A Review of Some Key Ideas in the Semantics of Plurals

1. Introduction: The Interpretations of Sentences Containing Plurals

(1) **Overarching Questions**

- What are the truth-conditions of sentences containing plural DPs?
- How are those T-conditions derived from the LFs of those sentences?

The discussion to follow will assume some familiarity with the basic semantic literature on plurals. For more information, see the handouts at:
http://people.umass.edu/scable/LING720-FA10/Handouts/

(2) **Key Opening Observation**
There are at least three kinds of 'interpretations' that sentences like (3a) allow for.

(3) **The Interpretations of Sentences With Plurals**

a. *Sentence:* Three men carried three pianos (into the room).

b. *Verifying Scenarios:*

(i) Collective Predication
Three men (working as a team) carried three pianos (at the same time)

Agent	*Theme*
Bill, Paul, and Steve (together)	piano1, piano2, and piano3

(ii) Cumulative Predication
A total of three men (working separately) carried pianos into the room, and a total of three pianos were so carried.

Agent	*Theme*
Bill	piano1
Paul	piano2
Steve	piano3

(iii) Distributive Predication (Not Salient Without Contextual Support)
Three men each carried three different pianos into the room.

Agent	*Theme*
Bill	piano1, piano2, piano3
Paul	piano4, piano5, piano6
Steve	piano7, piano8, piano9

Note: Whether these three different kinds of verifying scenarios represent three different *readings* is a difficult empirical matter. See Kratzer (2008).

In the following sections, we will build the ingredients of one common, general approach to the facts in (3). *The discussion here will synthesize many key works in the semantics of plurals:* Link 1983, Krifka 1992, Landman 2000, Beck & Sauerland 2000, Kratzer 2008

2. Key Conceptual Ingredients: The Semantics of Plural DPs

(4) **The Concept of a Plurality**

In addition to simple, 'atomic' entities, we also admit the existence of 'pluralities'. These are like sets, but are construed as a kind of entity (type *e*).

Atomic Entities	Pluralities	
Bill	Bill+Paul	'the plurality consisting of B and P'
Paul	Bill+Steve	'the plurality consisting of B and S'
Steve	Paul+Steve	'the plurality consisting of P and S'
	Bill+Paul+Steve	'the plurality consisting of B, P and S'

Like set union, this '+'-operator is idempotent, commutative and associative.

For all x,y,z: x+x = x (idempotence)
x+y = y+x (commutativity)
x+(y+z) = (x+y)+z (associativity)

(5) **The Star Operator on Sets (of Entities)**

Let P be a set of entities. Then *P is the smallest set such that (i) P ⊆ *P, and (ii) if x and y are elements of *P, then so is x+y.

Illustration:
P = {Bill, Paul, Steve}
*P = {Bill, Paul, Steve, Bill+Paul, Bill+Steve, Paul+Steve, Bill+Paul+Steve}

(6) **The Star Operator on Functions (of Type <et>)**

Let P be a function of type <et> with domain S. Then *P is the function such that (i) the domain of *P is *S, (ii) *P(x) = T *iff* P(x) = T, or x = y+z and *P(y) = T and *P(z) = T

Illustration:
P = {<Bill,T>, <Paul,T>, <Sally,F>}
*P = {<Bill,T>, <Paul,T>, <Sally,F>, <Bill+Paul,T>, <Bill+Sally,F>, <Paul+Sally, F>, <Bill+Paul+Sally,F>}

(7) **Fact:** Let S be a set of entities, and *f* be its characteristic function. Then, **f* is the characteristic function of *S.

(8) **The Semantics of Plural Number**

There is a plural number feature on NPs [PL], it is interpretable, and [[PL]] = *.

Illustration, Part 1:

- Suppose that [[man]] = {Bill, Paul, Steve}.

- Thus, [[men]] = [[man PL]] = *[[man]] = *{Bill, Paul, Steve} =
  {Bill, Paul, Steve, Bill+Paul, Bill+Steve, Paul+Steve, Bill+Paul+Steve}

Thus, if [[man]] is the set of men, then [[men]] is the set of all the pluralities you can form from the set of men…

Illustration, Part 2:

- Suppose that [[man]] = [λx : man(x)] = {<Bill,T>, <Steve,T>, <Sally,F>}

- Thus, [[men]] = [[man PL]] = *[[man]] = *[λx : man(x)] =
  {<Bill,T>, <Paul,T>, <Sally,F>, <Bill+Paul,T>, <Bill+Sally,F>, <Paul+Sally, F>, <Bill+Paul+Sally,F>}

Thus, if [[man]] is true of x iff x is a man, then [[men]] is true of x iff x is a plurality you can form from men…

(9) **Notation**
As an abbreviatory device, I will sometimes write '*man' for *[λx : man(x)]

(10) **More Notation**

a. *Notation:* 'atom(x)' = x is an atomic entity (*i.e.,* there are no y,z such that x = y+z
b. *Notation:* 'y ≤ x' = y is a part of x (*i.e., there is a z such that* x = y+z)
c. *Notation:* '|x|' = |{y: atom(y) & y ≤ x}|

(11) **The Semantics of Numerals**

Numerals are type <et> cardinality predicates. They function as modifiers of plural NPs.

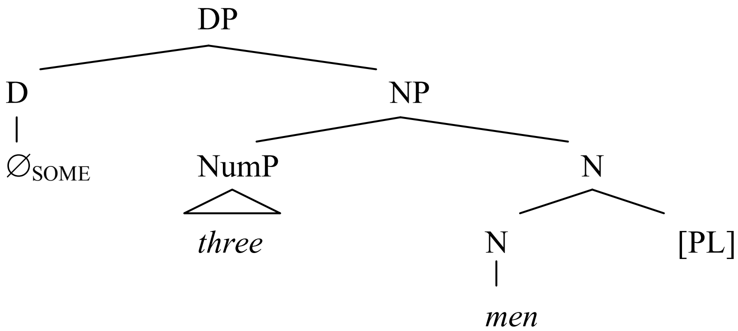
a. *Illustration:* [[three]] = [λx : |x| = 3]

b. *Illustration:* [[three men]] = [λx : [[three]](x) & [[men]](x)] =

[λx : |x| = 3 & *man(x)]
The function mapping x to T iff x is a triplet of men

(12) **The Semantics of Numerically Modified Plural Indefinites**

a. *Syntax of "three men"*



b. *Resulting Semantics*

[[$\varnothing_{SOME}$ three men]] = $[\lambda Q_{<e,\varepsilon t>} : \lambda e : \exists x \,.\, {*man}(x) \,\&\, |x| = 3 \,\&\, Q(x)(e)]$
[[$\varnothing_{SOME}$ three pianos]] = $[\lambda Q_{<e,\varepsilon t>} : \lambda e : \exists y \,.\, {*piano}(y) \,\&\, |y| = 3 \,\&\, Q(y)(e)]$

(13) **Important Note**
The phonologically null indefinite D in (12) is not (necessarily) the same phonologically null indefinite D that allegedly appears with simple bare plurals.

a. *Evidence: Scope Ambiguities*

(i) Dave didn't see dogs. ([NEG > ∃] ; *[∃ > NEG])
(ii) Dave didn't see two dogs. ([NEG > ∃] ; [∃ > NEG])

This raises the question of what, exactly, the null D in (12) is, where it comes from, and how exactly it differs from the null D found in bare plurals…

3. Key Conceptual Ingredients: The Semantics of VPs and vPs (Kratzer 2008)

(14) **The Generalized Star Operator on Sets of Tuples**

Let P be a set of *n*-tuples ($\langle x_1,\ldots,x_n\rangle$). Then *P is the smallest set such that (i) P ⊆ *P, and (ii) if $\langle x_1,\ldots,x_n\rangle$ and $\langle y_1,\ldots,y_n\rangle$ are elements of *P, then so is $\langle x_1+y_1 ,\ldots,x_n+y_n \rangle$.

Illustration:
P = {<Bill , Steve>, <Steve , Tom>, <Tom , Bill>}

*P = {<Bill , Steve>, <Steve , Tom>, <Tom , Bill>,
<Bill+Steve , Steve+Tom>, <Bill+Tom , Steve+Bill>,
<Steve+Tom, Tom+Bill>, <Bill+Steve+Tom, Steve+Tom+Bill> }

(15) **The Generalized Star Operator on Functions (From Tuples to T-Values)**

Let P be a function from *n*-tuples to truth values with domain S. Then *P is the function such that (i) the domain of *P is *S, (ii) $*P(x_1)\ldots(x_n) = T$ *iff* $P(x_1)\ldots(x_n) = T$, or $x_1 = y_1+z_1$, … , $x_n = y_n+z_n$, and $*P(y_1)\ldots(y_n) = T$ and $*P(z_1)\ldots(z_n) = T$.

Illustration:	P(Bill)(Steve) = T	*P(Bill)(Steve) = T
	P(Tom)(Frank) = T	*P(Tom)(Frank) = T
	P(Sally)(Bill) = F , *etc.*	*P(Sally)(Bill) = F
		*P(Bill+Tom)(Steve+Frank) = T
		*P(Bill+Sally)(Steve+Bill) = F , *etc.*

(16) **Fact:** Let S be a set of *n*-tuples, and *f* be its characteristic function. Then, **f* is the characteristic function of *S.

(17) **Key Hypotheses Concerning the Semantics of VPs (Kratzer 2008)**

a. Lexical verbs (*e.g.* 'carry') are relations between events and (any) themes.
b. Lexical verbs are *inherently pluralized.*

c. Illustration

(i) *Semantics of 'Carry'* [[carry]] = [λx : λe : *carry(e,x)]

(ii) *Simple (Atomic) Events of Carrying*

Event	Agent	Theme
e_1	Bill	piano1
e_2	Paul	piano2
e_3	Steve	piano3

Note: This is the 'cumulative predication' scenario in (3bii)

(iii) *The Values of* [[carry]]

[[carry]](piano1)(e_1) = T
[[carry]](piano2)(e_2) = T
[[carry]](piano3)(e_3) = T
[[carry]](piano1+piano2)(e_1+e_2) = T
[[carry]](piano1+piano3)(e_1+e_3) = T
[[carry]](piano2+piano3)(e_2+e_3) = T
[[carry]](piano1+piano2+piano3)(e_1+e_2+e_3) = T

[[carry]](piano1+piano3)(e_2+e_3) = F
[[carry]](piano1+piano2)(e_1+e_2+e_3) = F

(18) **Observation**

[[carry]] is the characteristic function of the following set:

{ <piano1, e_1> , <piano2, e_2> , <piano3, e_3> , <piano1+piano2, e_1+e_2> ,
<piano1+piano3, e_1+e_3 > , <piano2+piano3, e_2+e_3 > ,
< piano1+piano2+piano3 , $e_1+e_2+e_3$ > }

(19) **Key Hypotheses Concerning the Semantics of Little-*v* (Kratzer 2008)**

a. External arguments (agents) are introduced by the 'little-*v*' head.
b. The little-*v* head is inherently pluralized.

c. <u>Illustration</u>

(i) *Semantics of Little-v* [[*v*]] = [λy : λe : *Agent(e,y)]

(ii) *Simple (Atomic) Events of Carrying*

Event	Agent	Theme
e_1	Bill	piano1
e_2	Paul	piano2
e_3	Steve	piano3

(iii) *The Values of* [[*v*]]

[[*v*]](Bill)(e_1) = T
[[*v*]](Paul)(e_2) = T
[[*v*]](Steve)(e_3) = T
[[*v*]](Bill+Paul)(e_1+e_2) = T
[[*v*]](Bill+Steve)(e_1+e_3) = T
[[*v*]](Paul+Steve)(e_2+e_3) = T
[[*v*]](Bill+Paul+Steve)($e_1+e_2+e_3$) = T

[[*v*]](Bill+Steve)(e_2+e_3) = F
[[*v*]](Bill+Paul)($e_1+e_2+e_3$) = F

(20) **Observation**

[[*v*]] is the characteristic function of the following set:

{ <Bill, e_1> , <Paul, e_2> , <Steve, e_3> , <Bill+Paul, e_1+e_2> , <Bill+Steve, e_1+e_3 > ,
<Paul+Steve, e_2+e_3 > , < Bill+Paul+Steve , $e_1+e_2+e_3$ > }

(21) **The Compositional Semantics of vPs: Event Identification**

If X has daughters Y and Z, such that Y is of type <ε,t> and Z is of type <e,εt>, then [[X]] = [λy : λe : [[Z]](y)(e) & [[Y]](e)]

Illustration:

[[[*v* [carried piano1 and piano2]]]] =

[λy : λe : [[*v*]](y)(e) & [[carried piano1 and piano2]](e)] =

[λy : λe : *Agent(e,y) & *carry(e , piano1+piano2)]

(22) **Putting All the Pieces Together, Part 1**

a. *Sentence:* "Bill and Paul carried piano1 and piano2"

b. *Syntax:* [Bill and Paul [*v* [carried piano1 and piano2]]

c. *Semantics:*

[[[Bill and Paul [*v* [carried piano1 and piano2]]]] =

[[[*v* [carried piano1 and piano2]]]](Bill+Paul) =

[λy : λe : *Agent(e,y) & *carry(e , piano1+piano2)](Bill+Paul) =

[λe : *Agent(e , Bill+Paul) & *carry(e , piano1+piano2)] = (existential closure)

∃e . *Agent(e , Bill+Paul) & *carry(e , piano1+piano2)]

<u>Note:</u> The T-conditions above are satisfied in scenario (19cii), as they are witnessed by the plural event e_1+e_2.

Thus, we correctly predict that (22a) is true in that scenario!

(23) **Putting All the Pieces Together, Part 2**

a. *Sentence:* "Three men carried three pianos."

b. *LF Syntax:*

[$\varnothing_{\text{SOME}}$ three men [1 [$\varnothing_{\text{SOME}}$ three pianos [2 [t_1 [v [carried t_2]…]

d. *Derived T-Conditions*

$\exists e . \exists x . {}^*man(x) \ \& \ |x| = 3 \ \& \ \exists y . {}^*piano(y) \ \& \ |y| = 3 \ \& \ {}^*carry(e,y) \ \& \ {}^*Ag(e,x)$

There is an event e, a triplet of men x, and a triplet of pianos y such that e is a (plural) event of carrying, y is the (cumulative) theme of e, and x is the (cumulative) agent of e

Note: The T-conditions above are satisfied in the 'cumulative predication' scenario in (3bii), repeated below.

Event	Agent	Theme
e_1	Bill	piano1
e_2	Paul	piano2
e_3	Steve	piano3

Note that these T-conditions are witnessed by:
(i) the plural event $e_1+e_2+e_3$
(ii) the plural entity Bill+Paul+Steve (=x)
(iii) the plural entity piano1+piano2+piano3 (=y)

Conclusion: These semantic assumptions allow us to capture the 'cumulative interpretation' of (3a) in (3bii).

(24) **Key Observation**

The T-conditions in (23d) are also satisfied in the 'collective predication' scenario in (3bi), repeated below.

Event	Agent	Theme
e_1	Bill+Paul+Steve	piano1+piano2+piano3

Note that *carry(e_1 , piano1+piano2+piano3) and *Ag(e_1 , Bill+Paul+Steve), and so the T-conditions in (23d) hold in this scenario.

Conclusion: These semantic assumptions *also* allow us to capture the 'collective interpretation' of (3a) in (3bi).

4. Distributive Interpretations and Plural Number

Interim Summary: The semantic assumptions in Sections 2 and 3 capture the 'collective' and 'cumulative' interpretations in (3).

Outstanding Puzzle: How do we capture the 'distributive' interpretation in (3biii)? Under this interpretation, the sentence is true in the following scenario.

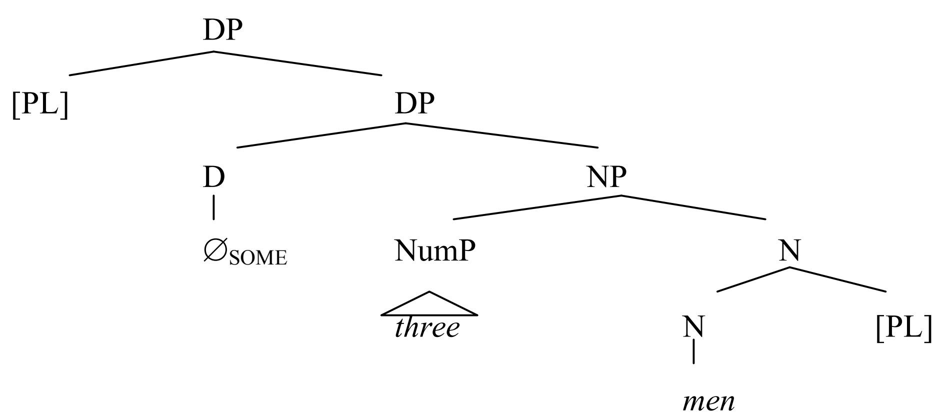
Event	Agent	Theme
e_1	Bill	piano1+piano2+piano3
e_2	Paul	piano4+piano5+piano6
e_3	Steve	piano7+piano8+piano9

Note that the T-conditions in (23d) would not be satisfied in this scenario.

- The only event that has a triplet of men as its (cumulative) agent is $e_1+e_2+e_3$
- In the scenario above, though, this event does not have a triplet as its (cumulative) theme, but a nonuplet.

(25) **Distributive Interpretations and Plural Number (Kratzer 2008)**

a. Syntactic Assumpitons, Part 1 (Sauerland 2005, Kratzer 2008)
A plural DP has a separate number projection, above the D. This could be the number feature that participates in plural number agreement.



b. Syntactic Assumptions, Part 2 (Kratzer 2008)
The [PL] feature above D can be 'released' into the sister of the DP.

$[_{DP}$ [PL] $[_{DP}$ three men]] $[_{vP}$ carried three pianos] ..] →

$[_{DP}$ three men]] [PL $[_{vP}$ carried three pianos] ..]

c. Semantic Assumption (Kratzer 2008)
A PL feature 'released' onto the sister of DP is still interpreted as '*'

(26) **The Analysis of Distributive Interpretations**

a. Sentence: Three men carried three pianos.

b. LF Syntax:
[$\varnothing_{SOME}$ three men [PL [1 [t_1 [v [$\varnothing_{SOME}$ three pianos [2 [carried t_2] …]

Feature 'Release' *QR to the Edge of VP*

c. Semantics, Part 1:

(i) *The Semantics of vP*
[[PL [1 [t_1 [v [$\varnothing_{SOME}$ three pianos [2 [carried t_2] …]]] =

*[λz : λe : ∃y . *piano(y) & |y| =3 & *carry(e , y) & *Agent(e,z)]

(ii) *Illustration*

- Recall the distributive scenario below:

Event	Agent	Theme
e_1	Bill	piano1+piano2+piano3
e_2	Paul	piano4+piano5+piano6
e_3	Steve	piano7+piano8+piano9

- Note that in this scenario:

[λz : λe : ∃y . *piano(y) & |y| =3 & *carry(e , y) & *Agent(e,z)](Bill)(e_1) = T
[λz : λe : ∃y . *piano(y) & |y| =3 & *carry(e , y) & *Agent(e,z)](Paul)(e_2) = T
[λz : λe : ∃y . *piano(y) & |y| =3 & *carry(e , y) & *Agent(e,z)](Steve)(e_3) = T

- Consequently:

*[λz : λe : ∃y . *piano(y) & |y| =3 &
*carry(e , y) & *Agent(e,z)](Bill+Paul+Steve)(e_1+e_2+ e_3) = T

d. Semantics Part 2:

(i) *The T-Conditions Derived for LF (26b)*

∃e' . ∃x . *man(x) & |x| =3 &
*[λz : λe : ∃y . *piano(y) & |y| =3 & *carry(e , y) & *Agent(e,z)](x)(e')

(ii) *Key Observation:*
The T-conditions above hold in scenario (26cii). They are witnessed by:
1. e_1+e_2+ e_3 and 2. Bill+Paul+Steve

(27) **Principle Conclusion**

With the additional assumptions in (25), we are able to predict that sentence (3a) can also be interpreted as true in the 'distributive scenario' in (3biii)!

Thus, our resulting theory can capture all the key facts in (3)!

(28) **Side Note**

Note that the T-conditions in (26d) will also hold in the 'collective' and 'cumulative' scenarios…

… thus, we could easily assume that sentence (3a) *always* has the LF in (26b), where the PL feature of the DP is 'released' into its sister (see Kratzer 2008)…

(29) **Question**

- The key idea in our analysis of the 'distributive interpretation' is the notion that a '*'-operator can be inserted just above the *vP*.
- In our analysis, this '*'-operator comes from the plural DP; it's ultimately a (redundant) number feature on that DP
- But why do we make that special assumption? Why not just suppose that '*'-operators can be freely inserted in the syntax? This more liberal idea is common in earlier works (*e.g.* Beck & Sauerland 2000).

(29) **Key Observation (Kratzer 2008)**
Sentence (a) can truthfully describe scenario (bi), but not (bii).

a. Mary knocked on a door for twenty minutes.

b. (i) Mary knocked multiple times, but on the same door each time.
(ii) Mary knocked multiple times, on a different door each time.

<u>Fact:</u> Our semantic system – where there isn't completely free insertion of '*'-operators – can easily capture this fact.

(30) **The Semantics of "For Twenty Minutes"**

[[for twenty minutes]] = [λe : f_{MINUTE}(e) = 20]
'the event *e* is 20 minutes in duration'

(31) **The Analysis of Observation (29)**

a. Sentence: Mary knocked on a door for twenty minutes.

b. LF Syntax: [for twenty minutes [a door [1 [Mary [*v* [knocked on t_1] …]

c. Predicted T-Conditions:

$\exists e . f_{\text{MINUTE}}(e) = 20 \ \& \ \exists x . \text{door}(x) \ \& \ {}^*\text{knock-on}(e , x) \ \& \ {}^*\text{Agent}(e,\text{Mary})$

There is a (plural) event e of knocking lasting 20 minutes long,
there is a door x such that x is the (cumulative) theme of e, and
Mary is the (cumulative) agent of e.

d. Key Facts:

(i) The T-conditions in (31c) hold in scenario (29bi), where there are multiple events of knocking, each with the same agent (Mary) and the same theme.

(ii) These T-conditions do *not* hold in scenario (29bii). In such a scenario, there is no single door that is the (cumulative) theme of the plural event of knocking.

e. Conclusion: Our system is able to predict the key observation in (29).

(32) **Problems With Free Insertion of '*'-Operator**

- If we could freely insert '*'-operators (Beck & Sauerland 2000), then sentence (31a) could receive the following LF:

  [for twenty minutes [***** [a door [1 [Mary [*v* [knocked on t_1] …]

- This LF will receive the following T-conditions:

  $\exists e. f_{\text{MINUTE}}(e) = 20 \ \& \ {}^*[\lambda e' : \exists x. \text{door}(x) \ \& \ {}^*\text{knock-on}(e' , x) \ \& \ {}^*\text{Agent}(e',\text{Mary})](e)$

- Note that in a scenario like the following, the plural event e_1+e_2 would witness the T-conditions above.

Events of Knocking	Agent	Location	Time
e_1	Mary	door1	10 minutes
e_2	Mary	door2	10 minutes

- Thus, the T-conditions above do not require each of the knockings to be on the same door. Thus, these T-conditions would be satisfied in a scenario like (29bii).

(33) **Conclusion**

- We don't want *complete* freedom to insert '*'-operators in the LF representation.
- The hypothesis that the '*'-operator is crucially tied to a neighboring plural DP seems to provide the right kind of limits on insertion (see Kratzer 2008 for more discussion).

5. Cumulativity Over Non-Lexical Predicates

One final issue to consider is the fact that sentence (33a) can be understood as true in a scenario like (33b).

(33) a. Sentence: Two boys gave a flower to two girls.

b. Scneario:

Events of Giving	Agent	Theme	Goal
e_1	Bill	flower1	Sue
e_2	Joe	flower2	Mary

(34) **T-Conditions That Would Hold in Scenario (33b) (Beck & Sauerland 2000)**

∃x . *boy(x) & |x| =2 & ∃y . *girl(y) & |y| =2 &
*[λs : λt : ∃z . flower(z) & t gave z to s](y)(x)

Illustration:

- Note that: [λs : λt : ∃z . flower(z) & t gave z to s](Sue)(Bill) = T
  [λs : λt : ∃z . flower(z) & t gave z to s](Mary)(Joe) = T
- Thus: *[λs : λt : ∃z . flower(z) & t gave z to s](Sue+Mary)(Bill+Joe) = T
- Thus, the T-conditions above hold in scenario (33b).

Question: If this is right, how do we assign the T-conditions in (34) to sentence (33a)?
What part of the structure can be interpreted as
*[λs : λt : ∃z . flower(z) & t gave z to s]

(35) **Beck & Sauerland's (2000) Syntactic Solution**

'Tucking in' movement (Richards 2001), followed by the insertion of a '*'-operator will derive an appropriate LF for (33a).

a. [Two boys gave a flower to two girls]] → (QR of "a flower")

b. [a flower [3 [two boys gave t_3 to two girls]] → (QR of "two boys")

c. [Two boys [1 [a flower [3 [t_1 gave t_3 to two girls] …] → (QR, with tucking in, of "two girls")

d. [Two boys [two girls [2 [1 [a flower [3 [t_1 gave t_3 to t_2] …] → (insertion of '*')

e. [Two boys [two girls [* [2 [1 [a flower [3 [t_1 gave t_3 to t_2] …]

f. <u>Truth-Conditions Assigned to LF (35e):</u>

∃x . *boy(x) & |x| =2 & ∃y . *girl(y) & |y| =2 &
*[λs : λt : ∃z . flower(z) & t gave z to s](y)(x)

(36) **Kratzer's (2008) Solution**

- Given our key assumptions in Sections 3 and 4, we don't actually need this mechanism of 'tucking in' movement to derive adequate truth-conditions for (33a).
- Instead, the T-conditions assigned to the following LF will be sufficient for (33a) to be true in scenario (33b).

'Release' of PL from 'two girls'

$[_{vP}$ two boys $[_{vP}$ v $[_{VP}$ two girls [PL $[_{VP}$ 2 $[_{VP}$ a flower $[_{VP}$ 1 $[_{VP}$ gave t_1 to t_2] …]

QR to the Edge of (Big) VP

(37) **Unpacking Kratzer's (2008) Solution, Part 1**

- Via QR and feature release, we create the following VP structure:

  [PL [$_{VP}$ 2 [$_{VP}$ a flower [$_{VP}$ 1 [$_{VP}$ gave t_1 to t_2] …]

- This VP structure is assigned the following interpretation:

  *[λx : λe : ∃z . flower(z) & *give(e,z) & *Goal(e,x)]

- Note that in the scenario in (33b), repeated below, the following holds:

Events of Giving	Agent	Theme	Goal
e_1	Bill	flower1	Sue
e_2	Joe	flower2	Mary

  [λx : λe : ∃z . flower(z) & *give(e,z) & *Goal(e,x)](Sue)(e_1) = T
  [λx : λe : ∃z . flower(z) & *give(e,z) & *Goal(e,x)](Mary)(e_2) = T

- Thus, the following holds in scenario (33b) as well:

  *[λx : λe : ∃z . flower(z) & *give(e,z) & *Goal(e,x)](Sue+Mary)(e_1+e_2) = T

(38) **Unpacking Kratzer's (2008) Solution, Part 2**

- Let's now consider the whole VP structure in LF (36):

  [$_{VP}$ two girls [PL [$_{VP}$ 2 [$_{VP}$ a flower [$_{VP}$ 1 [$_{VP}$ gave t_1 to t_2] …]

- This VP structure is assigned the following interpretation:

  [λe' : ∃y . *girl(y) & |y| =2 &
  *[λx : λe : ∃z . flower(z) & *give(e,z) & *Goal(e,x)](y)(e')]

- Now, note that, given our conclusion in (37), the following holds in scenario (33b), since it is witnessed by the pair *y* = Sue+Mary.

  ∃y . *girl(y) & |y| =2 &
  *[λx : λe : ∃z . flower(z) & *give(e,z) & *Goal(e,x)](y)(e_1+e_2)

- Thus, the following holds in scenario (33b):

  [λe' : ∃y . *girl(y) & |y| =2 &
  *[λx : λe : ∃z . flower(z) & *give(e,z) & *Goal(e,x)](y)(e')](e_1+e_2) = T

(39) **Unpacking Kratzer's (2008) Solution, Part 3**

- Now, let's consider the following *v*P sub-structure of LF (36).

  [$_{vP}$ *v* [$_{VP}$ two girls [PL [$_{VP}$ 2 [$_{VP}$ a flower [$_{VP}$ 1 [$_{VP}$ gave t_1 to t_2] …]

- Given our result in (38), it will be clearly be interpreted as the following:

  [λs : λe' : *Agent(e',s) & ∃y . *girl(y) & |y| =2 &
  *[λx : λe : ∃z . flower(z) & *give(e,z) & *Goal(e,x)](y)(e')]

- Now, note that in scenario (33b), repeated below, *Agent(e_1+e_2 , Bill+Joe)

Events of Giving	Agent	Theme	Goal
e_1	Bill	flower1	Sue
e_2	Joe	flower2	Mary

- Thus, given our conclusion in (38), the following condition holds in scenario (33b):

  *Agent(e_1+e_2 , Bill+Joe) & ∃y . *girl(y) & |y| =2 &
  *[λx : λe : ∃z . flower(z) & *give(e,z) & *Goal(e,x)](y)(e_1+e_2)

- Thus, the following T-conditions will hold in scenario (33b):

  ∃e' . ∃s . *boy(s) & |s| =2 & . *Agent(e' , s) & ∃y . *girl(y) & |y| =2 &
  *[λx : λe : ∃z . flower(z) & *give(e,z) & *Goal(e,x)](y)(e')]

- But note that the T-conditions above will be exactly those assigned to the LF in (36), repeated below:

  [$_{vP}$ two boys [$_{vP}$ *v* [$_{VP}$ two girls [PL [$_{VP}$ 2 [$_{VP}$ a flower [$_{VP}$ 1 [$_{VP}$ gave t_1 to t_2] …]

- **Conclusion:**
  The LF in (36) – which is predicted by our assumptions from Sections 3 and 4 – will be assigned T-conditions that hold in scenario (33b).

  Thus, we indeed do not need to make use of Beck & Sauerland's (2000) tucking-in operation to derive an appropriate set of T-conditions for (33a).

6. Some Outstanding Questions

(40) **Inherent Plurality and Pluractional Markers**

If lexical verbs and little-*v* are inherently plural, then we correctly predict that sentences like the following can describe scenarios of *multiple* knockings, and so can directly combine with adverbials like "for twenty minutes".

a. Dave knocked on the door (for twenty minutes).

- *But, what about the languages where unmarked verbs cannot describe iterated action?*
- As we will see later, some languages require verbs to bear special ('pluractional') morphology in order to describe multiple events…
- In such languages, the translation of English (40a) would not contain a simple, unmarked lexical verb…

(41) **Long-Distance Cumulativity**

Beck & Sauerland (2000) spend some time focusing on sentences like (41a), and the fact that they could be true in scenarios like (41b).

a. Two men want to marry two women.
b. (i) Bill wants to marry Jen.
   (ii) Joe wants to marry Sue.

They claim that such interpretations offer support for their account, which can derive them via LF structures like (41c).

c. [two men [two women [* [2 [1 [t_1 wants to marry t_2] …]

Such an analysis, however, would seem to predict that such cumulative readings require the embedded DP to be interpreted as transparent. This, however, does not seem to be the case; sentence (41dii) seems to be true in scenario (41di).

d. (i) *Scenario:* Dave wants to own three houses.
   John wants to own two houses.

   (ii) *Sentence:* Two men want to own five houses.

- Can we develop a more sophisticated theory of sentences like (41a), one that properly deals with their intensional sructure?

- Such a theory should extend to cases like the following. Note that due to the finite subordinate clause, the embedded DP should not be able to QR to the matrix clause.

e. (i) *Scenario:* Dave said that he caught three fish.
Bill said that the caught two fish.

(ii) *Sentenece:* The boys said that they caught five fish.

(iii) *Judgment:* Sentence (ii) can be read as true in scenrio (i).