LOCALITY CONSTRAINTS IN DISTANCE DISTRIBUTIVITY: A PROPOSITIONAL GLUE APPROACH

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Proceedings of the LFG14 Conference

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2014

CSLI Publications

http://csli-publications.stanford.edu/

Abstract

The aim of this paper is to provide a preliminary characterisation of locality constraints on distance distributivity in Polish. The generalisations are encoded using the propositional variant of glue and demonstrate its usefulness. An extension to distribution over events is sketched.

1 Introduction

While this paper has the ambition to be self-contained, it is preceded by a long series of papers on distance distributivity (DD) in Polish. Of these, Przepiórkowski and Patejuk 2013 presents an LFG analysis of the (morpho)syntax of Polish DD, while Przepiórkowski 2014b discusses problems with the analysis in Zimmermann 2002, the most comprehensive account of the syntax and semantics of the kind of DD that is observed in German and Slavic languages, and presents the general idea of a new semantic account couched in the "new glue" variant of Glue Semantics (Dalrymple et al. 1999, Dalrymple 2001). The technical details of this analysis – formalised in the first order variant of Glue Semantics (Kokkonidis 2008) and compatible with the (morpho)syntactic analysis of Przepiórkowski and Patejuk 2013 – are provided in Przepiórkowski 2014a.

The contribution of the current paper is empirical, theoretical and technical. On the empirical side, we attempt to provide a description of locality constraints on Polish DD. On the theoretical side, we extend the analysis of Przepiórkowski 2014a to include these empirical generalisations and sketch a further extension towards distribution over events (apart from objects). Finally, on the technical side, we replace the first order glue analysis of Przepiórkowski 2014a with an essentially propositional glue analysis, in the spirit of Lev 2007 and Andrews 2010.

2 Distance Distributivity

Distance distributivity[1] is a phenomenon where a distributive element such as *each* occurs at some structural distance from the phrase that restricts it and forms a constituent with some other noun phrase. For example, in *The boys have two apples each*, the distributive element *each* occurs within the object position, while its restriction, *the boys*, is the subject of the sentence. This should be contrasted with the determiner uses of *each*, as in *Each boy has two apples*, where *each* combines directly with its restriction, as other ad-nominal quantifiers do.

There are various terminological conventions in the literature, e.g., Choe 1987 calls such uses of *each* "anti-quantifiers", and Safir and Stowell 1988 call them

[†]Many thanks are due to the two reviewers, to the members of the glue discussion group at Oxford and to the audience of the LFG 2014 conference for comments that have led to various improvements. The work reported here was partially financed by the projects NEKST (`http://nekst.ipipan.waw.pl/`) and CLARIN-PL (`http://www.clarin-pl.eu/en/`).

[1]This section draws from the Introduction to Przepiórkowski 2014b.

"binominal". Both terms are suboptimal: much subsequent literature attempts to describe such distributive elements (DEs) as more-or-less ordinary quantifiers (not as special "anti-quantifiers") and it is clear now that DEs in other languages, including German and Polish, do not need two nominal expressions (*the boys* and *two apples* above) but – as shown by Moltmann 1991, 1997 – may quantify over events expressed by verbal constituents (hence, they are not "binominal"). In this paper we adopt the terminology of Zimmermann 2002, who introduced the term "distance distributivity" (DD), and call the nominal phrase DE attaches to (*two apples* above) "distributive share" (DS), and the phrase expressing the set of entities which restrict DE (*the boys* above) – "distributive key" (DK):[2]

(1) DD: *The boys* *have* *two apples* *each*.
DK DS DE

To the best of our knowledge, Zimmermann 2002 remains the only comprehensive syntactico-semantic analysis of DD of the kind observed in German and Polish. Przepiórkowski 2014b introduces a DD construction similar to inverse linking discussed, e.g., in May 1985: 68ff. and Heim and Kratzer 1998: §8.6, extensively argues that it cannot be accounted within the framework of Zimmermann 2002, and points out other problems with that analysis. An alternative first order glue analysis for Polish, though dealing only with a subset of kinds of data considered in Zimmermann 2002, is presented in Przepiórkowski 2014a. In the following section, we provide a description of locality constraints on Polish DD which motivate further restrictions to that glue analysis.

3 Constraints on DD in Polish

3.1 Permissible Grammatical Functions

A typical example of DD in Polish is given below:[3]

(2) Wagony mieszczą po 40 osób.
carriages.NOM hold DISTR 40 people
'Carriages seat 40 people each.'

Here, the distributive key (DK), *wagony*, occupies the subject position and the *po*-phrase with the distributive share (DS), *40 osób*, is found in the object position. The opposite, while perhaps less frequent, is also possible:

(3) Po 16 zawodników reprezentuje włoską Serię A i angielską
DISTR 16 players represent Italian.ACC series.ACC A and English.ACC
Premiership.
Premiership.ACC

[2] In Polish examples we follow Leipzig Glossing Rules, i.e., we mark the Polish DE *po* as DISTR.

[3] Unless explicitly indicated otherwise, examples are taken from the National Corpus of Polish (NKJP; `http://nkjp.pl`; Przepiórkowski et al. 2012, 2011), but they are often shortened or simplified in other ways.

'The Italian Series A and the English Premiership are represented by 16 players each.'

While a natural English translation of (3) is in the passive, note that the Polish sentence is in the active voice and the *po*-phrase is the subject. In general, DD is in various respects freer in Polish than in English, so free translations may be misleading and the reader is encouraged to pay attention to word-by-word glosses.

In these and further examples, we do not provide information about the case of the nominal phrase following *po*. As discussed at length in Przepiórkowski and Patejuk 2013, there are a number of homophonous and homonymous elements *po*, some assigning case and other transmitting case from outside, so such case information might be confusing to readers not familiar with the morphosyntax of *po*. We abstract away from such complications here and treat these morphosyntactically diverse elements as if they were a single preposition – this is in fact the traditional view (Łojasiewicz 1979, Franks 1995).

The configurations $\langle \textsc{subj}_{\textsc{dk}}, \textsc{obj}_{\textsc{ds}} \rangle$ and $\langle \textsc{obj}_{\textsc{dk}}, \textsc{subj}_{\textsc{ds}} \rangle$ illustrated in (2) and (3) do not exhaust the possibilities – apparently, the DK and the *po*-phrase containing the DS may occupy any grammatical functions, including ADJUNCT. The following examples illustrate some of these possibilities: $\langle \textsc{subj}_{\textsc{dk}}, \textsc{adj}_{\textsc{ds}} \rangle$ in (4), $\langle \textsc{obj-th}_{\textsc{dk}}, \textsc{obj}_{\textsc{ds}} \rangle$ in (5), $\langle \textsc{obl}_{\textsc{dk}}, \textsc{obj}_{\textsc{ds}} \rangle$ in (6), $\langle \textsc{adj}_{\textsc{dk}}, \textsc{obj}_{\textsc{ds}} \rangle$ in (7), $\langle \textsc{obj}_{\textsc{dk}}, \textsc{obj-th}_{\textsc{ds}} \rangle$ in (8), and $\langle \textsc{adj}_{\textsc{dk}}, \textsc{adj}_{\textsc{ds}} \rangle$ in (9).

(4) Wiele dzieci przebywa w placówce po kilka lat.
many children stay in unit DISTR several years
'Many children are staying in the unit a few years each.'

(5) W Centrali Banku wypłacono im po 1150 złotych gotówką.
in headquarters bank.GEN pay.IMPS they.DAT DISTR 1150 zloties cash.INST
'In the Bank Headquarters, they withdrew 1150 PLN in cash each.'

(6) Weźmy tylko po kilkadziesiąt metrów z dwóch ulic.
take.IMPF.1.PL only DISTR a few tens meters.GEN from two streets
'Let us only take several dozen meters from each of the two streets.'

(7) Ma po dwa pistolety z każdej strony.
have.3.SG DISTR two guns from each side
'He has two guns on each side.'

(8) Trzy pierwsze miejsca przyznano po dwóm grupom wieńcowym.
three first positions assigned.IMPS DISTR two group.PL wreath.PL
'The first three positions were assigned to two wreath groups each.' (Google)

(9) Ćwiczę pięć razy w tygodniu po 45 minut.
exercise.1.PRES five times in week DISTR 45 minutes
'I exercise for 45 minutes five times a week.'

In all the above examples the DK and the *po*-phrase containing the DS are co-dependents of the same verb, or nearly so: in (6) and (7) the DK is introduced by a preposition; this possibility is also illustrated by the following example, where the DS occurs in the subject position:

(10) Po 7 goli padło w Poroninie, Mszanie Dolnej i Klikuszowej.
DISTR 7 goals scored in Poronin, Mszana Dolna and Klikuszowa
'7 goals each were scored in Poronin, Mszana Dolna and Klikuszowa (place names; AP).'

However, DK and DS do not have to be co-dependents of the same predicate; they are not in the following examples, in which DKs are embedded within arguments of the verb:

(11) Zaledwie po kilka szkół planuje dodatkowe sprawdziany dla
only DISTR several schools plan additional tests for
kandydatów na socjologię, informatykę i nauki ekonomiczne.
candidates for sociology, informatics and sciences economic
'Only a few schools are planning additional tests for candidates for each of sociology, computer science and economics.'

(12) Po kilku chętnych zgłosiło zainteresowanie mieszkaniami
DISTR several interested ones expressed interest flats
jednopokojowymi i dwupokojowymi.
single-bedroom and two-bedroom
'A few people expressed interest in single-bedroom and in double-bedroom flats each.'

In particular, the coordinated DK *socjologię, informatykę i nauki ekonomiczne* 'sociology, computer science and economics' in (11) is relatively deeply embedded within the object headed by *sprawdziany* 'tests' – it occurs within the prepositional phrase dependent of *kandydatów* 'candidates', itself a dependent of *sprawdziany*.

The facts so far are still consistent with weaker generalisations, namely, 1) that DS and DK must belong to the same clause and 2) that the *po*-phrase must f-command DK. We will investigate these possible generalisations in the following subsections.

3.2 Same Clause

Starting with the former constraint, let us consider the following examples constructed on the basis of (12):

(13) a. Po pięć osób mówiło o zainteresowaniu każdym z tych
DISTR five people talked about interest.GER each of these
mieszkań.
flats
'Five people talked about their interest in each of these flats.'

b. *Po pięć osób mówiło, że są zainteresowane każdym z tych
DISTR five people talked that are.FIN interested.PAS each of these
mieszkań.
flats

c. *Po pięć osób mówiło, żeby się zainteresować każdym z tych
DISTR five people talked that REFL interest.INF each of these
mieszkań.
flats

d. Po pięć osób mówiło, że są zainteresowane mieszkaniami.
DISTR five people talked that are.FIN interested.PAS flats
'Five people talked each about their interest these flats.'

The minimal difference (13a–b) shows that the path between the *po*-phrase and the DK cannot cross a clausal boundary. Example (13c) shows that it is not finiteness that is the blocking factor, but rather the closed status of the clause (or COMP, in standard LFG terms). In this context, the acceptability of (13d) is at first surprising, but the difference of the intuitive meaning between (13b) and (13d) helps explain this apparent inconsistency. In (13a–c), the DK involves a form of the quantifier KAŻDY 'each', which enforces the binominal distributive interpretation – the DS *pięć osób* 'five people' within the *po*-phrase must be related to the nominal DK, and the (intended) meaning in each case is *For each of these flats, there are 5 people...* In contrast, the intuitive meaning of (13d) involves instead the collective understanding of *mieszkaniami* 'flats' and distribution over events expressed by the higher verb: *For each event of speaking of interest in (these) flats, 5 people were the agent of this event*. Hence, in (13d) the verbal DK is local with respect to the DS.

The above facts are still consistent with a number of understandings of the "same clause" requirement. We have already alluded to one: the dependency cannot cross the closed clause (COMP) boundary. Another is that both DS and DK are directly involved in the same event, i.e., in terms of LFG, that their f-structures are contained in exactly the same event-expressing f-structures. Example (13a) may be providing some evidence against this latter understanding of the "same clause" requirement: it involves the gerundial form *zainteresowaniu* 'interest', presumably expressing an event, and while the DK seems to be an argument of this event, the DS presumably only belongs to the domain of the higher event, expressed by *mówiło* 'talked'. In case of this example, all of these assumptions may be questioned – the apparently gerundial form may be analysed as a noun or the DS may be claimed to functionally control its subject, hence, occurring in its event domain – so let us construct a more convincing example:

(14) Po trzy lokalne gazety pisały o zapakowaniu każdej z tych
DISTR three local papers wrote about packaging.GER each of these
budowli przez Christo.
buildings by Christo
'Three local papers wrote about the wrapping of each of these buildings by Christo.'

Here, the underlying subject of the gerund is explicitly expressed by a *by*-phrase, *przez Christo* 'by Christo', so it cannot be functionally controlled by the higher *po*-phrase subject containing the DS. Moreover, the fact that such an underlying subject is present and that additional temporal or locative modifiers may be added (not shown here) convinces us that the gerund expresses an event. Yet, (14) is acceptable, so it looks like event domain is not an island for DD. The remaining understanding of "same clause", in terms of closed clausal complements being islands, should be easy to confirm by examining infinitival environments (XCOMP in terms of traditional LFG).

The following examples are again culled from the National Corpus of Polish:

(15) Po kilka osób ośmieliło się zdawać język angielski i niemiecki
DISTR several people dared REFL take language English and German
'A few people dared to take exams in each of English and German.'

(16) Po dwie osoby chcą rządzić w gminach Widawa, Buczek i Wodzierady.
DISTR two people want rule in counties Widawa Buczek and Wodzierady
'Two people want to govern Widawa, Buczek and Wodzierady each.'

As argued in Przepiórkowski 1999, 2004 on the basis of case transmission facts, in Polish, subject control involves structure-sharing (functional control in terms of LFG) and object control does not (it should be analysed via obligatory anaphoric control in terms of LFG). This means that in the two examples above the f-structure of the subject *po*-phrase is also the value of the subject of the lower verb. Hence, both DS and DK are co-dependents of the lower verb, so this configuration does not tell us anything about constraints on locality in DD; we need to look at object control instead.

Attested relevant examples are difficult to find, but the following constructed sentence seems to be acceptable, especially the version with the explicit quantifier *każdy*:

(17) Po dwie osoby radziły mi kupić te książki / każdą z tych książek.
DISTR two people advised me buy.INF these books each of these books
'Two people advised me to buy each of these books.'

Here, the *po*-phrase is the subject of the matrix object-control verb, and the DK is the object of the lower verb. Hence, they are related across the boundary of an open complement.

We conclude that the "same clause" requirement should be understood as a ban on DD across a closed clause boundary and that "event domain" or open infinitival complement are not islands for DD in Polish.

3.3 F-Command?

Let us turn to the second hypothesis expressed above, namely, that the f-structure corresponding to the *po*-phrase containing DS must f-command the f-structure corresponding to DK. Recall the definition of f-command, here taken from Dalrymple 2001: 159:

(18) f f-commands g if and only if $\neg(f\ \mathrm{GF}^*) = g$ (f does not contain g) and $((\mathrm{GF}\ f)\ \mathrm{GF}^+) = g$ (all f-structures whose value for some grammatical function GF is f also contain g).

While all examples above satisfy this f-command constraint, the following simplified NKJP example seems to violate it:

(19) Kościół pozwolił uczonym zabrać po włókienku czy po dwa.
church allowed scientists take DISTR thread or DISTR two
'The Church let each of the scientists take a thread or two (of the Shroud of Turin).'

Here, the object of the higher verb, *uczonym* 'scientists', controls the subject of the lower verb only anaphorically (again, see Przepiórkowski 1999, 2004 for arguments), so the f-structure of the *po*-object of the lower verb, *zabrać* 'take', does not f-command the f-structure of DK – the former only occurs as the object of the lower verb and the latter only occurs as the object of the higher verb.

An even more striking example of non-f-command would be if the DK were the subject of the higher verb instead of the controlling object of this verb, but we have not been able to find such examples in corpora. The following simplified example from NKJP, where the DS *kilkanaście procent* 'a dozen or more percent' apparently distributes over the subject *banki* of the higher verb (with the object of this higher verb only implicit), has another analysis, in which the DS distributes over the co-dependent *sobie* 'themselves', which is only anaphorically bound by *banki*:

(20) Banki każą sobie płacić po kilkanaście procent.
banks request self.DAT pay DISTR dozen or more percent
'Banks make (us) pay them a dozen or more percent each.'

A constructed example of the kind we are looking for is given in (21b).

(21) a. Kierownicy projektów polecili badaczom przygotować po raporcie.
heads projects.GEN asked researchers.DAT.PL prepare DISTR report
'PIs asked researchers to prepare a report each.'

b. Kierownicy projektów polecili zespołowi przygotować po raporcie.
heads projects.GEN asked team.DAT.SG prepare DISTR report
'PIs asked the team to prepare a report each.'

Unlike (21a), where – on the prominent understanding of the sentence – DK is the controlling object, as in (19) above, (21b) seems to be understood as involving distribution over the matrix subject DK. On the other hand, we cannot at this stage exclude the possibility that such examples are acceptable because of the availability of distribution over the events of the team preparing a report, so we do not treat this piece of data as decisive.

A final potential counterexample to the generalisation that *po*-phrases including a DS must f-command the corresponding DKs is (22), one among a few examples from the Internet cited in Przepiórkowski and Patejuk 2013 where a distributive *po*-phrase seems to be an argument of a preposition.

(22) Prawie wszyscy zawodnicy występowali w po dwóch formacjach.
almost all players played in DISTR two.LOC formations.LOC
'Almost all players played in two formations each.' (Google)

Such examples, while occasionally attested, are judged as marginal or downright unacceptable, so it is not clear whether the current analysis should try to take them into account. If so, and if we want to maintain some version of the f-command generalisation, there are at least two possible ways to tackle examples such as (22). The first is to adopt an analysis where some prepositions do not project a separate f-structure but rather add an attribute to the f-structure of their arguments; such an analysis is assumed in the PARGRAM implementation effort, where the attribute PFORM is used for this purpose. This solution would immediately solve the problem at hand – examples such as (22) would involve the run-of-the-mill f-command – but grammars employing PFORM use it only for non-semantic prepositions, and it is doubtful whether *w* 'in' in (22) is non-semantic. Second, the notion of f-command could be minimally relaxed to take the above counterexamples into account.

Summarising the facts so far, it seems that only a slightly relaxed version of f-command must hold between the *po*-phrase and the DK. It turns out, however, that f-command is not really the right relation to start with. The problem is the first part of the definition of f f-commanding g (cf. (18)): f *does not contain* g. While this possibility has long remained unnoticed in the DD literature, DK may in fact be contained within the DS – both at the level of c-structure and f-structure. Such a construction – and the problems it poses for previous accounts of DD – is extensively discussed in Przepiórkowski 2014a,b. The example given there is (23), where the DS is headed by *3 przedstawicieli* '3 representatives', and the DK *25 krajów* '25 countries' is the argument of this relational noun *przedstawicieli* 'representatives':

(23) Przybyło po 3 przedstawicieli 25 krajów.
arrive.PAST DISTR 3 representatives 25.GEN countries.GEN
'3 representatives arrived from each of 25 countries.'

Another example of "DK-within-DS" may be found in the following sentence, taken from NKJP verbatim:

(24) Pojadą tam po dwie osoby wytypowane przez placówki.
drive there DISTR two people assigned by branches
'Two people assigned by each of the branch will go there.'

Here, the DK is the noun *placówki* 'branches' contained within the participial phrase *wytypowane przez placówki* 'assigned by the branches', which is a modifier of the DS *dwie osoby* 'two people'. In both cases, the f-structure for the DK is not f-commanded by the f-structure for the *po*-phrase containing the DS. Rather, DK is contained in DS.

3.4 Empirical Summary

Let us collect the observations of the previous subsections. We saw that the *po*-phrase introducing the DS and the DK are not restricted to any particular grammatical functions. We also showed that they must belong to the same clause and that the DK should either be f-commanded (in a slightly relaxed sense of the term) by or contained within the *po*-phrase introducing the DS. These observations may be jointly reformulated in a much simpler way – we will do so in §4.3.

4 Propositional Glue Analysis

4.1 Basics

The underlying Glue Semantics analysis of DD in Polish is presented in detail in Przepiórkowski 2014a; this subsection summarises enough of that analysis to make the current paper relatively self-contained.

Let us consider the following constructed (but uncontroversial) example (25a), its *po*-less version in (25b), and their corresponding intended meaning representations in (26a–b), in which all bare common nouns are assumed to be quantified existentially.

(25) a. Piotr kupił dziewczynom po róży. (Cf. (26a))
Piotr.NOM bought.SG girls.DAT DISTR rose.LOC
'Piotr bought (the/some) girls a rose each.'

b. Piotr kupił dziewczynom różę. (Cf. (26b))
Piotr.NOM bought.SG girls.DAT rose.ACC
'Piotr bought a rose for (the/some) girls.'

(26) a. $exists(Z, girl^s(Z) \wedge |Z| > 1,$
$all(X, |X| = 1 \wedge X \subset Z,$
$exists(V, |V| = 1 \wedge rose^s(V), buy(p, V, X))))$

b. $exists(Z, girl^s(Z) \wedge |Z| > 1,$
$exists(V, |V| = 1 \wedge rose^s(V), buy(p, V, Z))))$

In these assumed meanings, generalised quantifiers are represented as relations between an individual and two propositions involving that individual, so that $all(X, person(X), yawn(X))$ is the representation of *Everyone yawned* (Dalrymple 2001: 227). Moreover, we follow Dotlačil 2012 and earlier work on treating entities as sets,[4] and properties – as sets of such sets. For example, $girl^s$ is the property of being a non-empty set of girls – either a singleton or a set of higher cardinality (the superscript s indicates the possible plural) – and $\lambda Z.\, girl^s(Z) \wedge |Z| > 1$ is the property of being a set of at least two girls. On this view, the standard inclusion relation $\subseteq$ is defined on entities. On the other hand, we ignore here event variables (but see §5), tense, aspect, etc.

[4] In particular, we do not distinguish between singleton sets and their elements.

The proposed account reflects the difference in meaning representations between (26a–b) rather directly: the distributive impact of *po* enters once a property is formed which contains the contribution of the DS (the form *róży* 'rose' in the examples above) but before this property combines with the DK (*dziewczynom* 'girls' above). The impact of *po* is to take a property holding of some set and transform it into an analogous property holding of each singleton subset of the set. In the example at hand, the property (27) is transformed into the property (28):

(27) $\lambda Z.exists(V, |V| = 1 \wedge rose^s(V), buy(p, V, Z))$

(28) $\lambda Z.all(X, |X| = 1 \wedge X \subset Z,$
$exists(V, |V| = 1 \wedge rose^s(V), buy(p, V, X)))$

The first version of a meaning constructor contributed by *po* which achieves this effect is given in (29):

(29) **[distr]** $\lambda S.\lambda Z.all(X, |X| = 1 \wedge X \subset Z, S(X)) :$
$\forall G, H.\ [e(G) \multimap t(H)] \multimap [e(G) \multimap t(H)]$

The glue side assumes the first order approach to Glue Semantics proposed in Kokkonidis 2008: atomic glue formulae are unary predicates expressing types (normally, but not necessarily, e and t), and their sole arguments are constants (f-structures) or universally quantified variables (G and H in (29)).[5] The use of the first order glue instead of the earlier "new glue" is not optional in the analysis of Przepiórkowski 2014a. First, since the DK can have a variable relationship to the DS, the above constructor involves quantification over *e*-type objects, which is explicitly forbidden in the "new glue" approach (cf. Dalrymple et al. 1999: 272 and Kokkonidis 2008: 62). Second, as we will see shortly, a more complete version of the above meaning constructor makes use of an additional type, apart from the standard e and t.

Let us put the above meaning constructor to use in an analysis of example (25a), whose f-structure is provided in (30).[6]

(30)
$$\boxed{0}\begin{bmatrix}
\textsc{pred} & \text{'}\textsc{buy}\langle\boxed{1},\boxed{2},\boxed{3}\rangle\text{'} \\
\textsc{subj} & \boxed{1}\begin{bmatrix}\textsc{pred} & \text{'}\textsc{Piotr}\text{'}\end{bmatrix} \\
\textsc{obj-th} & \boxed{2}\begin{bmatrix}\textsc{pred} & \text{'}\textsc{girls}\text{'}\end{bmatrix} \\
\textsc{obj} & \boxed{3}\begin{bmatrix}\textsc{pred} & \text{'}\textsc{po}\langle\boxed{4}\rangle\text{'} \\ \textsc{obj} & \boxed{4}\begin{bmatrix}\textsc{pred} & \text{'}\textsc{rose}\text{'}\end{bmatrix}\end{bmatrix}
\end{bmatrix}$$

Assume the following meaning constructors for the noun phrases in (25a), appropriately instantiated according to the above f-structure:

(31) **[Piotr]**
$p : e(\boxed{1})$

[5] We do not take advantage here of the possibility of introducing non-unary types or having function values as their arguments.

[6] Apart from PO and proper names, values of PRED are given in English for readers' convenience. Following Przepiórkowski and Patejuk 2013, PO is analysed here as taking an OBJect.

(32) **[girls]**
$\lambda S.exists(Z, girl^s(Z) \wedge |Z| > 1, S(Z)) : \forall H.[e(\boxed{2}) \multimap t(H)] \multimap t(H)$

(33) **[rose]**
$\lambda S.exists(Z, rose^s(Z) \wedge |Z| = 1, S(Z)) : \forall H.[e(\boxed{4}) \multimap t(H)] \multimap t(H)$

While **[Piotr]** above is a direct instantiation of a lexical constructor, **[girls]** is the result of the combination of the lexical constructor for *dziewczynom* 'girls' in (34) and a general "existential closure" constructor such as (35), and similarly for **[rose]**.[7]

(34) **[girls_lex]** $\lambda X.girl^s(X) \wedge |X| > 1 : e(\boxed{2}) \multimap t(\boxed{2})$

(35) **[existential-n]** $\lambda R.\lambda S.exists(Z, R(Z), S(Z)) :$
$\forall H.\, [e(\boxed{2}) \multimap t(\boxed{2})] \multimap [[e(\boxed{2}) \multimap t(H)] \multimap t(H)]$

The meaning constructor for the three-argument verb *kupił* 'bought' is standard (again, ignoring the event variable, tense, etc.):

(36) **[bought]** $\lambda X.\lambda Y.\lambda Z.buy(X, Y, Z) : e(\boxed{1}) \multimap [e(\boxed{2}) \multimap [e(\boxed{3}) \multimap t(\boxed{0})]]$

The last meaning constructor needed to derive the complete meaning of sentences involving the distributive *po* is (37a) – another constructor in the lexical entry of *po*, here instantiated to (37b):

(37) **[po]**

a. $\lambda P.P : \forall F.\, [e(\uparrow) \multimap t(F)] \multimap [e((\uparrow \textsc{obj})) \multimap t(F)]$

b. $\lambda P.P : \forall F.\, [e(\boxed{3}) \multimap t(F)] \multimap [e(\boxed{4}) \multimap t(F)]$

The effect of this constructor is that any property that holds of the meaning of the *po*-phrase must instead hold of the DS within this *po*-phrase.[8]

Given the constructors **[Piotr]**, **[rose]**, **[girls]**, **[bought]** and the two constructors introduced by *po*, **[distr]** and **[po]**, the proof in Figure 1 is available. Unfortunately, there is another proof for this set of meaning constructors: **[Piotr]**, **[bought]** and **[girls]** may combine into the property (38). This property may subsequently combine with **[distr]** into (39) and further with the result of combining **[po]** and **[rose]** into (40):

(38) $\lambda Z.exists(Y, girl^s(Y) \wedge |Y| > 1, buy(p, Y, Z)) : e(\boxed{3}) \multimap t(\boxed{0})$

(39) $\lambda X.all(Z, |Z| = 1 \wedge Z \subset X,$
$exists(Y, girl^s(Y) \wedge |Y| > 1, buy(p, Y, Z))) : e(\boxed{3}) \multimap t(\boxed{0})$

(40) $exists(X, rose^s(X) \wedge |X| = 1,$
$all(Z, |Z| = 1 \wedge Z \subset X,$
$exists(Y, girl^s(Y) \wedge |Y| > 1, buy(p, Y, Z))) : t(\boxed{0})$

[7] In Polish, depending on information structure, NPs can be generally understood as indefinites, as approximated by (35), or as definites. We assume that two corresponding meaning constructors are optionally available for any noun (perhaps via a general template; cf. Asudeh et al. 2013). Moreover, information about set cardinality (e.g., $|X| > 1$ in (34)) should ideally be systematically related to grammatical number, pace Andrews 2007, and not just idiosyncratically stated in particular lexical entries.

[8] A much simpler way to achieve the same effect would be not to project a separate f-structure for *po*, but rather treat it as a non-semantic preposition. This would require reevaluating the morphosyntactic analysis of Przepiórkowski and Patejuk 2013 and, hence, it is left for future research.

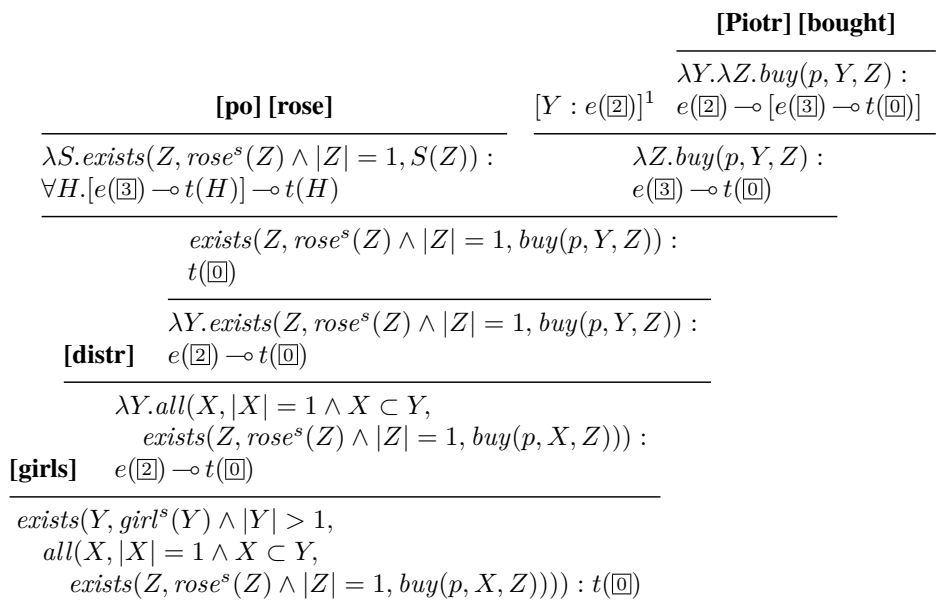

Figure 1: Proof of the reading (26a) for sentence (25a)

This meaning representation may at best be interpreted as a convoluted way of writing down the collective reading of (25b) – a reading that (25a) does not have.

A way to exclude such undesired proofs is to guarantee that the meaning which **[distr]** combines with already contains the contribution of DS — this is so in the proof in Figure 1, but not in the proof just sketched, where the meaning of the DS *róży* 'rose' – instead of the intended DK *dziewczynom* 'girls' – would combine with the distributive property formed by **[distr]**. In Przepiórkowski 2014a this is achieved by *po* labelling the DS; this label is transferred in the proof until it is removed by **[distr]**, which may only combine with a meaning so labelled.

Technically, Przepiórkowski 2014a takes advantage of the possibility of introducing additional types, apart from the standard e and t. Such an additional type, t^d, is to be understood as a "labelled" version of t (although formally it is a new symbol, unrelated to t). Given this new type, two modifications are needed: a new meaning constructor for *po* which labels the DS – we will call this meaning constructor **[distr-I]** – and a modification to **[distr]** which expects such a label and removes it – we will call the so modified meaning constructor **[distr-E]**.

The version of **[distr-I]** given below ((42a) is the general version, (42b) – its instantiation in (30)) also incorporates the intended effect of **[po]**, namely that the meaning of the DS should be treated as the meaning of the whole *po*-phrase:

(41) **[distr-E]**
$\lambda S.\lambda Z.all(X, |X| = 1 \wedge X \subset Z, S(X)) :$
$\forall G, H.\ [e(G) \multimap t^d(H)] \multimap [e(G) \multimap t(H)]$

(42) **[distr-I]**

a. $\lambda\mathcal{Q}.\mathcal{Q}$:
$\forall H.\,[[e((\uparrow \textsc{obj})) \multimap t(H)] \multimap t(H)] \multimap [[e(\uparrow) \multimap t(H)] \multimap t^d(H)]$

b. $\lambda\mathcal{Q}.\mathcal{Q}$:
$\forall H.\,[[e(\boxed{4}) \multimap t(H)] \multimap t(H)] \multimap [[e(\boxed{3}) \multimap t(H)] \multimap t^d(H)]$

The way these new constructors are used in the proof of (26a) is demonstrated in Figure 2. On the other hand, the undesired proof sketched above is now ruled out: **[distr-E]** cannot combine with the result of composing the meanings of **[Piotr]**, **[bought]** and **[girls]** given in (38). This is because **[distr-E]** expects a glue formula of the form $e(G) \multimap t^d(H)$ and none of these three constructors contains anything of type d – this type is introduced by **[distr-I]** applied to the meaning of the DS, i.e., to **[rose]**.

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{}{\lambda S.exists(Z, rose^s(Z) \wedge |Z| = 1, S(Z)) :\ \forall H.[e(\boxed{3}) \multimap t(H)] \multimap t^d(H)}\ \textbf{[distr-I] [rose]} \quad \dfrac{}{[Y : e(\boxed{2})]^1}}{\lambda Z.buy(p, Y, Z) :\ e(\boxed{3}) \multimap t(\boxed{0})} \quad \dfrac{}{\lambda Y.\lambda Z.buy(p, Y, Z) :\ e(\boxed{2}) \multimap [e(\boxed{3}) \multimap t(\boxed{0})]}\ \textbf{[Piotr] [bought]}}{exists(Z, rose^s(Z) \wedge |Z| = 1, buy(p, Y, Z)) :\ t^d(\boxed{0})}}{\lambda Y.exists(Z, rose^s(Z) \wedge |Z| = 1, buy(p, Y, Z)) :\ e(\boxed{2}) \multimap t^d(\boxed{0})}\ \textbf{[distr-E]}}{\lambda Y.all(X, |X| = 1 \wedge X \subset Y,\ exists(Z, rose^s(Z) \wedge |Z| = 1, buy(p, X, Z))) :\ e(\boxed{2}) \multimap t(\boxed{0})}\ \textbf{[girls]}}{exists(Y, girl^s(Y) \wedge |Y| > 1,\ all(X, |X| = 1 \wedge X \subset Y,\ exists(Z, rose^s(Z) \wedge |Z| = 1, buy(p, X, Z)))) : t(\boxed{0})}$$

Figure 2: Proof of the reading (26a) for sentence (25a) using semantically constrained meaning constructors of *po*

4.2 Propositional Glue

Andrews 2010 argues – following an implementational idea of Lev 2007 – for further simplification of the underlying glue logic from the first order approach of Kokkonidis 2008[9] to propositional logic, where atomic formulae such as $e(\boxed{1})$ are treated as unanalysable propositional symbols. The obvious problem for this idea

[9]The "new glue" of Dalrymple et al. 1999 and Dalrymple 2001 may also be considered first order despite its second order looks: Kokkonidis 2008: 59 shows that "new glue" is equivalent to a certain subset of first order glue.

is universal quantification in glue formulae for quantifiers. Also the meaning constructor **[distr-E]** uses such quantification – more robustly than is usual in LFG literature, as one of the glue variables (G in (41) and earlier in (29)) is e-typed.

Such quantification can, however, be avoided via the use of inside-out functional uncertainty (iofu) and local names (Dalrymple 2001: 143–148). For example, if GF is defined as in (43), the iofu assigned to the local name $\%F$ in (44) – when evaluated on any value of some grammatical function (or on the matrix f-structure) – specifies all such f-substructures within the whole matrix f-structure.[10]

(43) $\mathrm{GF} \equiv \{\textsc{subj}|\textsc{obj}|\textsc{obj}_\theta|\textsc{obl}|\textsc{xcomp}|\textsc{comp}|\textsc{adj}|\textsc{xadj}\} \in^*$

(44) $((\mathrm{GF}^* \uparrow)\ \mathrm{GF}^*) = \%F$

Similarly, the uninstantiated meaning constructors **[distr-E]** and **[distr-I]** given above in (41) and (42a) would be replaced by the following sequences of statements in the lexical entry of *po*:

(45) a. $((\mathrm{GF}^* \uparrow)\ \mathrm{GF}^*) = \%G$
b. $((\mathrm{GF}^* \uparrow)\ \mathrm{GF}^*) = \%H$
c. $\lambda S.\lambda Z.\mathit{all}(X, |X| = 1 \wedge X \subset Z, S(X)) :$
$[e(\%G) \multimap t^d(\%H)] \multimap [e(\%G) \multimap t(\%H)]$

(46) a. $((\mathrm{GF}^* \uparrow)\ \mathrm{GF}^*) = \%F$
b. $\lambda\mathcal{Q}.\mathcal{Q} :$
$[[e((\uparrow \textsc{obj})) \multimap t(\%F)] \multimap t(\%F)] \multimap [[e(\uparrow) \multimap t(\%F)] \multimap t^d(\%F)]$

These statements can be simplified by noticing that $\%H$ in (45) and $\%F$ in (46) point to the same f-structure, namely, to the f-structure which corresponds to the scope of the quantifier expressed by the DK (the matrix f-structure $\boxed{0}$ in the running example).[11] Hence, the semantic contributions of the distributive *po* may be jointly expressed as follows:

(47) a. $((\mathrm{GF}^* \uparrow)\ \mathrm{GF}^*) = \%G$
b. $((\mathrm{GF}^* \uparrow)\ \mathrm{GF}^*) = \%H$
c. $\lambda S.\lambda Z.\mathit{all}(X, |X| = 1 \wedge X \subset Z, S(X)) :$
$[e(\%G) \multimap t^d(\%H)] \multimap [e(\%G) \multimap t(\%H)]$
d. $\lambda\mathcal{Q}.\mathcal{Q} :$
$[[e((\uparrow \textsc{obj})) \multimap t(\%H)] \multimap t(\%H)] \multimap [[e(\uparrow) \multimap t(\%H)] \multimap t^d(\%H)]$

Note that specifications such as $e(\%G)$ are not that different from specifications such as $e((\uparrow \textsc{obj}))$; the difference is the number of their instantiations. While in the context of the f-structure (30) the latter instantiates deterministically to $e(\boxed{4})$, the former has five such possible instantiations: $e(\boxed{0}), \ldots, e(\boxed{4})$. This may be a practical problem for a naïve implementation of this idea, as lexical entries containing such meaning constructors become considerably ambiguous, but the proof space does not change, given sufficiently robust specifications of iofu paths. On the other hand,

[10] The slightly unusual $\in^*$ in (43) ensures that possibly nested coordinate structures are also properly traversed by this iofu.

[11] Slightly abusing the transformational terminology, we will call such scope-providing f-structures "landing sites" of the quantifier.

constraining such paths may provide a useful way of constraining glue analyses, as we will see in the next subsection.

4.3 Locality Constraints

Lev 2007: 77, 259 and Andrews 2010: 144 do not attempt to construct iofu paths which can instantiate to all possible f-structures (of relevant types), as in (44) above, but rather directly constrain such paths to f-structures containing a given one, as in (48) below, since only such f-structures are possible "landing sites" of quantifiers.

(48) $(\mathrm{GF}^{*} \uparrow) = \%F$

Andrews 2010: 144 mentions that, "[t]o give the idea some empirical bite, one would also want to see the iofu paths used to impose some constraints", but does not attempt to formulate such additional constraints. That is exactly what we will do in this subsection.

In §3, we saw that the *po*-phrase introducing the DS and the DK must belong to the same clause and that the DK should either be f-commanded (in a relaxed sense of the term) by or contained within the *po*-phrase introducing the DS. One more observation is needed to reformulate these constraints in simpler terms, namely, that the *po*-phrase is usually a direct dependent of the landing site of the quantifier expressed by the DK, i.e., a direct dependent of the f-structure specified by $\%H$ in (47). In a couple of very specific cases discussed in §3.3 – *po*-phrases within prepositional phrases and *po*-phrases in the domain of the lower verb in object-control constructions – there is one intervening f-structure. So, at the level of the *po*-phrase, the constraint on its functional position may be expressed as: $(\mathrm{GF}\ (\mathrm{GF}) \uparrow) = \%H$. This should be constrained even further, as neither of the two GFs can be a COMP: being a kind of a prepositional or nominal phrase, the f-structure of the *po*-phrase cannot be a direct value of COMP, and in the case when there is an intervening f-structure, it must be the value of XCOMP (in object-control cases) or of some GF which allows f-structures of prepositional phrases as values (again, not a COMP). Hence, the constraint on the position of the f-structure for the *po*-phrase may be formulated as follows:

(49) $\mathrm{GF}_{\neg\textsc{comp}} \equiv \{\textsc{subj}|\textsc{obj}|\textsc{obj}_{\theta}|\textsc{obl}|\textsc{xcomp}|\textsc{adj}|\textsc{xadj}\} \in^{*}$

(50) $(\mathrm{GF}_{\neg\textsc{comp}}\ (\mathrm{GF}_{\neg\textsc{comp}}) \uparrow) = \%H$

Let us now turn to the f-structure of the distributive key, represented by $\%G$ in (47). We saw that the path between the *po*-phrase and the DK must not contain COMP. When DK is not contained within the *po*-phrase, the path goes via the landing site of DK, so the part of the path between the landing site and the DK must also be COMP-free:[12]

(51) $(\%H\ \mathrm{GF}^{*}_{\neg\textsc{comp}}) = \%G$

[12]The COMP-freeness of the other part is already expressed by (50). Note also the use of the Kleene star instead of a plus in (51); the possibility of $\%H = \%G$ is crucial for the extension to events presented in §5.

Does this constraint also hold when DK is contained within the *po*-phrase? An attempt to construct examples minimally differing from the grammatical cases of "DK-within-DS" shows that this constraint also holds in such cases; compare (24) above with (52). The latter, if acceptable at all, does not have the meaning where people distribute over branches:[13]

(52) *Pojadą tam po dwie osoby, które zostały wytypowane przez placówki.
drive there DISTR two people which were.INF assigned by branches

Hence, (50)–(51), with $\mathrm{GF}_{\neg\mathbf{COMP}}$ defined in (49), seem to capture the basic locality generalisations between f-structures corresponding to the *po*-phrase introducing the DS, the DK, and the landing site of the DK. The final version of the relevant meaning constructors is given below:

(53) a. $(\mathrm{GF}_{\neg\mathbf{COMP}}\ (\mathrm{GF}_{\neg\mathbf{COMP}})\uparrow) = \%H$
b. $(\%H\ \mathrm{GF}^{*}_{\neg\mathbf{COMP}}) = \%G$
c. $\lambda S.\lambda Z.\mathit{all}(X, |X| = 1 \wedge X \subset Z, S(X)) :$
$[e(\%G) \multimap t^{d}(\%H)] \multimap [e(\%G) \multimap t(\%H)]$
d. $\lambda\mathcal{Q}.\mathcal{Q} :$
$[[e((\uparrow \textsc{obj})) \multimap t(\%H)] \multimap t(\%H)] \multimap [[e(\uparrow) \multimap t(\%H)] \multimap t^{d}(\%H)]$

Unfortunately, while these meaning constructors express valid linguistic constraints in Polish DD, and some of the spurious proofs are avoided, there are still multiple proofs available for sentences considered above, as verified by the Glue Logic theorem prover available at `http://xerxes.carleton.ca/~giorgolo/tp.html`. The matter of further constraints on the analysis is, however, left for future research.

5 Extension to Events

Moltmann 1991, 1997 and Zimmermann 2002 give multiple German examples of distribution over events; here, we will look at two corresponding examples in Polish, taken from Przepiórkowski 2014a, which does not provide an analysis of distribution of events:

(54) Piotr miał po dwa powody by chwalić i krytykować Marię.
Piotr had DISTR two reasons to praise and criticise Maria.
'Piotr had two reasons each to criticise and to praise Maria.'

(55) Papież zwiedzał po trzy kraje.
Pope visited DISTR three countries
'The Pope visited three countries each time.'

In (54), there are two events expressed by two coordinated verbs; the DS *dwa powody* 'two reasons' distributes over these events. In (55), the events constituting the DK are not given so explicitly; rather, the DS *trzy kraje* 'three countries' distributes over some contextually understood set of visiting events expressed by the single

[13] Again, perhaps this sentence can be made sense of on the interpretation where distribution is over some contextually given set of events expressed by the matrix verb.

verb *zwiedzał* 'visited'. The meaning of this latter sentence seems to be: "for each (within some contextually given domain) event of the Pope visiting, he visited three countries".

The extension of the current analysis to events is rather simple and mainly consists in reintroducing the standard event variable to the semantic representations of verbs. We assume the following lexical meaning constructor for *zwiedzał* 'visited':

(56) **[visited]**
$\lambda X.\lambda Y.\lambda E.visit(E, X, Y) : e((\uparrow \textsc{subj})) \multimap [e((\uparrow \textsc{obj})) \multimap [e(\uparrow) \multimap t(\uparrow)]]$

Just like nouns, verbs have an associated optional existential closure constructor associated with them (Asudeh 2012: 344):

(57) **[existential-v]**
$\lambda P.exists(E, event^s(E), P(E)) : [e(\uparrow) \multimap t(\uparrow)] \multimap t(\uparrow)$

Let us assume the following simplified f-structure for (55) and treat *Papież* 'Pope' as if it were a proper name:

(58) $\boxed{0}\begin{bmatrix} \textsc{pred} & \text{'}\textsc{visit}\langle\boxed{1},\boxed{2}\rangle\text{'} \\ \textsc{subj} & \boxed{1}\begin{bmatrix}\textsc{pred} & \text{'}\textsc{Pope}\text{'}\end{bmatrix} \\ \textsc{obj} & \boxed{2}\begin{bmatrix}\textsc{pred} & \text{'}\textsc{po}\langle\boxed{3}\rangle\text{'} \\ \textsc{obj} & \boxed{3}\begin{bmatrix}\textsc{spec} & \text{'3'} \\ \textsc{pred} & \text{'}\textsc{countries}\text{'}\end{bmatrix}\end{bmatrix}\end{bmatrix}$

Then the meaning constructor (56) instantiates to (59), and the meaning constructors for *Papież* 'Pope' and *trzy kraje* '3 countries' are given below it.

(59) **[visited]**
$\lambda X.\lambda Y.\lambda E.visit(E, X, Y) : e(\boxed{1}) \multimap [e(\boxed{2}) \multimap [e(\boxed{0}) \multimap t(\boxed{0})]]$

(60) **[Pope]** $p : \boxed{1}$

(61) **[3-countries]**
$\lambda S.exists(X, |X| = 3 \wedge country^s(X), S(X)) : [e(\boxed{3}) \multimap t(\boxed{0})] \multimap t(\boxed{0})$

Two comments are due about **[3-countries]**. First, this meaning constructor results from the combination of the usual meaning constructor for a common noun such as *kraje* 'countries' and the meaning constructor of the existential cardinal quantifier *3* (see Przepiórkowski 2014a for examples of such quantifiers). Second, we assume that the local name used in such meaning constructors of quantifiers is defined as in Andrews 2010: 144: $(\mathrm{GF}^* \uparrow) = \%H$, i.e., given (58): $(\mathrm{GF}^* \boxed{3}) = \%H$. Hence, instantiating $(\mathrm{GF}^* \boxed{3})$ to $(\textsc{obj}\ \textsc{obj}\ \boxed{3})$, $\%H$ may become $\boxed{0}$.

Additionally, we assume the following instantiations of the meaning constructors introduced in (53) by *po*:

(62) **[distr-E]**
$\lambda S.\lambda Z.all(X, |X| = 1 \wedge X \subset Z, S(X)) : [e(\boxed{0}) \multimap t^d(\boxed{0})] \multimap [e(\boxed{0}) \multimap t(\boxed{0})]$

(63) **[distr-I]**
$\lambda \mathcal{Q}.\mathcal{Q} : [[e(\boxed{3}) \multimap t(\boxed{0})] \multimap t(\boxed{0})] \multimap [[e(\boxed{2}) \multimap t(\boxed{0})] \multimap t^d(\boxed{0})]$

These instantiations are possible via the following mappings ($\mapsto$) of iofu specifica-

tions in (53a–b) into f-structures:

(64) a. $\%H = (\mathrm{GF}_{\neg\textsc{comp}}\ (\mathrm{GF}_{\neg\textsc{comp}})\ \boxed{2}) \mapsto (\textsc{obj}\ \boxed{2}) = \boxed{0}$

b. $\%G = (\%H\ \mathrm{GF}^{*}_{\neg\textsc{comp}}) \mapsto (\boxed{0}\ \mathrm{GF}^{*}_{\neg\textsc{comp}}) \mapsto \boxed{0}$

Note in particular that the f-structure of the DK, specified by $\%G$, is the same as the landing site, specified by $\%H$. This is because distribution is over events introduced by the verb which is also the only possible landing site of the quantifier. Given such instantiations, the complete proof of the intended meaning of (55) is given in Figure 3.

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{}{\lambda S.exists(Z, country^s(Z) \wedge |Z| = 3, S(Z)) : [e(\boxed{2}) \multimap t(\boxed{0})] \multimap t^d(\boxed{0})}\ \textbf{[distr-I] [3-countries]} \quad \dfrac{}{\lambda Y.visit(E,p,Y) : e(\boxed{2}) \multimap t(\boxed{0})}}{exists(Z, country^s(Z) \wedge |Z| = 3, visit(E,p,Z)) : t^d(\boxed{0})}}{\lambda E.exists(Z, country^s(Z) \wedge |Z| = 3, visit(E,p,Z)) : e(\boxed{0}) \multimap t^d(\boxed{0})}\ \textbf{[distr-E]}}{\lambda E.all(X, |X| = 1 \wedge X \subset E, exists(Z, country^s(Z) \wedge |Z| = 3, visit(X,p,Z)) : e(\boxed{0}) \multimap t(\boxed{0})}\ \textbf{[existential-v]}}{exists(E, event^s(E), all(X, |X| = 1 \wedge X \subset E, exists(Z, country^s(Z) \wedge |Z| = 3, visit(X,p,Z)))) : t(\boxed{0})}$$

$$\dfrac{\dfrac{\dfrac{}{visit(E,p,Y) : t(\boxed{0})}}{\lambda E.visit(E,p,Y) : e(\boxed{0}) \multimap t(\boxed{0})}}{\lambda Y.\lambda E.visit(E,p,Y) : e(\boxed{2}) \multimap [e(\boxed{0}) \multimap t(\boxed{0})]}$$

[Pope] [visited]

Figure 3: Proof for sentence (55)

6 Conclusion

The empirical contribution of this paper lies in the investigation of locality constraints on distance distributivity in Polish. They turn out to be broadly similar to those in other languages discussed in the DD literature, with facts crucially extending the known generalisations already discussed in Przepiórkowski 2014a,b. The proposed analysis may, however, be interesting for the glue audience, as it is couched in propositional glue and takes advantage of its strengths. Some of them are inherited from first order glue: the possibility of defining various types without the need to extend the underlying logic and quantification (here, via iofu definitions

of local names) over types different than t. Another – important for the current analysis – is inherent to propositional glue: the possibility of encoding f-structure locality constraints within specifications of propositional symbols. We hope that – by decoupling the use of propositional glue from implementational issues (Lev 2007) or proof nets (Andrews 2010) – this account will encourage other researchers to have a closer look at this variant of glue.

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