The Syntax of Distance Distributivity in Polish: Preserving Generalisations with Weak Heads

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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).

1 A 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).

2 We 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 generalization 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. ĆWIERĆ). Moreover, there seems to be a semantic restriction at work (cf. Łojasiewicz 1979; Przepiórkowski 2008; Boguṣławski 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., pluralis 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 POS 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)) 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 POS, Łojasiewicz 1979 gives the following example of its occurrence in the otherwise nominative (subject) position:

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

To this, the following examples of POS 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, POS 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

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5Genitive 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.
6RM stands here for reflexive marker, a part of the inherently reflexive verbs PRZYGŁADAĆ SIĘ ‘observe’ and CHWYCIC SIĘ ‘grab’.
7Note that the forms of JEDEN ‘one’ in these examples are not numerals, but rather adjectives, pace Saloni 1974 and Gruszczynski & Saloni 1978; see also Przepiórkowski 2006a for the reaffirmation of this position based on the cooccurrence of POS and JEDEN.

(11a) sounds acceptable to one of the authors.
At first glance facts seem to be similar for the adnumeral \textit{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) \begin{verbatim}
Na moich drzewach dojrzewa dziennie po kilka owoców.
do
donuts.

trees ripen daily several fruit.
\end{verbatim}

‘Several pieces of fruit ripen every day on each of my trees.’

(14) \begin{verbatim}
Dzieci nie dostaly po dwa pączki.

\end{verbatim}

‘The children did not get two donuts each.’

(15) \begin{verbatim}
Myśleliśmy o daniu dzieciom po trzy pączki.

\end{verbatim}

‘We thought about giving the children three donuts each.’

It should be noted that, while the accusative case of \textit{dwa jabłka} ‘two apples’ in (2) could in principle reflect the fact that the \textit{PO}NUM-phrase occupies an accusative position (\textit{PO}NUM would be transparent to case assignment on such an analysis), examples (14)–(15), where such \textit{PO}NUM-phrases occur in genitive positions, show that \textit{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 pięć śliwek.

‘Each of you will get one apple, two pears and five plums.’ \((\text{intended})\)

‘You will get one apple each, as well as two pears and five plums.’ \((\text{actual})\)

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 dwa fotelie.

‘There will be two armchairs in each room.’

(18) Na ławkach leżały trzy arkusze papieru.

‘There lay three sheets of paper on each bench.’

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\(^8\)She also considers the two fossilised expressions *po czemu* ‘how much each’ and *po złotemu* ‘one złoty each’, where *czemu* and *złotemu* are dative forms.

\(^9\)Case 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 (*fotelie, 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.

\( \text{council.ACC constitued.PL two.NOM representatives.NOM region.GEN} \)

‘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.

\( \text{NEG assigned-I them.DAT DISTR two.ACC representatives.ACC/GEN} \)

‘(Did not) assign(ed) them two representatives each.’

(21) *(Nie) przydzieliłem im po dwaj przedstawiciele.

\( \text{NEG assigned-I them.DAT DISTR two.NOM representatives.NOM} \)

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 (Derwojedowa, 2011, pp. 144–145), they do occur in texts, as in the following attested examples:\(^{11}\)

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\(^{10}\)See 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 Malecki 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 & Pałejuk 2012a,b for an LFG analysis.

\(^{11}\)The 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 dwaj przedstawiciele każdego regionu...

(23) Do Senatu wybierani są po dwaj senatorzy z każdego stanu.

(24) ... awans uzyskali po trzej najlepsi z każdej kategorii.

(25) Stańcie tu, po dwaj z każdej strony.

In summary, the data discussed in this subsection calls for distinguishing two adnumeral elements: one, which we will call \( PO_{acc} \), assigns the accusative case, even in the “secondary genitive” positions, and another one, \( PO_{mod} \), 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 \( PO_{mod} \) and some justification for the superscript \( \text{MOD} \) (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 trzem osobom z każdej klasy...

Also Łojasiewicz 1979, p. 158, admits forms such as “in some constructions” involving the distributive PO, citing as grammatical the following example:
While perhaps less frequent, analogous examples may be found involving instrumental positions,\textsuperscript{12} cf. (29)–(31), and even an occasional genitive or locative position, cf. (32) and (33), respectively.

\textsuperscript{12}We are grateful to Anna Kibort for pointing this out.
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 $\text{PO}^{\text{MOD}}_{\text{NUM}}$ 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 $\text{PO}^{\text{MOD}}_{\text{NUM}}$ 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 $\text{PO}^{\text{MOD}}_{\text{NUM}}$ as a syntactic head, on a par with $\text{PO}^{\text{ACC}}_{\text{NUM}}$ and $\text{PO}^{\text{N}}$.

2.3 The distribution of the three elements PO

It is easy to recognise $\text{PO}_{\text{N}}$ – it occurs with nominal, not numeral phrases. On the other hand, it is not always clear which of the two adnumeral elements, $\text{PO}^{\text{ACC}}_{\text{NUM}}$ or $\text{PO}^{\text{MOD}}_{\text{NUM}}$, surfaces in a given context. Consider the basic example (2) on p. 2. In the previous subsection we established that $\text{PO}^{\text{MOD}}_{\text{NUM}}$ is transparent to case assignment, so it could be claimed that po in this example is a form of $\text{PO}^{\text{MOD}}_{\text{NUM}}$ 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, $\text{PO}^{\text{ACC}}_{\text{NUM}}$, which assigns the accusative case, and this $\text{PO}^{\text{ACC}}_{\text{NUM}}$ could also be claimed to occur in (2). So now we have three ways of analysing (2): as involving $\text{PO}^{\text{ACC}}_{\text{NUM}}$, as involving $\text{PO}^{\text{MOD}}_{\text{NUM}}$, or as ambiguous between the two analyses.

Similarly, (13) on p. 4 could be analysed as involving $\text{PO}^{\text{ACC}}_{\text{NUM}}$, which assigns the accusative to kilka owoców ‘several fruit’, or as involving $\text{PO}^{\text{MOD}}_{\text{NUM}}$ 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 $\text{PO}^{\text{MOD}}_{\text{NUM}}$ are rare, often judged as marginal or unacceptable. That is, since both (2) and (13) are fully acceptable, we assume that they involve $\text{PO}^{\text{ACC}}_{\text{NUM}}$. Note that this in principle does not exclude the possibility of the ambiguity between $\text{PO}^{\text{ACC}}_{\text{NUM}}$ and $\text{PO}^{\text{MOD}}_{\text{NUM}}$, but the latter analysis will be more marginal than the former, perhaps altogether inaccessible to some speakers.\footnote{\text{Also, if } \text{PO}^{\text{MOD}}_{\text{NUM}} \text{ 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.}}

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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):

\[
\begin{align*}
\text{PO}_N &\rightarrow (1), (7)–(9), (10b)–(12b); \\
\text{PO}_{ACC}^{NUM} &\rightarrow (2), (13)–(15), (20); \\
\text{PO}_{MOD}^{NUM} &\rightarrow (22)–(33); \text{ perhaps marginally also in (2), (13) and (20).}
\end{align*}
\]

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 \(\text{PO}_{MOD}^{NUM}\) 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 \(\text{PO}_{MOD}^{NUM}\), but since they are acceptable, or at least clearly more acceptable than uncontroversial uses of \(\text{PO}_{MOD}^{NUM}\), they should rather involve \(\text{PO}_{ACC}^{NUM}\).

The following section presents an analysis which explains this contradiction away. According to this analysis, the acceptable (17)–(18) involve the accusative-assigning \(\text{PO}_{ACC}^{NUM}\), so the numeral phrases \textit{dwa fotele} ‘two armchairs’ and \textit{trzy arkusze papieru} ‘three sheets of paper’ are taken to be accusative here. However, \(\text{PO}_{ACC}^{NUM}\) 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 \(\text{PO}_{ACC}^{NUM}\) in hand, the final classification of all relevant examples above is as follows:

\[
\begin{align*}
\text{PO}_N &\rightarrow (1), (7)–(9), (10b)–(12b); \\
\text{PO}_{ACC}^{NUM} &\rightarrow (2), (13)–(15), (17)–(18), (20); \\
\text{PO}_{MOD}^{NUM} &\rightarrow (22)–(33); \text{ perhaps marginally also in (2), (13), (17)–(18) and (20).}
\end{align*}
\]

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 \textit{word} objects (where \(\text{LE}_i\) are lexical entries):

\[
\text{word} \rightarrow \text{LE}_1 \lor \text{LE}_2 \lor \ldots \lor \text{LE}_n
\]
Given this general approach, commonalities between a number of lexical entries may be factored out as follows, where \( \text{PO}_{\text{com}} \) is a description common to all distributive elements \( \text{PO} \), and \( \text{PO}_{\text{N}}, \text{PO}_{\text{ACC}} \) and \( \text{PO}_{\text{MOD}} \) stand for the descriptions of other – more idiosyncratic – properties of \( \text{PO} \), \( \text{PO}_{\text{NUM}} \) and \( \text{PO}_{\text{MOD}} \), respectively:

\[
\text{word} \rightarrow \text{LE}_1 \lor \text{LE}_2 \lor \ldots \lor (\text{PO}_{\text{com}} \land (\text{PO}_N \lor \text{PO}_{\text{ACC}} \lor \text{PO}_{\text{MOD}})) \lor \ldots \lor \text{LE}_n
\]

### 3.2 Lexical entry for \( \text{PO}_N \)

We propose the following lexical entry for the preposition \( \text{PO}_N \), before distributing it between \( \text{PO}_{\text{com}} \) and \( \text{PO}_N^d \):

\[
\text{PO}_{\text{com}} \land \text{PO}_N^d = \left[ \begin{array}{c}
\text{ORTH} [po] \\
\text{SS} \\
\text{CAT} \left[ \begin{array}{c}
\text{HEAD} [\text{prep}_\text{cased}]
\end{array} \right] \\
\text{VAL} \left[ \begin{array}{c}
\text{SUBJ} (\quad)
\end{array} \right]
\end{array} \right]
\]

According to this lexical entry, \( \text{PO}_N \) is a case-bearing preposition, \( \text{prep}_\text{cased} \) (a subtype of \( \text{prep} \) and \( \text{cased} \), the latter introducing the \( \text{CASE} \) attribute). Unlike proper (uncased) prepositions, such elements may occur in broadly nominal positions, i.e., in syntactic positions where case is assigned. Moreover, the \( \text{CASE} \) value is specified as \( \text{str}(\text{uctural}) \) – this accounts for the distribution of \( \text{PO}_N \) 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, \( \text{OKOŁO} \), which assigns the genitive case, as in the following example from Grochowski 1997, p. 73, where \( \text{Około stu kobiet podpisało} \ldots \) is also acceptable.

\[
(37) \quad \text{Około stu kobiet podpisało ten wniosek.}
\text{Around hundred GEN women GEN signed 3. N. SG this ACC petition ACC}
\text{‘Around a hundred women signed this petition.’}
\]

Returning to \( \text{PO}_N \), this preposition takes one complement which is specified as a saturated phrase in the locative case – but not a numeral phrase. This is empirically

\[14\text{Somewhat similarly to the distributive multi-lexeme PO, this preposition \text{OKOŁO} co-exists with a homophonous and homosemous adnumeral operator \text{OKOŁO} (Grochowski, 1997, pp. 73–74); hence, \text{Około sto kobiet podpisało} \ldots \text{ is also acceptable.} \]
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 najlepszej ‘best’:

(38) Komisja. . . wybrala. . . po najlepszej. . . ze złożonych
commission.NOM chose DISTR best.LOC.SG of submitted.GEN
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 lead 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., jabłku ‘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, 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 distributed share.

3.3 Lexical entry for PO\textsubscript{MOD}^\textsubscript{NUM}

It is natural to represent PO\textsubscript{MOD}^\textsubscript{NUM} as a modifier or a marker, as the whole PO\textsubscript{MOD}^\textsubscript{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:

\footnote{But 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.}
But for this to be a common part of all distributive elements, \( \text{PO}^{\text{MOD}} \) (and \( \text{PO}^{\text{ACC}} \), see below) – just like \( \text{PO}^{\text{N}} \) – 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 \textit{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 \textit{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 – \textit{syntactically vacuous heads} here.\(^{16}\)

The complete lexical entry for \( \text{PO}^{\text{MOD}} \) is given below:

\[
(40) \quad \text{PO}_\text{com}^d \land \text{PO}_\text{mod}^d \equiv \\
\begin{array}{l}
\begin{array}{l}
\text{ORTH} \langle po \rangle \\
\text{SS}
\end{array}
\begin{array}{l}
\text{CAT} | \text{VAL} | \text{COMPS} \\
\text{CONT} \text{distributive}'(2,3)
\end{array}
\end{array}
\end{array}
\]

Note that there are no restrictions on the \textit{CASE} value of \( \text{PO}_\text{NUM} \), 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:

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

Then the descriptions \( \text{PO}_\text{N}^d \) and \( \text{PO}_\text{MOD}^d \) boil down to the following:

\[16\text{Note by the way that such \textit{syntactically vacuous heads} are dual to the \textit{semantically vacuous heads} of Pollard & Yoo 1998 and Przepiórkowski 1998, where only semantics is shared. This means that \textit{weak heads} in the sense of Tseng 2002 may be treated as a derived notion and defined as the intersection of the set of syntactically vacuous heads and the set of semantically vacuous heads.}\]
Towards the end of §2.3 we noted that while $P_{\text{ACC}}$ 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 $P_{\text{ACC}}$ as a kind of a syntactically vacuous head, like in case of $P_{\text{MOD}}$. The only difference between these two elements would be that $P_{\text{ACC}}$ assigns the accusative to its complement and itself bears case – namely, structural, resolvable to nominative, accusative or (“secondary”) genitive.

This means that $P_{\text{ACC}}$ has the same case specification as $P_N$: $[\text{CASE str}]$. But here similarities end: $P_{\text{ACC}}$ 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 $P_{\text{ACC}}$-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.

The following partial lexical entry for $P_{\text{ACC}}$, with the part common to all distributive elements $P$ factored out in (41), reflects these considerations:

(44) $P_{\text{ACC}}^d \equiv \left[ \begin{array}{l}
\text{HEAD} \left[ \begin{array}{l}
\text{prep\_cased} \\
\text{CASE str}
\end{array} \right]
\end{array} \right] \\
\text{VAL} \mid \text{COMPS} \left\{ \left[ \begin{array}{l}
\text{CAT} \mid \text{HEAD} \\
\neg \text{numeral} \\
\text{CASE loc}
\end{array} \right] \right\}
\right]
$

This description introduces new notation inspired by the LFG mechanism of re-
striction (Kaplan & Wedekind, 1993). In LFG, \( f \text{\text{CASE}} = g \text{\text{CASE}} \) means that the f-structures \( f \) and \( g \) are equal up to their values of CASE (if any). In (44) multiple occurrences of \( \text{\text{CASE}} \) 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 \( \text{PO}^{\text{ACC}}_{\text{NUM}} \) 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) – \( \text{PO}^{\text{ACC}}_{\text{NUM}} \) 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 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 \text{\text{\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, \( \text{PO}^{\text{MOD}}_{\text{NUM}} \) 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 \( \text{PO}^{\text{ACC}}_{\text{NUM}} \) and not \( \text{PO}^{\text{MOD}}_{\text{NUM}} \). Technically, a constraint could be added to (44) to the effect that it cannot occupy structural case positions: \( \text{\neg[CASE str]} \). One argument for this stronger claim is that \( \text{PO}^{\text{MOD}}_{\text{NUM}} \) seems impossible in structural (or “secondary”) genitive positions, e.g.:

\[\text{(...)}\]
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 fruit’. 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 $¬[CASE \ str]$ 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 $PO_{NUM}^{ACC}$. 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), 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.

‘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

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19Namely: $[CASE \ str] \rightarrow [ACM \ congr \ GENDER \ m1]$. See, e.g., Przepiórkowski & Patejuk 2012a,b about the ACM attribute (appropriate to numerals) and the congr type (of agreeing numerals); $m1$ stands for human-masculine.
added to (43) blocking the occurrence of $PO_{MOD}^{NUM}$ 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 need 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.

References


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