

Abstract

This paper presents a syntactic HPSG analysis of distance distributivity in Polish, where the challenge is to uniformly analyse a number of function lexemes PO ‘each’ which share their form and semantic contribution, but differ in their syntactic behaviour. To this end, the HPSG notion of *weak head* is employed in a novel way.

1 Introduction

The empirical aim of this paper is to discuss a phenomenon in Polish which is somewhat similar to the behaviour of English EACH, as in: *I gave the boys two apples each*.¹ The phenomenon where the so-called binominal EACH (Safir & Stowell, 1988) attaches to the noun phrase (NP) denoting the distributed quantity (*two apples*) and looks elsewhere in the sentence for the set to distribute over (*the boys*) is called *distance distributivity* (Zimmermann, 2002). As we will see below, distance distributivity in Polish involves not one but a number of simultaneously homophonous and homosemous² elements which differ in their syntactic behaviour.

The theoretical goal is to provide an HPSG analysis of Polish distance distributivity that does not miss generalisations, i.e., one that relates the form *po* to the distributive semantics only once in the grammar, even though there are a few distinct lexical items sharing this form and meaning. To this end we – rather trivially – factor out constraints common to all relevant lexical entries within the Word Principle. For this to be possible, we also – perhaps less trivially – employ the notion of *weak head* (Tseng, 2002; Abeillé, 2003, 2006) in order to ensure the uniform headedness status of words described by these lexical entries.

There are two main sections corresponding to the two aims mentioned above: section 2 introduces the phenomenon in gory detail and section 3 proposes the HPSG analysis. This paper is strongly coupled with Przepiórkowski & Patejuk 2013, which presents an LFG account of the same facts; correspondingly, the empirical section 2 is shared between these two papers almost verbatim (with apologies to readers). Moreover, Przepiórkowski 2013 provides the semantic half of the complete syntactico-semantic analysis of distributivity in Polish, couched in Glue Semantics (Dalrymple, 1999, 2001).

¹A note on some conventions used in this paper: in the running text, lexemes are typeset in SMALL CAPITALS and word forms and example sentences – in *italics*. Numbered examples, as in (1)–(2) below, are typeset in ordinary upright font, with grammatical information in SMALL CAPITALS. Grammatical abbreviations mostly adhere to those recommended in Leipzig Glossing Rules (<http://www.eva.mpg.de/lingua/resources/glossing-rules.php>).

²We use the term *homosemous* as in Harley 2006, pp. 146ff., i.e., to refer to function (as opposed to content) morphemes or words which are not necessarily interchangeable in a given context but have the same meaning.

2 Distance distributivity in Polish

2.1 Preliminaries

The most basic use of the distributive PO is illustrated below:

- (1) Dałem im po jabłku.
gave-I them.DAT DISTR apple.LOC
'I gave them an apple each.'
- (2) Dałem im po dwa jabłka.
gave-I them.DAT DISTR two.ACC apples.ACC
'I gave them two apples each.'

These examples already illustrate one curious fact about PO: it may combine with the locative case (cf. (1)), reserved to arguments of prepositions in Polish, or with the accusative (cf. (2)). So at least some uses of PO must be treated as prepositional, as otherwise the overwhelming generalisation that in Polish locative only occurs on arguments of prepositions would be violated.

The first article-length treatment of the distributive PO in Polish linguistics is Łojasiewicz 1979.³ That paper suggests that the case of the phrase cooccurring with PO depends on the type of this phrase (NP in (1) and numeral phrase, or NumP, in (2); cf. Łojasiewicz 1979, p. 155), rather than on its grammatical number (singular in (1), plural in (2)). The matter should be easy to decide by considering plural noun phrases or singular numeral phrases. Unfortunately, the latter arguably do not exist in Polish; Przepiórkowski 2006b claims that all Polish numerals are plural, even those meaning 'a half' (Pol. PÓŁ) or 'a quarter' (Pol. Cwierć). Moreover, there seems to be a semantic restriction at work (cf. Łojasiewicz 1979; Przepiórkowski 2008; Bogusławski 2012) which prohibits locative NP arguments of PO from denoting aggregate entities of unspecified cardinality, as in:

- (3) *Dałem im po jabłkach.
gave-I them.DAT DISTR apples.LOC
'I gave them some apples each.' (intended)

Nevertheless, the issue may be resolved by considering plural NPs denoting non-aggregate entities, i.e., *plurale tantum* nouns such as SPODNIE 'trousers', PERFUMY 'perfumes', etc. As shown in Przepiórkowski 2006a, and contra Łojasiewicz 1979, such NPs may co-occur with the distributive PO and, when they do, they bear the locative case. This shows that the locative is indeed conditioned by the categorial status of the noun phrase and not by its singular grammatical number. Hence, from now on, we will refer to PO in (1) (and similar contexts) as *adnominal*, PO_N, and to PO in (2) (and such) as *adnumeral*, PO_{NUM}.

³See also Franks 1995, §5.2.1, for a generative account and comparison with the distributive PO in other Slavic languages.

Łojasiewicz 1979, p. 154, also notes that the distribution of the distributive PO is limited to the accusative (as in (1)–(2) above), nominative and “secondary genitive” positions. What is meant by a “secondary genitive” position is a genitive dependent of a negated (cf. (5))⁴ or nominalised (cf. (6)) verb (i.e., a gerundial form) corresponding to the accusative dependent of the affirmative verb form (cf. (4)):

- (4) Dałem im jabłko.
gave-I them.DAT apple.ACC
‘I gave them an apple.’
- (5) Nie dałem im jabłka / *jabłko.
NEG gave-I them.DAT apple.GEN/*ACC
‘I didn’t give them an apple.’
- (6) Myśleliśmy o daniu im jabłka / *jabłko.
thought-we about giving them.DAT apple.GEN/*ACC
‘We were thinking about giving them an apple.’

For the adnominal PO_N, Łojasiewicz 1979 gives the following example of its occurrence in the otherwise nominative (subject) position:

- (7) Z drzew spadło po jabłku.
from trees fell.3.N.SG DISTR apple.LOC
‘An apple fell from each tree.’

To this, the following examples of PO_N in “secondary genitive” positions could be adduced, parallel to (5)–(6) above:

- (8) Nie dałem im po jabłku.
NEG gave-I them.DAT DISTR apple.LOC
‘I didn’t give them an apple each.’
- (9) Myśleliśmy o daniu im po jabłku.
thought-we about giving them.DAT DISTR apple.LOC
‘We were thinking about giving them an apple each.’

On the other hand, PO_N cannot occur in other case positions, including dative, instrumental and “primary genitive”. This is illustrated in (10a)–(12a), involving verbs subcategorising for dative, instrumental and genitive complements, respectively, contrasted with (10b)–(12b) involving roughly synonymous verbs subcategorising for accusative complements:^{5,6,7}

⁴Genitive of negation in Polish, while more regular than in Russian, is more complex than would transpire from the remarks in this paper; see Przepiórkowski 2000.

⁵RM stands here for *reflexive marker*, a part of the inherently reflexive verbs PRZYGLĄDAĆ SIĘ ‘observe’ and CHWYCIĆ SIĘ ‘grab’.

⁶Note that the forms of JEDEN ‘one’ in these examples are not numerals, but rather adjectives, pace Saloni 1974 and Gruszczyński & Saloni 1978; see also Przepiórkowski 2006a for the reaffirmation of this position based on the cooccurrence of PO and JEDEN.

⁷(11a) sounds acceptable to one of the authors.

- (10) a. *Każdy z nich przyglądał się po (jednym) obrazie.
 each.NOM of them watched RM DISTR one.LOC painting.LOC
 ‘Each of them watched a/one painting.’ (intended)
- b. Każdy z nich oglądał po (jednym) obrazie.
 each.NOM of them watched DISTR one.LOC painting.LOC
 ‘Each of them watched a/one painting.’
- (11) a. *Każdy z nich kierował po (jednej) firmie.
 each.NOM of them ran DISTR one.LOC company.LOC
 ‘Each of them directed a/one company.’ (intended)
- b. Każdy z nich nadzorował po (jednej) firmie.
 each.NOM of them supervised DISTR one.LOC company.LOC
 ‘Each of them supervised a/one company.’
- (12) a. *Każdy z nich chwycił się po (jednej) linie.
 each.NOM of them grabbed RM DISTR one.LOC rope.LOC
 ‘Each of them grabbed a/one rope.’ (intended)
- b. Każdy z nich chwycił po (jednej) linie.
 each.NOM of them grabbed DISTR one.LOC rope.LOC
 ‘Each of them grabbed a/one rope.’

At first glance facts seem to be similar for the adnumeral PO_{NUM} . Its occurrence in an accusative position is illustrated in (2) above, and the following examples, all from Łojasiewicz 1979, illustrate a (normally, see below) nominative position (cf. (13)), a genitive of negation position (cf. (14)) and an ad-gerundial genitive position (cf. (15)):

- (13) Na moich drzewach dojrzewa dziennie po kilka owoców.
 on my trees ripen.3.SG daily DISTR several.ACC fruit.GEN
 ‘Several pieces of fruit ripen every day on each of my trees.’
- (14) Dzieci nie dostały po dwa pączki.
 children.NOM NEG received.3.PL DISTR two.ACC donuts.ACC
 ‘The children did not get two donuts each.’
- (15) Myśleliśmy o daniu dzieciom po trzy pączki.
 thought-we about giving children.DAT DISTR three.ACC donuts.ACC
 ‘We thought about giving the children three donuts each.’

It should be noted that, while the accusative case of *dwa jabłka* ‘two apples’ in (2) could in principle reflect the fact that the PO_{NUM} -phrase occupies an accusative position (PO_{NUM} would be transparent to case assignment on such an analysis), examples (14)–(15), where such PO_{NUM} -phrases occur in genitive positions, show that PO_{NUM} does (or at least *may*, see below) assign the accusative case, i.e., that it does (or may) behave like a preposition.

All these considerations lead to the conclusion that there must be (at least) two different distributive elements PO: one assigning the locative to NPs, and another assigning the accusative to NumPs. In fact, Łojasiewicz 1979, p. 158, discusses the possibility of a single distributive PO assigning a separate case, *distributivus*, which would always be syncretic with locative or accusative, depending on the grammatical class.⁸ She rejects this idea, though, on the basis of the apparent impossibility of such NP and NumP *distributivus* phrases to be coordinated into a single argument of PO and claims that the following example should only mean *You'll get one apple each, as well as two pears and five plums*, and not – as intended – *Each of you will get one apple, two pears and five plums*:

- (16) Dostaniecie po jednym jabłku, dwie gruszki i
 receive-you.FUT DISTR one.LOC apple.LOC two.ACC pears.ACC and
 pięć śliwek.
 five.ACC plums.GEN
 'Each of you will get one apple, two pears and five plums.' (intended)
 'You will get one apple each, as well as two pears and five plums.' (actual)

While remaining agnostic about such examples, we concur with Łojasiewicz 1979 that PO_N and PO_{NUM} should not be conflated into a single lexeme. In the remainder of this empirical section we will have nothing more to say about the adnominal PO_N and will concentrate on PO_{NUM}.

2.2 Three distributive elements PO

2.2.1 Adnumeral PO in subject positions

As in other Indo-European languages, also in Polish finite verbs agree with nominative subjects, and otherwise occur in the default third person singular neuter form (Dziwirek, 1990). This generalisation is upheld in (7) and (13) above, where the subjects headed by PO_N and PO_{NUM}, respectively, are prepositional phrases and, hence, apparently caseless (but see §3 below). From this perspective, the following examples from Łojasiewicz 1979, p. 154, are surprising:⁹

- (17) W pokojach będą po dwa fotele.
 in rooms be.FUT.PL DISTR two.NOM.PL armchair.NOM.PL
 'There will be two armchairs in each room.'
- (18) Na ławkach leżały po trzy arkusze papieru.
 on benches lay.PL PO three.NOM.PL sheet.NOM.PL paper.GEN.SG
 'There lay three sheets of paper on each bench.'

⁸She also considers the two fossilised expressions *po czemu* 'how much each' and *po złotemu* 'one zloty each', where *czemu* and *złotemu* are dative forms.

⁹Case values indicated in glosses reflect the received wisdom. In the analysis presented below we will claim that the numeral (*dwa, trzy*) and the noun heading the following NP (*fotele, arkusze*) are in the accusative, and that PO is the sole bearer of the nominative case; see §2.3.

Here, the verb clearly agrees with the numeral phrase following PO_{NUM} . Łojasiewicz 1979 does not draw the obvious conclusion from these examples, but if the overwhelming generalisation concerning subject–verb agreement in Polish is to be maintained, (17)–(18) must be analysed as involving nominative subjects. In particular, such subjects cannot be run-of-the-mill prepositional phrases.

The issue is somewhat obfuscated by the fact that numeral phrases following PO_{NUM} in all examples above are syncretic between nominative and accusative, at least in the sense that they may occur in subject positions and in (accusative) direct object positions.¹⁰ So perhaps all numeral phrases occurring after PO_{NUM} should be analysed as nominative, rather than accusative?

Fortunately, there exist non-syncretic nominative forms of the paucal numerals DWA ‘two’, TRZY ‘three’ and CZTERY ‘four’, namely, the human-masculine forms *dwaj*, *trzej* and *czterej*, as in the following example:

- (19) Radę tworzyli dwaj przedstawiciele regionu.
council.ACC constituted.PL two.NOM representatives.NOM region.GEN
‘Two region representatives constituted the council.’

Crucially, such nominative forms cannot occur after PO_{NUM} in accusative or “secondary genitive” positions, which confirms the analysis of PO_{NUM} as governing the accusative – not nominative – case there:

- (20) (Nie) przydzieliłem im po dwóch przedstawicieli.
NEG assigned-I them.DAT DISTR two.ACC representatives.ACC/GEN
‘I (did not) assign(ed) them two representatives each.’
- (21) *(Nie) przydzieliłem im po dwaj przedstawiciele.
NEG assigned-I them.DAT DISTR two.NOM representatives.NOM

On the other hand, phrases headed by such unambiguously nominative paucal numerals may co-occur with PO_{NUM} in the subject position, duly resulting in subject–verb agreement; although in some publications they are regarded marginal (Łojasiewicz, 1979, p. 158), doubtful or even downright unacceptable (Derwopedia, 2011, pp. 144–145), they do occur in texts, as in the following attested examples:¹¹

¹⁰See Przepiórkowski 1999, 2004 for arguments that non-paucal numerals (as well as some human-masculine paucal numerals) in the subject position are in fact accusative; e.g., (13) without the *po* would still be grammatical and the subject *kilka owoców* would be analysed as accusative. On the other hand, (non-human-masculine) paucal numeral forms like *dwa* ‘two’ and *trzy* ‘three’ in (17)–(18), would be analysed as nominative. The observation that some numeral phrases in the subject position occur in the accusative has a long history, dating back at least to Małecki 1863 and Krasnowolski 1897, and – more recently – Franks 1995, but it is also very controversial in Polish linguistics; see, e.g., Saloni 2005 and Miechowicz-Mathiasen & Witkoś 2007 for discussion, and Przepiórkowski & Patejuk 2012a,b for an LFG analysis.

¹¹The first example comes from the National Corpus of Polish (NKJP; Przepiórkowski et al. 2012; <http://nkjp.pl>), the other two were found in the Internet via Google (September 2013).

- (22) Prezydent proponuje, aby Radę Federacji tworzyli po
 president proposes that council.ACC federation.GEN constitute.PL DISTR
 dwaj przedstawiciele każdego regionu...
 two.NOM representatives.NOM each.GEN region.GEN
 ‘The President proposes that two representatives of each region constitute
 the Federation Council.’ (NKJP)
- (23) Do Senatu wybierani są po dwaj senatorzy z każdego
 to Senate elected.PL are.PL DISTR two.NOM senators.NOM from each
 stanu.
 state
 ‘Two senators from each state are elected to the Senate.’ (Google)
- (24) ... awans uzyskali po trzech najlepsi z każdej
 promotion obtained.PL DISTR three.NOM best.NOM.PL from each
 kategorii.
 category
 ‘Three best ones from each category qualified.’ (Google)

Also Łojasiewicz 1979, p. 158, admits forms such as *dwaj* “in some constructions” involving the distributive PO, citing as grammatical the following example:

- (25) Stańcie tu, po dwaj z każdej strony.
 stand.IMP.PL here DISTR two.NOM from each side
 ‘Stand here, two on each side!’

In summary, the data discussed in this subsection calls for distinguishing two adnumeral elements PO_{NUM} : one, which we will call PO_{NUM}^{ACC} , assigns the accusative case, even in the “secondary genitive” positions, and another one, PO_{NUM}^{MOD} , which may occur with nominative numeral phrases. The relative distribution of these two distributive adnumeral elements will be discussed in §2.3, but first we provide additional arguments for the existence of a separate PO_{NUM}^{MOD} and some justification for the superscript MOD (for *modifier*).

2.2.2 Adnumeral PO in other positions

As apparently first noted in Przepiórkowski 2010, PO_{NUM} sometimes occurs also in dative positions. When it does, the numeral phrase must also bear the dative case. The following attested examples illustrate this:

- (26) ... nagroda należy się po trzech osobom z każdej klasy...
 reward is due to DISTR three.DAT person.DAT.PL from each class
 ‘Three people from each class deserve a reward.’ (NKJP)

- (27) Broń... została przekazana po dwóm osobom z
 weapon AUX transferred.PASS DISTR two.DAT person.DAT.PL from
 każdego ugrupowania.
 each group
 ‘The weapon was handed in to two people from each group.’ (Google)

- (28) ...cyklicznie dawał odpoczywać po dwóm zawodnikom...
 cyclically let.SG rest DISTR two.DAT players.DAT
 ‘He cyclically let two players take rest.’ (Google)

While perhaps less frequent, analogous examples may be found involving instrumental positions,¹² cf. (29)–(31), and even an occasional genitive or locative position, cf. (32) and (33), respectively.

- (29) Obie strony dysponują w końcu po czterema armiami.
 both sides have at their disposal in the end DISTR four.INST armies.INST
 ‘Both sides have at their disposal four armies each in the end.’ (Google)

- (30) Każde z nich w białym kitlu, dużych okularach, z po dwiema
 each of them in white lab coat big glasses with DISTR two.INST
 teczkami – w jednej są narzędzia, w drugiej dokumentacja.
 briefcases.INST in one are tools in second documentation
 ‘Each of them in a white lab coat, big glasses, with two briefcases each –
 tools are in the first one, documentation in the other.’ (Google)

- (31) Jego... uszy są... ozdobione po trzema złotymi kolczykami u
 his ears are ornamented DISTR three.INST gold.INST earrings.INST at
 dołu małżowiny.
 bottom auricle
 ‘His ears are ornamented with three gold earrings each at the bottom of the
 auricle.’ (Google)

- (32) Komisja pracuje w zespołach złożonych z po dwóch
 Commission works in teams consisting of DISTR two.GEN
 przedstawicieli strony kościelnej i strony rządowej oraz po
 representatives.GEN side church and side governmental and DISTR
 jednym przedstawicielu organów nadrzędnych nad uczestnikami
 one.LOC representative.LOC authorities superior to participants
 postępowania.
 proceedings
 ‘(Church Property) Commission works in teams consisting of two rep-
 resentatives each of the church side and the government side and of
 one representative each of authorities superior to the participants of the
 proceedings.’ (NKJP)

¹²We are grateful to Anna Kibort for pointing this out.

- (33) 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)

Similarly to (22)–(25), such examples are often judged marginal or even unacceptable by many native speakers, and as fully acceptable by others. It seems reasonable, then, to assume that the same lexical item is responsible for all these occurrences and that it is internalised in the grammars of different native speakers to various extents. The most conspicuous feature of this PO_{NUM}^{MOD} is that it is transparent to case assignment and simply transmits the case assigned to its position: nominative in (22)–(25) (and, perhaps, in the earlier (17)–(18), but see below), dative in (26)–(28), instrumental in (29)–(31), genitive in (32) and locative in (33). We conclude that PO_{NUM}^{MOD} cannot be analysed as a case-assigning preposition, but should rather be treated as an element transparent to case assignment, a modifier, perhaps an “adnumeral operator” in the sense of Grochowski 1997, §2.4.10. Below, in §3.3, we provide an HPSG analysis which – while preserving this intuition – still treats PO_{NUM}^{MOD} as a syntactic head, on a par with PO_{NUM}^{ACC} and PO_N .

2.3 The distribution of the three elements PO

It is easy to recognise PO_N – it occurs with nominal, not numeral phrases. On the other hand, it is not always clear which of the two adnumeral elements, PO_{NUM}^{ACC} or PO_{NUM}^{MOD} , surfaces in a given context. Consider the basic example (2) on p. 2. In the previous subsection we established that PO_{NUM}^{MOD} is transparent to case assignment, so it could be claimed that *po* in this example is a form of PO_{NUM}^{MOD} and that the accusative case on *dwa jabłka* ‘two apples’ reflects the accusative case assignment to the direct object. On the other hand, we also saw that at least in some adnumeral positions, namely (14)–(15), a different PO is needed, PO_{NUM}^{ACC} , which assigns the accusative case, and this PO_{NUM}^{ACC} could also be claimed to occur in (2). So now we have three ways of analysing (2): as involving PO_{NUM}^{ACC} , as involving PO_{NUM}^{MOD} , or as ambiguous between the two analyses.

Similarly, (13) on p. 4 could be analysed as involving PO_{NUM}^{ACC} , which assigns the accusative to *kilka owoców* ‘several fruit’, or as involving PO_{NUM}^{MOD} , transparent to the assignment of the accusative case to such numeral phrases in the subject position (cf. fn. 10 on p. 6), or as ambiguous between the two.

When deciding such cases, we take as crucial the observation of the previous subsection, namely, that occurrences of PO_{NUM}^{MOD} are rare, often judged as marginal or unacceptable. That is, since both (2) and (13) are fully acceptable, we assume that they involve PO_{NUM}^{ACC} . Note that this in principle does not exclude the possibility of the ambiguity between PO_{NUM}^{ACC} and PO_{NUM}^{MOD} , but the latter analysis will be more marginal than the former, perhaps altogether inaccessible to some speakers.¹³

¹³Also, if PO_{NUM}^{MOD} surfaced in (2), we would expect – contrary to facts – the numeral phrase to be able to occur in the genitive when the verb is negated or nominalised; see the discussion in §3.5 below, esp., around (45) on p. 16.

On the basis of these considerations we assume that the three elements PO surface in the following examples (this is a partial list; see below):

PO_N – (1), (7)–(9), (10b)–(12b);

PO_{NUM}^{ACC} – (2), (13)–(15), (20);

PO_{NUM}^{MOD} – (22)–(33); perhaps marginally also in (2), (13) and (20).

The only two acceptable examples involving PO not classified here are (17)–(18), with paucal non-human-masculine numeral phrases following PO in the subject position. Such examples, while exhibiting subject–verb agreement and, hence, a nominative subject, are judged as acceptable by Łojasiewicz (1979, p. 154) and as significantly more acceptable than the clear cases of PO_{NUM}^{MOD} in (23) and (27) by Derwojedowa (2011, p. 145). As such, they seem to contradict the generalisation just proposed: since they occur in the nominative position and apparently contain a nominative NumP they should involve PO_{NUM}^{MOD} , but since they are acceptable, or at least clearly more acceptable than uncontroversial uses of PO_{NUM}^{MOD} , they should rather involve PO_{NUM}^{ACC} .

The following section presents an analysis which explains this contradiction away. According to this analysis, the acceptable (17)–(18) involve the accusative-assigning PO_{NUM}^{ACC} , so the numeral phrases *dwa fotele* ‘two armchairs’ and *trzy arkusze papieru* ‘three sheets of paper’ are taken to be accusative here. However, PO_{NUM}^{ACC} is not treated as an ordinary preposition here, but rather an element which may receive its own case – here nominative – and agree with the verb in number and gender.

With such a PO_{NUM}^{ACC} in hand, the final classification of all relevant examples above is as follows:

PO_N – (1), (7)–(9), (10b)–(12b);

PO_{NUM}^{ACC} – (2), (13)–(15), (17)–(18), (20);

PO_{NUM}^{MOD} – (22)–(33); perhaps marginally also in (2), (13), (17)–(18) and (20).

3 HPSG Analysis

3.1 Capturing generalisations

It might seem that postulating 3 lexical entries for function words with the same form and the same meaning is a clear case of a missing generalisation, but it is trivial to provide a description which states common properties of the 3 elements PO only once. We will assume here the simplest approach to the HPSG lexicon, namely, the Word Principle as construed in Höhle 1999 and Meurers 1999, i.e., essentially as the following constraint on *word* objects (where LE_i are lexical entries):

$$(34) \text{ word} \rightarrow LE_1 \vee LE_2 \vee \dots \vee LE_n$$

Given this general approach, commonalities between a number of lexical entries may be factored out as follows, where PO_{com}^d is a description common to all distributive elements PO , and PO_N^d , PO_{ACC}^d and PO_{MOD}^d stand for the descriptions of other – more idiosyncratic – properties of PO_N , PO_{NUM}^{ACC} and PO_{NUM}^{MOD} , respectively:

$$(35) \quad word \rightarrow LE_1 \vee LE_2 \vee \dots \vee (PO_{com}^d \wedge (PO_N^d \vee PO_{ACC}^d \vee PO_{MOD}^d)) \vee \dots \vee LE_n$$

3.2 Lexical entry for PO_N

We propose the following lexical entry for the preposition PO_N , before distributing it between PO_{com}^d and PO_N^d :

$$(36) \quad PO_{com}^d \wedge PO_N^d \equiv \left[\begin{array}{l} ORTH \langle po \rangle \\ SS \left[\begin{array}{l} CAT \left[\begin{array}{l} HEAD \left[\begin{array}{l} prep_cased \\ CASE \textit{str} \end{array} \right] \\ SUBJ \langle \rangle \end{array} \right] \\ VAL \left[\begin{array}{l} COMPS \langle \left[\begin{array}{l} CAT \left[\begin{array}{l} HEAD \left[\begin{array}{l} \neg numeral \\ CASE \textit{loc} \end{array} \right] \\ SUBJ \langle \rangle \\ COMPS \langle \rangle \end{array} \right] \\ VAL \left[\begin{array}{l} CONT [2] \end{array} \right] \end{array} \right] \rangle \rangle \rangle \end{array} \right] \\ CONT \textit{distributive}'([2], [3]) \\ COLL [3] \end{array} \right] \rangle \end{array} \right]$$

According to this lexical entry, PO_N is a case-bearing preposition, *prep_cased* (a subtype of *prep* and *cased*, the latter introducing the *CASE* attribute). Unlike proper (uncased) prepositions, such elements may occur in broadly nominal positions, i.e., in syntactic positions where case is assigned. Moreover, the *CASE* value is specified as *str*(uctural) – this accounts for the distribution of PO_N only in nominative, accusative and “secondary genitive” positions, i.e., exactly the structural case positions in Polish (Przepiórkowski, 1999).

While positing a cased preposition is highly non-standard, there is at least another such a preposition in Polish, namely, *OKOŁO*, which assigns the genitive case, as in the following example from Grochowski 1997, p. 73, where *Okolo stu kobiet* ‘around hundred women’ is the subject and the head numeral *stu* ‘hundred’ is in the genitive (the nominative form would be *sto*):¹⁴

- (37) *Okolo stu kobiet podpisało ten wniosek.*
 around hundred.GEN women.GEN signed.3.N.SG this.ACC petition.ACC
 ‘Around a hundred women signed this petition.’

Returning to PO_N , this preposition takes one complement which is specified as a saturated phrase in the locative case – but not a numeral phrase. This is empirically

¹⁴ Somewhat similarly to the distributive multi-lexeme *PO*, this preposition *OKOŁO* co-exists with a homophonous and homosemous adnumeral operator *OKOŁO* (Grochowski, 1997, pp. 73–74); hence, *Okolo sto kobiet podpisało...* is also acceptable.

more adequate than saying the complement must be a noun phrase, since also some locative adjective phrases – so-called elective constructions – may appear here, as in the following example with the complement headed by the adjective form *najlepszey* ‘best’:

- (38) Komisja... wybrała... po najlepszey... ze złożonych
 commission.NOM chose DISTR best.LOC.SG of submitted.GEN
 ofert każdego wykonawcy.
 offers.GEN every.GEN contractor.GEN
 ‘The commission selected the best offer each from those submitted by every
 contractor.’ (Google)

Finally, the semantic impact of the distributive PO is only marked in (36), as the semantics of distributivity is complex and a matter of ongoing work (cf., e.g., Zimmermann 2002 and Dotlačil 2012). The key problem, which has led to some non-compositional treatments of the semantically analogous binominal EACH in English (as in *I gave them an apple each*, with *each* arguably attaching to the preceding NP; Safir & Stowell 1988), is that – apart from the nominal or numeral phrase to which such a distributive element attaches (so-called *distributed share*; Choe 1987), e.g., *jablku* ‘an apple’ in (1) – it also takes another semantic argument, which occurs elsewhere in the sentence (called *sorting key* in Choe 1987), e.g., *im* ‘them’ in (1). Moreover, contrary to what might be suggested by the simple constructed example (1), the *sorting key* may be both linearly and configurationally distant from PO (see, e.g., (7), where the *sorting key* is embedded within an adjunct PP), may be implicit and may even be contained within the *distributed share* itself (as, e.g., in (22)).

While we do not have a detailed HPSG analysis of the semantics of distributive PO to offer at present,¹⁵ we envisage that the apparently non-compositional effects could be formalised in HPSG in terms of the COLL feature (Richter & Sailer, 1999), as explicated in Sailer 2003, § 8.2, possibly with restrictions argued for in Soehn 2004. A reference to the value of COLL, i.e., to the whole utterance (Sailer, 2003) or its appropriate constituent (Soehn, 2004), is needed in order to access the *sorting key* and compose it with the semantics of PO and the *distributive share*.

3.3 Lexical entry for PO^{MOD}_{NUM}

It is natural to represent PO^{MOD}_{NUM} as a modifier or a marker, as the whole PO^{MOD}_{NUM}-phrase behaves syntactically just as the following numeral phrase. On the other hand, we would like to factor out the semantics shared between the three distributive elements PO, i.e., minimally:

¹⁵But see Przepiórkowski 2013 for a Glue Semantics account compatible with the syntactic LFG analysis of Przepiórkowski & Patejuk 2013. It remains to be investigated whether the analysis presented in Przepiórkowski 2013 may be straightforwardly carried over to HPSG, e.g., building on Asudeh & Crouch 2002.

$$(39) \quad \text{PO}_{\text{com}}^d \equiv \left[\begin{array}{l} \text{ORTH } \langle po \rangle \\ \text{SS } \left[\begin{array}{l} \text{CAT|VAL|COMPS } \langle \text{CONT } [2] \rangle \\ \text{CONT } \mathbf{distributive}'([2], [3]) \end{array} \right] \\ \text{COLL } [3] \end{array} \right] \quad (\text{first version; cf. (41)})$$

But for this to be a common part of all distributive elements, $\text{PO}_{\text{NUM}}^{\text{MOD}}$ (and $\text{PO}_{\text{NUM}}^{\text{ACC}}$, see below) – just like PO_{N} – must also be treated as a head, here subcategorising for a numeral phrase.

In HPSG, there is an obvious way to analyse marker-like elements as heads, namely, as *weak heads* in the sense of Tseng 2002, p. 273. In brief, weak heads, unlike classical HPSG markers, subcategorise for a complement, but they take over all syntactic and semantic properties of this complement, and add their own MARKER value. Abeillé 2003, 2006 adapts this notion to the analysis of French coordinating conjunctions in a way that requires the structure-sharing of syntactic (but not semantic) properties between the weak head and its complement. We will call such elements – sharing their syntax (but not necessarily their semantics) with their complements – *syntactically vacuous heads* here.¹⁶

The complete lexical entry for $\text{PO}_{\text{NUM}}^{\text{MOD}}$ is given below:

$$(40) \quad \text{PO}_{\text{com}}^d \wedge \text{PO}_{\text{MOD}}^d \equiv \left[\begin{array}{l} \text{ORTH } \langle po \rangle \\ \text{SS } \left[\begin{array}{l} \text{CAT } \left[\begin{array}{l} \text{HEAD } [1] \\ \text{SUBJ } \langle \rangle \end{array} \right] \\ \text{VAL } \left[\begin{array}{l} \text{COMPS } \langle \left[\begin{array}{l} \text{CAT } \left[\begin{array}{l} \text{HEAD } [1] \text{numeral} \\ \text{SUBJ } \langle \rangle \\ \text{COMPS } \langle \rangle \end{array} \right] \end{array} \right] \rangle \end{array} \right] \\ \text{CONT } \mathbf{distributive}'([2], [3]) \end{array} \right] \\ \text{COLL } [3] \end{array} \right]$$

Note that there are no restrictions on the CASE value of $\text{PO}_{\text{NUM}}^{\text{MOD}}$, i.e., it may appear in any – also structural – case position. We will return to this issue in §3.5 below.

Comparing (40) with (36) above, we see that the following information may be factored out:

$$(41) \quad \text{PO}_{\text{com}}^d \equiv \left[\begin{array}{l} \text{ORTH } \langle po \rangle \\ \text{SS } \left[\begin{array}{l} \text{CAT|VAL } \left[\begin{array}{l} \text{SUBJ } \langle \rangle \\ \text{COMPS } \langle \left[\begin{array}{l} \text{CAT|VAL } \left[\begin{array}{l} \text{SUBJ } \langle \rangle \\ \text{COMPS } \langle \rangle \end{array} \right] \end{array} \right] \rangle \end{array} \right] \\ \text{CONT } \mathbf{distributive}'([2], [3]) \end{array} \right] \\ \text{COLL } [3] \end{array} \right]$$

Then the descriptions PO_{N}^d and PO_{MOD}^d boil down to the following:

¹⁶Note by the way that such *syntactically vacuous heads* are dual to the *semantically vacuous heads* of Pollard & Yoo 1998 and Przepiórkowski 1998, where only semantics is shared. This means that *weak heads* in the sense of Tseng 2002 may be treated as a derived notion and defined as the intersection of the set of syntactically vacuous heads and the set of semantically vacuous heads.

$$(42) \text{ PO}_N^d \equiv \left[\text{SS|CAT} \left[\begin{array}{l} \text{HEAD} \left[\begin{array}{l} \text{prep_cased} \\ \text{CASE } str \end{array} \right] \\ \text{VAL|COMPS} \langle \left[\text{CAT|HEAD} \left[\begin{array}{l} \neg numeral \\ \text{CASE } loc \end{array} \right] \right] \rangle \end{array} \right] \right]$$

$$(43) \text{ PO}_{MOD}^d \equiv \left[\text{SS|CAT} \left[\begin{array}{l} \text{HEAD } \boxed{1} \\ \text{VAL|COMPS} \langle \left[\text{CAT|HEAD } \boxed{1} numeral \right] \rangle \end{array} \right] \right]$$

3.4 Lexical entry for PO_{NUM}^{ACC}

Towards the end of §2.3 we noted that while PO_{NUM}^{ACC} assigns a specific case (namely, accusative) like prepositions do, it may still receive its own case and – when it bears the nominative case in the subject position – agree with the verb in number and gender (inherited from the numeral phrase). We claim that this behaviour is modelled well by treating PO_{NUM}^{ACC} as a kind of a syntactically vacuous head, like in case of PO_{NUM}^{MOD} . The only difference between these two elements would be that PO_{NUM}^{ACC} assigns the accusative to its complement and itself bears case – namely, structural, resolvable to nominative, accusative or (“secondary”) genitive.

This means that PO_{NUM}^{ACC} has the same case specification as PO_N : $[\text{CASE } str]$. But here similarities end: PO_{NUM}^{ACC} is a syntactically vacuous head taking over all other morphosyntactic features of its numeral complement, including the numeral part of speech. That is, with the right numeral (paucal and non-human-masculine), such a PO_{NUM}^{ACC} -phrase agrees with the verb in a nominative subject position, as in (17)–(18) above. On the other hand, we stipulate that prepositions do not agree with finite verbs, even when they bear the nominative case, as – by the current analysis – in (7) on p. 3.¹⁷

The following partial lexical entry for PO_{NUM}^{ACC} , with the part common to all distributive elements PO factored out in (41), reflects these considerations:

$$(44) \text{ PO}_{ACC}^d \equiv \left[\text{SS|CAT} \left[\begin{array}{l} \text{HEAD } \boxed{1 \backslash \text{CASE}} [\text{CASE } str] \\ \text{VAL|COMPS} \langle \left[\text{CAT|HEAD } \boxed{1 \backslash \text{CASE}} \left[\begin{array}{l} numeral \\ \text{CASE } acc \end{array} \right] \right] \rangle \end{array} \right] \right]$$

This description introduces new notation inspired by the LFG mechanism of re-

¹⁷This stipulation seems necessary, as phrases headed by the preposition PO_N arguably have INDEX so – when nominative – they would without it participate in the subject–verb agreement, which in Polish involves INDEX, not CONCORD (in the sense of Wechsler & Zlatić 2000; see Przepiórkowski et al. 2002). One argument for the claim that such PO_N -phrases have INDEX is that they apparently may act as controllers, as in the following attested example:

- (i) Do finału... zdołało zakwalifikować się po jednym bokserze Radomiaka
to finals managed.3.SG.N qualify RM DISTR one.LOC boxer.LOC Radomiak.GEN
i Polonii.
and Polonia.GEN

‘One boxer from each of Radomiak and Polonia managed to qualify to the finals.’ (Google)

Another argument could be provided by binding, but acceptability of relevant examples is more difficult to ascertain.

striction (Kaplan & Wedekind, 1993).¹⁸ In LFG, $f \backslash \text{CASE} = g \backslash \text{CASE}$ means that the f-structures f and g are equal up to their values of CASE (if any). In (44) multiple occurrences of $[1 \backslash \text{CASE}]$ indicate structures which are partially structure-shared, up to the value of the attribute CASE. That is, objects so described have the same type and they structure-share the values of all attributes apart from values of CASE (if this attribute happens to be among those appropriate to the given type at all). This in particular means that the HEAD value of $\text{PO}_{\text{NUM}}^{\text{ACC}}$ will be *numeral*, just as the head of its complement, that they will share all morphosyntactic attributes appropriate to *numeral*, including NUMBER and GENDER, but they will differ in CASE as indicated in (44) – $\text{PO}_{\text{NUM}}^{\text{ACC}}$ will have its case resolved to one of the morphological cases depending on the structural case position it will occupy (nominative, accusative or genitive), while its complement must always bear the accusative.

3.5 Analysis at work

Let us illustrate the analysis of this section with a few examples, starting with the most basic (1)–(2) on p. 2.

In (1), PO combines with a noun phrase, not a numeral phrase, so it cannot correspond to descriptions (43)–(44), which specify the complement to be *numeral*. On the other hand, (42) is applicable here, the locative case requirement is met by the noun phrase *jabłku* ‘apple.LOC’, and the cased preposition PO_N has its structural case resolved to nominative via case assignment principles like those described in Przepiórkowski 1999.

Conversely, (2) involves a numeral phrase, which is incompatible with the $\neg \text{numeral}$ condition in (42). However, both (43) and (44) lead to an analysis of (2). According to (43), *po* shares its HEAD value with that of the numeral phrase *dwa jabłka* ‘two.ACC apples.ACC’, i.e., both are analysed as accusative numeral phrases. According to (44), *po* does not share its CASE with that of the numeral complement. However, it assigns accusative case to that complement, and it has its own structural case resolved to accusative via general structural case principles, so the result is virtually indistinguishable from the analysis involving (43). Thus, as it stands, the account produces spurious ambiguity in case of (2).

We see two ways of attacking this problem. First, as repeatedly mentioned above, $\text{PO}_{\text{NUM}}^{\text{MOD}}$ is marginal, perhaps absent from grammars of some native speakers, so in any full-fledged grammar involving probabilities or Optimality Theory-like constraints, the analysis based on (43) will be blocked by that based on the fully acceptable (44). Unfortunately, current versions of HPSG do not take probabilities or ranking into account. Secondly, we may claim that (2) may only involve $\text{PO}_{\text{NUM}}^{\text{ACC}}$, and not $\text{PO}_{\text{NUM}}^{\text{MOD}}$. Technically, a constraint could be added to (44) to the effect that it cannot occupy structural case positions: $\neg[\text{CASE } str]$. One argument for this stronger claim is that $\text{PO}_{\text{NUM}}^{\text{MOD}}$ seems impossible in structural (or “secondary”) genitive positions, e.g.:

¹⁸We emphasise that this is a matter of notation and not the underlying logical formalism, which we assume to be essentially that of Richter 2000.

- (45) *Dzieci nie dostały po dwóch pączków.
 children.NOM NEG received.3.PL DISTR two.GEN donuts.GEN
 ‘The children did not get two donuts each.’ (intended; cf. (14))

In such positions, the numeral phrase may only bear the accusative case, as in (14)–(15) on p. 4, so only PO_{NUM}^{ACC} as specified in (44) may surface here.

Such a constraint would also prevent a similar spurious ambiguity in the analysis of (13) on p. 4, where *po* combines with *kilka owoców* ‘several.ACC fruit.GEN’. As a non-paucal numeral, *kilka* receives the accusative case in the subject position (cf. fn. 10 on p. 6), and since both PO_{NUM}^{ACC} and PO_{NUM}^{MOD} inherit the numeral characteristics of their complement, they also receive the accusative case (via the already mentioned general structural case assignment rules). So, for all intents and purposes, the subject position in (13) is a structural accusative position and two analyses are possible just as in case of (2) – unless we prohibit the analysis involving PO_{NUM}^{MOD} with a stipulation like $\neg[CASE\ str]$ added to (43).

However, as it stands, the stipulation is too strong, as it would make (22)–(24) on p. 7 ungrammatical. These examples involve uncontroversially nominative paucal numerals agreeing with the verb and may be analysed only via PO_{NUM}^{MOD} . But if this element were forbidden from occupying any structural positions, it would also be prohibited in the structural nominative in (22)–(24), contrary to facts. For this reason, while it is possible to formulate a more complicated constraint limiting occurrences of PO_{NUM}^{MOD} to environments such as those in (22)–(24),¹⁹ here we retain the version of the analysis which produces spurious ambiguities and assume that the choice between the analyses is made in other parts of the grammar (perhaps not expressible in contemporary HPSG).

Finally, let us consider the fully acceptable examples (17)–(18) on p. 5 involving numerals and NPs syncretic between nominative and accusative. Concentrating on (17), we note that PO_{NUM}^{ACC} assigns the accusative to *dwa fotele* ‘two armchairs’; all other morphosyntactic features are shared between *po* and the numeral *dwa*. Since *dwa* is a paucal agreeing numeral and the whole PO-phrase occurs in the subject position, the phrase receives the nominative case via general case principles. Hence, contrary to the initial grammatical glosses in (17), particular words in the subject phrase should bear the following grammatical features:

- (17') W pokojach będą po dwa fotele.
 in rooms be.FUT.PL DISTR.NOM.PL two.ACC.PL armchair.ACC.PL
 ‘There will be two armchairs in each room.’

Again, an analysis involving PO_{NUM}^{MOD} is in principle also possible here, but we assume that it is either blocked by the more acceptable analysis involving PO_{NUM}^{ACC} via mechanisms currently not expressible in HPSG or that a relevant constraint is

¹⁹Namely: $[CASE\ str] \rightarrow \left[\begin{smallmatrix} ACM\ congr \\ GENDER\ ml \end{smallmatrix} \right]$. See, e.g., Przepiórkowski & Patejuk 2012a,b about the ACM attribute (appropriate to numerals) and the *congr* type (of agreeing numerals); *ml* stands for human-masculine.

added to (43) blocking the occurrence of PO_{NUM}^{MOD} with non-human-masculine agreeing numerals (cf. fn. 19).

4 Conclusion

This paper deals with a very infrequent but intriguing phenomenon of distance distributivity in Polish involving function lexemes *PO*. We demonstrated that (at least) three distinct lexemes are needed to handle the variety of distributive constructions, but we also showed how these homophonous and at the same time homosemous lexemes may be encoded in a way that minimises redundancy in the lexicon and in the grammar. In particular, although case assignment properties of the three elements differ widely, with one of them actually being transparent to such case assignment, all three are analysed as heads of *PO*-phrases – the two adnumeral elements as syntactically vacuous heads. In the process, we also reaffirmed the usefulness of the LFG mechanism of restriction and proposed a shorthand for representing it in HPSG.

While dealing with a quirk in Polish, the analysis posits a more general question about the role of marginality – and, more generally, gradience – in HPSG: should it be represented via mechanisms known from the Optimality Theory (as in LFG), via tools specific to probabilistic parsing, or in yet another way? A number of talks at the HPSG 2013 conference suggested that answering this question is crucial for the further development of HPSG, and the current paper shares this position.

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