

A typology of proportional quantifiers: Evidence from Polish partitives

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Introduction

Proportional quantifiers in Polish

Przepiórkowski (2006), Dziubała-Szrejbrowska (2016), Wągiel (2018)

- ▶ partitive expressions: PART, HALF, QUARTER and MOST
- ▶ fractions \Rightarrow not today
- ▶ understudied \Rightarrow firmer empirical footing

Puzzle

- ▶ different properties of particular proportional quantifiers

Explanation

- ▶ interaction between degree semantics and mereotopology

Data

▶ PART-words

- (1) a. część
- b. cząstka

▶ QUARTER-words

- (2) a. ćwierć
- b. ćwiartka

▶ HALF-words

- (3) a. pół
- b. połowa
- c. połówka

▶ MOST-word

- (4) większość

Data

Morphological make-up

▶ PART words

- (5) a. część
root
- b. częst-k-a
root-derivational.suffix-inflectional.marker

▶ QUARTER words

- (6) a. ćwierć
root
- b. ćwiart-k-a
root-derivational.suffix-inflectional.marker

Data

Morphological make-up

▶ HALF words

- (7) a. pól
root
- b. poł-ow-a
root-derivational.suffix-inflectional.marker
- c. poł-ów-k-a
root-derivational.suffix₁-deriv.suffix₂-infl.marker

▶ MOST word

- (8) większ-ość-∅
root-derivational.suffix-inflectional.marker

Corpus Study

National Corpus of Polish (NCP)

Przepiórkowski et al. (2012)

- ▶ representative corpus of Polish
- ▶ distribution of Polish proportional quantifiers
- ▶ collocations
- ▶ syntactic environments

Corpus Study

Collocations: *ćwierć* ('quarter') and *pół* ('half')

- ▶ number words including denumeral nouns

(9) *tysiąc* ('thousand'), *milion* ('million'), *setka* ('hundred')

- ▶ measure words

(10) *minuta* ('minute'), *metr* ('meter'), *kilogram* ('kilogram')

- ▶ container words

(11) *szklanka* ('glass'), *łyżeczka* ('spoon'), *butelka* ('bottle')

- ▶ singular count nouns

(12) *bochenek* ('loaf'), *koło* ('wheel'), *obrót* ('spin')

- ▶ plurals, mass nouns ⇒ unattested

Corpus Study

Collocations: *część* ('part'), *połowa* ('half'), *większość* ('most')

- ▶ plurals

(13) *robotnicy* ('workers'), *mury* ('walls'), *ludzie* ('people')

- ▶ singular count nouns

(14) *twarz* ('face'), *droga* ('road'), *społeczeństwo* ('society')

- ▶ mass nouns

(15) *masła* ('butter'), *kler* ('clergy')

- ▶ measure words, numbers \Rightarrow unattested/marginal

Corpus Study

Collocations: *częstka* ('part')

- ▶ lexicalized meaning: 'particle' ⇒ excluded
- ▶ singular count nouns: food terms

(16) *pomarańcza* ('orange'), *owoc* ('fruit')

- ▶ singular count nouns: solid objects

(17) *różaniec* ('rosary'), *relikwia* ('relic')

- ▶ singular count nouns: abstract

(18) *prawda* ('truth'), *natura* ('nature'), *życie* ('life')

- ▶ measures, numbers, mass, plurals ⇒ unattested/marginal

Corpus Study

Collocations: *ćwiartka* ('quarter')

- ▶ lexicalized meaning: '0.25l bottle of liquor' ⇒ excluded
- ▶ singular count nouns: food terms

(19) *cytryna* ('lemon'), *chleb* ('bread'), *kurczak* ('chicken')

- ▶ singular count nouns: flat surfaces

(20) *papier* ('paper'), *ekran* ('screen')

- ▶ measures, numbers, mass, plurals ⇒ unattested/marginal

Corpus Study

Collocations: *połówka* ('half')

- ▶ singular count nouns: food terms

(21) *jabłko* ('apple'), *jajko* ('egg'), *orzech* ('nut')

- ▶ singular count nouns: solid objects

(22) *papieros* ('cigarette'), *muszla* ('shell'), *kamienica* ('house')

- ▶ measures, numbers, mass, plurals ⇒ unattested/marginal

Corpus Study

Degree modifiers: *prawie* ('almost') and *niemal* ('nearly')

▶ attested: *ćwierć*, *pół*, *połowa* and *większość*

(23) To już **prawie pół** roku...
that already almost half year.GEN
'It's been already almost half a year...' [NCP]

(24) **Niemal większość** inwestycji (...) zrealizowano
nearly most investments.GEN was.realized
bez pozwolenia...
without permission.GEN
'Nearly majority of investments were realized without the
permission...' [NCP]

▶ otherwise unattested/marginal

Corpus Study

Some contrasts

► measure terms

- (25) ...wiedzą, co znaczy ćwierć tony trotylu w
they-know what means quarter₁ tonne.GEN TNT.GEN in
rękach amatora.
hands amateur.GEN
'...they know what a quarter ton of TNT in the hands of an
amateur means.' [NCP]
- (26) #Wiedzą, co znaczy ćwiartka tony trotylu w
they-know what means quarter₂ tonne.GEN TNT.GEN in
rękach amatora.
hands amateur.GEN

Corpus Study

Some contrasts

► cumulative predicates

- (27) ...wywinał tylko ciupagą i połowa napastników
he-brandished only axe and half₂ agressors.GEN
padła na ziemię.
fell on ground
'...he only brandished an axe and half of the agressors hit
the ground.' [NCP]
- (28) #Wywinał tylko ciupagą i pół napastników padło
he-brandished only axe and half₁ agressors.GEN fell
na ziemię.
on ground

Corpus Study

Some contrasts

► degree modifiers

- (29) ...obie miały okulary automobilowe zakrywające
both had eyeglasses automobile.ADJ covering
niemal pół twarzy...
nearly half₁ face.GEN

'...they both had car goggles covering nearly half of the face...'

[NCP]

- (30) #Obie miały okulary automobilowe zakrywające
both had eyeglasses automobile.ADJ covering
niemal część twarzy.
nearly part face.GEN

Corpus Study

Distributional properties of Polish proportional quantifiers

- ▶ three different classes
- ▶ measure terms
- ▶ degree modifiers
- ▶ cumulative predicates

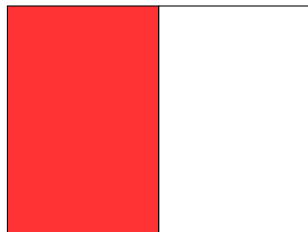
	<i>ćwierć</i> 'quarter'	<i>pół</i> 'half'	<i>połowa</i> 'half'	<i>większość</i> 'most'	<i>część</i> 'part'	<i>częstka</i> 'part'	<i>połówka</i> 'half'	<i>ćwiartka</i> 'quarter'
measure terms	✓	✓	*	*	*	*	*	*
degree modifiers	✓	✓	✓	✓	*	*	*	*
cumulative pred.	*	*	✓	✓	✓	*	*	*

More Data

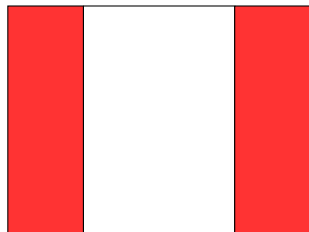
Relevance of spatial integrity in subatomic quantification

Wągiel (2018, 2019)

- ▶ NL semantics \Rightarrow sensitive to the way parts are arranged
- ▶ different structures \Rightarrow similar semantic effects
- ▶ diagnostics \Rightarrow the flag test



Flag AB



Flag ABA

More Data

Polish proportional quantifiers derived by the suffix *-k-*
Wągiel (2018, 2019)

- ▶ sensitive to the integrity condition

- (31) a. Pół flagi jest czerwone.
half flag.GEN is red
'Half the flag is red.' ✓AB, ✓ABA
- b. Połowa flagi jest czerwona.
half flag.GEN is red
'Half the flag is red.' ✓AB, ✓ABA
- c. Połówka flagi jest czerwona.
half flag.GEN is red
'A half of the flag is red.' ✓AB, #ABA

More Data

Physical and abstract objects

e.g., Pustejovsky (1995), Gotham (2017)

- ▶ class of ambiguous nouns: physical/abstract sense
- ▶ co-predication

- (32)
- The heavy **book** is easy to understand.
 - Lunch** was delicious but lasted hours.
 - The **school** that caught fire was celebrating 4th of July when the fire started.

- (33) **Książka** autorstwa Tokarczuk leży na stole.
book authorship.GEN Tokarczuk lies on table.LOC
'A book by Olga Tokarczuk is on the table.' Polish

More Data

Sortal classifiers in Hungarian

Csirmaz & Dékány (2014), Schvarcz & Wohlmuth (2020)

- ▶ optional
- ▶ general classifier *darab*
- ▶ physically distinct, integrated entities

- (34) a. három könyv
three book
'three books' ✓PHYS, ✓ABS
- b. három **darab** könyv
three CL book
'three books' ✓PHYS, #ABS

More Data

Polish proportional quantifiers derived by the suffix *-k-*

- ▶ similar effect as *darab*
- ▶ physically distinct, integrated entities

- (35) a. pól książki
half book.GEN ✓ PHYS, ✓ ABS
- b. połówka książki
half book.GEN ✓ PHYS, #ABS
- (36) a. Jadzia przeczytała pól książki.
Jadzia read half.ACC book.GEN
'Jadzia read half a book.' ✓ ABS
- b. #Jadzia przeczytała połówkę książki.
Jadzia read half.ACC book.GEN #ABS

More Data

Polish proportional quantifiers derived by the suffix *-k-*

- ▶ similar effect as *darab*
- ▶ physically distinct, integrated entities

- (37) a. część posiłku
part meal.GEN ✓PHYS, ✓ABS
- b. *cząstka* posiłku
part meal.GEN ✓PHYS, #ABS
- (38) a. Pierwsza część posiłku trwała do zmroku.
first part meal.GEN lasted to dusk.GEN
'The first part of the meal lasted until dusk.' ✓ABS
- b. #Pierwsza *cząstka* posiłku trwała do zmroku.
first part meal.GEN lasted to dusk.GEN #AB

Data Summary

Proportional quantifiers in Polish

- ▶ different properties
- ▶ (in)compatibility with measure terms
- ▶ (in)compatibility with cumulative predicates
- ▶ (in)compatibility with degree modifiers
- ▶ semantic effects relating to integrity and physicality

Proposal

- ▶ typology results from the interactions between degree semantics and mereotopology

Background

Measure phrases

Kotek (2013)

- ▶ denote sets of degrees

$$(39) \quad \llbracket \text{nine kilograms} \rrbracket = \lambda d[d = 9kg]$$

Contextually conditioned measure function μ

Bale & Barner (2009)

- ▶ different measures for different NPs \Rightarrow number, volume

$$(40) \quad m \text{ is interpreted as one of the measure functions } m_z \text{ in the series } \langle m_1, m_2, m_3 \dots m_n \rangle \text{ such that the argument for } m \text{ is in the range of } m_z; \text{ furthermore, contextually } m_z \text{ is preferred to } m_y \text{ if } z < y$$

Background

Polysemy of measurement

Rett (2014)

- ▶ $M-OP_e \Rightarrow$ covert measure operator
- ▶ shift between entities and degrees
- ▶ accounts for the polysemy

$$(41) \quad \llbracket M-OP_e \rrbracket = \lambda P \lambda d \lambda x [P(x) \wedge \mu(x) = d]$$

- (42) a. Four pizzas are vegetarian.
b. Four pizzas is more than we need.

Background

Degree modifiers

Penka (2005)

- ▶ cross-categorial *almost*
- ▶ scalar alternatives \Rightarrow ranked on a scale
- ▶ true lower 'close by' alternative required

$$(43) \quad \llbracket \text{almost}_{\approx} \rrbracket = \lambda w \lambda p_{\langle s, t \rangle} [\exists q [q \approx p \wedge q(w)] \wedge \neg p(w)]$$

- (44) a. Almost 100 students passed the exam.
b. n students passed the exam, $90 \leq n \leq 110$
 $\wedge \neg(100 \text{ students passed the exam})$

- (45) a. Almost half/all of the students passed the exam.
b. *Almost some/several/many students passed the exam.

Background

Mereotopology

Casati & Varzi (1999), Varzi (2007), Grimm (2012), Wągiel (2018)

- ▶ mereology + topological notions
- ▶ connectedness $C \Rightarrow$ primitive relation
- ▶ reflexive, symmetric
- ▶ implied by overlap

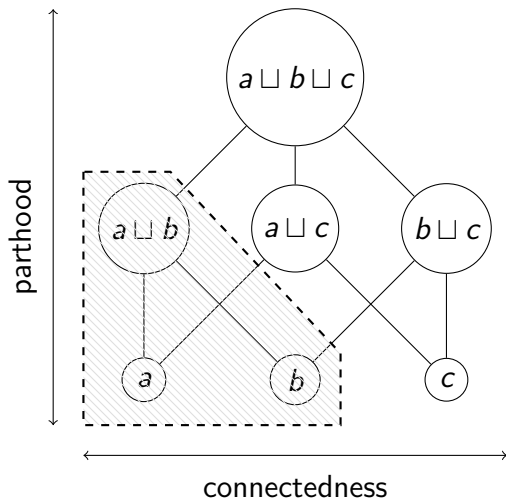
(46) Parthood \rightarrow connectedness

$$\forall x \forall y [x \sqsubseteq y \rightarrow \forall z [C(x, z) \rightarrow C(z, y)]]$$

Background

Mereotopology

Casati & Varzi (1999), Varzi (2007), Grimm (2012), Wągiel (2018)



Background

Maximally strongly self-connected relative to a property

Casati & Varzi (1999)

$$(47) \quad \text{MSSC}(P)(x) \stackrel{\text{def}}{=} P(x) \wedge \text{SSC}(x) \wedge \forall y [P(y) \wedge \text{SSC}(y) \wedge o(y, x) \rightarrow y \sqsubseteq x]$$

Strongly self-connected

- ▶ every part of the entity is connected to (overlaps) the whole

Maximality

- ▶ anything else which has that property, is strongly self-connected, and overlaps is part of it

Background

Partitivity

Barker (1998), Wągiel (2018)

- ▶ proper parthood
- ▶ in English typically postulated to be encoded by *of*
- ▶ instead \Rightarrow introduced by a proportional quantifier

$$(48) \quad \llbracket \text{PART} \rrbracket = \lambda y \lambda x [x \sqsubset y]$$

Partitive Constraint

de Hoop (1997), Wągiel (2018)

- ▶ embedded DP \Rightarrow entity-denoting
- ▶ covert MAX or CF

$$(49) \quad \llbracket \llbracket \text{PART} \llbracket \text{MAX/CF} \llbracket \text{NP} \rrbracket \rrbracket \rrbracket = \lambda x [x \sqsubset \llbracket \text{MAX/CF} (\llbracket \text{NP} \rrbracket) \rrbracket]$$

Proposal

Main claim

- ▶ the typology results from an interaction between degree semantic and mereotopological features

Semantic properties of Polish proportional quantifiers

- ▶ inferent degree semantics
- ▶ scalar alternatives
- ▶ mereotopological properties

	<i>ćwierć</i> 'quarter'	<i>pół</i> 'half'	<i>połowa</i> 'half'	<i>większość</i> 'most'	<i>część</i> 'part'	<i>częstka</i> 'part'	<i>połówka</i> 'half'	<i>ćwiartka</i> 'quarter'
degree semantics	yes	yes	no	no	no	no	no	no
introduces MSSC	no	no	no	no	no	yes	yes	yes
weaker scalar alternatives	yes	yes	yes	yes	no	no	yes	yes
presupposes MSSC	yes	yes	no	no	no	yes	yes	yes

Proposal

Ćwierć ('quarter') and *pół* ('half')

- ▶ underlyingly, they are simply measures
- ▶ denote sets of degrees \Rightarrow can be shifted to degrees
- ▶ compatibility with measure words and numerals

(50) *ćwierć* tony
quarter tonne.GEN

(51) $\llbracket \text{ćwierć tony} \rrbracket = \lambda d [d = 1 \text{ tonne} \times 0.25]$

(52) *pół* miliona
half million.GEN

(53) $\llbracket \text{pół miliona} \rrbracket = \lambda d [d = 1,000,000 \times 0.5]$

Proposal

Ćwierć ('quarter') and pół ('half')

- ▶ count nouns \Rightarrow shift from degrees to entities
- ▶ MSSC presupposition \Rightarrow only integrated entities
- ▶ incompatibility with cumulative predicates

(54) *ćwierć* jabłka
quarter apple.GEN

(55) $\llbracket \text{ćwierć jabłka} \rrbracket = \lambda x [x \sqsubset \text{MAX}(\llbracket \text{apple} \rrbracket)]$
 $\wedge \mu(x) = \mu(\text{MAX}(\llbracket \text{apple} \rrbracket)) \times 0.25]$

(56) *pół* książki
half book.GEN

(57) $\llbracket \text{pół książki} \rrbracket = \lambda x [x \sqsubset \text{MAX}(\llbracket \text{book} \rrbracket)]$
 $\wedge \mu(x) = \mu(\text{MAX}(\llbracket \text{book} \rrbracket)) \times 0.5]$

Proposal

Część ('part'), połowa ('half') and większość ('most')

- ▶ designate parts within an encoded part-whole structure
- ▶ contextually conditioned $\mu \Rightarrow \text{number} \sim \text{volume}$
- ▶ compatibility with cumulative predicates

(58) **połowa** książek
half books.GEN

(59) $\llbracket \text{połowa książek} \rrbracket = \lambda x [x \sqsubset \text{MAX}(\llbracket \text{books} \rrbracket)]$
 $\wedge \mu(x) = \mu(\text{MAX}(\llbracket \text{books} \rrbracket)) \times 0.5$

(60) **większość** jabłka
most apple.GEN

(61) $\llbracket \text{większość jabłka} \rrbracket = \lambda x [x \sqsubset \text{MAX}(\llbracket \text{apple} \rrbracket)]$
 $\wedge \mu(x) > \mu(\text{MAX}(\llbracket \text{apple} \rrbracket))/0.5$

Proposal

Częstka ('part'), *ćwiartka* ('quarter') and *połówka* ('half')

- ▶ presuppose and assert MSSC semantics
- ▶ partitioning operation $\pi \Rightarrow$ non-overlapping proper parts
- ▶ incompatibility with cumulative predicates

(62) *częstka* jabłka
part apple.GEN

(63) $\llbracket \text{częstka jabłka} \rrbracket = \lambda x [\text{MSSC}(\pi(\llbracket \text{część jabłka} \rrbracket))](x)$

(64) *połówka* flagi
half flag.GEN

(65) $\llbracket \text{połówka flagi} \rrbracket = \lambda x [\text{MSSC}(\pi(\llbracket \text{pół flagi} \rrbracket))](x)$

Proposal

Compatibility with degree modifiers

- ▶ no true scalar alternative \Rightarrow composition fails

(66) *Almost some students passed the exam.

(67) *Niemal **część** arbuza zgniła.
almost part watermelon.GEN got.spoiled

- ▶ no scale \Rightarrow composition fails

(68) ??Niemal arbuz zgnił.
almost watermelon got.spoiled

(69) ?Niemal **połówka** arbuza zgniła.
almost half watermelon.GEN got.spoiled

Conclusion

Puzzle

- ▶ different properties proportional quantifiers in Polish

	<i>ćwierć</i> 'quarter'	<i>pół</i> 'half'	<i>połowa</i> 'half'	<i>większość</i> 'most'	<i>część</i> 'part'	<i>częstka</i> 'part'	<i>połówka</i> 'half'	<i>ćwiartka</i> 'quarter'
measure terms	✓	✓	*	*	*	*	*	*
degree modifiers	✓	✓	✓	✓	*	*	*	*
cumulative pred.	*	*	✓	✓	✓	*	*	*

Explanation

- ▶ interaction between degree semantics and mereotopology

	<i>ćwierć</i> 'quarter'	<i>pół</i> 'half'	<i>połowa</i> 'half'	<i>większość</i> 'most'	<i>część</i> 'part'	<i>częstka</i> 'part'	<i>połówka</i> 'half'	<i>ćwiartka</i> 'quarter'
degree semantics	yes	yes	no	no	no	no	no	no
introduces MSSC	no	no	no	no	no	yes	yes	yes
weaker scalar alternatives	yes	yes	yes	yes	no	no	yes	yes
presupposes MSSC	yes	yes	no	no	no	yes	yes	yes

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Thanks!