples from Sag et al. (1985):

(71) Pat remembered [[the appointment] and [that it was important to be on time]]. (Sag et al. 1985: 165, (123a))

(72) [[That Himmler appointed Heydrich] and [the implications thereof]] frightened many observers. (Sag et al. 1985: 165, (123b))

The rest of this section focuses on examples which satisfy this constraint, so it will not cover subcategorisation violations such as (68).

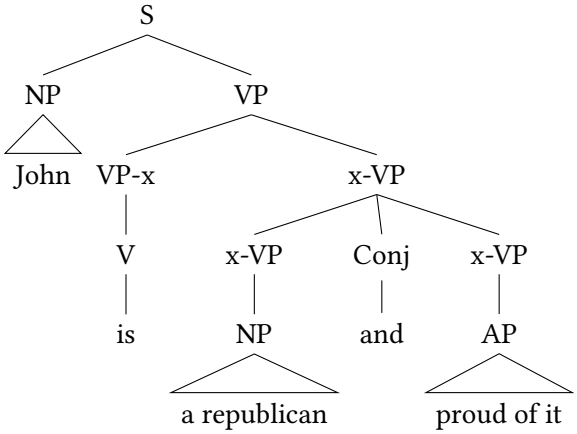
3.1 Unlike category coordination or ellipsis

One way to approach the phenomenon of unlike category coordination is to assume that ellipsis is involved, so that what is coordinated are not unlike categories, but larger categories of the same type: for instance two (or more) categories such as S, CP or VP – with ellipsis of the verb in one of the conjuncts (typically the second).

Maxwell & Manning (1996: 3) point out that the solution they propose for non-constituent coordination (NCC, discussed in Section 2) could be used to avoid unlike category coordination in examples such as *John is a republican and proud of it* by "coordinating partial VPs rather than attempting to coordinate an NP and an AP", see the structures in (73)–(74).[17]

[17]The contribution of *of it* is consistently omitted in the following f-structures.

(73)



(Maxwell & Manning 1996: (14))

(74)

$$\left[\begin{array}{l}\left\{\left(\begin{array}{l}\left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{be}\langle\boxed{2}\boxed{1}\rangle\text{'}\\ \textsc{subj}\ \boxed{1} & \left[\textsc{pred}\ \text{`}\textsc{John}\text{'}\right]\\ \textsc{xcomp}\ \boxed{2} & \left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{republican}\langle\boxed{1}\rangle\text{'}\\ \textsc{subj} & \boxed{1}\end{array}\right]\end{array}\right],\\ \left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{be}\langle\boxed{3}\boxed{1}\rangle\text{'}\\ \textsc{subj} & \boxed{1}\\ \textsc{xcomp}\ \boxed{3} & \left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{proud}\langle\boxed{1}\rangle\text{'}\\ \textsc{subj} & \boxed{1}\end{array}\right]\end{array}\right]\end{array}\right)\right\}\\ \textsc{conj}\quad \textsc{and}\end{array}\right]$$

As explained in Section 2, such an analysis produces multiclausal f-structures, as shown in (74).

While reanalysing unlike category coordination as same category coordination of larger categories seems to be a possibility in some cases, there are situations where it has undesired consequences such as having a different reading. As observed in Dalrymple (2017), examples with modifiers such as *simultaneously* and *alternately* have different readings depending on whether unlike category coordination is involved (see the bracketings in (75) and (77)), or an "ellipsis-based"[18] analysis is involved (compare (76) and (78), respectively):

(75) Fred is simultaneously [[a professor] and [ashamed of his work]].
(Dalrymple 2017: (16a))

(76) Fred [[is simultaneously a professor] and [~~is simultaneously~~ ashamed of his work]].
(Dalrymple 2017: (16b))

(77) Fred is alternately [[in a good mood] and [suicidal]].
(Dalrymple 2017: (17a))

(78) Fred [[is alternately in a good mood] and [~~is alternately~~ suicidal]].
(Dalrymple 2017: (17b))

[18]This includes the NCC reanalysis proposed by Maxwell & Manning (1996).

In the case of *John is a republican and proud of it*, the truth conditions are the same no matter whether this string is analysed as coordination of unlike categories (giving rise to a monoclausal structure where the predicative complement corresponds to unlike category coordination of an NP and an AP, see (79)) or as same category coordination of VPs, as in (74), which is equivalent to multiclausal *John [[is a republican] and [~~is~~ proud of it]]*.

(79)
$$\begin{bmatrix} \textsc{pred} & \text{`BE}\langle \boxed{2} \rangle \boxed{1}\text{'} \\ \textsc{subj}\ \boxed{1} & \left[\textsc{pred}\ \text{`JOHN'}\right] \\ \textsc{xcomp}\ \boxed{2} & \left[\begin{Bmatrix} \left[\textsc{pred}\ \text{`REPUBLICAN}\langle \boxed{1} \rangle\text{'} \right], \\ \left[\textsc{subj}\ \boxed{1}\right] \end{Bmatrix} \left[\textsc{pred}\ \text{`PROUD}\langle \boxed{1} \rangle\text{'}\right] \right\} \\ & \textsc{conj}\quad \textsc{and} \end{bmatrix} \end{bmatrix}$$

However, there is a clear difference when negation is involved. Consider the string *John is not a republican and proud of it*. Under the NCC reanalysis of unlike category coordination proposed in Maxwell & Manning (1996), this sentence involves a coordination of two negated VPs – this corresponds to (80) which involves a conjunction of two negated predicates, schematically shown in (81).

(80) John [[is not a republican] and [~~is not~~ proud of it]].

(81) $[\neg A \wedge \neg B]$

By contrast, under the analysis where genuine coordination of unlike categories is involved, as in (82), the semantics, schematically shown in (83), involves a negation of a conjunction – under De Morgan's laws, this is equivalent to a disjunction of negations.

(82) John is not [[a republican] and [proud of it]].

(83) $\neg[A \wedge B] \equiv [\neg A \vee \neg B]$

As a consequence, the two analyses of the string *John is not a republican and proud of it* have different meanings. Under the NCC analysis in (80), it can only mean (it has only one reading where it is true): John is not a republican, he is not proud of it ($[\neg A \wedge \neg B]$). Apart from this reading, the following two readings are also available under the unlike category coordination analysis in (82): John is a republican, he is not proud of it ($[A \wedge \neg B]$); John is not a republican, he is proud of it ($[\neg A \wedge B]$). Even though these two are possible readings of this string, they are not available under the NCC analysis.

An analogous issue arises in examples with modifiers such as (64). When negation is present (*We did not walk slowly and with great care*), different analyses also have different meanings. While NCC in (84) has the meaning in (81) which has

only one reading (he did not walk slowly, he did not walk with great care), unlike category coordination in (85) has the meaning in (83) where two more readings are possible (he walked slowly, he did not walk with great care; he did not walk slowly, he walked with great care).

(84) We [[did not walk slowly] and [~~did not walk~~ with great care]].

(85) We did not walk [[slowly] and [with great care]].

As shown above, while some examples of unlike category coordination can be reanalysed as conjunction reduction without undesired side-effects (such as distorted, bad semantics), it is not the case that all instances of unlike category coordination can be reanalysed as conjunction reduction (using the analysis designed for NCC). Let us therefore proceed to the discussion of how genuine unlike category coordination can be handled in LFG.

3.2 Categories and c-structure labels

Once the false assumption that coordination can only join elements corresponding to the same category is rejected, the following question immediately arises: when unlike categories are coordinated, what is the category of the coordinate phrase as a whole? Over time, there have been various answers to this question – these are discussed below.

Peterson (2004) proposed that the category of unlike category coordination is the same as the category of the first conjunct, as in the rule in (86):[19]

(86) $\mathrm{X} \longrightarrow \underset{\downarrow\in\uparrow}{\mathrm{X}}\ \mathrm{Conj}\ \underset{\downarrow\in\uparrow}{\mathrm{X}}$ (Peterson 2004: (20))

As pointed out in Dalrymple (2017: 38): "This analysis makes the incorrect prediction that the distribution of an unlike category coordination structure matches the distribution of the category of the first conjunct."[20]

While Peterson (2004) makes unlike category coordination endocentric in the sense that the topmost category is the same as one of the conjuncts, Patejuk

[19] While Peterson (2004) uses the C category for the conjunction, it was replaced with Conj in (86) for the sake of consistency as well as to avoid potential confusion (C is typically used for complementisers).

[20] As noted in Bruening & Al Khalaf (2020), Peterson (2004) focuses on cases where the coordinate phrase follows the selector, so the first conjunct is closest to the selector. However, there are cases where coordination precedes the selector (see (72)), so the first conjunct would be farthest from the selector (rather than closest). While this issue can be resolved by assuming that it is the conjunct closest to the selector that corresponds to the topmost category, the point made in Dalrymple (2017) would still hold.

(2015) proposed to use a special category for unlike category coordination (XP or UP), making it exocentric: the rule in (87) uses YP and ZP as variables for different categories.

(87) XP ⟶ YP Conj ZP (Patejuk 2015: (4.8))
↓∈↑ ↓∈↑

This proposal is complemented by the use of the distributive CAT attribute in f-structure, making it possible to impose category constraints at this level of representation – rather than using CAT predicate (see Section 3.5.1) and c-structure labels. Under the analysis of Patejuk (2015), the f-structure in (88) corresponds to *John is a republican and proud (of it).*

(88)
$$\begin{bmatrix} \text{PRED} & \text{`BE}\langle \boxed{2} \rangle \boxed{1}\text{'} \\ \text{SUBJ } \boxed{1} & \left[\text{PRED `JOHN'}\right] \\ \text{XCOMP } \boxed{2} & \left[\left\{ \left[\begin{array}{ll} \text{PRED} & \text{`REPUBLICAN}\langle \boxed{1} \rangle\text{'} \\ \text{SUBJ} & \boxed{1} \\ \text{CAT} & \text{N} \end{array} \right], \left[ \begin{array}{ll} \text{PRED} & \text{`PROUD}\langle \boxed{1} \rangle\text{'} \\ \text{SUBJ} & \boxed{1} \\ \text{CAT} & \text{ADJ} \end{array} \right] \right\} \right. \\ & \left. \text{CONJ AND} \right] \end{bmatrix}$$

According to Dalrymple (2017: 38): "the proposal does not allow the possibility of imposing the category requirements that were shown to be necessary […], since on this view all unlike category coordinations have the same category. It also makes it difficult to enforce category-function correlations and to control the distribution of phrases of different categories, since there is no relation between the category of the unlike category coordination structure and the categories of the conjuncts." This criticism only holds as far as c-structure is concerned (so when the CAT predicate is used, which operates on c-structure labels; see Section 3.5.1). Under the proposal of Patejuk (2015), the categorial constraints discussed in Dalrymple (2017) are imposed at the level of f-structure using the CAT attribute. As shown in (88), conjuncts corresponding to the XCOMP grammatical function have different categories: the value of CAT is N for the noun *republican* and ADJ for the adjective *proud*.

Dalrymple (2017) offers a novel, feature-based solution for choosing the c-structure label of unlike category coordination. While it is conceptually similar to the proposal of Sag et al. (1985), it does not involve controversial feature decomposition (see Bayer (1996) for an extensive critique) as features directly correspond to basic syntactic categories, see (89):

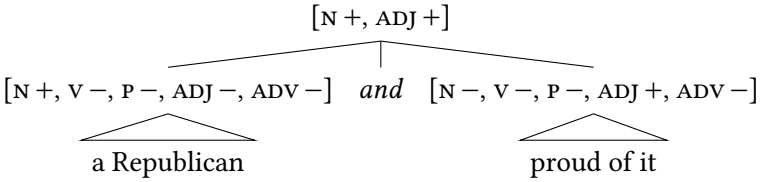
(89)

Abbreviation	Feature matrix
N	[N +, V −, P −, ADJ −, ADV −]
V	[N −, V +, P −, ADJ −, ADV −]
P	[N −, V −, P +, ADJ −, ADV −]
Adj	[N −, V −, P −, ADJ +, ADV −]
Adv	[N −, V −, P −, ADJ −, ADV +]

(Dalrymple 2017: (43))

These feature matrices correspond to lexical categories. The category of a coordinate phrase is resolved in a different way (Dalrymple 2017: 48): "the category of a coordinate phrase has the value + for a category feature if there is some conjunct with the value + for that feature". This makes it possible to provide a simple, elegant account of unlike category coordination: the c-structure in (90) corresponds to *a Republican and proud of it*, where the label of unlike category coordination is [N +, ADJ +].

(90)



(Przepiórkowski & Patejuk 2021: (5))

However, as noted in Przepiórkowski & Patejuk (2021: 208, fn. 4), under such an analysis of coordination, same category coordination has a different category than its conjuncts. For instance, in the case of NP coordination, while the category of all NP conjuncts is [N +, V −, P −, ADJ −, ADV −], the category of the coordinate NP is [N +].

Also, Dalrymple (2017) does not discuss how functional categories such as CP (complementizer phrase) or InfP (infinitival phrase) would be distinguished under this account, which is relevant for unlike category coordination (such as CP and NP, CP and PP, etc.).

Przepiórkowski & Patejuk (2021) offer an alternative solution to the problem of the category of coordination of unlike categories. The analysis proposed in Dalrymple (2017) is limited to categories, while some instances of unlike category coordination require additional constraints, such as appropriate case, complementizer or preposition form (see Section 3.5.2). As a consequence, in order to account for unlike category coordination, it is not enough to state categorial constraints using the built-in CAT predicate (see Section 3.5.1). Przepiórkowski & Patejuk (2021) propose to remove c-structure labels altogether (which is formally equivalent to having just one label) and instead use CAT attribute in f-structure

for imposing categorial restrictions (as in Patejuk (2015)). As an example, Przepiórkowski & Patejuk (2021) propose the rule in (91) as a replacement for the rule in (92):

(91) $\bullet \longrightarrow \underset{(\downarrow \textsc{cat}) =_c \mathrm{P}}{\underset{\uparrow=\downarrow}{\bullet}} \quad \underset{(\downarrow \textsc{cat}) \in_c \{\mathrm{P},\mathrm{N}\}}{\underset{(\uparrow \textsc{obj})=\downarrow}{\bullet}}$

(Przepiórkowski & Patejuk 2021: (35))

(92) $\mathrm{P}' \longrightarrow \underset{\uparrow=\downarrow}{\mathrm{P}} \quad \underset{(\uparrow \textsc{obj})=\downarrow}{\{\mathrm{NP}|\mathrm{PP}\}}$ (Przepiórkowski & Patejuk 2021: (32))

Under this proposal, as in Patejuk (2015), all constraints (related to categories and other features such as case, complementizer or preposition form, etc.) are imposed in f-structure.[21] However, unlike in Patejuk (2015), there is no need for arbitrary c-structure labels for unlike category coordination (such as XP or UP), which was criticised in Dalrymple (2017).

Summing up, this subsection presented different approaches to the problem of choosing the topmost category corresponding to coordination of unlike categories.

3.3 Categories and grammatical functions

Since imposing constraints in f-descriptions relies on grammatical functions to identify the element to be constrained, there is the key question of which grammatical function is appropriate when coordinating unlike categories.

Answering this question can be non-trivial, partially because the choice of the appropriate grammatical function can be controversial even outside of coordination. While LFG considers grammatical functions as primitives of the theory, independent of the position in the c-structure and/or the c-structure category, there have been some discussions and controversy concerning certain grammatical functions. See Belyaev 2023 [this volume] for discussion and references.

Probably the least controversial (though not uncontroversial) grammatical functions include the SUBJ(ect) and the OBJ(ect). Still, there are different definitions of OBJ: some (e.g. Patejuk (2015)) choose to define it as the grammatical function which changes to SUBJ when undergoing passivisation, while others (e.g. Börjars & Vincent (2008)) do not consider this as a necessary characteristic.

[21] While Patejuk (2015) uses complex off-path constraints to formalise disjunctive constraints, Przepiórkowski & Patejuk (2021) propose to reuse the local variable notation, which results in simpler and more readable constraints – see the discussion in Section 3.5.2.

There has been a lot of debate about complement clauses. Dalrymple & Lødrup (2000) argue that different grammatical functions may be appropriate for complement clauses in different languages, considering OBJ(ect) and COMP ((non-object) closed clausal complement) and proposing criteria for distinguishing these. By contrast, Alsina et al. (2005) argue for getting rid of COMP and using OBL(ique) instead for non-object complement clauses (among other argument types). Furthermore, Alsina et al. (2005) suggest that it should also be possible to get rid of XCOMP (open clausal complement).

On the basis of data from Polish and English, Patejuk & Przepiórkowski (2014a) argue that using XCOMP for open (controlled) clausal complements can be problematic, because it is possible to coordinate infinitival phrases (open, controlled) with non-predicative nominals which are closed (do not require control):

(93) Polish
Chcę [[pić] i [papierosa]].
want drink.INF and cigarette.ACC
'I want to drink and a cigarette.' (Patejuk & Przepiórkowski 2014a: (1))

(94) My uncle said to hell with that and taught me [[karate], and [to fire weapons]]. (Patejuk & Przepiórkowski 2014a: (27))

Patejuk & Przepiórkowski (2014a) argue that such examples provide independent motivation to get rid of the XCOMP: while it would be suitable for the controlled infinitival conjunct (its subject is structure-shared with the matrix subject), it is not suitable for the nominal conjunct which is not controlled and does not have a subject.

Patejuk & Przepiórkowski (2014a) propose an analysis in terms of unlike category coordination, choosing OBJ as the grammatical function corresponding to coordination in (93).[22] An important novel feature of this analysis is making it possible to establish control into selected conjuncts. This is achieved using the CONTROLLER attribute (see Section 3.5.2 for detailed discussion), as shown in (95)[23] which corresponds to (93).

(95)
$$\begin{bmatrix} \text{PRED} & \text{`WANT}\langle \boxed{1}, \boxed{2} \rangle\text{'} \\ \text{SUBJ} & \boxed{1}\begin{bmatrix}\text{PRED} & \text{`I'}\end{bmatrix} \\ \text{OBJ} & \boxed{2}\begin{bmatrix} \left\{ \begin{bmatrix} \text{PRED} & \text{`DRINK}\langle \boxed{1} \rangle\text{'} \\ \text{SUBJ} & \boxed{1} \\ \text{CONTROLLER} & \boxed{1} \end{bmatrix}, \begin{bmatrix} \text{PRED} & \text{`CIGARETTE'} \\ \text{CASE} & \text{ACC} \\ \text{CONTROLLER} & \boxed{1} \end{bmatrix} \right\} \\ \text{CONJ} \quad \text{AND} \end{bmatrix} \end{bmatrix}$$

(Patejuk & Przepiórkowski 2014a: (26))

[22] If the ability to be passivised is a defining feature of OBJ, this argument should be an OBL in Polish.

[23] The CONJ attribute was added to this f-structure.

Building on the proposals of Alsina et al. (2005) and Patejuk & Przepiórkowski (2014a), Patejuk & Przepiórkowski (2016) reexamine the repertoire of grammatical functions in LFG, providing additional arguments for getting rid of COMP and XCOMP. They show that it is possible to coordinate categories that would normally correspond to open and closed complements (which again leads to the issue of control into selected conjuncts).

While Patejuk & Przepiórkowski (2016) focus on the discussion of arguments, an analogous observation can be made with respect to adjuncts, where a similar distinction is often made, splitting adjuncts into closed, not controlled (ADJ) and open, controlled (XADJ). In the Polish examples in (96)–(98), the first conjunct would normally be classified as closed (ADJ), while the second conjunct would be open (XADJ). To account for such coordination, a common grammatical function should be identified for such dependents:[24]

(96) Polish
Wychodziliśmy [[szybko] i [unikając spojrzeń innych]].
left.1.PL.M1 quickly and avoiding gazes others
'We were leaving quickly and avoiding peoples' gazes.'

(97) Polish
Przyjechaliśmy do Kotoru [[dosyć późno] i [głodni jak
returned.1.PL.M1 to Kotor pretty late and hungry.NOM.PL.M1 like
wilki]]…
wolves
'We returned to Kotor pretty late and hungry as wolves…' (Google)

(98) Polish
Gdy [[niechętnie] i [zażenowany]] wchodził za
when reluctantly and embarrassed.NOM.SG.M1 entered.3.SG.M1 after
Nirą…
Nira
'When, reluctantly and hungry, he entered following Nira…' (NKJP)[25]

This observation is consistent with the general proposal of Patejuk & Przepiórkowski (2016: 549), who conclude that the repertoire of grammatical functions in LFG could be limited to just three: SUBJ(ect), OBJ(ect) (defined as the item that can

[24] In Polish, the verb agrees with its subject (which may be implicit, as in (96)–(98)), while predicative adjectives agree with their controller (which may also be implicit, as in (97)–(98)).
[25] NKJP is the National Corpus of Polish (Przepiórkowski et al. (2011, 2012); http://nkjp.pl).

undergo passivisation) and OBL(ique) which serves as the elsewhere grammatical function: "All other dependents, including adjuncts, may be called OBLiques, as in Alsina (1996)." Control into selected conjuncts of OBLiques would be handled in the same way as in (95).

Kaplan (2017) proposes that examples such as (99), analysed as unlike category coordination in Patejuk & Przepiórkowski (2016), see the f-structure in (100), could instead be analysed as non-constituent coordination (NCC, Maxwell & Manning (1996); see Section 2 and Section 3.1), compare the f-structure in (101).[26]

(99) The majority want [[peace] and [to live a comfortable life]].
(Patejuk & Przepiórkowski 2016: (9))

(100)
$$\begin{bmatrix} \text{PRED} & \text{`WANT}\langle \boxed{1},\boxed{2}\rangle\text{'} \\ \text{SUBJ} & \boxed{1}\left[\text{PRED `MAJORITY'}\right] \\ \text{OBJ} & \boxed{2}\left[\begin{bmatrix} \left\{\begin{bmatrix} \text{PRED} & \text{`PEACE'} \\ \text{CONTROLLER} & \boxed{1} \end{bmatrix}, \begin{bmatrix} \text{PRED} & \text{`LIVE}\langle \boxed{1},\boxed{3}\rangle\text{'} \\ \text{SUBJ} & \boxed{1} \\ \text{OBJ} & \boxed{3}\left[\text{PRED `LIFE'}\right] \\ \text{CONTROLLER} & \boxed{1} \end{bmatrix}\right\} \\ \text{CONJ} \quad \text{AND} \end{bmatrix} \end{bmatrix}$$

(101)
$$\begin{bmatrix} \left\{\begin{bmatrix} \text{PRED} & \text{`WANT}\langle \boxed{1},\boxed{2}\rangle\text{'} \\ \text{SUBJ} & \boxed{1}\left[\text{PRED `MAJORITY'}\right] \\ \text{OBJ} & \boxed{2}\left[\text{PRED `PEACE'}\right] \end{bmatrix}, \begin{bmatrix} \text{PRED} & \text{`WANT}\langle \boxed{1},\boxed{3}\rangle\text{'} \\ \text{SUBJ} & \boxed{1} \\ \text{XCOMP} & \boxed{3}\begin{bmatrix} \text{PRED} & \text{`LIVE}\langle \boxed{1},\boxed{4}\rangle\text{'} \\ \text{SUBJ} & \boxed{1} \\ \text{OBJ} & \boxed{4}\left[\text{PRED `LIFE'}\right] \end{bmatrix} \end{bmatrix}\right\} \\ \text{CONJ} \quad \text{AND} \end{bmatrix}$$

(Kaplan 2017: (29))

While (100) involves one instance of the predicate WANT with a coordinate object, the NCC strategy in (101) involves coordination of identical larger categories (VPs), which results in a multiclausal analysis: there are two instances of the predicate WANT, each with a different non-coordinate complement (OBJ vs. XCOMP).

Kaplan (2017: 138) explains that normally the lexical entry in (102) cannot give rise to the f-structure in (101) because "Disjunction in LFG normally has wide scope. Thus either the OBJ frame or the XCOMP frame would be distributed to both elements of the coordination set, and in each case one of the elements will fail the completeness/coherence tests."

(102) *want* (↑ PRED)='WANT⟨SUBJ,OBJ⟩'
∨ [(↑ PRED)='WANT⟨SUBJ,XCOMP⟩'
(↑ XCOMP SUBJ)=(↑ SUBJ)] (Kaplan 2017: (24))

[26]The contribution of *comfortable* is ignored in (100)–(101).

Kaplan (2017) offers two solutions to this problem. The first is to use the lexical entry in (103) which uses functional uncertainty for grammatical functions (OBJ or XCOMP) plus an off-path constraint attached to XCOMP establishing the subject control relation:

(103) *want* (↑ PRED)='WANT⟨SUBJ,{OBJ | XCOMP }⟩'
(→ SUBJ)=(← SUBJ)
(Kaplan 2017: (28))

There are two potential challenges for (103): it uses functional uncertainty constructively (disjunction over grammatical functions in PRED) and it uses off-path constraints constructively (introducing a defining control equation). However, as mentioned in Patejuk & Przepiórkowski (2014a), while off-path constraints are non-constructive in XLE (Crouch et al. 2011), the native platform for implementing LFG grammars, this does not need to be the case in theoretical analyses (they point out that drafts of the following works allow constructive off-path constraints: Bresnan et al. (2016), Dalrymple et al. (2019)).

The second solution proposed by Kaplan (2017: 138, fn. 9) is to introduce a new built-in template, DISTRIB (see the discussion of (134) in Section 3.5.2), which makes it possible to "declare the disjunctive entry for *want* [(102)] as a narrow-scope distributive property".

Both solutions proposed in Kaplan (2017) make it possible to reanalyse simple cases of unlike category coordination as NCC (building on Maxwell & Manning (1996)), though without the requirement of strict identity of grammatical functions (due to the possibility of using different lexical entries for different conjuncts). However, these solutions suffer from the same problems as NCC: they cannot handle more complex cases of unlikes (involving negation or modifiers, see the discussion in Section 3.1). There are no such issues with the analysis assuming unlike category coordination.

3.4 Coordinating predicative complements with participles

In early LFG work (Bresnan 1982, Kaplan & Bresnan 1982) the auxiliary BE is analysed as a raising verb. The f-structure in (104)[27] corresponds to the sentence *The elephant was worshipped by the child*, which involves passive voice: BE is the main verb (having a PRED attribute, with BE as its value), taking a raised subject and a verbal complement (VCOMP) corresponding to the passive lexical verb.

[27]Two errors in the original f-structure (Joan Bresnan, pc) were corrected in (104) by adding: the non-semantic SUBJ in the PRED of BE; structure-sharing of the SUBJ of BE and the SUBJ of WORSHIP.

(104)
$$\begin{bmatrix} \text{PRED} & \text{`BE}\langle \boxed{2} \rangle \boxed{1}\text{'} \\ \text{SUBJ} & \boxed{1}\begin{bmatrix} \text{PRED} & \text{`ELEPHANT'} \end{bmatrix} \\ \text{VCOMP} & \boxed{2}\begin{bmatrix} \text{PRED} & \text{`WORSHIP}\langle \boxed{1}, \boxed{3} \rangle\text{'} \\ \text{SUBJ} & \boxed{1} \\ \text{OBL}_{\text{AG}} & \boxed{3}\begin{bmatrix} \text{PRED} & \text{`CHILD'} \end{bmatrix} \end{bmatrix} \\ \text{TENSE} & \text{PAST} \end{bmatrix}$$

(Bresnan 1982: Figure 1.4b)

The early LFG analysis of progressive constructions is very similar. Kaplan & Bresnan (1982) analyse the sentence *A girl is handing the baby a toy* using the lexical entries for the present participle *handing* and the auxiliary *is* in (105)–(106).[28] These would give rise to the (simplified) f-structure in (107) where the auxiliary is the main verb (note that its PRED value is PROG, unlike in the passive (104)), taking a raised subject and a verbal complement (VCOMP) corresponding to the lexical verb.

(105) *handing* V (↑ PRED)=‘HAND⟨(↑ SUBJ)(↑ OBJ2)(↑ OBJ)⟩’
(↑ PARTICIPLE)=PRESENT

(Kaplan & Bresnan 1982: (65))

(106) *is* V (↑ PRED)=‘PROG⟨(↑ VCOMP)⟩(↑ SUBJ)’
(↑ VCOMP PARTICIPLE)=$_c$ PRESENT
(↑ VCOMP SUBJ)=(↑ SUBJ)
(↑ SUBJ NUM)=SG

(Kaplan & Bresnan 1982: (70))

(107)
$$\begin{bmatrix} \text{PRED} & \text{`PROG}\langle \boxed{2} \rangle \boxed{1}\text{'} \\ \text{SUBJ} & \boxed{1}\begin{bmatrix} \text{PRED} & \text{`GIRL'} \end{bmatrix} \\ \text{VCOMP} & \boxed{2}\begin{bmatrix} \text{PRED} & \text{`HAND}\langle \boxed{1}, \boxed{3}, \boxed{4} \rangle\text{'} \\ \text{SUBJ} & \boxed{1} \\ \text{OBJ} & \boxed{3}\begin{bmatrix} \text{PRED} & \text{`BABY'} \end{bmatrix} \\ \text{OBJ2} & \boxed{4}\begin{bmatrix} \text{PRED} & \text{`TOY'} \end{bmatrix} \\ \text{PARTICIPLE} & \text{PRESENT} \end{bmatrix} \end{bmatrix}$$

Later, the standard LFG analysis of passive/progressive constructions has been to treat the lexical verb as the main verb, while the auxiliary only contributes a bundle of features (such as agreement features, tense, aspect, etc.) – it does not have its own PRED attribute. This results in a “flat” analysis (without embedding) of such constructions: (108) is the flat, monoclausal counterpart of (104), while (109) corresponds to (107).[29]

[28]The PRED value in the lexical entry in (106) has been modified to include a non-semantic SUBJ.
[29]Instead of OBJ2 used in early works for the secondary object, as in (107), (109) uses OBJ_θ.

(108)
$$\begin{bmatrix} \text{PRED} & \text{`WORSHIP}\langle \boxed{1}, \boxed{2} \rangle \\ \text{SUBJ} & \boxed{1}\left[\text{PRED `ELEPHANT'}\right] \\ \text{OBL}_{\text{AG}} & \boxed{2}\left[\text{PRED `CHILD'}\right] \\ \text{TENSE} & \text{PAST} \\ \text{PASSIVE} & + \end{bmatrix}$$

(109)
$$\begin{bmatrix} \text{PRED} & \text{`HAND}\langle \boxed{1}, \boxed{2}, \boxed{3} \rangle \\ \text{SUBJ} & \boxed{1}\left[\text{PRED `GIRL'}\right] \\ \text{OBJ} & \boxed{2}\left[\text{PRED `BABY'}\right] \\ \text{OBJ}_{\theta} & \boxed{3}\left[\text{PRED `TOY'}\right] \\ \text{TENSE} & \text{PRESENT} \\ \text{ASPECT} & \text{PROG} \end{bmatrix}$$

With predicative complements, the copula has been analysed over time as a raising verb – taking a subject and a predicative complement: open (XCOMP)[30] or closed (PREDLINK), depending on the analysis. There have also been analyses where the predicative item is the main predicate, while the copula only contributes certain features (having no PRED). See Dalrymple et al. (2004) for a comprehensive discussion of all the possibilities.

There is an interesting interaction between unlike category coordination and constructions with an auxiliary (such as passive/progressive constructions). As discussed in Peterson (1981, 2004), it is possible to coordinate a predicative complement with a present/passive participle, see (110)–(115). In order to avoid having to analyse such examples as an instance of ellipsis (conjunction reduction resulting in a multiclausal structure),[31] it is necessary to adopt a uniform analysis of the linking word (as the main verb or not).

In English, many examples of unlike category coordination of a predicative complement and a present participle are discussed in Peterson (1981). Using examples such as (112), among others, Peterson (1981) argues that these are not instances of ellipsis (conjunction reduction) but genuine coordination of unlike categories:

(110) The children were [[happy] and [smiling]]. (Peterson 1981: (9))

(111) John is [[awake] and [asking for you]]. (Peterson 1981: (10))

[30] While XCOMP is category neutral, in early LFG (Bresnan 1982, Kaplan & Bresnan 1982) different grammatical functions were used for different categories: ACOMP for adjectives, NCOMP for nouns, etc.

[31] This is also the case under the proposal of Kaplan (2017) to introduce the DISTRIB template, making it possible to treat disjunctive lexical entries as narrow-scope distributive properties (see (134) in Section 3.5.2).

(112) He was [both [happy] and [smiling]]. (Peterson 1981: (27))

Peterson (2004) provides more examples, including one with a passive participle, (114):

(113) Bill could be [[a plumber] and [making a fortune]]. (Peterson 2004: (8c))

(114) I imagined John [[a convicted felon] and [imprisoned for life]]. (Peterson 2004: (8g))

(115) The children are [[awake] and [asking for you]]. (Peterson 2004: (45))

Peterson (2004) provides the f-structure in (116) as the representation of (115):

(116)
$$\begin{bmatrix} \textsc{pred} & \text{`}\textsc{be}\langle \boxed{2} \rangle \boxed{1}\text{'} \\ \textsc{subj}\ \boxed{1} & \left[\textsc{pred}\ \text{`}\textsc{children}\text{'}\right] \\ \textsc{xcomp}\ \boxed{2} & \left[\begin{Bmatrix} \left[\begin{smallmatrix} \textsc{pred} & \text{`}\textsc{awake}\langle \boxed{1} \rangle\text{'} \\ \textsc{subj} & \boxed{1} \end{smallmatrix}\right], \left[\begin{smallmatrix} \textsc{pred} & \text{`}\textsc{ask}\langle \boxed{1},\boxed{3} \rangle\text{'} \\ \textsc{subj} & \boxed{1} \\ \textsc{obl}_{\textsc{goal}} & \boxed{3}\left[\textsc{pred}\ \text{`}\textsc{you}\text{'}\right] \end{smallmatrix}\right] \end{Bmatrix} \\ & \begin{bmatrix} \textsc{conj} & \textsc{and} \end{bmatrix} \end{bmatrix} \\ \textsc{tense} & \textsc{pres} \end{bmatrix}$$

(Peterson 2004: (47))

While Peterson (2004) does not discuss the possibility of using the NCC analysis of Maxwell & Manning (1996) for unlike category coordination, it seems clear that he would not want to adopt it, because it results in a multiclausal f-structure representation, equivalent to VP-level coordination – an elliptical analysis that Peterson (2004) explicitly argues against.

Patejuk & Przepiórkowski (2014b) discuss similar data from Polish, focusing on the coordination of adjectives and passive participles such as in (117), where the first conjunct (*zrobiony* 'made') is a passive participle, the second (*bezpieczny* 'safe') is an adjective and the third (*zarejestrowany* 'registered') is a passive participle with a *by*-phrase:

(117) Polish
Nasz pas jest [[dobrze zrobiony], [bezpieczny]
our runway.NOM.SG.M3 is well made.NOM.SG.M3 safe.NOM.SG.M3
i [zarejestrowany przez Urząd Lotnictwa Cywilnego]].
and registered.NOM.SG.M3 by Office.ACC Aviation.GEN Civil.GEN
'Our runway is well made, safe and registered by the Civil Aviation Office.' (Patejuk & Przepiórkowski 2014b: (1))

Using Polish negation data as independent evidence, Patejuk & Przepiórkowski (2014b) argue for a unified treatment of BYĆ 'be' as a raising verb taking a complement which can be an adjective, a passive participle, or a coordination of these – as in (117), which they analyse as (118). As a result, as in Peterson (2004), passive and predicative constructions use the embedded representation (as opposed to the flat representation using co-heads).

(118)
$$\left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{be}\langle\boxed{2}\rangle\boxed{1}\text{'}\\ \textsc{subj}\ \boxed{1} & \left[\textsc{pred}\ \text{`}\textsc{runway}\text{'}\right]\\ \textsc{xcomp}\ \boxed{2} & \left[\begin{array}{l}\left\{\left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{make}\langle\boxed{1}\rangle\\ \textsc{subj} & \boxed{1}\\ \textsc{adj} & \left\{\left[\textsc{pred}\ \text{`}\textsc{well}\text{'}\right]\right\}\\ \textsc{passive} & +\end{array}\right],\left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{safe}\langle\boxed{1}\rangle\text{'}\\ \textsc{subj} & \boxed{1}\end{array}\right],\left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{register}\langle\boxed{1},\boxed{3}\rangle\\ \textsc{subj} & \boxed{1}\\ \textsc{obl}_{\textsc{ag}} & \boxed{3}\left[\textsc{pred}\ \text{`}\textsc{cao}\text{'}\right]\\ \textsc{passive} & +\end{array}\right]\right\}\\ \textsc{conj}\quad \textsc{and}\end{array}\right]\end{array}\right]$$

(Patejuk & Przepiórkowski 2014b: (53))

3.5 Disjunctive constraints

The main remaining question related to unlike category coordination is how to impose disjunctive constraints (such as subcategorisation in examples discussed earlier). Over time, there have been two main approaches to this issue. They may also be used together.

3.5.1 CAT predicate

The first approach focuses on constraints related to c-structure categories, relying on the built-in CAT predicate for imposing such constraints, as defined in (119):

(119) $\text{CAT}(f, C)$ iff $\exists n \in \phi^{-1}(f) : \lambda(n) \in C$

> "$\text{CAT}(f, C)$ is true if and only if there is some node n that corresponds to f via the inverse ϕ correspondence (ϕ^{-1}) whose label (λ) is in the set of categories C." (Dalrymple (2017: (24)) after Kaplan & Maxwell (1996: 93))

Dalrymple (2017) shows how CAT can be used to account for disjunctive subcategorisation requirements of the verb BECOME: assuming that CAT is distributive, each conjunct must satisfy the constraint imposed by CAT. As a result, (120) ensures that the predicative complement (PREDLINK or XCOMP, depending on the analysis) of BECOME must be an adjectival phrase (AdjP), a nominal phrase (NP), or a coordination of these, as in (121).

(120) $\text{CAT}((\uparrow \textsc{predlink}), \{\text{AdjP}, \text{NP}\})$ (Dalrymple 2017: (26))

(121) Fred became [[a professor] and [proud of his work]].
(Dalrymple 2017: (6a))

The CAT predicate is designed specifically for imposing constraints on c-structure categories. However, as discussed earlier, accounting for unlike category coordination may require additional constraints, such as having a certain value of case, preposition or complementiser form, etc., or introducing control equations (see (93)–(94)).

Technically, features such as case, preposition form and complementiser form can be added to c-structure category labels, resulting in complex categories such as NP[case], PP[pform,case] or CP[compform], making it possible to impose extra constraints using the CAT predicate that is normally used only for category labels. However, there are some issues with such a solution. First, it requires copying f-structure information to c-structure, resulting in redundancy. More importantly, such a solution would not be sufficient for more complex phenomena such as structural case assignment to the object in Polish because its value of case depends on the presence or absence of negation on the verb assigning case. Simplifying, in Polish the structural object is accusative without negation, but it is genitive if negation is present. This requires more complex constraints.

Consider again the example in (93) (with the corresponding f-structure in (95)), where the object involves unlike category coordination. While the first conjunct (*pić* 'drink') is a controlled infinitival phrase (InfP), the second conjunct (*papierosa* 'cigarette') is an NP bearing accusative case (as structural case when there is no sentential negation). The simple CAT constraint in (122) restricts categories corresponding to the object of the verb CHCIEĆ 'want' to InfP or NP. The version using complex categories in (123) additionally restricts the case of the NP to accusative or genitive (the two possible values, as above).

(122) CAT((↑ OBJ), {InfP, NP})

(123) CAT((↑ OBJ), {InfP, NP[acc], NP[gen]})

While (122) does not restrict the value of case of the NP object in any way, (123) restricts it to accusative or genitive, but the crucial constraint making the value of case dependent on sentential negation is absent. Even with complex categories, it is not sufficient to use the CAT predicate to express more complex constraints necessary in unlike category coordination (such constraints are discussed in Section 3.5.2).

Dalrymple (2017) offers a novel solution to the issue of the category of unlike category coordination by replacing atomic c-structure labels (such as NP, AdjP,

PP) with labels consisting of attribute-value structures (see Section 3.2). However, as discussed in Przepiórkowski & Patejuk (2021), such a solution would also not be able to handle more complex disjunctive subcategorisation requirements needed to account for unlike category coordination.

As an alternative, Przepiórkowski & Patejuk (2021) propose to remove category labels from c-structure and move category information to f-structure (see Section 3.2), so that all necessary constraints can be imposed at one level of representation: f-structure. This is discussed in more detail in Section 3.5.2.

3.5.2 F-structure constraints

The second type of disjunctive constraints is related to f-structure. In order to account for unlike category coordination, where each conjunct may satisfy a different set of constraints, such disjunctive constraints must be interpreted distributively, so that the disjunction is evaluated separately for each conjunct.

Consider (124): the object of UNDERSTAND involves unlike category coordination – its first conjunct is an NP, while the second conjunct is a CP with the complementizer THAT:

(124) I understand [[those concerns] and [that they are sincerely held]].
(Patejuk & Przepiórkowski 2023: (39))

Intuitively, the constraint in (125) should be appropriate to account for (124):

(125) $[(\uparrow \textsc{obj case})=_c \textsc{acc} \vee (\uparrow \textsc{obj comp-form})=_c \textsc{that}]$

However, as observed in Przepiórkowski & Patejuk (2012) when discussing structural case assignment to Polish subjects which also involves disjunction,[32] while the intended effect of such a disjunctive constraint is for it to be evaluated independently for each conjunct, so that different conjuncts may have different specifications, the actual effect is exactly the opposite: the disjunctive constraint is evaluated once (one disjunct is chosen) and the result is distributed to all conjuncts – as a consequence, all conjuncts must have the same specification. The following formulae from Patejuk (2015) formalise this contrast:

(126) a. $\forall x \in (\uparrow \textsc{gf})[A(x) \vee B(x)]$ (intended)
b. $\forall x \in (\uparrow \textsc{gf})\, A(x) \vee \forall x \in (\uparrow \textsc{gf})\, B(x)$ (actual)

[32] In Polish the subject requiring structural case can be – simplifying – nominative or, if it is a non-agreeing numeral, accusative, or a coordination of these. Apart from this, some predicates may take verbal subjects (InfP or CP) which may be coordinated with NPs bearing structural case.

The "liberal" solution offered in Przepiórkowski & Patejuk (2012: 485) is to "understand (non-)distributivity not as a property of features, but as a property of statements". This involves making statements distributive by default – non-distributive statements must be marked explicitly (with "@"). As Przepiórkowski & Patejuk (2012: 485) point out, "An interesting consequence of this proposal is that a given feature may behave distributively in some ways and non-distributively in others.", providing CASE as an example: while it is a non-distributive attribute in Polish, an additional distributive statement is used to ensure that each of the conjuncts bears an appropriate value of case.

The second solution described[33] in Przepiórkowski & Patejuk (2012: 486) is called "conservative" as it does not require any modifications to the LFG theory: it relies on the existing mechanism of off-path constraints. A distributive attribute (typically PRED, as below) is used as an anchor, so that the disjunctive constraint is distributed to each conjunct and evaluated independently: (127) is the off-path counterpart of (125), achieving its intended effect. This solution is presented in more detail in Patejuk & Przepiórkowski (2012a).

(127) $(\uparrow \textsc{obj} \quad \textsc{pred} \quad [(\leftarrow \textsc{case})=_c \textsc{acc} \vee (\leftarrow \textsc{comp-form})=_c \textsc{that}])$

Note that (127) uses constraining equations. While "plain" (not off-path) constraints can be defining (=, introducing an attribute-value pair) or constraining ($=_c$, checking if a given attribute-value pair is present), there are different formal views on off-path constraints. Some works assume these are non-constructive, which means that off-path constraints can only be constraining, so it is not possible to have defining off-path constraints – this is consistent with how off-path constraints work in XLE.[34] However, some theoretical works assume that off-path constraints can be constructive (see the discussion of (103) in Section 3.3), making it is possible to use these for introducing new attribute-value pairs.

This issue (whether off-path constraints can be constructive or not) is of significant importance in the context of unlike category coordination, since some constraints are typically defining – this includes control equations in examples such as (93), where one of the conjuncts requires control. As explained in Patejuk & Przepiórkowski (2014a), the control equation in (128)[35] would produce an ill-formed, incoherent f-structure because the non-infinitival conjunct does not take a subject. The disjunctive constraint in (129), aiming to address this issue, would

[33] As explained in Przepiórkowski & Patejuk (2012), this solution is the idea of Mary Dalrymple.

[34] https://ling.sprachwiss.uni-konstanz.de/pages/xle/doc/notations.html#N4.1.5b

[35] As mentioned in footnote 22, OBL may be more appropriate than OBJ for the coordinate phrase in (93).

also not work – as explained above, instead of being distributed as in (126a), it would be interpreted as in (126b): depending on which disjunct is chosen, one of the conjuncts would not satisfy the chosen constraint. (130) is the off-path version of (129) – whether it would have the intended effect depends on whether off-path constraints can be constructive.

(128) (↑ SUBJ)=(↑ OBJ SUBJ)

(129) [(↑ OBJ CAT)=$_c$ INF ∧ (↑ SUBJ)=(↑ OBJ SUBJ)] ∨ (↑ OBJ CAT)≠ INF

(130) (↑ OBJ PRED [(← CAT)=$_c$ INF ∧ (← SUBJ)=((OBJ ←) SUBJ)] ∨ (← CAT)≠ INF)

To avoid the potential issue with (130) (since off-path constraints are non-constructive in XLE, this is a real issue for implemented grammars), Patejuk & Przepiórkowski (2014a) describe an alternative solution, again due to Mary Dalrymple: the idea is to use a dedicated attribute, CONTROLLER, to host the controller.

Let us consider again the example in (93), where the complement of CHCIEĆ 'want' consists of an infinitival phrase controlled by the subject and a noun phrase bearing structural case. Under this alternative proposal, instead of (128), the lexical entry of CHCIEĆ introduces the modified control equation in (131). As a consequence, the subject of CHCIEĆ is structure-shared with the CONTROLLER attribute of its OBJ complement. This does not trigger the coherence violation in the NP conjunct that is caused by (128).

(131) (↑ SUBJ)=(↑ OBJ CONTROLLER)

In the absence of (128) the InfP conjunct would be incomplete (its SUBJ needs to be filled), so the constraint in (132) is used instead to satisfy completeness. When used inside the InfP, (132) structure-shares the value of its CONTROLLER attribute with its SUBJ, providing the InfP complement of CHCIEĆ with a subject.

(132) (↓ CONTROLLER)=(↓ SUBJ)

Together, (131) and (132) make it possible to satisfy completeness by providing the InfP with a controller for its subject without violating coherence in non-infinitival conjuncts in examples such as (93).[36] This solution can also be used for unlike modifiers in (96)–(98).

[36]The CONTROLLER attribute could also be used to host the controller of predicative complements, providing an alternative solution to the problem of predicative complements that have a subject of their own such as gerunds or CPs (Dalrymple et al. 2004). While standard open complement (XCOMP(-PRED)) analyses result in incoherence (two different values of SUBJ – one internal vs. one resulting from control), there would be no such problem when control is established via CONTROLLER.

It is worth noting that the CONTROLLER attribute introduced by (131) is represented in each conjunct, no matter whether a given conjunct requires control (as the infinitival conjunct in (93)) or not (as the nominal conjunct in (93)). CONTROLLER would be present even if there is no conjunct requiring control. If this is considered an issue, the restriction operator (\) can be used to remove the CONTROLLER attribute where is not necessary.

As mentioned above, the complement of CHCIEĆ 'want' may be an NP taking structural case (accusative or genitive, depending on the presence of sentential negation) or a controlled InfP. This is formalised in (133) using off-path constraints (non-constructive):

(133) $$(\uparrow \textsc{obj} \quad \textsc{pred} \quad)$$
$$[(\leftarrow \textsc{cat}) =_c \textsc{inf} \ \wedge \ (\leftarrow \textsc{subj}) =_c ((\textsc{obj} \leftarrow) \textsc{subj})]$$
$$\vee$$
$$[(\leftarrow \textsc{cat}) =_c \textsc{n} \ \wedge$$
$$[[\neg((\textsc{obj} \leftarrow) \textsc{neg}) \ \wedge \ (\leftarrow \textsc{case}) =_c \textsc{acc}] \ \vee$$
$$[((\textsc{obj} \leftarrow) \textsc{neg}) =_c + \ \wedge \ (\leftarrow \textsc{case}) =_c \textsc{gen}]]]$$

While off-path constraints make it possible to impose disjunctive constraints under coordination, the resulting constraints are rather complex and hard to read. If off-path constraints are non-constructive (as in XLE), this limitation forces a special way of imposing constraints (defining constraints must be used elsewhere, as shown above).

Alternative solutions include the "liberal" solution of Przepiórkowski & Patejuk (2012) discussed above (making distributivity a property of statements, so that statements are distributive by default, while non-distributive statements must be marked as such).

Kaplan (2017: 133–4, fn. 6) offers another alternative, proposing to formalise the idea of the "liberal" solution of Przepiórkowski & Patejuk (2012) by introducing DISTRIB, "an explicit operator declaring that an arbitrary description P is a distributive property when it is applied to an f-structure f that happens to be a set":

(134) $\textsc{distrib}(f, v, P)$

Kaplan (2017: 134) adds: "In any invocation (perhaps notated as a built-in template call) f will be a designator (e.g. ↑) and P will be a formula with a variable v that is bound in the scope of P to either the non-set designated by f or to each of its elements in turn."

(135) is the DISTRIB template call corresponding to the off-path constraint in (127), while (136) is the counterpart of (133). (136) is compatible with the CONTROLLER-based approach to establishing control relations shown in (131)–(132).

(135) @DISTRIB((↑ OBJ), %O, [(%O CASE)=$_c$ ACC ∨ (%O COMP-FORM)=$_c$ THAT])

(136) @DISTRIB((↑ OBJ), %O,
[(%O CAT)=$_c$ INF ∧ (↑ SUBJ)=$_c$(%O SUBJ)] ∨ [(%O CAT)=$_c$ N ∧
[[¬(↑ NEG) ∧ (%O CASE)=$_c$ ACC] ∨ [(↑ NEG) ∧ (%O CASE)=$_c$ GEN]]])

However, since constraints imposed using DISTRIB can be constructive, (137) can be used instead. It introduces a standard defining control equation ((↑ SUBJ)=(%O SUBJ) instead of (↑ SUBJ)=$_c$(%O SUBJ)), so there is no need to use the CONTROLLER attribute.

(137) @DISTRIB((↑ OBJ), %O,
[(%O CAT)=$_c$ INF ∧ (↑ SUBJ)=(%O SUBJ)] ∨ [(%O CAT)=$_c$ N ∧
[[¬(↑ NEG) ∧ (%O CASE)=$_c$ ACC] ∨ [(↑ NEG) ∧ (%O CASE)=$_c$ GEN]]])

The last alternative solution, proposed by Przepiórkowski & Patejuk (2021), is to reuse the formal device of local names (local variables) as a way of stating distributive properties – (138) is the counterpart of (127), while (139) corresponds to (133).

(138) (↑ OBJ)=%O ∧
[(%O CASE)=$_c$ ACC ∨ (%O COMP-FORM)=$_c$ THAT]

(139) (↑ OBJ)=%O ∧
[(%O CAT)=$_c$ INF ∧ (↑ SUBJ)=$_c$(%O SUBJ)] ∨ [(%O CAT)=$_c$ N ∧
[[¬(↑ NEG) ∧ (%O CASE)=$_c$ ACC] ∨ [(↑ NEG) ∧ (%O CASE)=$_c$ GEN]]]

As in the case of DISTRIB proposed by Kaplan (2017), constraints imposed in this way can also be constructive, so – as in (137) – it is possible to use (139) with a defining control equation in order to avoid using the CONTROLLER attribute to establish control.

While the "liberal" solution of Przepiórkowski & Patejuk (2012) makes statements (including disjunctive constraints) distributive (as in (126a); non-distributive properties need to be marked explicitly), the solutions proposed by Kaplan (2017) and Przepiórkowski & Patejuk (2021) are both "conservative" in the sense that statements are non-distributive (see (126b)) unless they are stated using the DISTRIB template or local names, respectively.

4 Coordination of unlike grammatical functions

Coordination can be even more unlike than when unlike categories are involved: in some languages it is possible to coordinate unlike grammatical functions under some circumstances. This is very robust in Slavic, Romanian and Hungarian,

but it is also possible, to a lesser extent, in other languages, including English. This phenomenon has been discussed in the literature under different names, including: "lexico-semantic coordination" (Sannikov 1979, 1980, Mel'čuk 1988), "hybrid coordination" (Chaves & Paperno 2007) and "heterofunctional coordination" (Przepiórkowski 2022). While this type of coordination is sometimes referred to as "wh-coordination" (Bîlbîie & Gazdik 2012) when the discussion is restricted to interrogative items (as in (140)),[37] there are many more possible types of conjuncts, corresponding to different types of quantifiers: the universal quantifier in (141), the existential quantifier (indefinite pronouns in (142), free choice pronouns in (143)), *n*-words in (144) (existential quantifier in scope of negation), etc. The basic generalisation is that this variety of coordination joins elements which belong to the same (restricted) semantic type, but they correspond to different grammatical functions.

(140) Polish
[[Kogo] i [komu]] przedstawił?
who.ACC and who.DAT introduced
'Who did he introduce to whom?' (Kallas 1993: 121, (241))

(141) Polish
Obiecać można [[wszystko] i [wszystkim]].
promise may everything.ACC and everyone.DAT
'One may promise everything to everyone.' (NKJP)

(142) Polish
[[Ktoś], [gdzieś] i [coś]] mocno pokiełbasił.
someone.NOM somewhere and something.ACC really messed up
'Someone really messed something up somewhere.' (NKJP)

(143) Polish
czy [[komukolwiek], [kiedykolwiek] i [do czegokolwiek]]
PRT anybody.DAT anytime and for anything
przydał się poradnik
come in handy guide
'Has a(ny) guide ever come in handy to anybody for anything?' (NKJP)

(144) Polish
[[nikogo] i [nic]] nie może tłumaczyć.
nobody.GEN and nothing.NOM NEG can excuse
'Nothing can excuse anybody.' (NKJP)

[37] All examples used in this section are in Polish. Except for (148), all examples are from Patejuk (2015). Some glosses and translations have been modified.

4.1 Is this really coordination?

When discussing coordination of different grammatical functions, a fundamental question arises: is this really coordination? For instance, in Polish the word *i* can be a conjunction, but it can also be an interjection or a particle. So perhaps the word that seems to be a conjunction in this construction is not a conjunction (but some other element) and such examples do not involve coordination. Patejuk & Przepiórkowski (2012b), Patejuk (2015), Patejuk & Przepiórkowski (2019) present a range of arguments showing that coordination of different grammatical functions is a genuine instance of coordination.

As Patejuk & Przepiórkowski (2019: 28) point out: "in all languages which allow for joining different grammatical functions the joining element has the same form as a conjunction". As shown below, different conjunctions may be used.

There are examples with unambiguous conjunctions, such as *oraz* in (145).

(145) Polish
[[kto] oraz [kiedy]] miałby płacić za postawiony budynek
who.NOM and when should pay for erected building
'Who and when would be supposed to pay for the erected building?'
(NKJP)

There are examples such as (146) where other interpretations exist, but these are not appropriate in the given context. Apart from the conjunction, the only alternative interpretation of *lub* is as the imperative form of the verb LUBIĆ 'like', clearly not suitable in (146).

(146) Polish
Mile widziane odpowiedzi merytoryczne, bez przypuszczeń
welcome responses substantive without speculating
[[kto] lub [czego]] będzie w Wikipedii szukał.
who.NOM or what.GEN AUX in Wikipedia seek
'Welcome are substantive responses, without speculating who will seek what in Wikipedia.' (NKJP)

Some conjunctions have special requirements – for instance, *ani* 'neither/nor' belongs to *n*-words, so it needs negation to be licenced. As shown in (147), removing negation results in ungrammaticality, which is consistent with the behaviour of the conjunction *ani*.

(147) Polish
Nigdy nie wyjeżdżałyśmy na wakacje, bo *(nie) miałyśmy [[z
never NEG leave for holidays because NEG had with
kim] ani [za co]]...
who.INS nor for what.ACC
'We would never go on holiday because there was nobody we could go with and there was no money to go.' (Joanna Bator, *Ciemno, prawie noc*, 119)

Some examples, apart from a conjunction, also include a preconjunction, as in (148).

(148) Polish
...kiedy wyjawisz [nie tylko [kto], ale i [dlaczego]] otrzymał
when disclose not only who.NOM but and why received
awans.
promotion
'...when you explain not only who, but also why got promoted.'
(Patejuk & Przepiórkowski 2019: (9))

Finally, it is possible to coordinate more than two items – see (142) and (143).

Summing up, there is substantial evidence showing that different grammatical functions are joined with a conjunction and the construction in question is a variety of coordination.

4.2 How to represent such coordination?

Having established that coordination of different grammatical functions is indeed an instance of coordination, the next question is how it should be represented.

Patejuk & Przepiórkowski (2012b) offer an analysis with two possible representations: monoclausal (involving one clause, where all conjuncts are dependents of the same clause) or multiclausal (involving more than one clause, where conjuncts are dependents of different clauses; this is equivalent to clause-level coordination with ellipsis). It may be the case that the two different representations are needed in the same language, as in Polish.

Patejuk (2015) provides a critical review of various diagnostics/arguments for determining the right representation for coordination of different grammatical functions. While there are cases when it is necessary to adopt the multiclausal representation (for instance, when the conjuncts cannot belong to the same clause,

see Section 4.4), it is hard to rule out the multiclausal representation elsewhere, unless it is assumed that ellipsis only operates under identity. Without this assumption, it is difficult to argue against arbitrary ellipsis mechanisms (which may be arbitrarily powerful). Due to this, it seems reasonable to assume that unless there are good reasons to adopt the multiclausal analysis, the monoclausal analysis should be preferred by default as the more economical representation.

The analysis presented below is the one proposed in Patejuk (2015) (which is an improved version of Patejuk & Przepiórkowski (2012b)). (149) is the topmost rule corresponding to the coordination of different grammatical functions; the two disjuncts on the right-hand side correspond to two different representations discussed in detail later: XPlxm_{type} is monoclausal (Section 4.3),[38] while XPlxb_{type} is bi/multiclausal (Section 4.4).

(149) $\text{anyLEXSEM} \longrightarrow \left\{ \begin{array}{l|l} \text{XPlxm}_{type} & \text{XPlxb}_{type} \\ \downarrow \in (\uparrow \textsc{udf}) & \end{array} \right\}$

The category anyLEXSEM is mostly intended to be used as the initial[39] dependent of S (or CP): (150) is a modified version of (16). Since conjuncts inside anyLEXSEM have appropriate annotations (including GF), anyLEXSEM has no annotation (equivalent to ↓=↑).

(150) S ⟶ anyLEXSEM VP

4.3 Monoclausal

The monoclausal representation is appropriate for coordination of different grammatical functions when all conjuncts can be dependents of the same clause. This has been the case in all examples so far. However, conjuncts do not have to be dependents of the same head. There are examples where they depend on different heads, as in (144) and below:

(151) Polish
[[Skąd] i [jakie]] otrzymujemy informacje?
whence and what.ACC receive information.ACC
'What information and from where do we receive?' (NKJP)

[38] UDF (unbounded dependency function, Asudeh (2011)) is a discourse function used instead of TOPIC/FOCUS so as to avoid representing information structure concepts in f-structure.
[39] Examples such as (147) show that such coordination can also be used non-initially.

(152) Polish
[[Jakie] i [kto]] może ponieść konsekwencje?
what.ACC and who.NOM can bear consequences.ACC
'Who can suffer what consequences?' (Google)

(153) Polish
[[Ile] i [czego]] znaleźli?
how much.ACC and what.GEN found
'How much, and (of) what, did they find?' (NKJP)

In (144) the first conjunct (*nikogo* 'nobody') is the object of the infinitival complement (*tłumaczyć* 'excuse'), while the second conjunct (*nic* 'nothing') is the subject of the main verb (*może* 'can'). In (151) the first conjunct (*skąd* 'from where') is a modifier of the verb (*otrzymujemy* 'get'), while the second conjunct (*jakie* 'what') is a modifier of the verb's object (*informacje* 'information'). (152) is similar to (144) and (151): the first conjunct (*jakie* 'what') is a modifier of the object (*konsekwencje* 'consequences') of the infinitival complement (*ponieść* 'suffer'), while the second conjunct (*kto* 'who') is the subject of the main verb (*może* 'can'). (153) is different because one conjunct depends on the other:[40] while the first conjunct (*ile* 'how much') is the object of the verb (*znaleźli* 'found'), the second conjunct (*czego* 'what') is the nominal complement of *ile*.[41]

The formalisation of Patejuk (2015) relies on the following components:

(154) $\text{XPlxm}_{type} \longrightarrow \underset{\downarrow\in\uparrow}{\text{XPlxmC}_{type}} \; [, \; \underset{\downarrow\in\uparrow}{\text{XPlxmC}_{type}}]^* \; \text{Conj} \; \underset{\downarrow\in\uparrow}{\text{XPlxmC}_{type}}$

(155) $\text{XPlxmC}_{type} \longrightarrow \{ \; \text{XPextr}_{type} \mid \text{XPlxm}_{type} \; \}$

(156) $\text{XPextr}_{type} \longrightarrow \underset{\substack{\uparrow=\downarrow \\ ((\text{UDF} \in^* \uparrow) \; \text{XPATH} \; \text{GF}^+)=\downarrow}}{\text{XP}_{type}}$

(157) $\text{XP}_{type} \equiv \{\text{NP}|\text{PP}|\text{ADVP}|\text{AP}\}_{type}$

(158) $type \equiv \{ \; all \mid any \mid int \mid neg \; \}$

(159) $\text{XPATH} \equiv \text{XCOMP}^*$

[40] ZNALEŹĆ 'find' cannot take a genitive partitive object, so *czego* cannot be analysed as its object: **Czego znaleźli?*

[41] In Polish, the numeral phrase is headed by the numeral which takes a nominal complement (with agreeing numerals, it has the same case while with non-agreeing numerals it is genitive).

(160) $\text{GF} \equiv \{\text{SUBJ}|\text{OBJ}|\text{OBJ}_\theta|\text{OBL}|\text{ADJ} \in\}$

All rules in (154)–(157) use the $_{type}$ variable defined in (158) – its value must be the same on both sides of the rule. (154) is the topmost rule corresponding to monoclausal (hence "m" in XPlxm) coordination of different grammatical functions ("lx" in XPlxm stands for "lexico-semantic", the term first used in Sannikov (1979, 1980) to refer to such coordination). XPlxm_{type} rewrites to a sequence of XPlxmC_{type} conjuncts (hence "C" in XPlxmC) – it is only possible to coordinate conjuncts belonging to the same semantic type (listed in (158)). (155) rewrites XPlxmC_{type} to XPextr_{type} (no embedding) or XPlxm_{type}, which makes it possible to embed such coordination. (156) rewrites XPextr_{type} to XP_{type} – the metacategory[42] defined in (157) as a disjunction of categories of the same $_{type}$.

Together with (149)–(150), these produce the following monoclausal f-structure for (151):

(161)
$$\left[\begin{array}{ll}
\text{PRED} & \text{`RECEIVE}\langle\boxed{1},\boxed{2}\rangle\text{'} \\
\text{SUBJ} & \boxed{1}\left[\text{PRED } \text{`PRO'}\right] \\
\text{OBJ} & \boxed{2}\left[\begin{array}{ll}\text{PRED} & \text{`INFORMATION'} \\ \text{CASE} & \text{ACC} \\ \text{ADJ} & \{\boxed{3}\}\end{array}\right] \\
\text{ADJ} & \{\boxed{4}\} \\
\text{UDF} & \left\{\left[\left\{\left(\boxed{4}\left[\begin{array}{ll}\text{PRED} & \text{`WHENCE'} \\ \text{TYPE} & \text{INT}\end{array}\right], \boxed{3}\left[\begin{array}{ll}\text{PRED} & \text{`WHAT'} \\ \text{CASE} & \text{ACC} \\ \text{TYPE} & \text{INT}\end{array}\right]\right)\right\}\right.\right. \\
 & \left.\left.\left[\text{CONJ } \text{AND}\right]\right]\right\}
\end{array}\right]$$

(Patejuk 2015: (5.125))

To see how the monoclausal analysis of Patejuk (2015) works, let us consider its procedural intuition showing how (161) is built using the rules in (149)–(150) and (154)–(160).

(162) and (163) are the partial f-structures built by the words *skąd* and *jakie*, respectively:

(162)
$$\left[\begin{array}{ll}\text{PRED} & \text{`WHENCE'} \\ \text{TYPE} & \text{INT}\end{array}\right]$$

(163)
$$\left[\begin{array}{ll}\text{PRED} & \text{`WHAT'} \\ \text{CASE} & \text{ACC} \\ \text{TYPE} & \text{INT}\end{array}\right]$$

[42] Unlike XPlxm_{type}, XPlxmC_{type} and XPextr_{type}, XP_{type} is a metacategory: $\equiv$ is used instead of $\longrightarrow$ as the rewrite symbol in the rule defining XP_{type}, so the right-hand side categories in (157) appear in c-structure instead of XP_{type}.

These words are interrogative (their lexical entries specify the value of the TYPE attribute as INT), so they correspond to categories $ADVP_{int}$ and AP_{int}, respectively. According to (157), each of these categories is an instance of XP_{int} meta-category. Following (155)–(156), $XPextr_{int}$ rewrites to XP_{int} and $XPlxmC_{int}$ to $XPextr_{int}$, so: $XPlxmC_{int} \longrightarrow XPextr_{int} \longrightarrow XP_{int}$. Next, the rule in (154) adds $XPlxmC_{int}$ conjuncts to a set, building the f-structure in (164), which contains the f-structures in (162) and (163) as set elements. Then the rule in (149) rewrites anyLEXSEM to $XPlxm_{int}$ with ↓∈(↑ UDF) annotation. As a result, the f-structure in (164) is added as a member of the UDF set, see (165).

(164)
$$\left[\begin{array}{l}\left\{\left(\begin{array}{ll}\text{PRED} & \text{'WHENCE'}\\ \text{TYPE} & \text{INT}\end{array}\right], \left[\begin{array}{ll}\text{PRED} & \text{'WHAT'}\\ \text{CASE} & \text{ACC}\\ \text{TYPE} & \text{INT}\end{array}\right]\right\}\\ \text{CONJ} \quad \text{AND}\end{array}\right]$$

(165)
$$\left[\begin{array}{l}\text{OBJ} \quad \left[\text{ADJ} \quad \{\boxed{3}\}\right]\\ \text{ADJ} \quad \{\boxed{4}\}\\ \text{UDF} \quad \left\{\left[\begin{array}{l}\left\{\left(\boxed{4}\left[\begin{array}{ll}\text{PRED} & \text{'WHENCE'}\\ \text{TYPE} & \text{INT}\end{array}\right], \boxed{3}\left[\begin{array}{ll}\text{PRED} & \text{'WHAT'}\\ \text{CASE} & \text{ACC}\\ \text{TYPE} & \text{INT}\end{array}\right]\right\}\\ \text{CONJ} \quad \text{AND}\end{array}\right]\right\}\end{array}\right]$$

It is now possible to see and explain the effect of the rule in (156), where XP_{int} has two annotations. While ↑=↓ builds the f-structures in (162)–(163), which are later used to build the coordinate f-structure in (164), ((UDF $\in^*$ ↑) XPATH GF^+)=↓ structure-shares the f-structure of each conjunct. (UDF $\in^*$ ↑) is the path to the top-level f-structure containing the UDF attribute, XPATH defined in (159) produces any sequence (including zero) of XCOMPS (making it possible to embed the f-structure inside verb chains), while GF^+ produces any non-zero sequence of GFs defined in (160). Together, these equations make it possible to structure-share each conjunct inside the UDF set with any grammatical function that can be reached using this path. As a result of this annotation, in (165) the f-structure 4 corresponding to *skąd* is structure-shared with the element of the ADJ set at the main level (via resolved ((UDF $\in^*$ ↑) ADJ ∈)=↓ annotation, equivalent to ↓ ∈ ((UDF $\in^*$ ↑) ADJ)), while the f-structure 3 corresponding to *jakie* is structure-shared with the element of the ADJ set of the OBJ attribute at the main level (via resolved ((UDF $\in^*$ ↑) OBJ ADJ ∈)=↓ annotation, equivalent to ↓ ∈ ((UDF $\in^*$ ↑) OBJ ADJ)).

Finally, using the rule in (150), the partial f-structure in (165) corresponding to the coordination of different grammatical functions (*skąd i jakie* 'where from and what') is unified with the partial f-structure in (166) corresponding to the rest of

the sentence (*otrzymujemy informacje* ‘(we) get information’), yielding the final f-structure in (161) – a monoclausal representation where all conjuncts belong to the same clause (even though they depend on different heads).

(166)
$$\begin{bmatrix} \textsc{pred} & \text{‘}\textsc{receive}\langle \boxed{1}, \boxed{2} \rangle\text{’} \\ \textsc{subj} & \boxed{1}\begin{bmatrix} \textsc{pred} & \text{‘}\textsc{pro}\text{’} \end{bmatrix} \\ \textsc{obj} & \boxed{2}\begin{bmatrix} \textsc{pred} & \text{‘}\textsc{information}\text{’} \\ \textsc{case} & \textsc{acc} \end{bmatrix} \end{bmatrix}$$

4.4 Multiclausal (including biclausal)

The multiclausal representation, unlike the monoclausal one, is appropriate for instances of coordination of different grammatical functions where conjuncts are dependents of different clauses. Such a representation is suitable when conjuncts cannot be codependents (as in Polish where certain examples would otherwise be ungrammatical). While it may also be preferred for other reasons (as in English and other languages with optional arguments but without pro-drop), this will not be discussed here for reasons of space.

In Polish, there are two cases where the multiclausal analysis of coordination of different grammatical functions is necessary: coordination of the *yes/no* interrogative particle CZY with another interrogative item, as in (167), and coordination of relatives, see (168):

(167) Polish
Nie wiadomo było, [[czy] *(i) [kiedy]] wróci.
NEG know was PRT and when returns
‘It was not clear whether and when (s)he/it would return.’ (NKJP)

(168) Polish
SŁOWA tej księgi pozwalają budować człowieka [[któremu] *(i)
words this book let build man who.DAT and
[z którym]] jest dobrze żyć.
with whom is good live
‘Words of this book let one build a man for and with whom it is good to live.’ (NKJP)

Patejuk (2015) proposes two representations for multiclausal coordination of different grammatical functions: one involves as many clauses as conjuncts (Section 4.4.1), while the other always involves two clauses (Section 4.4.2). While only the “as many clauses as conjuncts” representation is appropriate for coordination of relatives, coordination of CZY with other interrogative items may be

analysed using either representation. The difference is visible with more than two conjuncts, so let us consider an example with three conjuncts:

(169) Polish
[[Czy], [kiedy] i [kto]] zajmie się drogami […] nie wiadomo.
PRT when and who.NOM take care roads.INS NEG known
'It is not known, whether, who and when will take care of the roads.'
(NKJP)

4.4.1 As many clauses as conjuncts

These rules produce the representation where it is possible to have more than two clauses:

(170) $\text{XPlxb}_{rel} \longrightarrow \underset{\downarrow\in\uparrow}{\text{XPextrbicl}_{rel}}\ [,\ \underset{\downarrow\in\uparrow}{\text{XPextrbicl}_{rel}}]^*\ \text{Conj}\ \underset{\downarrow\in\uparrow}{\text{XPextrbicl}_{rel}}$

(171) $\text{XPlxb}_{int} \longrightarrow \underset{\downarrow\in\uparrow}{\text{PARTbicl}_{int}}\ [,\ \underset{\downarrow\in\uparrow}{\text{XPextrbicl}_{int}}]^*\ \text{Conj}\ \underset{\downarrow\in\uparrow}{\text{XPextrbicl}_{int}}$

(172) $\text{PARTbicl}_{type} \longrightarrow \underset{\substack{\uparrow=\downarrow \\ @\text{PRODROP}}}{\text{PART}_{type}}$

(173) $\text{XPextrbicl}_{type} \longrightarrow \underset{\substack{\downarrow\in(\uparrow \text{ UDF}) \\ @\text{PRODROP}}}{\text{XPextr}_{type}}$

(174) PRODROP ≡
((↑ SUBJ PRED)='PRO')
((↑ OBJ PRED)='PRO')
…
((↑ GF PRED)='PRO')

(170)–(171) are the topmost rules handling bi/multiclausal (hence "b" in XPlxb, while "m" stands for "monoclausal" in XPlxm) coordination of different grammatical functions where XPlxb rewrites to a sequence of conjuncts: relative (XPextrbicl_{rel}) in (170), or interrogative in (171) – with PARTbicl_{int} (the *yes*/*no* interrogative particle CZY) as the first conjunct and XPextrbicl_{int} as the remaining conjuncts. According to (172)–(173), PARTbicl_{type} and XPextrbicl_{type} rewrite to PART_{type} and XPextr_{type}, respectively; both right-hand side categories contain calls to the PRODROP template defined in (174). It contains conjoined optional

statements, so each call may optionally introduce various implicit arguments (in case these are not filled locally, which would violate completeness).

Together with (149)–(150) and (156)–(160), rules in (171)–(174) produce the following multiclausal f-structure for (169) (leaving out the contribution of *nie wiadomo*):

(175)
$$\left[\begin{array}{l}\left\{\left(\begin{array}{l}\left[\begin{array}{l}\textsc{pred}\ \text{`take\_care}\langle\boxed{1},\boxed{2}\rangle\text{'}\\ \textsc{subj}\ \ \boxed{1}\left[\textsc{pred}\ \text{`pro'}\right]\\ \textsc{obl}\ \ \boxed{2}\left[\textsc{pred}\ \text{`roads'}\right]\\ \textsc{clause-type}\ \ \textsc{int}\end{array}\right],\left[\begin{array}{l}\textsc{pred}\ \text{`take\_care}\langle\boxed{3},\boxed{2}\rangle\text{'}\\ \textsc{subj}\ \ \boxed{3}\left[\textsc{pred}\ \text{`pro'}\right]\\ \textsc{obl}\ \ \boxed{2}\\ \textsc{adj}\ \ \left\{\boxed{4}\right\}\\ \textsc{udf}\ \ \left\{\boxed{4}\left[\begin{array}{l}\textsc{pred}\ \text{`when'}\\ \textsc{type}\ \ \textsc{int}\end{array}\right]\right\}\end{array}\right],\left[\begin{array}{l}\textsc{pred}\ \text{`take\_care}\langle\boxed{5},\boxed{2}\rangle\text{'}\\ \textsc{subj}\ \ \boxed{5}\\ \textsc{obl}\ \ \boxed{2}\\ \textsc{udf}\ \ \left\{\boxed{5}\left[\begin{array}{l}\textsc{pred}\ \text{`who'}\\ \textsc{type}\ \ \textsc{int}\end{array}\right]\right\}\end{array}\right]\end{array}\right)\right\}\\ \textsc{conj}\ \ \textsc{and}\end{array}\right]$$

(Patejuk 2015: (5.239))

To better understand this multiclausal analysis, let us consider its procedural intuition showing how the f-structure in (175) is built using the rules listed above.

(176)–(178) are the f-structures built by the words *czy* 'whether', *kiedy* 'when' and *kto* 'who' which correspond to categories PART_{int}, ADVP_{int} and NP_{int}, respectively:

(176) $\left[\textsc{clause-type}\ \ \textsc{int}\right]$

(177) $\left[\begin{array}{l}\textsc{pred}\ \text{`when'}\\ \textsc{type}\ \ \textsc{int}\end{array}\right]$

(178) $\left[\begin{array}{l}\textsc{pred}\ \text{`who'}\\ \textsc{type}\ \ \textsc{int}\end{array}\right]$

According to (157), ADVP_{int} and NP_{int} are instances of the XP_{int} metacategory. The rule in (173) rewrites XPextrbicl_{int} to XPextr_{int}, while (156) rewrites XPextr_{int} to XP_{int} (so: $\text{XPextrbicl}_{int} \longrightarrow \text{XPextr}_{int} \longrightarrow \text{XP}_{int}$). The rule in (172) rewrites PARTbicl_{int} to PART_{int}. The f-structures below built by these rules contain the contributions of calls to the PRODROP template as well as structure-sharing via UDF (resulting from the annotation in (156)): (179) corresponds to PARTbicl_{int}, while (180)-(181) correspond to XPextrbicl_{int}.

(179) $\left[\begin{array}{l}\textsc{subj}\ \ \left[\textsc{pred}\ \text{`pro'}\right]\\ \textsc{clause-type}\ \ \textsc{int}\end{array}\right]$

(180) $\left[\begin{array}{l}\textsc{subj}\ \ \left[\textsc{pred}\ \text{`pro'}\right]\\ \textsc{adj}\ \ \left\{\boxed{4}\right\}\\ \textsc{udf}\ \ \left\{\boxed{4}\left[\begin{array}{l}\textsc{pred}\ \text{`when'}\\ \textsc{type}\ \ \textsc{int}\end{array}\right]\right\}\end{array}\right]$

(181)
$$\begin{bmatrix} \textsc{subj} & \boxed{5} \\ \textsc{udf} & \left\{ \boxed{5} \begin{bmatrix} \textsc{pred} & \text{`who'} \\ \textsc{type} & \textsc{int} \end{bmatrix} \right\} \end{bmatrix}$$

(179) consists of (176) (contributed by *czy*, the first conjunct) and an implicit subject introduced by the first optional equation in the PRODROP template defined in (174). (180) consists of (177) (contributed by *kiedy*, the second conjunct) added to the UDF set using (173) as $\boxed{4}$ and structure-shared using (156) as a member of the ADJ set of the main-level f-structure; it also contains an implicit subject introduced by PRODROP. (181) consists of (178) (contributed by *kto*, the third conjunct) added to the UDF set as $\boxed{5}$ and structure-shared with the value of the SUBJ attribute of the main-level f-structure. (181) does not contain any contributions of PRODROP – all statements in (174) are optional.

Using the rule in (171) which handles coordination of interrogative items corresponding to different grammatical functions, the f-structures in (179)–(181) are added to a set, yielding the f-structure in (182) which corresponds to XPlxb_{int}. The rule in (149) rewrites any LEXSEM to XPlxb_{int} without any annotation (so it is interpreted as ↓=↑ by default).

(182)
$$\begin{bmatrix} \left\{ \begin{bmatrix} \textsc{subj} & \left[\textsc{pred} \text{ `pro'}\right] \\ \textsc{clause-type} & \textsc{int} \end{bmatrix}, \begin{bmatrix} \textsc{subj} & \left[\textsc{pred} \text{ `pro'}\right] \\ \textsc{adj} & \{\boxed{4}\} \\ \textsc{udf} & \left\{ \boxed{4} \begin{bmatrix} \textsc{pred} & \text{`when'} \\ \textsc{type} & \textsc{int} \end{bmatrix} \right\} \end{bmatrix}, \begin{bmatrix} \textsc{subj} & \boxed{5} \\ \textsc{udf} & \left\{ \boxed{5} \begin{bmatrix} \textsc{pred} & \text{`who'} \\ \textsc{type} & \textsc{int} \end{bmatrix} \right\} \end{bmatrix} \right\} \\ \textsc{conj} \quad \textsc{and} \end{bmatrix}$$

(183)
$$\begin{bmatrix} \textsc{pred} & \text{`take\_care}\langle \textsc{subj}, \boxed{2} \rangle\text{'} \\ \textsc{obl} & \boxed{2}\left[\textsc{pred} \text{ `roads'}\right] \end{bmatrix}$$

Finally, using the rule in (150), the f-structure in (182) corresponding to the coordination of different grammatical functions (*czy, kiedy i kto* 'whether, when and who') is unified with the f-structure in (183) corresponding to the rest of the sentence (*zajmie się drogami* 'will take care of the roads'), yielding (175) as the final f-structure for (169) – it is a multiclausal representation where each conjunct belongs to a different clause.

While the multiclausal representation presented above is simple (there are as many clauses as conjuncts), it has some shortcomings. Since each clause has its own call to the PRODROP template, this can result in multiple implicit pronouns, as in (175) where the first two clauses have different implicit subjects – even though they look the same, they are distinct entities. While this could be solved by coindexation, such a representation is not economical.

There is another issue related to economy of representation: while the *yes*/*no* interrogative particle CZY cannot be placed in the same clause as other interrogative items (such as *skąd* 'where' or *kto* 'who'), interrogative items other than CZY can be co-dependents, which means these could be placed in the same clause. This observation is the reason for exploring the alternative multiclausal (biclausal) representation discussed in Section 4.4.2 below.

4.4.2 Always two conjuncts

The following rules are used to obtain a biclausal representation of coordination of different grammatical functions – one that always involves two coordinated clauses: the first clause contains PARTbicl_{int}, while the second one contains XPextrbicl_{int}. If such coordination involves more than two conjuncts, as in (169), the second clause is analysed an instance of monoclausal coordination of different grammatical functions (XPlxm_{type}, see Section 4.3) – such cases involve embedded monoclausal coordination in the second conjunct.

(184) $\text{XPlxb}_{int} \longrightarrow \underset{\downarrow\in\uparrow}{\text{PARTbicl}_{int}}\ \text{Conj}\ \underset{\downarrow\in\uparrow}{\text{XPextrbicl}_{int}}$

(185) $\text{XPextrbicl}_{type} \longrightarrow \left\{ \begin{array}{c|c} \text{XPextr}_{type} & \text{XPlxm}_{type} \\ \downarrow\in(\uparrow \textsc{udf}) & \downarrow\in(\uparrow \textsc{udf}) \\ @\textsc{prodrop} & @\textsc{prodrop} \end{array} \right\}$

Together with (149)–(150), (154)–(160), (172) and (174), the rules in (184)–(185) produce the f-structure in (186) for (169). (186) consists of two clauses: the first one contains the *yes*/*no* interrogative particle CZY, while the second clause involves monoclausal coordination of *kiedy* 'when' and *kto* 'who' in the UDF attribute, whose elements are structure-shared with the relevant dependents of this clause (ADJ and SUBJ, respectively).

(186)
$$\left\{ \begin{bmatrix} \textsc{pred} & \text{'take\_care}\langle \boxed{1}, \boxed{2} \rangle\text{'} \\ \textsc{subj} & \boxed{1}\begin{bmatrix}\textsc{pred} & \text{'pro'}\end{bmatrix} \\ \textsc{obl} & \boxed{2}\begin{bmatrix}\textsc{pred} & \text{'roads'}\end{bmatrix} \\ \textsc{clause-type} & \textsc{int} \end{bmatrix}, \begin{bmatrix} \textsc{pred} & \text{'take\_care}\langle \boxed{3}, \boxed{2} \rangle\text{'} \\ \textsc{subj} & \boxed{3} \\ \textsc{obl} & \boxed{2} \\ \textsc{adj} & \{\boxed{4}\} \\ \textsc{udf} & \left\{ \begin{bmatrix} \{\boxed{4}\begin{bmatrix}\textsc{pred} & \text{'when'} \\ \textsc{type} & \textsc{int}\end{bmatrix}, \boxed{3}\begin{bmatrix}\textsc{pred} & \text{'who'} \\ \textsc{type} & \textsc{int}\end{bmatrix}\} \\ \textsc{conj} \quad \textsc{and} \end{bmatrix} \right\} \end{bmatrix} \right\}$$

(Patejuk 2015: (5.244))

The f-structures produced by the words *czy*, *kiedy* and *kto* are the same as in (176)–(178).

While the f-structure corresponding to PARTbicl$_{int}$ is the same as in (179), the f-structure corresponding to XPextrbicl$_{int}$ is different from what is described in Section 4.4.1. According to the rule in (185), XPextrbicl$_{int}$ rewrites to XPextr$_{int}$ or XPlxm$_{int}$. (169) involves three conjuncts: the first one (*czy*) corresponds to PARTbicl$_{int}$, while the remaining two must be analysed as XPlxm$_{int}$ – as monoclausal coordination of different grammatical functions described in Section 4.3. Rules presented there produce the f-structure in (187) for *kiedy i kto*:

(187)
$$\begin{bmatrix} \text{SUBJ } \boxed{3} \\ \text{ADJ } \left\{\boxed{4}\right\} \\ \text{UDF } \left\{\left[\begin{bmatrix} \left\{\boxed{4}\begin{bmatrix}\text{PRED } \text{`WHEN'} \\ \text{TYPE } \text{INT}\end{bmatrix}, \boxed{3}\begin{bmatrix}\text{PRED } \text{`WHO'} \\ \text{TYPE } \text{INT}\end{bmatrix}\right\} \\ \text{CONJ } \text{AND}\end{bmatrix}\right\}\right] \end{bmatrix}$$

Using the topmost rule for biclausal coordination of different grammatical functions in (184), the f-structures corresponding to PARTbicl$_{int}$ and XPextrbicl$_{int}$, (179) and (187), respectively, are added to a set, producing the f-structure in (188) for *czy, kiedy i kto*.

(188)
$$\left\{\begin{bmatrix}\text{SUBJ } \boxed{1}\begin{bmatrix}\text{PRED } \text{`PRO'}\end{bmatrix} \\ \text{CLAUSE-TYPE } \text{INT}\end{bmatrix}, \begin{bmatrix} \text{SUBJ } \boxed{3} \\ \text{ADJ } \left\{\boxed{4}\right\} \\ \text{UDF } \left\{\left[\begin{bmatrix} \left\{\boxed{4}\begin{bmatrix}\text{PRED } \text{`WHEN'} \\ \text{TYPE } \text{INT}\end{bmatrix}, \boxed{3}\begin{bmatrix}\text{PRED } \text{`WHO'} \\ \text{TYPE } \text{INT}\end{bmatrix}\right\} \\ \text{CONJ } \text{AND}\end{bmatrix}\right\}\right] \end{bmatrix}\right\}$$

Finally, the f-structure in (188) corresponding to *czy, kiedy i kto* is unified with the f-structure in (183) corresponding to the rest of the sentence (*zajmie się drogami*), yielding the f-structure in (186) as the final representation of (169).

Unlike (175) discussed in Section 4.4.1, the representation in (186) is biclausal: the first clause contains the first conjunct (*czy*), while the second clause contains the remaining conjuncts (second *kiedy* and third *kto*) analysed as monoclausal coordination of different grammatical functions (Section 4.3). As a consequence, (186) uses only one implicit argument (the subject of the first clause), making it a more economic representation of (169) than (175).[43]

[43]The place where the conjunction is represented is another difference between (175) and (186). While in (175) it joins the three clauses, in (186) it joins the last two conjuncts inside the UDF set in the second clause. Patejuk (2015: 131) addresses this issue by copying the conjunction from UDF to the clause level.

5 Coordination and ellipsis

This section discusses selected phenomena involving multiclausal structures and ellipsis. In German Subject Gap in Finite/Fronted (SGF) construction and Polish "intertwined" coordination a dependent is shared by clauses headed by different predicates, while gapping involves sharing at least the main predicate.

5.1 SGF: Subject Gap in Finite/Fronted construction

Frank (2002) offers an analysis of the German SGF:

(189) German
[[In den Wald ging der Jäger] und [fing einen Hasen]].
into the forest went the hunter and caught a rabbit
'The hunter went into the forest and caught a rabbit.'
(Frank 2002: (4), from Wunderlich 1988)

As shown in (189), SGF involves coordination of clauses (headed by different verbs) with a shared subject which is placed inside the first clause (rather than to the left or to the right of the coordinated clauses, which would make dependent sharing straightforward).

Examples such as (189) are handled using (190), a dedicated c-structure rule for CP-level coordination which optionally structure-shares the GDF (grammaticalised discourse function) inside the first conjunct so that it is distributed across all conjuncts. While, following Bresnan (2001), GDF is defined in (191) as SUBJ, TOPIC or FOCUS, in German SGF it is further restricted – it must be the subject, as explained in Frank (2002).

(190) $\text{CP} \longrightarrow \underset{\substack{\downarrow\in\uparrow \\ ((\downarrow \text{GDF})=(\uparrow \text{GDF}))}}{\text{CP}}\ \text{Conj}\ \underset{\downarrow\in\uparrow}{\text{CP}}$

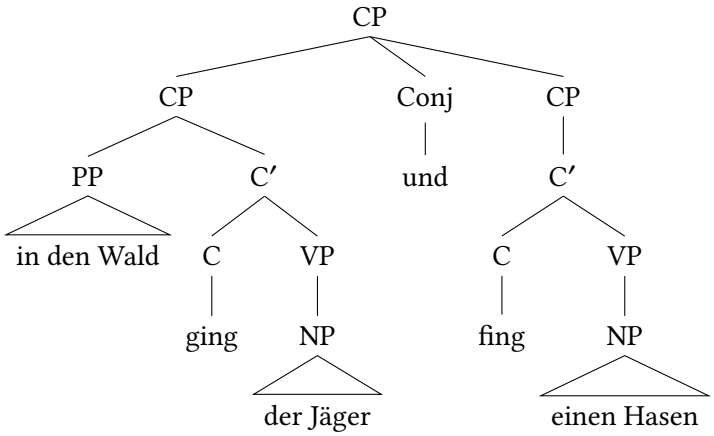
(191) $\text{GDF} \equiv \{\text{SUBJ}|\text{TOPIC}|\text{FOCUS}\}$

The structures below,[44] created using (190), correspond to (189). Even though the NP *der Jäger* belongs exclusively to the first conjunct in the c-structure in (193), the corresponding f-structure fragment, $\boxed{1}$, is structure-shared by both conjuncts in (192).

[44](192)-(193) are a modified (normalised/translated) version of Frank (2002: (36)).

(192)
$$\begin{bmatrix} \left\{ \left(\begin{bmatrix} \text{PRED} & \text{`GO}\langle \boxed{1}, \boxed{2} \rangle\text{'} \\ \text{SUBJ} & \boxed{1}\begin{bmatrix}\text{PRED} & \text{`HUNTER'}\end{bmatrix} \\ \text{OBL} & \boxed{2}\begin{bmatrix}\text{PRED} & \text{`INTO}\langle \boxed{3} \rangle\text{'} \\ \text{OBJ} & \boxed{3}\begin{bmatrix}\text{PRED} & \text{`FOREST'}\end{bmatrix}\end{bmatrix} \\ \text{TOPIC} & \boxed{2} \end{bmatrix} \right), \begin{bmatrix} \text{PRED} & \text{`CATCH}\langle \boxed{1}, \boxed{4} \rangle\text{'} \\ \text{SUBJ} & \boxed{1} \\ \text{OBJ} & \boxed{4}\begin{bmatrix}\text{PRED} & \text{`RABBIT'}\end{bmatrix} \end{bmatrix} \right\} \\ \text{CONJ} \quad \text{AND} \end{bmatrix}$$

(193)



5.2 Sharing "intertwined" dependents

Discussing coordination data from Polish,[45] Patejuk & Przepiórkowski (2015) offer an analysis of "intertwined" dependents – dependents which are interpreted as shared by all conjuncts, even though they are placed inside the first conjunct, like the subject in German SGF discussed in Section 5.1. However, there are fewer restrictions in Polish – unlike in German, it seems that any dependent may be shared: subject in (194), object in (195) and even particles such as *się*, as in (196) where it is a reciprocal marker (RECP).

(194) Polish
[[Przyjechali żandarmi] i [chodzili od domu do
came.PL.M1 soldier.NOM.PL.M1 and walked.PL.M1 from house to
domu]].
house
'Soldiers came and walked from house to house.' (NKJP)

[45] Except for (203)–(204), all examples in Section 5.2 are from Patejuk & Przepiórkowski (2015).

(195) Polish
[[Zakleiła kopertę] i [wepchnęła do torebki]].
sealed.SG.F envelope.ACC and stuffed.SG.F into handbag
'She sealed the envelope and stuffed it into the handbag.' (NKJP)

(196) Polish
[[Całowali się] i [przytulali]]!
kissed.PL.M1 RECP|RECP and hugged.PL.M1
'They were kissing and hugging each other!' (Google)

While (194) and (195) could also be analysed as involving an implicit argument (an instance of pro-drop) in the second conjunct coreferent (via coindexation) with the appropriate argument (subject or object) in the first conjunct, this does not apply to (196). This is because *się* is analysed as a marker: it is not put on the list of arguments (the verbs in (196) only take a subject), so it cannot be analysed as an implicit argument.

As discussed in Patejuk & Przepiórkowski (2015), *się* has many functions in Polish: it can be a reflexive/reciprocal marker, an impersonal marker, or it can be "inherent" – a semantically contentless particle that is required lexically by certain predicates. In (196) the shared *się* has the same function (reciprocal) with respect to both predicates (KISS and HUG) – this is glossed as RECP|RECP where | separates functions. In (197) the shared marker has a different function in each conjunct – as shown in (198), the first conjunct requires inherent *się* (INH), while the second conjunct takes reflexive *się* (REFL):

(197) Polish
[[Śmiali się] i [pukali w głowy]].
laughed.PL.M1 INH|REFL and knocked.PL.M1 in heads
'They were laughing and asking if somebody is nuts.' (literally: 'They were laughing and knocking themselves on their heads.')

(198) Polish
[[Śmiali się] i [pukali się w głowy]].
laughed.PL.M1 INH and knocked.PL.M1 REFL in heads

On the basis of examples such as (197), Patejuk & Przepiórkowski (2015) argue that the SGF analysis would not be appropriate: not only because *się* is not an argument (it is analysed as a marker, so it is not on the list of arguments), but also because it is a weak, unstressed form (as opposed to the pronoun *siebie* 'self'), so it cannot bear discourse functions such as TOPIC or FOCUS. Also, while the SGF analysis involves distributing a designated grammatical function of the first

conjunct (the subject) over the entire coordination, Patejuk & Przepiórkowski (2015) show that structure sharing the f-structure contribution corresponding to *się* would not be appropriate in (197), because the first conjunct requires a different type of *się* than the second conjunct, as shown in (198).

In Patejuk & Przepiórkowski (2015), the word *się* introduces two kinds of constraints: (↑ SIE PRESENT) = +, a defining equation marking that this word is present in the f-structure, and a constraining equation ensuring that the type of *się* is specified elsewhere (by the verb, if it is required lexically, or constructionally for impersonal *się*). Verbs that lexically require *się* also introduce two constraints: a constraining equation requiring the presence of this marker, (↑ SIE PRESENT) $=_c$ +, and a defining equation specifying the type of *się*: (↑ SIE REFL) = + for reflexive *się* and (↑ SIE INH) = + for inherent *się*. If one were to adopt an SGF-like analysis by structure-sharing the SIE attribute of the first conjunct with the entire coordination, the result would be incorrect. This is because the SIE attribute contains the contribution of *się* as well as the verb in the first conjunct, so it would not yield an appropriate analysis of (197): the second verb would have multifunctional *się* (inherent and reflexive), instead of having inherent *się* in the first conjunct and reflexive *się* in the second conjunct. In principle, this problem with the SGF-like analysis could be worked around by using the constraint (↓ SIE PRESENT)=(↑ SIE PRESENT) instead of (↓ SIE)=(↑ SIE) when sharing *się*.

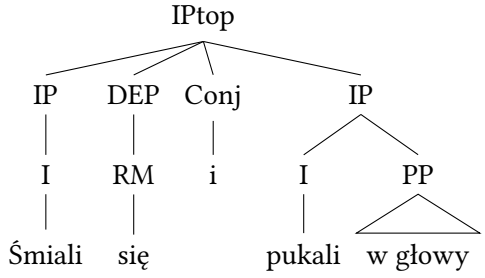
However, instead of an SGF-like analysis, Patejuk & Przepiórkowski (2015) propose an alternative solution by introducing a rule handling coordination with "intertwined" dependents, see (199), where such dependents (DEP) are placed in the c-structure at the same level as the conjuncts (IP) and the conjunction (Conj). This way, the f-structure contribution of DEP, possibly disjunctive or underspecified, can be resolved independently for each conjunct, making it possible to account for examples such as (197). The rules in (199)–(200) produce the structures in (201)–(202) corresponding to (197).[46]

(199) IPtop ⟶ IP DEP Conj IP
↓∈↑ ↓∈↑

(200) DEP ⟶ { ARG | MOD | RM }
(↑ GF)=↓ ↓ ∈ (↑ ADJUNCT)

[46]Additional constraints are used to structure-share the implicit subject (see also: (195)–(196)).

(201)



(202)

$$\left[\left\{\left(\left[\begin{array}{ll}\text{PRED} & \text{`LAUGH}\langle\boxed{1}\rangle\text{'}\\ \text{SUBJ} & \boxed{1}\left[\begin{array}{ll}\text{PRED} & \text{`PRO'}\\ \text{CASE} & \text{NOM}\\ \text{NUM} & \text{PL}\end{array}\right]\\ \text{SIE} & \left[\begin{array}{ll}\text{INH} & +\\ \text{PRESENT} & +\end{array}\right]\end{array}\right]\right),\left[\begin{array}{ll}\text{PRED} & \text{`KNOCK}\langle\boxed{1},\boxed{2}\rangle\text{'}\\ \text{SUBJ} & \boxed{1}\\ \text{OBL} & \boxed{2}\left[\begin{array}{ll}\text{PRED} & \text{`HEAD'}\\ \text{PFORM} & \text{W}\end{array}\right]\\ \text{SIE} & \left[\begin{array}{ll}\text{REFL} & +\\ \text{PRESENT} & +\end{array}\right]\end{array}\right]\right\}\\ \text{CONJ}\quad \text{AND}\end{array}\right]$$

(Patejuk & Przepiórkowski 2015: (64))

The defining equation (↑ SIE PRESENT) = + introduced by *się* is distributed across coordination in (201), together with the constraining equation requiring that the type of *się* is specified ((↑ SIE {REFL|RECP|INH}) $=_c$ +). The latter is resolved independently for each conjunct: the type of *się* is specified by the lexical entry of the verb; it is inherent (INH) in the first conjunct, while in the second it is reflexive (REFL), as shown in (202).

The analysis of Patejuk & Przepiórkowski (2015) could be used for German SGF: while the c-structure would be different, the corresponding f-structure would be the same.

Apart from the analysis of shared *się*, there is one more situation which clearly distinguishes between the effects of the analysis of Patejuk & Przepiórkowski (2015) and an SGF-like analysis: when a shared dependent displays case syncretism that is disambiguated by predicates requiring different values of case, as in the following example:

(203) Polish
[[Marysia lubi Janka]], a [Zosia nienawidzi]].
Marysia.NOM likes Janek.ACC/GEN and Zosia.NOM hates
'Marysia likes Janek, while Zosia hates him.'

In this example, the first verb (*lubi* 'likes') requires an accusative object (in the absence of sentential negation), while the second verb (*nienawidzi* 'hates') requires a genitive object – the form *Janka* is syncretic between accusative and

genitive, so it can be used as the object of both predicates, despite their different case requirements.

Except for word order, (203) is analogous to (204) (originally from Dyła (1984)):

(204) Polish
Kogo [[Janek lubi] a [Jerzy nienawidzi]]?
who.ACC/GEN Janek.NOM likes and Jerzy.NOM hates
'Who does Janek like and Jerzy hate?' (Dalrymple et al. 2009: (10))

Dalrymple et al. (2009) offer an analysis of (204) which involves a complex CASE attribute (instead of atomic values used so far for CASE), making it possible to account for case syncretism and feature indeterminacy. The lexical entry of the noun *kogo* (the same applies to *Janka* in (203)) contains a disjunctive specification of case: (↑ CASE {ACC|GEN}) = +, while lexical entries of verbs assign appropriate values of case to their object: (↑ OBJ CASE ACC) = + for *lubi* (when there is no sentential negation) and (↑ OBJ CASE GEN) = + for *nienawidzi*. Under such an analysis, the f-structure in (205) corresponds to (204).[47]

(205)
$$\begin{bmatrix} \left\{ \left(\begin{bmatrix} \text{PRED} & \text{`LIKE}\langle \boxed{1}, \boxed{2} \rangle\text{'} \\ \text{SUBJ} & \boxed{1}\begin{bmatrix} \text{PRED} & \text{`JANEK'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ} & \boxed{2}\begin{bmatrix} \text{PRED} & \text{`WHO'} \\ \text{CASE} & [\text{ACC} +] \end{bmatrix} \end{bmatrix}, \begin{bmatrix} \text{PRED} & \text{`HATE}\langle \boxed{3}, \boxed{4} \rangle\text{'} \\ \text{SUBJ} & \boxed{3}\begin{bmatrix} \text{PRED} & \text{`JERZY'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ} & \boxed{4}\begin{bmatrix} \text{PRED} & \text{`WHO'} \\ \text{CASE} & [\text{GEN} +] \end{bmatrix} \end{bmatrix} \right) \right\} \\ \text{CONJ} \quad \text{AND} \end{bmatrix}$$

Coming back to (203): under an SGF-like analysis the accusative object of the first conjunct is distributed over the entire coordination, so the object of the first conjunct would be marked for accusative case, while the object of the second conjunct would be marked for accusative and genitive case – this is undesired. By contrast, under the account of Patejuk & Przepiórkowski (2015) case is assigned independently in each conjunct (rather than being copied from the first conjunct), so the f-structure representation of (203) would be analogous to (205): the object of the first conjunct would only be marked for accusative case, while the object of the second conjunct would only bear genitive case.

5.3 Gapping

Gapping is a variety of clause-level coordination where certain elements of the first conjunct (the non-gapped conjunct, the conjunct without a gap) are shared

[47] In Dalrymple et al. (2009) NPs lexically specify impossible values of CASE as −. To save space, these attribute-value pairs are omitted in (205). For OBJ these are: NOM −, DAT −, INST −, LOC −, VOC −.

(marked with underline) with the second conjunct (the gapped conjunct, the conjunct with some gap(s)). Minimally the main verb is shared, as in (206), but some of its dependents may also be shared, as in (207) where the direct object (*an apple*) is also shared.

(206) [[Marge gave an apple to Lisa], and [Homer a donut to Bart]].
(Patejuk & Przepiórkowski 2017: (1))

(207) [[Marge gave an apple to Lisa], and [Homer to Bart]].
(Patejuk & Przepiórkowski 2017: (2))

5.3.1 Basics of the Patejuk & Przepiórkowski (2017) analysis

Patejuk & Przepiórkowski (2017) offer an LFG analysis of gapping which relies on two key features: the set-based representation of coordination and distribution. The material in the first conjunct (the verb and all its dependents) is split into two parts: shared and non-shared. The shared material is distributed over the coordination of non-shared material, namely the set which contains non-shared material from the first conjunct and the partial f-structure produced by dependents in the second conjunct.

The analysis relies on the rules shown in (208)–(211). (208) is the main coordination rule for gapping where IP1 is the non-gapped conjunct (defined in (209)),[48] while IP is the gapped conjunct (see (210)).[49] Each dependent (DEP, see its definition in (211)) of the non-gapped conjunct (IP1) may be shared or not. This is achieved using the annotation (↑ (LOCAL))=↓ on DEP in (209), which resolves to one of two possible annotations: ↑=↓ distributes the DEP over the entire coordination (so that it is shared by all conjuncts: non-gapped and gapped), while (↑ LOCAL)=↓ makes it belong to the non-gapped conjunct only (it is not distributed over coordination in gapping). Finally, each dependent (DEP, in IP1 and IP) is assigned appropriate f-structure annotation (including GF) in (211).

(208) IP ⟶ IP1 [, IP]* Conj IP
↑=↓ ↓∈↑ ↓∈↑
(↓ LOCAL) ∈ ↑

(209) IP1 ⟶ DEP*, I
(↑ (LOCAL)) = ↓

[48] IP1 may contain negation: sentential negation is a prefix in Polish (though it may be separated from the verb by whitespace), so it is part of I. However, negation in the gapped conjunct is not a prefix (there is no verb, it is gapped) and it comes as the last element – this is why (210) contains an extra NEG.

[49] The optional NEG (sentential negation) in (210) is required by Polish examples such as (226).

(210) IP ⟶ [DEP*, (I)] (NEG)

(211) DEP ≡ { NP | PP | InfP | … }
(↑ {SUBJ|OBJ}) = ↓ (↑ OBL) = ↓ (↑ XCOMP) = ↓

Together, these rules give rise to (212) as the f-structure corresponding to (206).

(212)
$$\begin{bmatrix} \left\{ \left(\boxed{0} \begin{bmatrix} \text{PRED} & \text{`GIVE}\langle \boxed{1},\boxed{2},\boxed{3} \rangle\text{'} \\ \text{SUBJ} & \boxed{1}\left[\text{PRED `MARGE'}\right] \\ \text{OBJ} & \boxed{2}\left[\text{PRED `APPLE'}\right] \\ \text{OBL} & \boxed{3}\left[\text{PRED `LISA'}\right] \end{bmatrix} \right), \begin{bmatrix} \text{PRED} & \text{`GIVE}\langle \boxed{4},\boxed{5},\boxed{6} \rangle\text{'} \\ \text{SUBJ} & \boxed{4}\left[\text{PRED `HOMER'}\right] \\ \text{OBJ} & \boxed{5}\left[\text{PRED `DONUT'}\right] \\ \text{OBL} & \boxed{6}\left[\text{PRED `BART'}\right] \end{bmatrix} \right\} \\ \text{CONJ} \quad \text{AND} \\ \text{LOCAL} \quad \boxed{0} \end{bmatrix}$$

(Patejuk & Przepiórkowski 2017: (19))

What follows is a procedural intuition of this analysis, showing how (212) is constructed.

(213) is the partial f-structure corresponding to the first (non-gapped) conjunct, constructed using the rules in (209) and (211). Using (211), each dependent of the first conjunct is assigned an appropriate GF, as shown in (214)–(216): *Marge* is the SUBJ(ect), *an apple* is the OBJ(ect), *to Lisa* is an OBL(ique). According to (209), the main verb is shared (by default, it has the co-head annotation: ↓=↑), while each of its dependents (DEP) may be shared or not. In (206) the annotation of all dependents resolves to (↑ LOCAL)=↓, so they are not shared. This results in the partial f-structure in (213) corresponding to IP1.

(213)
$$\begin{bmatrix} \text{PRED} & \text{`GIVE}\langle \text{SUBJ,OBJ,OBL} \rangle\text{'} \\ \text{LOCAL} & \boxed{0} \begin{bmatrix} \text{SUBJ} & \left[\text{PRED `MARGE'}\right] \\ \text{OBJ} & \left[\text{PRED `APPLE'}\right] \\ \text{OBL} & \left[\text{PRED `LISA'}\right] \end{bmatrix} \end{bmatrix}$$

(214) $\left[\text{SUBJ} \left[\text{PRED `MARGE'}\right]\right]$

(215) $\left[\text{OBJ} \left[\text{PRED `APPLE'}\right]\right]$

(216) $\left[\text{OBL} \left[\text{PRED `LISA'}\right]\right]$

(217) is the partial f-structure corresponding to the second (gapped) conjunct, constructed using the rules in (210) and (211). Using (211), each dependent (DEP) is assigned an appropriate GF, as shown in (218)–(220). According to (210), all dependents (DEP) of the gapped conjunct (IP) have the default co-head annotation, so their partial f-structures are unified, yielding (217) as the partial f-structure corresponding to IP (gapped conjunct).

(217) $\begin{bmatrix} \textsc{subj} & \left[\textsc{pred} \text{ `Homer'}\right] \\ \textsc{obj} & \left[\textsc{pred} \text{ `donut'}\right] \\ \textsc{obl} & \left[\textsc{pred} \text{ `Bart'}\right] \end{bmatrix}$

(218) $\left[\textsc{subj} \left[\textsc{pred} \text{ `Homer'}\right]\right]$

(219) $\left[\textsc{obj} \left[\textsc{pred} \text{ `donut'}\right]\right]$

(220) $\left[\textsc{obl} \left[\textsc{pred} \text{ `Bart'}\right]\right]$

The final step is to apply the gapping coordination rule in (208). While it does two things at the same time, this will be presented as two separate steps for the sake of exposition. The first effect of (208) is to produce (221) – the partial f-structure corresponding to the coordination of non-shared material from both conjuncts. As a result of the $(\downarrow \textsc{local}) \in \uparrow$ annotation on the non-gapped conjunct (IP1) in (208), the content of its LOCAL attribute is added to the set (see (213) for the f-structure of the non-gapped conjunct); the standard $\downarrow\in\uparrow$ annotation on the gapped conjunct (IP) adds its f-structure (see (217)) to the set.

(221) $\begin{bmatrix} \left\{ \left(\boxed{0} \begin{bmatrix} \textsc{subj} & \left[\textsc{pred} \text{ `Marge'}\right] \\ \textsc{obj} & \left[\textsc{pred} \text{ `apple'}\right] \\ \textsc{obl} & \left[\textsc{pred} \text{ `Lisa'}\right] \end{bmatrix}, \begin{bmatrix} \textsc{subj} & \left[\textsc{pred} \text{ `Homer'}\right] \\ \textsc{obj} & \left[\textsc{pred} \text{ `donut'}\right] \\ \textsc{obl} & \left[\textsc{pred} \text{ `Bart'}\right] \end{bmatrix} \right) \right\} \\ \textsc{conj} \quad \textsc{and} \end{bmatrix}$

The second effect of (208), resulting from the $\downarrow=\uparrow$ annotation on IP1, is to distribute the partial f-structure in (213), corresponding to the shared material from the first conjunct,[50] over the f-structure in (221) which corresponds to the coordination of non-shared material from both conjuncts. The result of this operation is (212): the final f-structure for (206).

5.3.2 Distribution under gapping: Interactions with other phenomena

Patejuk & Przepiórkowski (2017) discuss interactions between the proposed analysis of gapping, which relies on distribution, and other phenomena, including subject-verb agreement, case assignment and unlike category coordination.

Unlike in (206)–(207), where the verb form used in the first conjunct (*gave*) would also be appropriate in the second conjunct (if it was present), there are examples where different agreement features would be required in different conjuncts, as in (222) from Polish, see the corresponding f-structure in (223):

[50] Apart from the main predicate, this includes the LOCAL attribute – this is the desired result (Section 5.3.2).

(222) Polish
[[Lisa lubiła Nelsona], a [Nelson (lubił)
Lisa.NOM.F liked.F Nelson.ACC.M1 and Nelson.NOM.M1 liked.M1
Lisę]].
Lisa.ACC.F
'Lisa liked Nelson and Nelson (liked) Lisa.'
(Patejuk & Przepiórkowski 2017: (28))

(223)
$$\left[\begin{array}{l}\left\{\left(\boxed{0}\left[\begin{array}{ll}\text{PRED} & \text{`LIKE}\langle\boxed{1},\boxed{2}\rangle\text{'}\\ \text{SUBJ} & \boxed{1}\left[\begin{array}{ll}\text{PRED} & \text{`LISA'}\\ \text{CASE} & \text{NOM}\\ \text{GEND} & \text{F}\end{array}\right]\\ \text{OBJ} & \boxed{2}\left[\begin{array}{ll}\text{PRED} & \text{`NELSON'}\\ \text{CASE} & \text{ACC}\\ \text{GEND} & \text{M1}\end{array}\right]\end{array}\right],\left[\begin{array}{ll}\text{PRED} & \text{`LIKE}\langle\boxed{3},\boxed{4}\rangle\text{'}\\ \text{SUBJ} & \boxed{3}\left[\begin{array}{ll}\text{PRED} & \text{`NELSON'}\\ \text{CASE} & \text{NOM}\\ \text{GEND} & \text{M1}\end{array}\right]\\ \text{OBJ} & \boxed{4}\left[\begin{array}{ll}\text{PRED} & \text{`LISA'}\\ \text{CASE} & \text{ACC}\\ \text{GEND} & \text{F}\end{array}\right]\end{array}\right]\right)\right\}\\ \text{CONJ}\quad \text{AND}\\ \text{LOCAL}\quad \boxed{0}\end{array}\right]$$
(Patejuk & Przepiórkowski 2017: (29))

The key feature of the analysis presented above is that it distributes the verb from first conjunct over the entire coordination – as a result, all constraints imposed by the verb are distributed. Assuming a standard account of S-V agreement, where it is handled in the lexical entries of verbs (requiring the subject to satisfy certain agreement constraints, as in (224) where the subject must be singular and feminine), such requirements are distributed to each conjunct, so the subject of each conjunct must satisfy these requirements.

(224) $(\uparrow \text{SUBJ NUM}) =_c \text{SG} \wedge (\uparrow \text{SUBJ GEND}) =_c \text{F}$

This is problematic in (222), where the verb *lubiła* 'liked' in the first conjunct requires a singular feminine subject. While *lubiła* is compatible with *Lisa* in the first conjunct, it is not appropriate for *Nelson* in the second (gapped) conjunct. Though *Nelson* is singular, it is masculine – so it would be compatible with the masculine verb form *lubił*.

Patejuk & Przepiórkowski (2017) offer a solution, presenting it as conceptually similar to single conjunct agreement (see Section 1.4), where, instead of agreeing with the entire subject, the verb may agree with a designated conjunct as the agreement target. The proposed solution accounts for potential mismatches in S-V agreement between the first conjunct (without a gap) and the gapped conjunct using the LOCAL attribute, which contains the non-shared material from the first conjunct. (225) below is a modified version of (224).

(225) $[\%\text{S} = (\uparrow \text{SUBJ}) \vee \%\text{S} = (\uparrow \text{LOCAL SUBJ})] \wedge$
$[(\%\text{S NUM}) =_c \text{SG} \wedge (\%\text{S GEND}) =_c \text{F}]$

While (224) uniformly requires the subject to be singular and feminine, (225) has a disjunctive specification of the agreement target (%S). The constraint in (225) is distributed to all conjuncts, where it is resolved independently. When %S resolves to (↑ SUBJ), (225) has the same effect as (224), requiring the subject of the given conjunct to satisfy these constraints – it is not satisfied in the second conjunct of (222). However, when %S resolves to (↑ LOCAL SUBJ) in the second conjunct, the relevant agreement requirements are trivially satisfied, because they are checked against the SUBJ inside the LOCAL attribute (see the f-structure in (223)) – instead of the SUBJ attribute of the given conjunct.

The fact that constraints imposed by the verb are distributed to all conjuncts and resolved independently in each conjunct makes it possible to account for independent case assignment in gapping. Consider (226) with the corresponding f-structure in (227).

(226) Polish
[[Lisa lubiła Nelsona], a [Nelson Lisy nie]].
Lisa.NOM.F liked.F Nelson.ACC.M1 but Nelson.NOM.M1 Lisa.GEN.F NEG
'Lisa liked Nelson, but Nelson didn't like Lisa.'
(Patejuk & Przepiórkowski 2017: (34))

(227)
$$\left[\begin{array}{l}\left\{\left(\boxed{0}\left[\begin{array}{ll}\text{PRED} & \text{'LIKE}\langle\boxed{1},\boxed{2}\rangle\text{'}\\ \text{SUBJ} & \boxed{1}\left[\begin{array}{ll}\text{PRED} & \text{'LISA'}\\ \text{CASE} & \text{NOM}\\ \text{GEND} & \text{F}\end{array}\right]\\ \text{OBJ} & \boxed{2}\left[\begin{array}{ll}\text{PRED} & \text{'NELSON'}\\ \text{CASE} & \text{ACC}\\ \text{GEND} & \text{M1}\end{array}\right]\end{array}\right]\right),\left[\begin{array}{ll}\text{PRED} & \text{'LIKE}\langle\boxed{3},\boxed{4}\rangle\text{'}\\ \text{SUBJ} & \boxed{3}\left[\begin{array}{ll}\text{PRED} & \text{'NELSON'}\\ \text{CASE} & \text{NOM}\\ \text{GEND} & \text{M1}\end{array}\right]\\ \text{OBJ} & \boxed{4}\left[\begin{array}{ll}\text{PRED} & \text{'LISA'}\\ \text{CASE} & \text{GEN}\\ \text{GEND} & \text{F}\end{array}\right]\\ \text{NEG} & +\end{array}\right]\right\}\\ \text{CONJ}\quad \text{AND}\\ \text{LOCAL}\quad \boxed{0}\end{array}\right]$$
(Patejuk & Przepiórkowski 2017: (35))

As mentioned earlier (see Section 3.5.1), simplifying, in Polish objects marked for structural case are required to bear accusative case in the absence of sentential negation, while genitive case is required if negation is present. In (226) the object of the first conjunct is accusative due to the lack of negation, while the object of the gapped conjunct is genitive because negation is present there. The relevant

disjunctive case constraint is evaluated independently in each conjunct, leading to the f-structure representation in (227).

There is another interesting consequence of the fact that disjunctive constraints imposed by the verb are distributed across coordination under gapping. If a given verb allows for coordination of different categories – for instance, its object may correspond to an NP or a CP, as in (228) – then the object of the first conjunct may be an NP, while the object of the gapped conjunct may be a CP, as in (229), whose f-structure is given in (230).

(228) Polish
Lisa chciała [[książkę] i [żeby ktoś ją
Lisa.NOM wanted book.ACC and that somebody.NOM she.ACC
przytulił]].
hug
'Lisa wanted a book and that somebody hug her.'
(Patejuk & Przepiórkowski 2017: (38))

(229) Polish
[[Lisa <u>chciała</u> książkę], a [Maggie żeby ktoś
Lisa.NOM wanted book.ACC and Maggie.NOM that somebody.NOM
ją przytulił]].
she.ACC hug
'Lisa wanted a book and Maggie wanted that somebody hug her.'
(Patejuk & Przepiórkowski 2017: (39))

(230)
$$\left[\begin{array}{l}\left\{\left(\begin{array}{l}\boxed{0}\left[\begin{array}{ll}\textsc{pred} & \text{`want}\langle\boxed{1},\boxed{2}\rangle\text{'}\\ \textsc{subj} & \boxed{1}\left[\begin{array}{ll}\textsc{pred} & \text{`Lisa'}\\ \textsc{case} & \textsc{nom}\end{array}\right]\\ \textsc{obj} & \boxed{2}\left[\begin{array}{ll}\textsc{pred} & \text{`book'}\\ \textsc{case} & \textsc{acc}\end{array}\right]\end{array}\right],\\ \left[\begin{array}{ll}\textsc{pred} & \text{`want}\langle\boxed{3},\boxed{4}\rangle\text{'}\\ \textsc{subj} & \boxed{3}\left[\begin{array}{ll}\textsc{pred} & \text{`Maggie'}\\ \textsc{case} & \textsc{nom}\end{array}\right]\\ \textsc{obj} & \boxed{4}\left[\begin{array}{ll}\textsc{pred} & \text{`hug}\langle\boxed{5},\boxed{6}\rangle\text{'}\\ \textsc{subj} & \boxed{5}\left[\begin{array}{ll}\textsc{pred} & \text{`sb'}\\ \textsc{case} & \textsc{nom}\end{array}\right]\\ \textsc{obj} & \boxed{6}\left[\begin{array}{ll}\textsc{pred} & \text{`she'}\\ \textsc{case} & \textsc{acc}\end{array}\right]\\ \textsc{comp-form} & \textsc{that}\end{array}\right]\end{array}\right]\end{array}\right)\right\}\\ \textsc{conj} \quad \textsc{and}\\ \textsc{local} \quad \boxed{0}\end{array}\right]$$
(Patejuk & Przepiórkowski 2017: (41))

6 Conclusion

On the basis of various phenomena, this chapter discussed the possibilities created by the two key concepts related to coordination in LFG: the set-based representation (conjuncts are elements of a set) and distribution whose effects are important at two levels (attributes vs. properties). The distinction between distributive and non-distributive attributes is crucial not only for phenomena related to agreement (including feature resolution), it also makes it possible to share parts of f-structure (enabling dependent sharing). This chapter also discussed distribution at the level of properties (complex statements), showing that it is necessary to account for disjunctive subcategorisation constraints in coordination, which include not only category, but also features such as CASE, preposition/complementiser form, etc.

Apart from run-of-the-mill coordination, this chapter presented a range of more challenging coordination phenomena, including non-constituent coordination (NCC), coordination of unlike categories, coordination of different grammatical functions (showing the difference between monoclausal and multiclausal representation) and phenomena associated with ellipsis such as German SGF, sharing intertwined dependents and gapping. Selected interactions between these phenomena have also been discussed.

Despite its considerable size, this chapter could only discuss a selection of topics related to coordination. Feature resolution was only mentioned very briefly, on the assumption that it is more closely related to agreement than coordination. A key issue which has not been touched upon here is the semantics of coordination. Dalrymple et al. (2019: Chapter 16) is an excellent chapter devoted to coordination in LFG (with a different selection of phenomena, providing rich references) which extensively covers these two topics. It is remarkable in that it includes semantics as its key component, together with a formalisation in Glue.

Abbreviations

Besides the abbreviations from the Leipzig Glossing Conventions, this chapter uses the following abbreviations.

M1	human masculine (virile) gender
M3	inanimate masculine gender
PRT	particle
INH	inherent

Acknowledgements

I am very grateful to three anonymous reviewers, Mary Dalrymple and Adam Przepiórkowski for valuable feedback that led to many improvements in earlier versions of this chapter.

References

Alsina, Alex. 1996. *The role of argument structure in grammar: Evidence from Romance* (CSLI Lecture Notes). Stanford: CSLI Publications.

Alsina, Alex, K. P. Mohanan & Tara Mohanan. 2005. How to get rid of the COMP. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '05 conference*, 21–41. Stanford: CSLI Publications.

Asudeh, Ash. 2011. Resumptive Pronouns at the Interfaces. In Alain Rouveret (ed.), *Towards a unified theory of resumption*, 121–188. John Benjamins.

Bayer, Samuel. 1996. The coordination of unlike categories. *Language* 72(3). 579–616. DOI: 10.2307/416279.

Belyaev, Oleg. 2023. Grammatical functions in LFG. In Mary Dalrymple (ed.), *Handbook of Lexical Functional Grammar*, 97–161. Berlin: Language Science Press. DOI: 10.5281/zenodo.10185938.

Bîlbîie, Gabriela & Anna Gazdik. 2012. Wh-coordination in Hungarian and Romanian multiple questions. *Empirical Issues in Syntax and Semantics 9*. 19–36. http://www.cssp.cnrs.fr/eiss9/.

Blevins, James P. 1994. Phrasal coordination. Unpublished manuscript, University of Western Australia.

Börjars, Kersti & Nigel Vincent. 2008. Objects and OBJ. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '08 conference*, 150–168. Stanford: CSLI Publications.

Bresnan, Joan. 1982. The passive in lexical theory. In Joan Bresnan (ed.), *The mental representation of grammatical relations*, 3–86. Cambridge, MA: The MIT Press.

Bresnan, Joan. 2001. *Lexical-Functional Syntax*. Oxford: Blackwell.

Bresnan, Joan, Ash Asudeh, Ida Toivonen & Stephen Wechsler. 2016. *Lexical-Functional Syntax*. 2nd edn. (Blackwell Textbooks in Linguistics 16). Malden, MA: Wiley-Blackwell.

Bruening, Benjamin & Eman Al Khalaf. 2020. Category mismatches in coordination revisited. *Linguistic Inquiry* 51(1). 1–36. DOI: 10.1162/ling_a_00336.

Chaves, Rui P. & Denis Paperno. 2007. On the Russian hybrid coordination construction. In Stefan Müller (ed.), *Proceedings of the 14th international conference on Head-Driven Phrase Structure Grammar*, 46–64. Stanford: CSLI Publications. DOI: 10.21248/hpsg.2007.3.

Chomsky, Noam. 1957. *Syntactic structures*. The Hague: Mouton. DOI: 10.1515/9783110218329.

Crouch, Richard, Mary Dalrymple, Ronald M. Kaplan, Tracy Holloway King, John T. III Maxwell & Paula S. Newman. 2011. *XLE Documentation*. Xerox Palo Alto Research Center. Palo Alto, CA. https://ling.sprachwiss.uni-konstanz.de/pages/xle/doc/xle_toc.html.

Dalrymple, Mary. 2017. Unlike phrase structure category coordination. In Victoria Rosén & Koenraad De Smedt (eds.), *The very model of a modern linguist – In honor of Helge Dyvik*, vol. 8, 33–55. Bergen: Bergen Language & Linguistics Studies (BeLLS). DOI: 10.15845/bells.v8i1.1332.

Dalrymple, Mary, Helge Dyvik & Tracy Holloway King. 2004. Copular complements: Closed or open? In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '04 conference*, 188–198. Stanford: CSLI Publications. http://csli-publications.stanford.edu/LFG/9/pdfs/lfg04ddk.pdf.

Dalrymple, Mary, Ronald M. Kaplan, John T. III Maxwell & Annie Zaenen (eds.). 1995. *Formal issues in Lexical-Functional Grammar*. Stanford: CSLI Publications.

Dalrymple, Mary, Tracy Holloway King & Louisa Sadler. 2009. Indeterminacy by underspecification. *Journal of Linguistics* 45. 31–68. DOI: 10.1017/s0022226708005513.

Dalrymple, Mary & Helge Lødrup. 2000. The grammatical functions of complement clauses. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '00 conference*, 104–121. Stanford: CSLI Publications.

Dalrymple, Mary, John J. Lowe & Louise Mycock. 2019. *The Oxford reference guide to Lexical Functional Grammar*. Oxford: Oxford University Press. DOI: 10.1093/oso/9780198733300.001.0001.

Dyła, Stefan. 1984. Across-the-board dependencies and case in Polish. *Linguistic Inquiry* 15(4). 701–705.

Frank, Anette. 2002. A (discourse) functional analysis of asymmetric coordination. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '02 conference*, 174–196. Stanford: CSLI Publications.

Haug, Dag. 2023. Agreement. In Mary Dalrymple (ed.), *Handbook of Lexical Functional Grammar*, 193–218. Berlin: Language Science Press. DOI: 10.5281/zenodo.10185942.

Kallas, Krystyna. 1993. *Składnia współczesnych polskich konstrukcji współrzędnych*. Toruń: Wydawnictwo Uniwersytetu Mikołaja Kopernika.

Kaplan, Ronald M. 2017. Preserving grammatical functions in LFG. In Victoria Rosén & Koenraad De Smedt (eds.), *The very model of a modern linguist – In honor of Helge Dyvik*, 127–142. Bergen: Bergen Language & Linguistics Studies (BeLLS). DOI: 10.15845/bells.v8i1.1342.

Kaplan, Ronald M. & Joan Bresnan. 1982. Lexical-Functional Grammar: A formal system for grammatical representation. In Joan Bresnan (ed.), *The mental representation of grammatical relations*, 173–281. Cambridge, MA: The MIT Press. Reprinted in Dalrymple, Kaplan, Maxwell & Zaenen (1995: 29–130).

Kaplan, Ronald M. & John T. III Maxwell. 1988. Constituent coordination in Lexical-Functional Grammar. In *COLING '88: Proceedings of the 12th Conference on Computational Linguistics*, 303–305. Budapest. DOI: 10.3115/991635.991696. Reprinted in Dalrymple, Kaplan, Maxwell & Zaenen (1995: 199–210).

Kaplan, Ronald M. & John T. III Maxwell. 1996. *LFG Grammar Writer's Workbench*. Xerox Palo Alto Research Center. Palo Alto, CA. https://www.researchgate.net/profile/John_Maxwell5/publication/2760068_Grammar_Writer's_Workbench/links/0c96052405e97928e9000000.pdf.

Maxwell, John T. III & Christopher D. Manning. 1996. A theory of non-constituent coordination based on finite-state rules. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '96 conference*. Stanford: CSLI Publications. http://cslipublications.stanford.edu/LFG/1/MaxwellManning.ps.

Mel'čuk, Igor A. 1988. *Dependency syntax: Theory and practice*. Albany, NY: State University of New York Press.

Patejuk, Agnieszka. 2015. *Unlike coordination in Polish: An LFG account*. Cracow: Institute of Polish Language, Polish Academy of Sciences. (Doctoral dissertation). http://nlp.ipipan.waw.pl/Bib/pat:15.pdf.

Patejuk, Agnieszka & Adam Przepiórkowski. 2012a. A comprehensive analysis of constituent coordination for grammar engineering. In *COLING 12: The 24th International Conference on Computational Linguistics*, 2191–2207. Mumbai, India: The COLING 2012 Organizing Committee. http://aclweb.org/anthology/C/C12/C12-1134.pdf.

Patejuk, Agnieszka & Adam Przepiórkowski. 2012b. Lexico-semantic coordination in Polish. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '12 conference*, 461–478. Stanford: CSLI Publications.

Patejuk, Agnieszka & Adam Przepiórkowski. 2014a. Control into selected conjuncts. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '14 conference*, 448–460. Stanford: CSLI Publications.

Patejuk, Agnieszka & Adam Przepiórkowski. 2014b. In favour of the raising analysis of passivisation. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '14 conference*, 461–481. Stanford: CSLI Publications.

Patejuk, Agnieszka & Adam Przepiórkowski. 2015. An LFG analysis of the so-called reflexive marker in Polish. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '15 conference*, 270–288. Stanford: CSLI Publications.

Patejuk, Agnieszka & Adam Przepiórkowski. 2016. Reducing grammatical functions in LFG. In Doug Arnold, Miriam Butt, Berthold Crysmann, Tracy Holloway King & Stefan Müller (eds.), *Proceedings of the joint 2016 conference on Head-Driven Phrase Structure Grammar and Lexical Functional Grammar*, 541–559. Stanford: CSLI Publications.

Patejuk, Agnieszka & Adam Przepiórkowski. 2017. Filling the gap. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '17 conference*, 327–347. Stanford: CSLI Publications.

Patejuk, Agnieszka & Adam Przepiórkowski. 2019. Coordination of unlike grammatical functions. In Kim Gerdes & Sylvain Kahane (eds.), *Proceedings of the fifth international conference on Dependency Linguistics (DepLing, SyntaxFest 2019)*, 26–37. Association for Computational Linguistics. DOI: 10.18653/v1/w19-7705.

Patejuk, Agnieszka & Adam Przepiórkowski. 2023. Category mismatches in coordination vindicated. *Linguistic Inquiry* 54(2). 326–349. DOI: 10.1162/ling_a_00438.

Peterson, Peter G. 1981. Problems with constraints on coordination. *Linguistic Analysis* 8. 449–460.

Peterson, Peter G. 2004. Coordination: Consequences of a Lexical-Functional account. *Natural Language & Linguistic Theory* 22(4). 643–679. DOI: 10.1023/b:nala.0000027673.49915.2b.

Przepiórkowski, Adam. 2022. A compositional intersective account of heterofunctional coordination. In John R. Starr, Juhyae Kim & Burak Öney (eds.), *Proceedings of Semantics and Linguistic Theory 32*, 270–293. DOI: 10.3765/salt.v1i0.5333.

Przepiórkowski, Adam, Mirosław Bańko, Rafał L. Górski & Barbara Lewandowska-Tomaszczyk (eds.). 2012. *Narodowy Korpus Języka Polskiego*. Warsaw: Wydawnictwo Naukowe PWN.

Przepiórkowski, Adam, Mirosław Bańko, Rafał L. Górski, Barbara Lewandowska-Tomaszczyk, Marek Łaziński & Piotr Pęzik. 2011. National Corpus of Polish. In Zygmunt Vetulani (ed.), *Proceedings of the 5th language & technology conference: human language technologies as a challenge for computer science and*

linguistics, 259–263. Poznań, Poland. http://nlp.ipipan.waw.pl/Bib/prz:etal:11a.pdf.

Przepiórkowski, Adam & Agnieszka Patejuk. 2012. On case assignment and the coordination of unlikes: The limits of distributive features. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG '12 conference*, 479–489. Stanford: CSLI Publications.

Przepiórkowski, Adam & Agnieszka Patejuk. 2021. Coordinate structures without syntactic categories. In I Wayan Arka, Ash Asudeh & Tracy Holloway King (eds.), *Modular design of grammar: Linguistics on the edge*, 205–220. Oxford: Oxford University Press. DOI: 10.1093/oso/9780192844842.003.0013.

Sag, Ivan A., Gerald Gazdar, Thomas Wasow & Steven Weisler. 1985. Coordination and how to distinguish categories. *Natural Language & Linguistic Theory* 3(2). 117–171. DOI: 10.1007/bf00133839.

Sannikov, Vladimir Z. 1979. Sočinitel'nye i sravnitel'nye konstrukcii: ix blizost', ix sintaksičeskoe predstavlenie I. *Wiener Slawistischer Almanach* 4. 413–432. https://periodika.digitale-sammlungen.de/wsa/Blatt_bsb00000470,00413.html.

Sannikov, Vladimir Z. 1980. Sočinitel'nye i sravnitel'nye konstrukcii: ix blizost', ix sintaksičeskoe predstavlenie II. *Wiener Slawistischer Almanach* 5. 211–242. https://periodika.digitale-sammlungen.de/wsa/Blatt_bsb00000473,00221.html.

Williams, Edwin. 1981. Transformationless grammar. *Linguistic Inquiry* 12(4). 645–653.

Wunderlich, Dieter. 1988. Some problems of coordination in German. In Uwe Reyle & Christian Rohrer (eds.), *Natural language parsing and linguistic theories* (Studies in Linguistics and Philosophy 35), 289–316. Dordrecht: Reidel. DOI: 10.1007/978-94-009-1337-0_11.