

# individual/degree polysemy\*

*The Emergence of Number Conference, OSU*

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June 29, 2018

## 1 introduction

- historically, several different and distinct phenomena:

– amount relatives (Carlson, 1980; Heim, 1987; Grosu and Landman, 1998)

- (1) a. Jane drank [DP the champagne [CP they bought that evening]] *individual*  
b. It will take us the rest of our lives  
to drink [DP the champagne [CP they spilled that evening]] *amount*

– container/pseudopartitive polysemy (Chierchia, 1998)

- (2) a. Jane smashed [DP the bottle of wine] *container*  
b. Jane drank [DP the bottle of wine] *content*

– measure phrase polysemy (Stavrou, 2003; Landman, 2004; Rothstein, 2009)

- (3) a. The [two cups of wine] on this tray are blue. *substance*  
b. The [two cups of wine] in this soup is overkill. *measure noun*

– the ‘how many’ ambiguity (Cresti, 1995; Romero, 1998)

- (4) How many books must Jane read?  
a. Jane was told to read specific books. How many of them? *object*  
b. Jane was told to read a specific number of books. What was it? *amount*

- correspondingly, different and distinct formal accounts:

– amount relatives (Grosu, 2009; Kotek, 2011)

- \* lots of options, all construction-specific:
- \* syntactic ambiguity from a covert maximality operator in the CP; or
- \* syntactically restricted deferred reference or polysemy

– container/pseudopartitive polysemy

- \* from Chierchia 1998: a construction-specific type-shifter  $C$  from a container  $x$  to its contained substance  $y$

- (5) a. John smoked two packs of cigarettes.  
b.  $[\lambda x(\text{smoke}(\text{John}, C(x)))] (2(\text{PL}(\text{pack}(\iota \text{ cigarettes}))))$

- \* informally: ‘John smoked the contents of two packs of cigarettes.’
- \* elsewhere (in line with what I will propose; Pustejovsky 1995; Pustejovsky and Bouillon 1995): this is a semantic polysemy with syntactic effects

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\*The bulk of this talk is based on Rett 2014. The processing studies reported here come from joint work with Meg Grant and Sonia Michniewicz, forthcoming in Grant et al. *to appear*. Thanks also to Adrian Brasoveanu, Dylan Bumford, Ivano Caponigro, Sam Cumming, Jesse Harris, Ed Keenan, Angelika Kratzer, Roumi Pancheva, Barry Schein, Roger Schwarzschild, and audiences at CUSP 2 (UCSC); Semantics Tea (UCLA); and LynFest (UMass Amherst).

– measure phrase polysemy

\* measure nouns are lexically ambiguous (Landman, 2004; Rothstein, 2009)

- (6) a.  $\llbracket \text{glass} \rrbracket = \lambda y \lambda x. \text{glass}(x) \wedge \text{contain}(x, y)$  *container*  
 b.  $\llbracket \text{glass} \rrbracket = \lambda n \lambda P \lambda x. P(x) \wedge \text{MEAS}(x) = \langle n, \text{glassful} \rangle$  *substance*

\* measure phrases are additionally syntactically ambiguous (ibid.)

- (7) a.  $[\text{DP three}_i [\text{NumP } t_i [\text{NP glasses of } [\text{DP wine } ]]]]$  *substance*  
 b.  $[\text{DP } [\text{NP } [\text{MeasP } [\text{Num}^\circ \text{ three } ] [\text{Meas}^\circ \text{ glasses of } ] ] [\text{N wine } ]]]$  *measure noun*

– the ‘how many’ ambiguity

\* *many* encodes a measurement quantifier (type  $\langle d, \langle \langle e, t \rangle, \langle \langle e, t \rangle, t \rangle \rangle \rangle$ );

\* can scope with the modal independently of *how* (Cresti, 1995; Romero, 1998)

- (8) How many books must Jane read?  
 a.  $[\text{CP how}_d [\text{C}^\circ \text{ C}_{+wh} [ t_d \text{ many books } ]_x [\text{IP must John read } t_x ]]]$   
 b.  $[\text{CP how}_d [\text{C}^\circ \text{ C}_{+wh} [ \text{must } [ t_d \text{ many books } ]_x ] [\text{IP John read } t_x ]]]$

\* with the following truth-conditional ambiguities:

- (9) a. **object interpretation:**  $\exists x > \text{must}$   
 $\lambda p \exists d [p(w^\circ) \wedge p = \lambda w \exists x [\text{books}_w(x) \wedge \forall w' R w [\text{read}_{w'}(j, x)] \wedge |x| = d]]$   
 b. **amount interpretation:**  $\text{must} > \exists x$   
 $\lambda p \exists d [p(w^\circ) \wedge p = \lambda w \forall w' R w [\exists x [\text{books}_{w'}(x) \wedge \text{read}_{w'}(j, x) \wedge |x| = d]]]$

\* can’t account for parallel ambiguities in languages with different quantity question morphology (e.g. Romanian) or syntax (e.g. French; Rett 2008b)

• my claim: each phenomenon can be seen as instances of a DP denoting an individual or some degree corresponding to the measure of that individual along some salient dimension (e.g. quantity, volume)

– one important restriction: degree polysemy can only occur in contexts in which the salient dimension of measurement is monotonic on the part-whole structure (Schwarzschild, 2006b)

– this means the individual interpretation is primary;

– it also provides insight into the mandatory monotonicity of quantity words like *much* (ibid.)

– but recent processing data suggest the story is a little more complicated (Grant et al. *to appear*)

## 2 individual/degree polysemy generally

• what’s polysemy?

– a word is polysemous iff it is associated with more than one related meaning (Nunberg, 1979; Pustejovsky, 1995)

1. concrete/abstract polysemy

\* producer for product polysemy (e.g. *Dickens*)

\* place for event polysemy (e.g. *Vietnam*)

2. mass/count polysemy (e.g. *beer/beers*; *pear/imported pear*)

3. deferred reference

- (10) a. The ham sandwich wants his check.  
 b. Jane is parked across the street.

– polysemy differs from ambiguity in:

- \* its cross-linguistic universality;
- \* the semantic relatedness of its readings;
- \* its productivity across semantic classes of DPs;
- \* its ability to condition agreement

- (11) a. The french fries are delicious.  
 b. The french fries is getting impatient.

\* in how it is processed (more in §5):

- for ambiguous interpretations, processing penalties correlate with frequency (Rayner and Duffy, 1986)
- for some types of polysemy, only the derived reading carries a processing penalty (Frazier and Rayner, 1990)

• examples of degree polysemy

– quantity-word DPs

- (12) a. [Many guests] are drunk. *individual*  
 b. [Many guests] is more than Bill had anticipated. *degree*

– numeral DPs

- (13) a. [Four pizzas] are vegetarian. *individual*  
 b. [Four pizzas] is enough. *degree*

– bare plural DPs

- (14) a. [French fries] were eaten by the senators. *individual*  
 b. [French fries] is not enough. The senators will need protein. *degree*

– (pseudo-)partitives (regardless of the definite, cf. Kotek 2011)

- (15) a. [Four feet of (the) plywood] are warped. *individual*  
 b. [Four feet of (the) plywood] is more than Betty asked for. *degree*

– DPs with overt determiners

- (16) a. [The paintings he salvaged] were damaged/was enough.  
 b. [How many books] are on the table?/is too many?  
 c. [Some (of the) cookies] are delicious/is more than they deserve.

- (17) a. Sue accepted money from lobbies like [so many politicians] before her. *individual*  
 b. Sue will get in trouble for bringing [so many politicians] to the party. *degree*

• properties of degree polysemy

– it is productive across all DP types...

\* ...provided determiner agreement is properly controlled for

- (18) a. These many children were advanced a grade. *individual*  
 b. #These many children was more than expected. *#degree*

- (19) a. These many guests asked for their coats the same time. They had arranged for several cabs. *individual*  
 b. This many guests asked for their coats the same time. \*They had arranged for several cabs. *\*individual*

- the degree reading corresponds to a salient measure (often quantity) of the denoted individual; although see §3 for a semantic restriction
- it conditions agreement, licensing the singular, inanimate pronoun *it*
- but it isn't restricted to subject position:

- (20) Jane bought three pizzas.
- a. They were delicious. *individual*
  - b. It was more than we needed. *degree*
- (21) a. Jane prefers three square pizzas to those round ones. *individual*
- b. Jane prefers three square pizzas to two. *degree*

- it is distinct from the specific/non-specific ambiguity; (21a) is itself ambiguous
- preliminary research suggests it's universal (Greek, Hebrew, Romanian)

- additional notes:

- predicates like *be delicious* seem to only function as individual predicates; predicates like *be more than* seem to only function as degree predicates.
- *be enough* seems as though it can do both:

- (22) a. Four drinks are enough (drinks) to get me drunk. *individual*
- b. Four drinks is enough (alcohol) to get me drunk. *degree*

- there's reason to think that verbs are event/degree polysemous in a parallel way (Doetjes, 1997, 2007; Nakanishi, 2007a,b; Burnett, 2012); I have reason to believe the present individual-based account extends to those data (and that domain), à la Krifka 1989, 1990.

- (23) a. Jane [rode the roller coaster five times], (all of) which were fun. *event*
- b. Jane [rode the roller coaster five times], which was enough. *degree*

### 3 the monotonicity restriction

- what is monotonicity (on the part-whole structure of an individual)?

- the notion comes to us from Schwarzschild 2005, who was interested in restrictions on attributive and pseudo-partitive measure phrases

- (24) a. 18-karat gold *attributive*
- b. \*18 karats of gold *pseudopartitive*

- (25) a. 2-inch cable *attributive*
- b. 2 inches of cable *pseudopartitive*

- background assumption: dimensions of measurement are contextually fixed but lexically constrained (e.g. *20-inch television/sub*; Schwarzschild 2002)

- two empirical claims:

1. pseudopartitives can only encode dimensions of measurement that are **monotonic** on the part-whole structure
2. attributive configurations can only encode dimensions of measurement that are **non-monotonic** on the part-whole structure

(26) **definition of monotonicity**

A dimension DIM is non-monotonic iff  $\forall x, y [x \leq_{part} y \rightarrow x =_{DIM} y]$   
 “all parts of *y* have the dimension to the same extent as *x*”

- Schwarzschild observed that quantity words, too, require monotonic dimensions of measurement.
  - (27) Much rice was consumed that day.
    - a. *possible dimensions*: volume, weight
    - b. *prohibited dimensions*: stickiness, expense-per-unit
  - (28) John has as much cheese as he does beer.
    - a. *possible dimensions*: volume, weight
    - b. *prohibited dimensions*: age, acidity
- a DP can only receive a degree interpretation when the degree it denotes is associated with a monotonic dimension of measurement
  - quantity is monotonic...
    - (29) Four pizzas is vegetarian/more than Betty asked for.
  - ...but distributive heaviness (forced by *heavy*; Schwarzschild 2009) is not
    - (30) a. Heavy barbells are on that side of the gym. *individual*
    - b. #Heavy barbells is more (heavy) than Betty had asked for. *degree*
  - although dimensions of measurement are still quite context-sensitive, so
    - (31) Heavy barbells is not enough; to get in shape, you’ll need to do some cardio, too.
  - another example:
    - (32) *context: The nobles are instructed to bring three 22-karat gold rings to the Queen.*
      - a. Lord A brought two 22-karat gold rings. The rings Lord A brought is not enough.
      - b. Lord B brought three 18-karat gold rings. #The rings Lord B brought is not enough.
  - coupling Schwarzschild’s data with the polysemy data:
    - (33) a. 4-inch cables are warped. *attributive individual*
    - b. 4 inches of cable are warped. *pseudopartitive individual*
    - (34) a. #4-inch cables is more than Betty asked for. *attributive degree*
    - b. 4 inches of cable is more than Betty asked for. *pseudopartitive degree*

## 4 the analysis

- degree polysemy arises via the same mechanism as deferred reference: a freely available type-shifter from one thing to its salient counterpart
- a degree can be the counterpart of an individual only if the salient dimension of measurement allows for an informative inference between the individual and its measure (“equality of measure”)

### 4.1 a degree-semantic foundation

- gradable adjectives differ from non-gradable ones in lexicalizing a degree argument (Cresswell, 1976)

- (35) a.  $\llbracket \text{amphibian} \rrbracket = \lambda x. \text{amphibian}(x)$
- b.  $\llbracket \text{tall} \rrbracket = \lambda d \lambda x. \text{tall}(x)$

- these degrees are shorthand for triples  $\langle D, <_o, \psi \rangle$ , with  $D$  a set of points;  $>_o$  a total ordering on  $D$ ; and  $\psi$  a dimension of measurement (Bartsch and Vennemann, 1972; Bierwisch, 1989)

- dimensions of measurement are **lexically restricted** (e.g. by measure nouns, adjectives) but **contextually determined** (Schwarzschild, 2002)
- MPs like *two* and *two inches* denote degrees, too (or possibly modify sets of degrees, Schwarzschild 2006a); we can account for their behavior in nominals if we assume a null measurement operator that maps individuals to their degree of measurement (Bartsch and Vennemann, 1972; Cresswell, 1976; Higginbotham, 1993; Nerbonne, 1995; Villalba, 2003, a.o.)

(36) **an individual measurement operator**, for a salient dimension of measurement  $\mu$ :

- predicative version:  $\text{MEAS} = \lambda d \lambda x. \mu(x) = d$
- attributive version:  $\text{MEAS} = \lambda P \lambda d \lambda x. P(x) \wedge \mu(x) = d$

(37) Four pizzas are vegetarian.

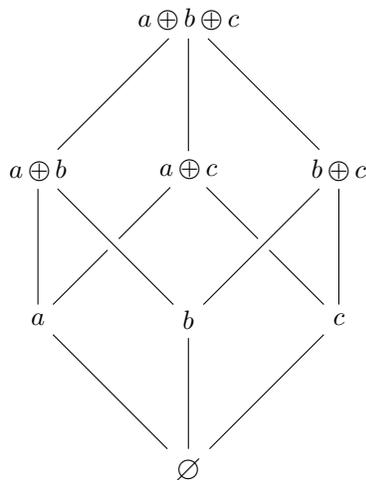
- $\llbracket \text{MEAS pizzas} \rrbracket = \lambda d \lambda x. \text{pizzas}(x) \wedge \mu(x) = d$
- $\llbracket \text{four MEAS pizzas} \rrbracket = \lambda x. \text{pizzas}(x) \wedge \mu(x) = 4$
- $\llbracket \text{four MEAS pizzas are vegetarian} \rrbracket = \lambda x. \text{veg}(x) \wedge \text{pizzas}(x) \wedge \mu(x) = 4$
- $=_{EC} \exists x[\text{veg}(x) \wedge \text{pizzas}(x) \wedge \mu(x) = 4]$

- the measurement operator has a type-flexible domain: it can measure (plural) events, and it can also measure plural degrees<sup>1</sup>
- some quick Measure Theory (Halmos, 1950):
  - if a plurality of degrees is non-dense,  $\mu$  counts the number of degrees in the set
  - if dense,  $\mu(d) = d_l - d_u$ , for  $d_l$  the lower bound and  $d_u$  the upper bound

## 4.2 equality of measure

- an observation (Rett, 2007, 2008b): if a plural individual falls in the extension of a downward-monotonic property (in the sense of Beck and Rullman 1999), then the maximum measure of the plurality is equivalent to the number of measures of the sub-pluralities.

- (38)
  - $\mu_{\text{quantity}}(a) = \mu_{\text{quantity}}(b) = \mu_{\text{quantity}}(c) = 1$
  - $\mu_{\text{quantity}}(a \oplus b) = \mu_{\text{quantity}}(a \oplus c) = \mu_{\text{quantity}}(b \oplus c) = 2$
  - $\mu_{\text{quantity}}(a \oplus b \oplus c) = 3$



- d.  $\mu_d(\{1, 2, 3\}) = 3$

<sup>1</sup>My 2014 paper analyzes plural degrees as type  $\langle d, t \rangle$ ; following the work in Rett (2015a) and Dotlačil and Nouwen (2016), I assume basic types for all plural entities. In the case of e.g. individuals, a variable  $x$  ranges over a join semi-lattice (Link, 1983); in the case of degrees, a variable ranges over an interval.

- the original motivation (Rett, 2007): quantity words are optional in Balkan quantity questions, and when they occur, they're incompatible with upward- or non-monotonic predicates

- (39) a. Cîte femeî cunoaşte?  
how-many.FPL women know.3SG  
b. Cît de multe femeî cunoaşte?  
how-many of many.FPL women know.3SG  
How many women does he know?

Romanian

- the account: MEAS is available for free to count the degrees; *mult* ('many') lexically encodes a degree MEAS, a function from a set of degrees (here, a degree plurality) to its measure

- (40) a. informal semantics, (39a): What is the  $d$  st the quantity of women  $x$  that he knows is  $d$ ?  
b. informal semantics, (39b): What is the  $d$  st the size of the quantities  $d'$  of the women  $x$  that he knows is  $d$ ?

- there is a clear relevance to monotonicity on the part-whole structure

- (41) A dimension of measurement  $\omega$  demonstrates **equality of measure** iff:  
for all  $x$ ,  $\mu_d(\omega(x)) = \text{MAX}(\omega(x))$

- this is a precondition for *cît de mult* questions; it's a precondition for degree polysemy, too.

### 4.3 degree polysemy as an informative homomorphism

- (42) **a degree measurement operator**, for  $\mu_d$  a measure of an interval, or set of degrees:<sup>2</sup>  
D-MEAS =  $\lambda D \lambda d. \mu_d(D) = d$

- degree readings arise when MEAS is applied successively: over individuals and then over their measures
  - the reading is only licensed when, as in Romanian, one can infer from the second-order measure to the first-order measure (i.e. when the salient dimension of measurement is monotonic)
  - a degree reading derivation with successive MEAS application (cf. (37))

- (43) Four pizzas is enough
- $\llbracket \text{MEAS pizzas} \rrbracket = \lambda d \lambda x. \text{pizzas}(x) \wedge \mu_{\text{quant}}(x) = d$
  - $=_{\text{EC}} \lambda d \exists x [\text{pizzas}(x) \wedge \mu_{\text{quant}}(x) = d]$
  - $\llbracket \text{D-MEAS MEAS pizzas} \rrbracket = \lambda d'. \mu_d(\lambda d \exists x [\text{pizzas}(x) \wedge \mu_{\text{quantity}}(x) = d]) = d'$
  - $\llbracket \text{is enough} \rrbracket = \lambda d. \text{enough}(d)$
  - $\llbracket \text{D-MEAS MEAS pizzas is enough} \rrbracket = \lambda d'. \mu_d(\lambda d \exists x [\text{pizzas}(x) \wedge \mu_{\text{quantity}}(x) = d]) = d' \wedge \text{enough}(d')$
  - $\llbracket \text{four} \rrbracket = \lambda D. D(4)^3$
  - $\llbracket \text{four pizzas is enough} \rrbracket = \mu_d(\lambda d \exists x [\text{pizzas}(x) \wedge \mu_{\text{quant}}(x) = d]) = 4 \wedge \text{enough}(4)$

- recall from (22) the context-sensitivity of *enough* (and e.g. *many*, Rett 2008b):

- (44) a. Four pizzas is too many.      b. Four eggs is too many.

- if degrees are triples  $\langle D, <_o, \psi \rangle$  (or enriched in the traditional way, Grosu and Landman 1998), the difference between 'd is many for pizza-quantities' and 'd is many for egg-quantities' can be tracked by the value of the contextual variable  $\psi$
- but it may be more general: *Mary drank a vodka-double ('s-worth) of sake*

<sup>2</sup>Note that this is the definition of quantity words in Rett 2007, 2008b, 2018; I will discuss the parallel with quantity words in §4.4.

<sup>3</sup>See Schwarzschild (2005) for arguments that MPs are of a higher order than type  $d$ .

#### 4.4 useful theoretical consequences

- assuming degree polysemy involves semantic coercion, we wouldn't expect co-predication:
 

(45) a. \*The ham sandwich is kosher and wants his check.  
b. \*Four pizzas is enough and are delicious.
- empirical extensions of the monotonicity requirement of degree polysemy:
  - Schwarzschild (2006b) observed that pseudopartitives require monotonic dimensions of measurement; some DPs seem to require a pseudopartitive syntax to receive a degree interpretation
 

(46) a. We didn't bring all of the cookies, but some (of the) cookies is more than they deserve.  
b. We brought all of the cookies, but even all ??(of the) cookies is less than we need.
  - Grosu (1994) and Kotek (2011) observe that, in English and Hebrew, only relative clauses headed by definites can function as amount relatives:
 

(47) a. \*(The) nine kilos your bag weighs won't prevent you from boarding.  
b. \*(The) \$20 this book costs won't upset your students.

    - \* they associate definiteness with the ability to denote a degree (and encode it lexically in the definite determiner); we've seen ample evidence this isn't so.
    - \* a construction-specific explanation: these subject MPs receive a strong, 'exactly' interpretation (instead of a weak, 'at least' one); this is another run-in with monotonicity – 'weighs exactly 9 kilos' is monotonic; 'weighs at least 9 kilos' isn't
    - \* the present analysis may need an additional type-shift (along the lines of Brasoveanu, 2009) to account for the instances of amount relatives selected by individual predicates
- and we can extend this account to explain the monotonicity of quantity words like *much*
  - (Schwarzschild, 2006b, 106): quantity words, too, require monotonicity (see (27), (28)); his analysis is syntactic ("The only way they can enter the nominal projection is by being in Spec,MonP").
  - quantity words denote a degree-specific measurement operator (Rett, 2007, 2008b); this predicts their monotonicity (contra Wellwood 2018), as equality of measure predicts monotonicity in (39b)
    - \* I assume the denotation for quantity adjectives in (48) (from Rett, 2007, 2008b, 2018):
 

(48)  $[[\text{many}]] = \lambda D \lambda d. \mu(D) = d$
    - \* I assume that quantity words are associated with their evaluative, 'greater than the standard' meaning – in certain contexts – by the same mechanism that provides the same meaning to gradable adjectives like *tall* (see Rett, 2008a,b, 2015b, 2018, for an explanation).
 

(49)  $[[\text{Many guests are drunk}]] = \textit{individual}$   
 $\exists d' [\mu_d(\lambda d \exists x [\text{guests}(x) \wedge \text{drunk}(x) \wedge \mu_{\text{quant}}(x) = d] = d' \wedge d' > s)]$

(50)  $[[\text{Many guests is enough}]] = \textit{degree}$   
 $\exists d' [\mu_d(\lambda d \exists x [\text{guests}(x) \wedge \mu_{\text{quant}}(x) = d] \wedge \text{be-enough}(d)) = d' \wedge d' > s]$
- additional evidence for this claim: *much*-support (Corver, 1997)
 

(51) a. (*pointing at pizzas*) That's not what we ordered last time. *individual demonstrative*  
b. John is fond of Sue. But not that \*(much) so. *degree demonstrative*

(52) A: How many pizzas did you order?  
B: (*pointing to pizzas*) That \*(many).

- monotonicity seems to be playing a role:

- (53) a. John is  $[_{MP} 3 \text{ feet}]$  tall and Bill is  $[_{MP} \text{ that } (*\text{many}/*\text{much})]$  wide.  
 b. John is  $[_{MP} 3 \text{ feet}]$  tall and Bill is  $[_{MP} \text{ that } *(many) \text{ inches}]$  wide.

- these cases make it seem like quantity words – by virtue of the fact that they force the monotonic degree reading – are obligatory in cases in which that reading is obligatory.

## 5 processing individual/degree polysemy

### 5.1 a quick background on processing studies of polysemy

- processing lexical ambiguity:
  - balanced ambiguous words (e.g. *coach*) show a processing penalty compared to unambiguous words in a neutral context (Rayner and Duffy, 1986)
  - biased ambiguity (e.g. *port*) has a penalty only for the infrequent meaning (Rayner et al., 1994)
- related word senses (i.e. polysemy: concrete/abstract *newspaper*; place-for-event *Vietnam*) have not been associated with a processing penalty (Frazier and Rayner, 1990; Frisson and Pickering, 1999)
  - these can be co-predicated: *The enthralling book fell off the table*
  - this is interpreted as a lack of commitment (i.e. underspecification) in processing (Frisson, 2009)
- rule-based polysemy (e.g. the count/mass noun distinction; collective/distributive readings) behaves differently in processing (Frisson and Frazier, 2005; Frazier et al., 1999)
  - these can't be co-predicated: *\*Sam fed and carved the lamb*
  - the non-primary sense is associated with a processing cost
  - this is interpreted as 'immediate commitment' to the primary interpretation
- the theory above predicts that individual/degree polysemy is rule-based, which accounts for its inability to be co-predicated
- it also characterizes the individual reading of DPs as primary, so we predict the non-primary, degree reading will carry a processing cost

### 5.2 Study 1

- three types of stimuli (the construction condition):
  1. definite DPs (e.g. *the pizza*);
  2. numeral DPs (e.g. *four pizzas*);
  3. *many* DPs (e.g. *many pizzas*)
  - no complementizer to avoid *that many* as a degree demonstrative
  - the use of *would be* masks number agreement
- two disambiguating environments following the DP (the predicate condition):
  1. individual predicates (e.g. *be delicious*)
  2. degree predicate (e.g. *be enough*)

(54) SAMPLE STIMULI

- a. Ella assumed {the toothbrushes/30 toothbrushes/many toothbrushes} would be {extra soft/enough} for the dentists to give to their patients.
  - b. Jackie concluded {the coconuts/2 coconuts/many coconuts} would be {hard to crack open/more than was required} for the piña colada recipe.
  - c. Christine decided {the tickets/5 tickets/many tickets} would be {cheap and easy to get/more than they needed} for everyone to watch the game.
- naturalness rating task to gauge stimuli (n=54 on AMT, 1-7 Likkert scale): interaction effect ( $p < .001$ )
    - degree continuations more acceptable for definite and numeral DPs
    - degraded ratings for quantity DPs regardless of continuation
  - subjects: n=31 (U Toronto undergraduates)
  - methodology: eye-tracking experiment
    - Ss presented with 42 items and 96 fillers
    - Ss read the stimulus and answered a comprehension question
  - measures
    - Go-Past Time
      - \* at critical region, individual continuations had longer Go-Past Times than degree ( $p < .01$ )
      - \* for degree predicates, GPTs were longer for definite DPs than numeral DPs ( $p < .05$ )
      - \* for individual predicates, GPTs were longer for numeral DPs than definite DPs ( $p < .05$ )
      - \* for quantity DPs: no significant difference between individual and degree predicates
    - Total Time
      - \* main effect of predicate ( $p < .01$ ): individual continuations had overall longer TTs
      - \* main effect of DP type ( $p < .01$ ): definite and *many* DPs longer TTs on degree continuations than numeral DPs; numeral DPs longer TTs on individual continuations
  - summary: an overall penalty for individual predicates; a relative penalty for degree predicates with definites, and a relative penalty for individual predicates with numeral DPs

### 5.3 Study 2

- slightly different stimuli: overt complementizers; no *many* DPs
  - same conditions (minus the *many* DP type)
  - 70 participants performing a self-paced reading task over AMT
  - another naturalness rating task (n=24): degree interpretations rated higher for numeral DPs; individual interpretations rated higher for definite DPs
- (55) SAMPLE STIMULI
- a. The florist {trimmed/tripled} {the/12 roses} in the bouquet, as the bride requested.
  - b. The baker {soaked/decreased} {the/50 raisins} in the muffin recipe to add more flavor.
  - c. The police officer {signed/reduced} {the/20 tickets} he gave out this month for speeding.
- methodology: IBEX self-paced reading study
    - Ss presented with 40 items
    - Ss read the stimuli and answered comprehension questions

- measure: reading rate
  - numeral DPs read slower overall than definite DPs
  - in the regions containing and following the DP: a significant effect of only DP type ( $p < .001$ )
  - definite DPs: individual and degree predicates read equally fast
  - numeral DPs: degree predicates were read faster than individual predicates

## 5.4 discussion

- these results are incompatible with our hypothesis that individual/degree polysemy is exactly like other rule-based polysemy; if it were, we would expect an across-the-board penalty for degree readings
- instead, we see an interaction between predicate and DP type: readers do commit to a single interpretation, but these interpretations differ by DP
  - definite DPs have a processing cost associated with the degree interpretation;
  - numeral DPs have a processing cost associated with the individual interpretation;
  - *many* DPs were judged unnatural, and both interpretations seemed hard to process
- we believe that the distributional arguments (especially the monotonicity restriction) still strongly suggest that the individual interpretation of all DPs is grammatically primary...
  - hypothesis 1: numeral DPs ‘invite’ a degree interpretation because numerals make salient the cardinality of an entity (which is a monotonic dimension of measurement)
  - hypothesis 2: numeral DPs ‘invite’ a degree interpretation as the result of frequency effects (because numeral DPs are more frequently used to denote degrees than definite DPs)

## 6 conclusions

- it seems as though any DP can denote an individual or a degree, as long as the salient dimension of measurement is monotonic on the part/whole structure of the individual
- this accounts for:
  - MP or container polysemy
  - the ‘how many’ ambiguity
  - amount relatives (perhaps modulo a second type-shift)
  - many other instances, regardless of determiner head
- a great test for the difference is the conditioning of singular agreement (by a plural-marked DP); this makes individual/degree polysemy seem a lot like deferred reference, a rule-based polysemy
- we can account for the phenomenon by assuming that the homomorphism from an entity to its salient measure is freely available in the compositional semantics (much like we have to assume that the homomorphism from Jane to her car in e.g. (10) is available in the compositional semantics)...
- ...and that it can measure (plural) individuals as well as (plural) degrees
  - for perspicuity’s sake, I’ve encoded this homomorphism in a null measurement operator MEAS (which is domain-general, so it can measure individuals, events, and degrees alike)
  - only measures of monotonic measures are informative and thereby licensed in certain contexts, e.g. Balkan *how many* questions; degree senses (**‘equality of measure’**, Rett 2007, 2008b)

- degree polysemy arises when (and only when) context makes salient a monotonic dimension of measurement, and by virtue of two successive homomorphisms: from an individual to an interval, or plural degree, representing its measures; and from that plural degree to its measure
- in addition to accounting for the previously disparate phenomena listed above, this account can explain:
  - the definiteness restriction on amount relatives (cf. Kotek, 2011);
  - the monotonicity of quantity words (cf. Schwarzschild, 2006b);
  - ‘much’-support (cf. Corver, 1997)
- but it relies on the assumption that all instances of individual/degree polysemy are ones in which the individual reading is primary, and the degree reading is derived
- processing data suggest that this isn’t clearly the case:
  - some DPs seem more naturally associated with the individual reading;
  - some DPs (e.g. MPs) seem more naturally associated with the degree reading;
- what next?

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