The Scope of Reciprocal Degree Operators and Degree Pluralities

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1. Introduction

The examples in (1)-(3) all express that the weight of John and that of Mary are mutually equivalent; degree sentences of this kind have been termed 'reciprocal equatives' by Schwarz (2007). As he points out, the meaning of this degree construction may be characterized as both *reciprocal* and *equivalent*.

(1) *English*

John and Mary are ***equally*** *heavy.*

(2) *German*

Hans und Maria sind ***gleich*** *schwer*
Hans and Maria are equally heavy
'John and Mary are equally heavy.'

(3) *Mandarin*

Yūehàn hé Mǎlì ***yíyàng*** *zhòng*
John and Mary equally heavy
'John and Mary are equally heavy.'

This paper intends to provide an analysis of this degree construction that covers the full range of the data. The proposal suggests that i) reciprocal equative morphemes (e.g., *yíyàng/gleich/equally*) always take scope and undergo movement at LF, and ii) they quantify over degree pluralities (Dotlačil & Nouwen 2016; c.f., Beck 2010, 2014). To the extent that the suggested analysis is on the right track, the analysis provides support for Dotlačil & Nouwen's suggestion that plural semantics is needed in the domain of degrees and further shows how pluralities in the domains of individuals and degrees may interact. Through the brief review of Schwarz's (2007) analysis in Section 2, we will see more syntactic and semantic properties of reciprocal equatives.

2. Schwarz's (2007) analysis

Building on the assumption that a gradable predicate such as *tall* relates a degree d and an individual x in the way that x's weight at least reaches d (see (4a)), Schwarz suggests that a reciprocal equative morpheme such as German *gleich* relates a gradable predicate R and a plural individual X (see (4b)) and asserts that all the relevant subparts of X have the same degree with respect to R.

(4) a. $[\![\mathit{schwer/heavy}]\!] = \lambda d_d.\ \lambda x_e.\ \mu_{\text{weight}}(x) \geq d$
(where μ_{weight} is a measure function that maps an individual x to x's weight)
b. $[\![\mathit{gleich}]\!] = \lambda R_{<d,<e,t>>}.\ \lambda X_e\text{: } \neg\text{ATOM}(X).\ \forall x,y \sqsubseteq X[x \neq y \text{ and } x,y \in C \rightarrow \{d\text{: } R(d)(x)\} = \{d\text{: } R(d)(y)\}]$

In (4b), C is the contextual restriction on plural predication and may be taken to be a *cover á la* Schwarzschild (1996). Along with these assumptions, the truth conditions (6) may be derived for (2).

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With the natural assumption that C contains the individuals Hans and Maria, the derived truth conditions then say that the weight of Hans is equivalent to that of Maria.

(5) ⟦ [*Hans and Maria*] *are* [*gleich heavy*]⟧=1 iff
$\forall x,y \sqsubseteq (H \sqcup M)[x \neq y$ and $x,y \in C \rightarrow \{d: \mu_{weight}(x) \geq d\} = \{d: d: \mu_{weight}(y) \geq d\}]$

The reciprocal equative morpheme need not be interpreted *in situ*. When combined with a relational gradable adjective like *angry* (see (6)), *gleich* moves out of its base-generation position (see (7a)-(7b)) to resolve type mismatch.

(6) *Hans und Maria sind mir gleich böse*
Hans and Maria are me.DAT equally angry
'Hans and Maria are equally angry at me.'

(7) a. ⟦ *angry/böse* ⟧$=\lambda d_d. \lambda x_e. \lambda y_e. \mu_{anger\text{-}at\text{-}x}(y) \geq d$
b. ⟦ [*H&M* [*gleich* [1 [[d_1 *angry-at me*]]]] ⟧=1 iff
$\forall x,y \sqsubseteq (H \sqcup M)[x \neq y$ and $x,y \in C \rightarrow \{$d: x is d-angry at me$\} = \{$d: y is d-angry at me$\}]$

Schwarz (2007) also points out that in an amount reciprocal equative like (8), *gleich* must move out of its base-generation and get interpreted outside its containing DP.[1] Assuming that in (9b) C contains the group of the pets Hans has and that of the pets Maria has, the derived truth conditions amount to saying that the number of the pets Hans Has is the same as that of those Maria has,

(8) *Hans und Maria haben* [*gleich viele*] *Haustiere*
Hans and Maria have equally many pets
'Hans and Maria have equally many pets.'

(9) a. ⟦ *viele/many* ⟧$=\lambda d_d. \lambda P_{<e,t>}. \lambda Q_{<e,t>}. \exists Z[|Z| \geq d$ and P(Z) and Q(Z)]
b. ⟦ [*H&M* [***gleich*** [1 [***have* [∃ [[d_1 *many*] **cat*]]]]]] ⟧=1 iff
$\forall x,y \sqsubseteq (H \sqcup M)[x \neq y$ and $x,y \in C \rightarrow$ {d: ∃Z[*pet(Z) and |Z|≥d and **have(Z)(x)]}=
{d: ∃Z[*pet(Z) and |Z|≥d and **have(Z)(y)]}]

Schwarz (2007) suggests that an adnominal reciprocal equative like (10) may be parsed in two different ways. In one, *gleich* is interpreted *in situ* (see (11a)); in the other, *gleich* moves out of its containing DP at LF (see (12a)).

(10) *Hans und Maria tragen gleich schwere Rucksäcke*
Hans and Maria carry equally heavy backpacks
'Hans and Maria carry equally backpacks.'

(11) a. LF 1 of (10): [*H&M* [***carry* [∃ [[***gleich*** *heavy*] **backpacks*]]]]
b. ⟦ (11a) ⟧=1 iff ∃Z[*backpack(Z) and **carry(Z)(H&M) and
$\forall x,y \sqsubseteq Z[x,y \in C$ and $x \neq y \rightarrow \{d: \mu_{weight}(x) \geq d\} = \{d: \mu_{weight}(y) \geq d\}]]$

(12) a. LF 2 of (10): [*H&M* [***gleich*** [1 [***carry* [∃ [[d_1 *heavy*] **backpacks*]]]]]]
b. ⟦ (12a) ⟧=1 iff $\forall x,y \sqsubseteq (H \sqcup M)[x,y \in C$ and $x \neq y \rightarrow$
{d: ∃Z[*backpack(Z) and **carry(Z)(x) and $\mu_{weight} \geq d$]}=
{d: ∃Z[*backpack(Z) and **carry(Z)(y) and $\mu_{weight} \geq d$]}]

As Schwarz (2007) notes, these two LF's may lead to the same prediction in a situation in which Hans and Maria each carry only one backpacks: Assuming that C contains each of the backpack Hans and Maria carry respectively in (11a) and on the other hand contains the individuals Hans and Maria in (12a), these two sets of truth conditions both predict that (10) is true iff the backpacks they carry weigh the same. Nevertheless, in a situation like (13), where Hans and Maria each carry two backpacks, these

[1] Having *gliech* interpreted *in situ* in an amount reciprocal equative, in Schwarz's analysis, leads to the truth conditions that further lead to the wrong prediction that *Hans and Maria have equally many cats* entails *Hans and Maria have equally many pets.* I refer the reader to Schwarz (2007) for detailed discussion.

two LF's lead to different predictions: while (11b) predicts that (10) is true in (13), (12b) predicts that it is false.

(13) Hans carries: a (15kgs) and b (10kgs)
Maria carries: c (10kgs) and d (5kgs)

Schwarz (2007) reports that intuitively (10) can be true or false in (13) and hence concludes that both analyses are consistent with intuitions.

Promising as it might initially seem to be, Schwarz (2007) analysis suffers from several problems some of which are already noted by himself. One problem has to do with reciprocal equatives with a universal quantificational subject. In Mandarin, the subject of a reciprocal equative can be a universal quantifier (see (14)); Schwarz also notes that the German example (15) is significantly better than its counterpart with a singular-denoting nominal in subject position (e.g., **Hans war gleich schnell*), and it is unclear how such cases may be addressed in his analysis.

(14) *měi-gė xúeshēng dōu pǎo-dė yíyàng kùai*
every-CL student ALL run-PART equally fast
'Every student runs/ran equally fast.'

(15) $^{?/ok}$*Jeder Junge war gleich schnell*
every boy was equally fast
'Every boy was equally fast.'

Another challenge Schwarz's faces comes from examples like (16) (from German) and its Mandarin counterpart (17). In both examples, the number of the dogs John has and that of the cats he has are being compared.

(16) *Hans hat [gleich viele] [Hunde und Katzen]*
Hans has equally many dogs and cats
'Hans has equally many dogs and cats.'

(17) *Yūehàn yǎng-lė yíyàng dūo-dė gǒu gēn māo*
John keep-PERF equally many-MOD dog and cat
'John has equally many dogs and cats.'

As noted above, in an amount reciprocal equative, a reciprocal equative morpheme, in Schwarz's setting, must move out of the containing DP. Nevertheless, having the reciprocal equative morpheme interpreted DP-externally in these cases wrongly predicts that (16)-(17) are unacceptable for the reason why **John has equally many dogs* is.

3. The proposal

Given the challenges Schwarz (2007) faces, an analysis that covers a wider range of the data would be more desirable. In the following, I suggest an alternative analysis according to which the reciprocal equative morpheme always takes scope at LF. My proposal dwells on two ingredients: one is the theory of plural predication that makes use of the operators * and ** (Link 1983; Sternefeld 1998; Beck 2000, 2001; and others) and *covers* (Schwarzschild 1996); the other is the degree semantics in which plural semantics is extended to degrees (Beck 2010, 2014; Dotlačil & Nouwen 2016).

3.1. Plural predication, distributivity and cumulativity

Following Link (1983), Sternefeld (1998) and many others, I assume that the pluralization operations * and ** are introduced through operators syntactically present. * gives rise to the distributive reading of, e.g., *John and Mary left*, according to which John left and Mary, too, did; ** gives rise to the so called 'cumulative reading' of, e.g., *John and Mary love Bill and Sue*, according to which each of John and Mary loves one of Bill and Sue, and each of Bill and Sue is loved by one of John and Mary. Both operations are sensitive to *covers á la* Schwarzschild (1996), a salient way in the context of utterance objects in the universe of discourse are divided into subgroups . Following Schwarzschild (1996), I assume that *covers* are introduced via a free pronoun *C*, whose value C is contextually determined.

(18) a. $[\![*]\!](C)(P_{<e,t>}) = \lambda X_e.\ \forall x \sqsubseteq X[x \in C \rightarrow [*P](x)]$

b. **Distribution**: * is that function: $D_{<e,t>} \rightarrow D_{<e,t>}$ such that for any $f \in D_{<e,t>}$ and any x in D_e, $[*f(x)]=1$ iff $f(x)=1$ or $\exists u \exists v[x=u \sqcup v$ and $[*f](u)$ and $[*f](v)]$

(19) a. $[\![**]\!](C)(P_{<e,<e,t>>}) = \lambda X_e.\ \lambda Y_e.\ \forall y \sqsubseteq Y[\ y \in C \rightarrow \exists X \sqsubseteq x[x \in C$ and $[**P](x)(y)\ ]]$ and $\forall x \sqsubseteq X[\ x \in C \rightarrow \exists y \sqsubseteq Y[y \in C$ and $[**P](x)(y)\ ]]$

b. **Cumulation**: ** is that function: $D_{<e,<e,t>>} \rightarrow D_{<e,<e,t>>}$ such that for any $R \in D_{<e,<e,t>>}$ and any x, y such that $x \in D_e$ and $y \in D_e$, $[**R](x)(y)=1$ iff: $R(x)(y)$ or $\exists x_1 \exists x_2 \exists y_1 \exists y_2[x=x_1 \sqcup x_2$ and $y=y_1 \sqcup y_2$ and $[**R](x_1)(y_1)$ and $[**R](x_2)(y_2)\ ]$

3.2. Degree plurality

Many research (e.g., Fitzgibbons et al. 2008; Beck 2010, 2013, 2014; Dotlačil & Nouwen 2016) suggest that the ontology and semantic mechanism designated for plurality of individuals should be extended to degrees. Among them, Dotlačil & Nouwen (2016) explicitly suggest that one may form a sum d of degrees via the same summation operation according to which a sum of individuals is formed: for any two degrees d and d′, d⊔d′ is the sum of d and d′. As Dotlačil & Nouwen (2016) notes, it is not surprising that the semantic mechanisms governing plurality formation and plural predication may be exteded to degrees, given that degrees and entities behave very much alike. For instance, (20a) carries a cumulative interpretation (e.g., John is 20 years old, Peter is 22, and Mary 26) in the way that (20b) possibly could (e.g., John likes Bill, Peter likes Chris and Mary likes Sue). This suggests that the same cumulation relation may be involved in both (20a) and (20b).

(20) a. John, Peter and Mary are 20, 22 and 26 years old.

b. John, Peter and Mary like Bill, Chris and Sue

Building on this idea, Dotlačil & Nouwen further suggest that a gradable adjective such as *tall* relates a sum d of degrees and an individual x in the way that the height of x (i.e., $\mu_{height}(x)$) is part of d (see (21a)). An operator MIN is designated to pick out the unique member d′ from a set D of sums of degrees such that d′ does not contain any other members in D as its subpart. Applying MIN to the set of sums d of degrees that contain John's height (i.e., $\mu_{height}(J) \sqsubseteq d$) gives John's height (i.e.,) (see (22)).

(21) a. $[\![\textit{tall}]\!] = \lambda d_d.\ \lambda x_e.\ \mu_{height}(x) \sqsubseteq d$

b. For any $D' \in D_{<d,t>}$, $\text{MIN}(D') = \iota d[\ D'(d)$ and $\neg \exists d'[D'(d')$ and $d' \sqsubset d\ ]\ ]$; otherwise, undefined.

(22) If $\mu_{height}(J)$=180cm, $\{d: [\![\textit{tall}]\!](d)(J)\ \} = \{d: \mu_{height}(J) \sqsubseteq d\} = \{d: 180cm \sqsubseteq d\ \}$; $\text{MIN}(\lambda d.\ \mu_{height}(J) \sqsubseteq d) = \mu_{height}(J)$

Dotlačil & Nouwen's (2016) main goal is to account for comparatives with a universal quantifier inside the *than*-clause.[2] Intuitively, *John is taller than every girl is* is true iff John is taller than the tallest girl. Along with their idea sketched above, this intuition may be captured in the following way. Suppose that in the context there are three girls a, b and c; the *than*-clause then denotes the set of sums d of degrees such that d contains every girl's height as its subpart (see (23a); i.e., $(\mu_{height}(a) \sqcup \mu_{height}(b) \sqcup \mu_{height}(c)) \sqsubseteq d$); MIN then pick out the unique sum from this set that contains all and only every girl's height (i.e., $\mu_{height}(a) \sqcup \mu_{height}(b) \sqcup \mu_{height}(c)$). With the application of the cumulation operation **, the truth conditions (23b) are derived, which amounts to saying that $\mu_{height}(J)$ is greater than all of $\mu_{height}(a)$, $\mu_{height}(b)$ and $\mu_{height}(c)$. This then correctly predicts that *John is taller than every girl is* is true only if John is taller than the tallest girl.

(23) a. $[\![\textit{than every girl is } \sout{\textit{tall}}]\!] = \lambda d_d.\ \forall x[x \text{ is a girl} \rightarrow \mu_{weight}(x) \sqsubseteq d]$

b. $\mu_{height}(J)[**>]\text{MIN}(\lambda d.\ \forall x[x \text{ is a girl} \rightarrow \mu_{height}(x) \sqsubseteq d])$

[2] For detailed discussion on quantifiers in the *than*-clause, see Beck (2010, 2014), Alrenga & Kennedy (2014), Dotlačil & Nouwen (2016) and the references cited therein.

3.3. The reciprocal equative morpheme

Along with the assumptions laid out above, I suggest that a reciprocal equative morpheme such as *yíyàng*/*gleich*/*equally* has the denotation in (24a).

(24) a. $[\![$ *yíyàng/gleich/equally* $]\!] = \lambda D'_{<d,t>}.\ \forall d',d''[d',d'' \sqsubseteq \text{MIN}(D') \rightarrow d'=d'']$

A reciprocal equative morpheme operates on a set of sums of degrees and asserts that the unique member picked out by MIN has subparts mutually equivalent. At LF, it moves out of its base-generation position and leaves a degree variable bound a λ-abstractor (c.f., Heim & Kratzer 1998).

(25) [$_{AP}$ *yíyàng/gleich/equally* [$_{A'}$ *heavy*]] $\Rightarrow$ [*yíyàng/gleich/equally* [7 [... [$_{AP}$ d_7 [$_{A'}$ *heavy*]]]]

The predicative reciprocal equative such as (1)-(3) then may be analyzed as in (26): with the natural assumption that the cover C contains each of the individuals John and Mary, MIN picks out the unique sum d of degrees that contains all and only the weight of John and that of Mary; the derived truth conditions then say that all the subparts of d are mutually equivalent, which amounts to saying that John's weight is the same as Mary's.

(26) a. [*yíyàng/gleich/equally* [7 [*J&M* [[* *C*] [$_{AP}$ d_7 *heavy*]]]]

b. $[\![$ *heavy* $]\!] = \lambda d_d.\ \lambda x_e.\ \mu_{weight}(x) \sqsubseteq d$

c. Let $C \supseteq \{J, M\}$, $[\![$ *yíyàng/gleich/equally* $]\!](\lambda d_d.\ \forall x \sqsubseteq (J \sqcup M)[x \in C \rightarrow \mu_{height}(x) \sqsubseteq d\ ])=1$ iff: $\forall d',d''[d',d'' \sqsubseteq \text{MIN}(\lambda d_d.\ \forall x \sqsubseteq (J \sqcup M)[x \in C \rightarrow \mu_{height}(x) \sqsubseteq d\ ]) \rightarrow d'=d''\ ]$
'The unique sum of degrees that contains only μ_{weight}(J) and μ_{weight}(M) has subparts that are mutually equivalent. '

3.4. Universal reciprocal equatives

With Dotlačil & Nouwen's (2016) idea of degree plurality, a universal reciprocal equative like (27) may be accounted for in a very similar fashion as a comparative with a universal quantifier in the *than*-clause. In (27), the reciprocal degree morpheme takes as its argument the set of sums of degrees that contain the thickness of every steak (see (28b)); the operator MIN then picks out the unique element in this set that does not contain any other members in this set as its subpart.

(27) *měi-yī-kùai níupái dōu yíyàng hòu*
every-one-CL steak all equally thick
'Every steak is equally thick.'

(28) a. [*yíyàng* [7 [*every steak* [d_7 *thick*]]]]

b. $[\![$ [7 [*every steak* [d_7 *thick*]]] $]\!] = \lambda d_d.\ \forall x[x \text{ is a steak} \rightarrow \mu_{thickness}(x) \sqsubseteq d]$
$[\![$ (27)/(28a) $]\!] = [\![$ *yíyàng* $]\!](\lambda d_d.\ \forall x[x \text{ is a steak} \rightarrow \mu_{thickness}(x) \sqsubseteq d]) = 1$
iff $\forall d',d''[d',d'' \sqsubseteq \text{MIN}(\lambda d_d.\ \forall x[x \text{ is a steak} \rightarrow \mu_{thickness}(x) \sqsubseteq d]) \rightarrow d'=d'']$

The derived truth conditions say that all the subparts of the unique sum of degrees picked out by MIN are mutually equivalent. Suppose that the steaks in comparison are a, b, and c; the set of degree pluralities *yíyàng* operates on contains all and only those that have as their subparts all of $\mu_{thickness}$(a), $\mu_{thickness}$(b) and $\mu_{thickness}$(c); MIN then picks out the sum $\mu_{thickness}(a) \sqcup \mu_{thickness}(b) \sqcup \mu_{thickness}(c)$. By saying that all the subparts of $\mu_{thickness}(a) \sqcup \mu_{thickness}(b) \sqcup \mu_{thickness}(c)$ are mutually equivalent, the derived truth conditions amount to saying that $\mu_{thickness}(a) = \mu_{thickness}(b) = \mu_{thickness}(c)$.

3.5. Amount reciprocal equatives

A piece required to account for an amount reciprocal equative like (16)/(17) is the syntax and semantics of Q-adjectives. It has been suggested recently that although the meaning of Q-adjectives involves gradability, measurement of quantity is not introduced by these elements; instead, it is introduced via a functional head that co-occurs with the Q-adjectives (Rett 2008; Solt 2015; and others). Below I work with Solt's (2015) analysis, according to which Q-adjectives have a quite trivial semantics and do not encode a measure function in their lexical meaning (see (29a)). Measurement of quantity is introduced by the functional head Meas, whose lexical meaning, along with Dotlačil & Nouwen's (2016) idea of degree plurality, is given in (29b). Following Solt (2015), I further assume the compositional rule **D**egree **A**rgument **I**ntroduction to resolve the type-mismatch between Meas and the NP it combines with.

(29) a. $[\![$ *many/much/viele/dūo* $]\!]=\lambda d_d.\ \lambda I_{<d,t>}.\ I(d)$

b. $[\![$ Meas $]\!]=\lambda x_e.\ \lambda d_d.\ \mu_{quantity}(x)\sqsubseteq d$

c. **D̲egree A̲rgument I̲ntroduction**: (Solt 2015, with slight modification)
For any branching node α, whose daughters are β and γ, if $[\![\beta]\!]\in D_{<e,t>}$ and $[\![\gamma]\!]\in D_{<e,<d,t>>}$, then $[\![\alpha]\!]=[\lambda d_d.\ \lambda x_e.\ [\![\beta]\!](x)$ and $[\![\gamma]\!](x)(d)]$

Along with these assumptions and the LF in (30), the truth conditions of (16)/(17) are derived as in (31b).

(30) [*yíyàng/gleich* [$_{②}$ 7 [[$_{QP}$ d_7 *many*] [$_{①}$ 5 [[$_{ConjP}$ [$_{DP_1}$ $\exists$ [$_{MeasP}$ d_5 [$_{Meas'}$ Meas *dogs*]]] *and* [$_{DP_2}$ $\exists$ [$_{MeasP}$ d_5 [$_{Meas'}$ Meas *cats*]]]] [1 *J **-C-have* t_1]]]]]]

(31) a. $[\![and]\!]=\lambda P_{<\tau,t>}.\ \lambda Q_{<\tau,t>}.\ \lambda x_\tau.\ P(x)$ and $Q(x)$ (τ is a semantic type) (Champollion 2016)

$[\![DP_{1/2}]\!]=\lambda P_{<e,t>}.\ \exists X[$*dog/*cat$(X)$ and $\mu_{quantity}(X)\sqsubseteq d$ and $P(X)]$

$[\![ConjP]\!]=\lambda P.\ \exists X\exists Y[$ *dog(X) and $\mu_{quantity}(X)\sqsubseteq d$ and P(X) and *cat(Y) and $\mu_{quantity}(Y)\sqsubseteq d$ and P(Y)]

b. $[\![②]\!]=[\![①]\!]=\lambda d_d.\exists X[$ *dog(X) and $\mu_{heavy}(x)\sqsubseteq d$ and
$\forall z\sqsubseteq J[z\in C\to \exists x\sqsubseteq X[x\in C$ and **have(x)(Z)]] and
$\forall x\sqsubseteq X[x\in C \to \exists z\sqsubseteq J[z\in C$ and **have(x)(z)]]] and
$\exists Y[$ *cat(Y) and $\mu_{quantity}(Y)\sqsubseteq d]$ and
$\forall z\sqsubseteq J[z\in C\to \exists y\sqsubseteq Y[y\in C$ and **have(y)(z)]] and
$\forall y\sqsubseteq Y[y\in C \to \exists z\sqsubseteq J[z\in C$ and **have(y)(z)]]]

$[\![$*yíyàng/gleich*$]\!]([\![②]\!])=1$ iff

$$\forall d,d''[d,d''\sqsubseteq \textsc{min}\left(\begin{array}{l}\lambda d.\ \exists X[\text{*dog}(X) \text{ and } \mu_{quantity}(X)\sqsubseteq d] \text{ and}\\ \quad\forall z\sqsubseteq J[z\in C\to \exists x\sqsubseteq X[x\in C \text{ and **have}(x)(Z)]] \text{ and}\\ \quad\forall x\sqsubseteq X[x\in C \to \exists z\sqsubseteq J[z\in C \text{ and **have}(x)(z)]]] \quad \text{and}\\ \exists Y[\text{*cat}(Y) \text{ and } \mu_{quantity}(Y)\sqsubseteq d] \text{ and}\\ \quad\forall z\sqsubseteq J[z\in C\to \exists y\sqsubseteq Y[y\in C \text{ and **have}(y)(z)]] \text{ and}\\ \quad\forall y\sqsubseteq Y[y\in C \to \exists z\sqsubseteq J[z\in C \text{ and **have}(y)(z)]]\end{array}\right) \to d=d'']$$

'(with $C\supseteq\{J$, the-cats-he-has, the-dogs-he-has$\}$) the unique sum d that contains only the number of the dogs John has and the number of the cats John has has mutually equivalent subparts. '

With the natural assumption that C contains J, M, the sum of the dogs J has, and the sum of the cats he has, MIN operates on the set of sums of degrees that contain $\mu_{quantity}$(the-dogs-J-has) and $\mu_{quantity}$(the-cats-J-has) and picks out the sum that contains all and only these two. The truth conditions derived then assert that $\mu_{quantity}$(the-cats-J-has)$\sqcup\mu_{quantity}$(the-cats-Mary-has) has mutually equivalent subparts, which amounts to saying that the number of the cats John has is exactly the same as the number of the dogs he has.

4. Adnominal reciprocal equatives and context dependency

As Schwarz (2007) noted, intuitions around an adnominal reciprocal equative like (10) may be vague; it can be true or false in a scenario like (13), where each of John and Mary carries more than one backpack, and only one of those John carries weighs the same as one of those Mary carries. In the alternative analysis I have suggested above, a reciprocal equative morpheme moves obligatorily at LF; therefore, the vagueness observed can no longer be accounted for by assigning (10) multiple LF's. Instead, I suggest that this may be captured via manipulation of covers, the contextual constraint on plural predication.

Along with the proposal and the LF (32a), the truth conditions (32b) are derived for (10).

(32) a. [*yíyàng/gleich/equally* [$_{①}$ 7 [[$_{DP}$ ∃ [[[* *C*] [d_7 *heavy*]] *backpacks*]] 1 [*J&M **-C-carry* t_1]]]]

b. $[\![\text{DP}]\!] = \lambda P_{<e,t>}.\ \exists X[\text{*backpack}(X) \text{ and } \forall x \sqsubseteq X[x \in C \rightarrow \mu_{\text{weight}}(x) \sqsubseteq d] \text{ and } P(X)]$

$[\![\textit{yíyàng/gleich/equally}]\!]([\![①]\!])=1$ iff

$$\forall d', d''[d', d'' \sqsubseteq \text{MIN}\left(\begin{array}{l}\lambda d.\ \exists X[\ \text{*backpack}(X) \text{ and } \forall x \sqsubseteq X[x \in C \rightarrow \mu_{\text{weight}}(x) \sqsubseteq d] \text{ and} \\ \qquad \forall y \sqsubseteq (J \sqcup M)[y \in C \rightarrow \exists x \sqsubseteq X[x \in C \text{ and **carry}(x)(y)] \text{ and} \\ \qquad \forall x \sqsubseteq X[x \in C \rightarrow \exists y \sqsubseteq (J \sqcup M)[y \in C \text{ and **carry}(x)(y)]]\end{array}\right) \rightarrow d' = d'']$$

'The unique d that contains all and only the weight of some backpacks **in C** that John carries and the weight of some backpacks **in C** that Mary carries has subparts mutually equivalent.'

In the scenario in which John and Mary each carry only one backpack, these truth conditions, with the natural assumption that the cover C contains John, Mary, the backpack John carries and that Mary carries, correctly predict that (10) is true iff the weight of John's backpack is the same as that of Mary's.

The situation however gets complicated in a scenario like (13), where John and Mary each carry more than one backpack. With the scenario in (13) in mind, let's first consider the possibility according to which the cover C contains John, Mary and each individual backpack carried by either of them (i.e., {J, M, a, b, c, d}⊆C). With this possibility, the reciprocal equative morpheme operates on the set of sums of degrees in (33); MIN then serves to pick out the unique sum from this set that does not contain any other members as its subpart.

(33) {d: d conatins as its subpart at least one of **15kg⊔5kg**, 15kg⊔10kg, 10kg⊔5kg, and **10kg**}

Applying MIN to this set however leads to undefinedness: in this set, the sum **10kg** does not contain any other members as its subparts, and neither does the sum **15kg⊔5kg**; MIN hence fails to pick out the unique member from this set. Consequently, (10) cannot be true under this possibility.

It seems that the only possible value for C that may render (10) true in (13) is one according to which it is a so-called 'ill-fitting cover' for the backpacks in this scenario (Brisson 1998, 2003). Being such a cover, C may contain the individual backpacks b and c but group a and d in a 'junkpile'; for instance, the backpacks a and d are grouped together with e, where e is some random object in the universe of discourse (i.e., {J, M, b, c, (a⊔d)⊔e}⊆C). With this possibility, the truth conditions derived in (32b) may be satisfied in the scenario in (13) in the following way: the operator MIN picks out 10kgs, $\mu_{\text{weight}}(b) \sqcup \mu_{\text{weight}}(c)$, which has subparts mutually equivalent.

The idea of using an 'ill-fitting cover' in plural predication has been suggested to account for the tolerance of exceptions of a plural statement such as *the students built a raft*. As already observed in various research, this sentence can be true even if there is one student who did not participate in any raft building. Brisson (1998, 2003) suggests that this intuition may be captured if the cover C groups the exceptions with some random objects in the universe of discourse and hence escape from quantification introduced in plural predication. The crucial role the cover C plays in the truth conditions (32b) provides us a nice way to approach the vague intuition Schwarz (2007) reports with respect to a scenario like (13). In an out-of-the-blue context, the default value for C, according which it contains each individual backpack, leads to undefinedness; this explains why speakers might not consider (10) true in such a scenario. On the other hand, once an ill-fitting cover, such as the one discussed above, becomes a salient option available in the context of utterance, (10) then may be easily judged true in the same scenario. Compared to the possibility for C containing each individual backpack, that of C being an ill-fitting cover that groups the backpacks a and d in (13) in a 'junkpile' is far from salient in an out-of-the-blue context. Such a context dependency explains why enrichment of the contextual information and a different choice of verb may render (10) get judged trueagainst (13) more easily. To my ear, the Mandarin example may get judged true much more easily in (13) if the contextual information in (34) is added. The change of the verb from *carry* to *pick*, as shown in (35), may have the very same effect as well.

(34) All the students randomly pick two backpacks to carry in the hiking trip. After the hiking trip, let's weigh the backpacks they choose and see whether there are any two students who get at least two backpacks that have the same weight. It then happens that ...

a. *Yūehàn hé Mǎlì bēi-lė yíyàng zhòng-dė bēibāo*
John and Mary carry-PERF equally heavy-MOD backpack
'John and Mary carried equally heavy backpacks.'

(35) *Yūehàn hé Mǎlì* ***tīao****-lė yíyàng zhòng-dė bēibāo*
John and Mary **pick**-PERF equally heavy-MOD backpack
'John and Mary picked equally heavy backpacks.'

All these are expected if the source of the vagueness observed in (10) is the context-sensitivity of C; after all, the saliency of a cover is sensitive to the contextual information as well as the nature of the property distributed (Schwarzschild 1996). In these examples, the additional contextual information or the change of verb 'highlights' the backpacks that weigh the same and consequently, in Brisson's (1998) term, render those that do not weigh the same salient enough to be ignored. An ill-fitting cover that may render (10) true is then easier to be drawn by the hearer in face of a scenario like (13).

Intuitions around statements with plurals generally are vague about the contribution of each individual in question and are sensitive to the context of utterance when large groups are involved. The discussion above shows that such vagueness and context sensitivity are observed in adnominal reciprocal degree constructions as well. Along with the cover-based theory of plural predication the proposal is couched on, this may be seen as the result from the context dependency of covers.

5. Conclusion

It has been suggested repeatedly that plurality on degrees may have played a role in the semantic derivation of a degree construction, especially that of a comparative sentence with a quantifier in the *than*-clause (e.g., Heim 2006; Beck 2010, 2014; Dotlačil & Nouwen 2016). Building on the insight of these research, I have attempted to extend the idea of **degree plurality** to reciprocal equatives, a degree construction that conveys reciprocity and equivalence. Taking Schwarz's (2007) pioneer study as the starting point, I offer an account for this degree construction that covers a wider range of data. The discussion not only provides new support for the need of building in plurality in degree semantics but also reveals the intricate interaction between plurality in the domains of degrees and that in the domain of individuals.

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