

Countability and spatial integrity in partitives

Marcin Wągiel (Masaryk University in Brno/University of Warsaw)

Introduction. Since Link (1983), it is commonly assumed that the denotations of concrete count nouns consist of atoms, i.e., mereological objects without proper parts (often relative to a property). The main aim of this paper is to contribute to our understanding of quantification in natural language by exploring so far neglected countability in partitives (cf. Chierchia 2010). Since standard approaches to nominal semantics are grounded in mereology, they model entities as being equivalent to mere sums of their parts, i.e., neglect the arrangement of parts. This contrasts with an old ontological intuition that entities are often made up of smaller entities, i.e., parts, related to each other in a particular manner (Varzi 2016). In addition, humans conceive objects simultaneously as complete wholes and collections of parts (Elkind et al. 1964). The vital question is to what extent these facts are relevant for natural language. In this paper, I present new evidence in favor of a mereotopological approach to nominal semantics where building blocks of nominals' denotations are modeled as integrated wholes rather than simply as atoms (Grimm 2012). I argue that certain quantificational expressions are sensitive to subatomic part-whole structures and indicate topological relations such as integrity.

Data. Moltmann (1997) observes an analogy between partitives involving proportional quantifiers and singular and plural terms which suggests a unified parthood structure for both singular and plural entities, see (1) (the pattern holds cross-linguistically). Moreover, partitives with number-neutral nominals such as object mass nouns and pluralia tantum are ambiguous between a part-of-a-singularity and part-of-a-plurality reading, see (2). A similar effect is reported in languages with general number, see (3) (Sauerland & Yatsushiro 2004).

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|-----|---|--------|-----|---|--------|
| (1) | Teil des Apfels/der Äpfel
part of-the apple/of-the apples | German | (2) | połowa obuwia/nożyczek
half of-the-footwear/scissors | Polish |
| (3) | John-wa hotondo hon-o yomi-oeta
John-TOP most book-ACC read-finished
'John finished reading most of the books/most parts of the book(s).' | | | | |
| | Japanese | | | | |

However, the fact that PART words modifying plurals are uncountable (on a part-of-a-plurality reading) has been claimed to be a counterargument for a unified mereology (Schwarzschild 1996). While (4a) denotes 3 subdivisions of the wall, (4b) cannot refer to 3 subsets of the walls. I argue that the phenomenon results from the fact that regular plurals refer to scattered entities. Crucially, since Italian irregular plurals employ the notion of integrity or cohesion of a sum (Ojeda 1995, Acquaviva 2008), counting parts of a plurality is valid, see (4c).

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|-----|--|--|---|---------|
| (4) | a. tre parti del muro
three parts of-the wall | b. #tre parti dei muri
three parts of-the walls | c. tre parti delle mura
three parts of-the walls _{COHESIVE} | Italian |
|-----|--|--|---|---------|

Further evidence comes from properties of partitives involving proportional quantifiers. Such constructions remain understudied (but see Ionin et al. 2006) despite their great relevance for understanding part-whole structures. In particular, Polish distinguishes lexically between topology-neutral and topology-sensitive proportional quantifiers. For instance, let us consider the three HALF words *połowa*, *pół* and *połówka* (all 'half'). At first sight, they seem synonymous but closer examination reveals some non-trivial distributional and interpretative contrasts. Specifically, *połowa* simply designates approximately 50% of an entity. If it is a singularity, it quantifies in terms of volume, whereas in the case of a plurality, it quantifies over singularities making it up and as such it is compatible with count singulars, plurals and mass terms. On the other hand, *pół* and *połówka* are sensitive to whether the referent of the c-commanded DP comes in one piece or constitutes a discontinuous entity. While *pół* yields a measure only of an integrated object, *połówka* has even a stronger meaning, i.e., it also requires a resulting part to constitute an integrated object in its own right. These properties are reflected in the distribution since both *pół* and *połówka* can only combine with singular count nouns and are incompatible with expressions denoting arbitrary sums and scattered entities, i.e., plurals and mass terms, see (5) for the contrasts. Furthermore, since partitives involving *połowa* and *pół* in (6) denote an arbitrary half, they are felicitous in both scenarios illustrated in Figure 1 and 2. On the other hand, *połówka* has to denote a contiguous subdivision, and thus it is inadequate in a scenario illustrated in Figure 2. A similar pattern arises in other proportional quantifiers, e.g., *ćwierć* ~ *ćwiartka* ('quarter') and *część* ~ *częstka* ('part').

- (5) a. połowa / pół / połówka jabłka
half₁ / half₂ / half₃ of-the-apple
b. połowa / #pół / #połówka jabłek
half₁ / half₂ / half₃ of-the-apples
c. połowa / #pół / #połówka wody
half₁ / half₂ / half₃ of-the-water

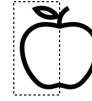


Figure 1:



Figure 2:

- (6) Połowa / Pół / #Połówka jabłka jest zgniła/-e/-a.
half₁ / half₂ / half₃ of-the-apple is rotten_{F/N/F}
‘A half of the apple is rotten.’

SCENARIO: Figure 2

The contrasts in (5) and (6) are not a Polish idiosyncrasy. In the talk, I will discuss novel data from several other languages demonstrating that various formal means may be employed in order to differentiate between topology-neutral and topology-sensitive partitives. For instance, while Portuguese and Dutch distinguish lexically between the two types of proportional quantifiers, German marks an obligatory contiguous part reading with a special marker and Mandarin and English use different constructions, cf. *half the* NP ~ *a half of the* NP.

Analysis. Building on Grimm (2012), I develop a mereotopological approach to nominal expressions. I assume mereology augmented with topological notions such as connectedness (Casati & Varzi 1999). First, I model concrete singular individuals in terms of mereotopology, whereas pluralities are modeled in terms of mereology, and thus bear not topological commitments. Specifically, count singulars incorporate the notion of maximally strongly self-connected (MSSC; for details see Casati & Varzi 1999) which guarantees that an entity is an integrated whole, see (7) and (12). On the other hand, plurals denote arbitrary sums of MSSC entities, see (13), whereas Italian irregular plurals refer to clusters (Grimm 2012), i.e., pluralities formed by connected singular parts, see (14). Next, I assume that singular count nouns are semantically more complex than mass nouns since they specify their referents as integrated object (cf. natural units in Krifka 1989; also Quine 1960). For instance, the difference between count *apple* and mass *apple-stuff* is that the first is a predicate of integrated wholes as opposed to scattered substances or arbitrary sums. Furthermore, in order to account for the partitive constraint (de Hoop 1997) I assume that embedded DPs are entity-denoting (via maximization or a choice function). In addition, I posit a partitioning function π which is an operation of type $\langle\langle e, t \rangle, \langle e, t \rangle\rangle$ which selects a set of entities, i.e., a predicate P , and yields its subset $\pi(P)$ such that it is a set of those elements in P that do not overlap (relative to a context; Scontras 2014). Application of MSSC to $\pi(P)$ would then yield a contiguous part (8). In *połówka*, IND is introduced by a suffix but it can also have other exponents. Finally, I employ a contextually conditioned measure function μ which returns different measures for different DPs, e.g., number or volume (Bale & Barner 2009). The denotations of Polish HALF words are given in (9)–(11) and the semantics for the Italian PART word in (15). To conclude, the semantics for the components of Polish topology-sensitive partitives are given in (7)–(11) whereas the meanings for Italian partitives are in (12)–(16). The proposed semantics explains the contrasts in (4-a) and (5)–(6) and proves more advantageous than atomicity-based theories.

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|---|---|
| (7) $\llbracket \text{jabłko} \rrbracket = \lambda x [\text{MSSC}(\text{APPLE})(x)]$ | (12) $\llbracket \text{muro} \rrbracket = \lambda x [\text{MSSC}(\text{WALL})(x)]$ |
| (8) $\llbracket \text{IND} \rrbracket = \lambda P \lambda x [\text{MSSC}(\pi(P))(x)]$ | (13) $\llbracket \text{muri} \rrbracket = \lambda x [* \llbracket \text{muro} \rrbracket (x)]$ |
| (9) $\llbracket \text{połowa} \rrbracket = \lambda y \lambda x [x \sqsubset y \wedge \mu(x) \approx \mu(y) \times 0.5]$ | (14) $\llbracket \text{mura} \rrbracket = \lambda x [\text{CLUSTER}(\llbracket \text{muro} \rrbracket)(x)]$ |
| (10) $\llbracket \text{pół} \rrbracket = \lambda y . y_{\text{MSSC}} \lambda x [x \sqsubset y \wedge \mu(x) \approx \mu(y) \times 0.5]$ | (15) $\llbracket \text{parte} \rrbracket = \lambda y \lambda x [x \sqsubset y]$ |
| (11) $\llbracket \text{połówka DP} \rrbracket = \llbracket \text{IND} \rrbracket (\llbracket \text{pół DP} \rrbracket)$ | (16) $\llbracket 3 \rrbracket = \lambda P . P_{\text{MSSC}} \lambda x [* P(x) \wedge \#(P)(x) = 3]$ |

References. Bale & Barner (2009) *The interpretation of functional heads* • Acquaviva (2008) *Lexical plurals* • Casati & Varzi (1999) *Parts and places* • Chierchia (2010) *Mass nouns, vagueness and semantic variation* • de Hoop (1997) *A semantic reanalysis of the partitive constraint* • Elkind et al. (1964) *The part-whole perception* • Grimm (2012) *Number and individuation* • Ionin et al. (2006) *Parts of speech: Toward a unified semantics for partitives* • Krifka (1989) *Nominal reference, temporal constitution and quantification in event semantics* • Link (1983) *The logical analysis of plural and mass nouns* • Moltmann (1997) *Parts and wholes in semantics* • Quine (1960) *Word and object* • Ojeda (1995) *The semantics of the Italian double plural* • Sauerland & Yatsushiro (2004) *A silent noun in partitives* • Scontras (2014) *The semantics of measurement* • Schwarzschild (1996) *Pluralities* • Varzi (2016) *Mereology*