The Ubiquitous Pseudopartitive Head: Evidence from Spanish and English

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(1)   three liters of water

Semantic analyses of pseudopartitives have tended to account for two generalizations:

- Monotonicity of the measure phrase

- Cumulativity of the substance noun

(2)   a.   three gallons of water
      b.   *thirty degrees Celsius of water

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and $[\![degrees\ Celsius]\!] = \lambda n_{\mathrm{d}}.\lambda x_{\mathrm{e}}.\mathbf{degC}(\mathbf{temp}(x)) = n$

Then only $[\![gallons]\!]$ is <u>monotonic</u>.

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If α is type $\langle d, \langle e, t \rangle \rangle$, then it is <u>monotonic</u> iff for any $d, d' \in D_d$ and $x, x' \in D_e$, where $\alpha(d)(x) = 1$ and $\alpha(d')(x') = 1$, $x > x' \rightarrow d > d'$.

($x > x'$ if x contains x' as a proper subpart (Link, 1983).)

(3) a. three pounds of cherries
     b. *three pounds of a cherry

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For any two things x and y, if $[\![cherries]\!](x) = 1$ and $[\![cherries]\!](y) = 1$, then $[\![cherries]\!](x \vee y) = 1$.

This is not the case for $[\![cherry]\!]$.

Previous analyses, e.g., Schwarzschild (2002, 2006); Champollion (2010), have taken the pseudopartitive head to be responsible for both constraints.

For example, Schwarzschild defines 'monotonicity' so that it applies to properties and measurements, where the relevant measure gives at least two distinct values.

$\llbracket P(\textit{three pounds of cheese})\rrbracket =$
$\exists x_e[\exists \mathrm{DIM}[\textbf{cheese}(x) \ \& \ \textbf{3Oz}(\mathrm{DIM}(x)) \ \& \ \mathrm{MON}(\mathrm{DIM}, \textbf{cheese}) \ \&$
$\llbracket P \rrbracket(x)]]$

Here, I will attempt to motivate the following:

• There is a layer in pseudopartitives whose purpose is only to ensure cumulativity (monotonicity comes separately).

• All DPs containing mass nouns and plurals are pseudopartitives in this sense—they all have this head.

The head in the nominal projection:

$$[\![of]\!] = \lambda x_e.\lambda y_e.y \leq x$$

There must therefore be a higher head for introducing measure phrases (and ensuring monotonicity).

$$[\![\text{higher head}]\!] = \lambda P_{\langle e,\ t\rangle}.\lambda \alpha_{\langle d,\ \langle e,\ t\rangle\rangle}.\lambda d_d.\lambda x_e.\text{MON}(\alpha)\ \&\ \alpha(d)(x)\ \&\ P(x)$$

The Carlson/Chierchia story for bare plurals (/mass nouns): they denote kinds (Carlson, 1977; Chierchia, 1998).

• A special type, which for Chierchia appears to be a subtype of $\langle s, e \rangle$ (s, the type of worlds).

Carlson (1977):

(4) A cat is in this room.
     A cat isn't in this room.
     ∴ A cat is in this room, and a cat isn't in this room.

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(4)   A cat is in this room.
       A cat isn't in this room.
       ∴ A cat is in this room, and a cat isn't in this room.

(5)   Cats are in this room.
       Cats aren't in this room.
       ∴ Cats are in this room, and cats aren't in this room.

(A slight variation of) Carlson (1977):

(6)   a.   Mick trapped lemmings yesterday even though he knows full well they are protected by the law

        b.   Lemmings are protected by the law, but Mick went ahead and trapped them yesterday anyway

In (6-a), the antecedent has an existential interpretation, and the anaphor, a kind one. In (6-b), the opposite holds.

Conclusion: bare plurals denote kinds.

Data set 1: interpretations of bare nouns

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How to get existential interpretation?

• Carlson: It's in the semantics of the predicate.

• Chierchia: It's in the semantics of the bare noun (but after a type shift).

Some data from Spanish, however, motivates a somewhat different conclusion...

First, to introduce the paradigm (taken from Chierchia's own examples of Italian).

(7) a. *Studenti hanno telefanato
        Students have phoned
        'Students have phoned'

     b. Leo ha   mangiato patate
        Leo PAST eat   potatoes
        'Leo ate potatoes'

Bare plurals are ruled out in subject position, but are allowed in object position, where they are lexically governed (Chomsky, 1981).

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Chierchia's conclusion: In Italian (and other Romance languages), NPs may not denote kinds, but require a determiner to do so.

In (7-a), the determiner must be overt, but in (7-b), it may be covert, as it is lexically governed.

Recall Carlson's test using anaphora to kinds.

(8)   Los perros son   el   animal favorite de   Juan, porque
          the dogs   be.PL the animal favorite DE Juan, because
          son   fieles
          be.PL loyal
          'Dogs are Juan's favorite animal, because they are loyal'

As Spanish is *pro*-drop, the anaphor here is *pro*.

A kind-interpretation can be anaphoric to an existential one.

(9) Juan tiene   algunos perros, porque son   animales
     Juan have.SG some   dogs   because be.PL animals
     fieles
     loyal
     'Juan has some dogs, because they are loyal animals'

But going the other way doesn't work...
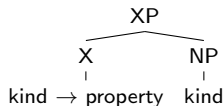
(10)   *Los perros son   el   animal favorito de Juan, y
        the dogs   be.PL the animal favorite DE Juan, and
        por eso   están en su casa
        for that be.PL in his house
        'Dogs are Juan's favorite animal, and because of that they
        are in his house'

Data set 1: interpretations of bare nouns
Finding covert determiners: Spanish

This pattern is explained if existential interpretations of kind-anaphora require a null determiner. I.e., if

• The existential interpretation is not provided by the surrounding predicate (Carlson).

• The existential interpretation is not provided by a type shift (Chierchia).

• But rather, it is provided by a null functional head in the nominal projection, ungoverned in subject position (10).

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              XP
         ┌─────────┐
         X         NP
         │          │
kind → property   kind
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Prediction: the existential interpretation of kind-anaphora should improve in object position.

(11)   ?Los perros son   el   animal favorite de   Juan, y
          the dogs   be.PL the animal favorite DE Juan, and
          por eso   tiene   en su casa
          for that have.SG in his house
          'Dogs are Juan's favorite animal, and because of that he
          has them in his house'

Not perfect, but apparently better.

Data set 1: interpretations of bare nouns
Finding covert determiners: English?

The same paradigm seems to be detectable in English...

(12)   a.   Lemmings are protected by the law, but Mick went
            ahead and trapped them yesterday anyway
       b. ??Lemmings are protected by the law, but they were
            trapped yesterday anyway

(13)   a.   Apples are delicious, and so I ate them for lunch
       b. ??Apples are delicious, but they made me sick yesterday

- Anaphora to kinds in Spanish appear to lack an existential interpretation when the anaphor is in subject position.

- Anaphora to an existential interpretation, however, allows a kind interpretation.

- This is explained if the existential properly contains the kind, but not vice versa.

- The existential contains the kind via a mediating functional head, the same as that found in the pseudopartitive.

- Such a functional head converts a kind into a property:
$\lambda k_k.\lambda x_e.x \leq k$

Schwarzschild (2006) notes the following restriction on attributive modifiers of nouns:

(14)   a.   sixty-degree water/cherries
          b.   *three-liter water/cherries

The restriction is opposite to that observed in pseudopartitives: here, the modifier cannot be monotonic.

In fact, this restriction is predicted, assuming attributive modifiers must attach below the relevant functional head.

But, we already know they must:

(15)   a.   *sixty degree(s) of water/cherries
         b.   *three liter(s) water/cherries

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Why can't monotonic measure phrases modify the noun directly?

The Chierchia (1998) theory of kinds: kinds are functions from worlds to maximal individuals.

So that they allow direct modification, let's change that to properties of kinds. Then, they are properties of type $\langle k, t \rangle$, where $D_k \subseteq D_{\langle s, t \rangle}$.

$[\![water]\!] = \lambda k_k.\exists P_{\langle e, \langle s, t \rangle \rangle}[\forall w_s[k(w) = \text{MAX}(\lambda x_e.\textbf{water}(x)(w) \ \& \ P(x)(w))]]$

Data set 2: Restrictions on attributive modifiers

$\llbracket water \rrbracket = \lambda k_k . \exists P_{\langle e, \langle s, t \rangle \rangle} [\forall w_s [k(w) = \text{MAX}(\lambda x_e . \textbf{water}(x)(w) \ \& \ P(x)(w))]]$

Assuming measure phrases and adjectives denote (world-relative) properties, they will have to type-shift so that they can modify kinds.

$\rightarrow \llbracket three\text{-}liter \rrbracket_{kind} = \lambda k_k . \forall w_s [\llbracket three\text{-}liter \rrbracket (k(w))(w)]$

Data set 2: Restrictions on attributive modifiers

$[\![water]\!] = \lambda k_k.\exists P_{\langle e, \langle s, t\rangle\rangle}[\forall w_s[k(w) = \text{MAX}(\lambda x_e.\textbf{water}(x)(w) \ \& \ P(x)(w))]]$

Assuming measure phrases and adjectives denote (world-relative) properties, they will have to type-shift so that they can modify kinds.

$\rightarrow [\![three\text{-}liter]\!]_{kind} = \lambda k_k.\forall w_s[[\![three\text{-}liter]\!](k(w))(w)]$

But $[\![three\text{-}liter]\!]_{kind}$ is undefined! Three-liter portions are not ordered by the part-of relation holding among pluralities and masses.

Therefore, *three-liter* could never modify a kind meaning.

three-liter cannot modify a kind meaning. The present account predicts **three-liter water*, if

• the modifier attaches below the relevant functional head, and

• such a functional head is always present to turn kind meanings into properties.

A functional head in the nominal projection converts kinds into properties. This accounts for two things...

• Anaphora to properties can be interpreted with a kind meaning, but anaphora to kinds can be interpreted with a property meaning only in object (governed) position.

• Attributive measure phrases may not be monotonic, because then they can't denote properties of kinds, i.e., maximal individuals.

This functional head is just that responsible for cumulativity in pseudopartitives, in their case, pronounced as 'of'.

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