An Alternatives-based Semantics for Dependent Plurals

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1 Properties of Dependent Plurals

1.1 Scopelessness

Bare plural noun phrases in the context of other plurals can sometimes get a reading which appears to be synonymous with that of singular indefinites (cf. Chomsky 1975, de Mey 1981):

(1) Unicycles have wheels.
(2) Unicycles have a wheel.

In a neutral context, sentences (1) and (2) are synonymous, both stating that, generally, each unicycle has one wheel. Crucially, sentence (1) does not state that that each unicycle has \textit{more than one} wheel, contrary to fact.

Compare (1) with (3):

(3) Unicycles have several wheels.

Sentence (3) must be judged false, since it states that unicycles generally have more than one wheel.

1.2 Multiplicity

Based on the semantic parallelism between (1) and (2), Chomsky (1975) analyzed the plural marking on the bare plural as a semantically vacuous reflex of subject-verb agreement.

But plural feature on the dependent DP does in fact make a contribution to the semantics. And consequently, in general dependent plurals are not synonymous with singular indefinites.

Zweig (2009) refers to this semantic contribution as the \textit{Multiplicity Condition} (see also Kamp and Reyle 1993, Spektor 2003 a.o.):

(4) Ten students live in New York boroughs.
(5) Ten students live in a New York borough.
Sentence (4) can have a reading on which each student lives in just one New York borough. A similar reading is readily available for sentence (5), on the low-scope interpretation of the indefinite DP. The crucial difference between these examples is that (5) would be true in a scenario where all the students live in the same New York borough (e.g., Manhattan), while sentence (4) could not be judged true under this scenario. Sentence (4) requires that, overall, more than one New York borough is involved.

Generally, the Multiplicty Condition requires that overall more than one of the things referred to by the dependent plural must be involved.

1.3 Intervention Effects

Zweig (2008, 2009) analyzes dependent plurals in constructions with ditransitives predicates. He observes that sentences such as (6) and (7) are ambiguous: either the agent scopes over the recipient or vice versa. But either way, the bare plural can be interpreted as dependent on the higher scoping DP:

(6) Two boys told three girls secrets.
(7) Two boys told secrets to three girls.

On the surface scope reading, (6) can be true in a scenario where boy A told three different girls secret X, while boy B told three different girls secret Y. On the inverse scope reading, it can be true in a scenario where girl A is told secret X by two boys, girl B is told secret Y by two boys, and girl C is told secret Z by two boys. Similar readings obtain for the surface and inverse scope interpretations of (7).

Examples (6) and (7) contrast with those in (8) and (9):

(8) Two boys told a girl secrets.
(9) Two boys told secrets to a girl.

Like (6) and (7), these sentences for both surface scope and inverse scope interpretations, with either the agent scoping over the recipient or vice versa. But unlike (6) and (7), on the surface reading scope reading the bare plural cannot be interpreted as dependent on the higher agent DP. I.e. these sentences cannot be judged true in a scenario where boy A told one girl secret X and boy B told a different girl secret Y.

On the other hand, on the inverse scope reading with the recipient DP taking wide scope, the bare plural can be interpreted as dependent on the agent DP. I.e. (6) and (7) are true if boy A told one girl secret X and boy B told the same girl secret Y.

Note that the dependence between a licensor and a bare plural is not disrupted by scopeless singular DPs, such as pronouns:
Two boys told John secrets.

Two boys told secrets to John.

A singular DP blocks the dependence between a potential licensor and a bare plural in a ditransitive construction just in case it takes scope below that licensor.

2 The Cumulativity-based Approach to Dependent Plurals

2.1 Scopelessness and Multiplicity

A number of accounts assimilate the phenomenon of dependent plurality to cumulativity, most explicitly Zweig 2008, 2009 (see also Roberts 1990, Bosveld-de Smet 1998, Beck 2000, de Swart 2006).

Consider the following example from Nouwen (to appear):

(12) Six frogs swallowed twelve ladybirds.

Sentence (12) has at least two readings. On the distributive reading, it is true in a situation where each frog swallowed twelve ladybirds. However, (12) also has a cumulative reading, on which (12) can be true in a situation where six frogs swallowed twelve ladybirds in total, e.g. each frog swallowed just two ladybirds.

The intuition behind cumulativity-based approaches to dependent plurals: Whatever mechanism is responsible for the cumulative reading in (12), it can also be used to account for dependent plurals.

E.g. in (4) the noun phrase New York boroughs can be taken to denote the sum of all the New York boroughs that the students live in, in the same way as twelve ladybirds in (12) denotes the sum of all the ladybirds eaten by the frogs.

Zweig (2008, 2009) has proposed an account of dependent plurals based on Landman’s (2000) approach to cumulativity. Under this approach, sentence (13) involving a dependent plural and sentence (15) under a cumulative reading get parallel semantic treatment, given in (14) and (16).

(13) Five boys flew kites.

(14) $\exists e \exists X \exists Y | |X| = 5 \land *\text{BOY}(X) \land |Y| > 1 \land *\text{KITE}(Y) \land *\text{FLEW}(e) \land *\text{AG}(e)(X) \land *\text{TH}(e)(Y)]$

(15) Five boys flew three kites.

(16) $\exists e \exists X \exists Y | |X| = 5 \land *\text{BOY}(X) \land |Y| = 3 \land *\text{KITE}(Y) \land *\text{FLEW}(e) \land *\text{AG}(e)(X) \land *\text{TH}(e)(Y)]$
Following Krifka (2004), Sauerland et al. (2005), Spector (2007), Zweig assumes that bare plurals are number neutral, and that the multiplicity condition associated with them in many contexts is derived as a scalar implicature. Thus, in (14) the *Multiplicity Condition* associated with the bare plural (represented as $|Y| > 1$) is a scalar implicature calculated by negating the stronger alternative, which would correspond to the use of an atomic variable instead of $Y$. Crucially, the multiplicity implicature must be calculated before the existential closure of the event variable takes place. On the other hand, in the case of cumulative readings in (16) the quantity of $Y$ is lexically specified. Apart from this difference, the logical treatment of dependent plurals and cumulative readings is completely parallel under Zweig’s analysis.

### 2.2 Intervention Effects

Zweig accounts for the intervention effect in examples like (8), repeated in (17), by assuming that a scopal relation between the subject *two boys* and the indirect object *a girl* is only possible if *two boys* “scopes out”, taking scope over the event closure. But since the multiplicity implicature is added before event closure, this would also necessarily lead to a scopal, non-dependent, relation between two boys and the bare plural secrets, cf. (18)-(19).

(17) Two boys told a girl secrets.

(18) Two boys$_i$ [$_{event\, closure}$ $t_i$ told a girl secrets].

(19) $\exists X [|X| = 2 \land \exists^*BOY(X) \land \forall x \in X [\exists e \exists y \exists Z [\text{GIRL}(y) \land |Z| > 1 \land \exists^*SECRET(Z) \land \exists^*TELL(e) \land \exists^*AG(e)(x) \land \exists^*GOAL(e)(y) \land \exists^*TH(e)(Z)]]$

### 3 Long-Distance Interactions: *certain NPs*

The cumulative approach defines a locality domain for dependent plurals: the licensor and the dependent must be related to a single event variable.

In fact, the relation between a licensor and the dependent plural seems to be much less constrained, at least in some cases.

Consider plural nouns phrases with *certain*:

(20) Mary and Jane like certain books.

*Certain NPs* exhibit the same properties of scopelessness and multiplicity as bare plurals.

(21) Mary and Jane told a girl certain secrets.
Certain NPs exhibit the same intervention effects as bare plurals. But: certain NPs freely allow for long distance interactions with the licensor. Out of control complements:

(22) Mary, Jane, and Bill / most of my friends want to meet certain phonologists.

Out of tensed complements:

(23) Mary, Jane, and Bill / most of my friends claim that they like certain phonologists.

Out of adjunct clauses:

(24) Mary, Jane, and Bill / most of the guests came to the party in order to meet certain people.

(25) Mary, Jane, and Bill / most of these children will immediately fall asleep if I sing them certain songs.

These examples are particularly important because it means that this phenomenon cannot be attributed to some property of attitude predicates (cf. e.g. Dotlačil & Nilsen 2009).

The presence of an intermediate variable isn’t necessary:

(26) Mary, Jane, and Bill / most of my friendsl want Ann to meet certain phonologists.

(27) Mary, Jane, and Billl / most of my friends hope that Ann meets certain phonologists.

(28) Mary, Jane, and Bill / most of my friends will only return to Russia if the government repeals certain laws.

It seems that to account for dependent certain NPs we need a much less restricted mechanism of establishing the relation between the dependent and the licensor.

4 An Alternatives-based Account

4.1 Standard Hamblin Semantics for Indefinites

I will use an extensional version of the system in Kratzer & Shimoyama 2002 and Kratzer 2004, slightly simplified for the current purposes, to illustrate the way Hamblin semantics deals with singular indefinites, and then see if this approach can be applied to the analysis of dependent plurals.

In alternative semantics a DP such as *a book* is taken to denote a set of alternative individuals, each of which is a book:

\[(a \text{ book}) = \{x: \text{book}(x)\}\]

Verbs denote singleton sets of functions. E.g. disregarding the event argument for the time being, a verb like *buy* would have the following denotation:

\[(\text{buy}) = \{\lambda x.\lambda y.\text{buy}(y)(x)\}\]

Denotations are combined via point wise functional application:

**Hamblin Functional Application**

If \(\alpha\) is a branching node with daughters \(\beta\) and \(\gamma\), and \([\beta] \subseteq D_\sigma\) and \([\gamma] \subseteq D_{(\sigma \tau)}\), then \([\alpha] = \{a \in D_\tau: \exists b. \exists c. b \in [\beta] \land c \in [\gamma] \land a = c(b)\}\).

The result of applying (30) to (29) via Hamblin Functional Application is represented in (31):

\[(\text{buy a book}) =
\{f \in D_{(et)}: \exists a. \exists b. a \in \{x: \text{book}(x)\} \land b \in \{\lambda x.\lambda y.\text{buy}(y)(x)\} \land f = b(a)\}\]

\[= \{f \in D_{(et)}: \exists a. \text{book}(a) \land f = \lambda y.\text{buy}(y)(a)\}\]

Pointwise functional application thus gives us a set of functions of type \((et)\). This set can then be combined with another set of individuals denoted by an indefinite in (32), to yield a set of propositions in (33):

\[(a \text{ boy}) = \{x: \text{boy}(x)\}\]

\[(a \text{ boy buys a book}) =
\{p \in D_I: \exists a. \exists b. a \in \{x: \text{boy}(x)\} \land b \in \{f \in D_{(et)}: \exists a. \text{book}(a) \land f = \lambda y.\text{buy}(y)(a)\} \land p = b(a)\}\]

\[= \{p \in D_I: \exists a. \exists b. \text{book}(a) \land \text{boy}(b) \land p = \text{buy}(b)(a)\}\]
This set of propositions is then interpreted via existential closure:

\[ \exists \alpha = \{ \exists p. p \in \alpha \& p = 1 \} \]

I will now try to extend this analysis to capture the properties of *certain* plural indefinites, and specifically dependent plurals.

### 4.2 Hamblin Semantics for Dependent Plurals

To account for dependent plurals I will add one level of complexity to the traditional Hamblin denotations. The basic idea is that sentences such as (35) assert the existence of a *set* of true propositions:

(35) Certain girls laughed.

(36) There exists a set \( P \) of true propositions of the form \( \{ g_1 \text{laughed}, \ldots, g_n \text{laughed} \} \), where \( \{ g_1, \ldots, g_n \} \) is a set of girls.

The challenge is to derive this compositionally.

I will assume that natural language expressions do not denote sets of objects (individuals, functions) as in standard Hamblin semantics, but rather *sets of sets* of objects. The outer layer corresponds to standard Hamblin alternatives, while the inner layer encodes plurality.

I will re-write the denotation for singular indefinites in the following form, where *books* stands for the set of all books, and \( \mathcal{P}(\text{books}) \) stands for the power set of that set:

(37) \( [\text{a certain book}] = \{ \{ x \} \subseteq D_e : \{ x \} \in \mathcal{P}(\text{books}) \} \)

(38) \( [\text{a certain girl}] = \{ \{ x \} \subseteq D_e : \{ x \} \in \mathcal{P}(\text{girls}) \} \)

Thus a *certain book* denotes the set of alternative singleton subsets of books. A plural *certain books* will then denote the set of all subsets of books:

(39) \( [\text{certain books}] = \{ \{ x_1, \ldots, x_n \} \subseteq D_e : \{ x_1, \ldots, x_n \} \in \mathcal{P}(\text{books}) \} = \mathcal{P}(\text{books}) \)

(40) \( [\text{certain girls}] = \{ \{ x_1, \ldots, x_n \} \subseteq D_e : \{ x_1, \ldots, x_n \} \in \mathcal{P}(\text{girls}) \} = \mathcal{P}(\text{girls}) \)

Verbs denote singleton sets of singleton sets of functions (in what follows I am disregarding the event argument for ease of exposition):

(41) \( [\text{laugh}] = \{ f \subseteq D_{(et)} : f = \{ \lambda x.\text{laugh}(x) \} \} \)

(42) \( [\text{buy}] = \{ f \subseteq D_{(e \langle \text{et} \rangle)} : f = \{ \lambda x.\lambda y.\text{buy}(y)(x) \} \} \)
These denotations combine via the following rule of functional application:

**Plural-Friendly Hamblin Functional Application**

If \( \alpha \) is a branching node with daughters \( \beta \) and \( \gamma \), and \( \llbracket \beta \rrbracket \subseteq D_{i}^{(\langle\sigma_{t}\rangle)t} \) and \( \llbracket \gamma \rrbracket \subseteq D_{i}^{(\langle\sigma_{t}\rangle)t} \), then \( \llbracket \alpha \rrbracket = \{ \{ c_{1}(b_{1}), \ldots, c_{n}(b_{n}) \} \subseteq D_{t} : \{ b_{1}, \ldots, b_{n} \} \in \llbracket \beta \rrbracket \land \{ c_{1}, \ldots, c_{n} \} \in \llbracket \gamma \rrbracket \} \).

(43)  \[ \llbracket \text{Certain girls laughed} \rrbracket = \]

\[ \{ \{ f_{1}(g_{1}), \ldots, f_{n}(g_{n}) \} : \{ g_{1}, \ldots, g_{n} \} \in \mathcal{P}(\text{girls}) \land \{ f_{1}, \ldots, f_{n} \} \in \{ f : f = \{ \lambda x. \text{laugh}(x) \} \} \]  

\[ = \{ \{ \text{laugh}(g_{1}), \ldots, \text{laugh}(g_{n}) \} : \{ g_{1}, \ldots, g_{n} \} \in \mathcal{P}(\text{girls}) \} \]

The final step is to apply existential closure to this set and to define truth for sets of propositions:

(44)  \[ \llbracket \exists \alpha \rrbracket = \{ \exists \ p. \ p \in \alpha \land p = 1 \} \]

(45)  \[ p_{t} = 1 \iff \forall p' \in p. \ p' = 1 \]

After existential closure:

(46)  \[ \exists g.q \in \{ \{ \text{laugh}(g_{1}), \ldots, \text{laugh}(g_{n}) \} : \{ g_{1}, \ldots, g_{n} \} \in \mathcal{P}(\text{girls}) \} \land q = 1 \iff \exists g_{1} \ldots g_{n}. \{ g_{1} \ldots g_{n} \} \in \mathcal{P}(\text{girls}) \land \text{laugh}(g_{1}) \land \ldots \land \text{laugh}(g_{n}) \]

4.3 **Basic Properties of Dependent Plurals: Scopelessness and Multiplicity**

(47)  Certain girls bought certain books.

The denotation for *certain books* is given in (39), and the denotation for *buy* in (42). When these denotations are combined via *Plural-Friendly Functional Application* we get the following interpretation for the verb phrase:

(48)  \[ \llbracket \text{buy certain books} \rrbracket = \]

\[ \{ \{ c_{1}(b_{1}), \ldots, c_{n}(b_{n}) \} \subseteq D_{i}^{(\langle\sigma_{t}\rangle)t} : \{ b_{1}, \ldots, b_{n} \} \in \mathcal{P}(\text{books}) \land \{ c_{1}, \ldots, c_{n} \} \in \{ f : f = \{ \lambda x. \lambda y. \text{buy}(y)(x) \} \} \]  

\[ = \{ \{ \lambda y. \text{buy}(y)(b_{1}), \ldots, \lambda y. \text{buy}(y)(b_{n}) \} : \{ b_{1}, \ldots, b_{n} \} \in \mathcal{P}(\text{books}) \} \]
Thus, we get the set of all sets of functions of the form $\lambda y.\text{buy}(y)(b_1), \ldots, \lambda y.\text{buy}(y)(b_n)$, where the themes $b_1 \ldots b_n$, taken together, form a subset of books.

This denotation is then combined with the denotation for the subject certain girls, which is analogous to the denotation for certain books\(^1\):

\[
(49) \quad [\text{certain girls}] = \{x_1, \ldots, x_n\} \subseteq D_e : \{x_1, \ldots, x_n\} \in \mathcal{P}(\text{girls})
\]

Combining this with (48) via \textit{Plural-Friendly Functional Application} we get:

\[
(50) \quad [\text{certain girls buy certain books}] =
\]

\[
\{\{c_1(d_1), \ldots, c_n(d_n)\} \subseteq D_t : \{d_1, \ldots, d_n\} \in \mathcal{P}(\text{girls}) \wedge \{c_1, \ldots, c_n\} \in \{\{\lambda y.\text{buy}(y)(b_1), \ldots, \lambda y.\text{buy}(y)(b_n)\} : \{b_1, \ldots, b_n\} \in \mathcal{P}(\text{books})\}\}
\]

\[
= \{\{\text{buy}(d_1)(b_1), \ldots, \text{buy}(d_n)(b_n)\} : \{b_1, \ldots, b_n\} \in \mathcal{P}(\text{books}) \wedge \{d_1, \ldots, d_n\} \in \mathcal{P}(\text{girls})\}
\]

We end up with a set of a set of sets of propositions of the form $\text{buy}(d_1)(b_1) \ldots \text{buy}(d_n)(b_n)$, where the agents $d_1 \ldots d_n$ taken together constitute a subset of girls, while the themes $b_1 \ldots b_n$ taken together constitute a subset of book.

After the application of existential closure we get the following final interpretation for (47):

\[
(51) \quad \exists q, q \in \{\{\text{buy}(d_1)(b_1), \ldots, \text{buy}(d_n)(b_n)\} : \{b_1, \ldots, b_n\} \in \mathcal{P}(\text{books}) \wedge \{d_1, \ldots, d_n\} \in \mathcal{P}(\text{girls})\} \wedge q = 1 \iff
\]

\[
\exists b_1 \ldots b_n. \exists d_1 \ldots d_n. \{b_1 \ldots b_n\} \in \mathcal{P}(\text{books}) \wedge \{d_1, \ldots, d_n\} \in \mathcal{P}(\text{girls}) \wedge \text{buy}(d_1)(b_1) \wedge \ldots \wedge \text{buy}(d_n)(b_n)
\]

The final interpretation states that there is a set of true propositions of the form $\text{buy}(d_1)(b_1) \ldots \text{buy}(d_n)(b_n)$, where the agents $d_1 \ldots d_n$ taken together constitute a subset of girls, while the themes $b_1 \ldots b_n$ taken together constitute a subset of book. It is clear that this interpretation correctly captures the scopeless reading of dependent plurals, since each girl $d_m$ may buy just one book $b_m$.

What about the \textit{Multiplicity Condition} discussed in section 1.2? There are two ways to deal with multiplicity in this system, and the choice between them is independent of the system itself. The easiest way is to modify the denotation for certain plurals so that they denote sets of non-singeton sets of individuals:

\[
(52) \quad [\text{certain books}] = \{x_1, \ldots, x_n\} \subseteq D_e : \{x_1, \ldots, x_n\} \in \mathcal{P}(\text{books}) \wedge |\{x_1, \ldots, x_n\}| > 1
\]

\(^{1}\) I am disregarding tense for this illustration.
This requirement will then be projected into the final denotation for (47), ensuring that overall more than one girl and more than one book are involved:

(54) \[ \exists b_1 \ldots b_n. \exists d_1 \ldots d_n. \{b_1, \ldots, b_n\} \in \mathcal{P}(\text{books}) \land |\{b_1, \ldots, b_n\}| > 1 \land \{d_1, \ldots, d_n\} \in \mathcal{P}(\text{girls}) \land |\{d_1, \ldots, d_n\}| > 1 \land \text{buy}(d_1)(b_1) \land \ldots \land \text{buy}(d_n)(b_n) \]

Alternatively, we can assume that denotations for certain plurals are neutral with respect to the size of the sets in their denoted set, as in (39) and (49). Then the relevant restrictions will be added at some stage of interpretation as implicatures, negating the stronger meaning of singular indefinites (cf. Krifka 2004, Sauerland et al. 2005, Spector 2007, Zweig 2009).

4.4 Accounting for Zweig’s Intervention Effects

It turns out that the intervention effects discussed in section 1.3 fall out naturally in the current system. To demonstrate this, I will start with the interpretation of a simple ditransitive sentence with no intervention:

(55) Certain boys told John certain secrets.

Certain boys and certain secrets receive the familiar interpretation for certain plurals:

(56) \[[\text{certain boys}] = \{\{x_1, \ldots, x_n\} \subseteq D_e : \{x_1, \ldots, x_n\} \in \mathcal{P(\text{boys})} \land |\{x_1, \ldots, x_n\}| > 1\}\]

(57) \[[\text{certain secrets}] = \{\{x_1, \ldots, x_n\} \subseteq D_e : \{x_1, \ldots, x_n\} \in \mathcal{P(\text{secrets})} \land |\{x_1, \ldots, x_n\}| > 1\}\]

I will take tell to be a (set of a singleton set containing a) three-place predicate, again disregarding the event argument:

(58) \[[\text{tell}] = \{f \subseteq D_{\langle e(e(e))\rangle} : f = \{\lambda x.\lambda y.\lambda z.\text{tell}(z)(y)(x)\}\}\]

John is a set consisting of a singleton set of individuals:

(59) \[[\text{John}] = \{\{x\} \subseteq D_e : x = \text{John}\}\]

Successively employing Plural Friendly FA, we can derive the interpretation for (55):
(60) \[\text{[tell certain secrets]} = \]

\[
\{ \{ c_1(b_1), \ldots, c_n(b_n) \} \subseteq D_{\{x\}} : \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \}
\]

\[
\{ \{ c_1, \ldots, c_n \} \subseteq \mathcal{F} \land \{ f : f = \{ \lambda x. \lambda y. \lambda z. \text{tell}(z)(y)(x) \} \} \}
\]

\[
= \{ \{ \lambda y. \lambda z. \text{tell}(z)(y)(b_1), \ldots, \lambda y. \lambda z. \text{tell}(z)(y)(b_n) \} : \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \}
\]

(61) \[\text{[tell John certain secrets]} = \]

\[
\{ \{ a_1(m_1), \ldots, a_n(m_n) \} \subseteq D_{\{x\}} : \{ m_1, \ldots, m_n \} \in \{ x \in D_x : x = \text{John} \} \land \}
\]

\[
\{ a_1, \ldots, a_n \} \subseteq \{ \lambda y. \lambda z. \text{tell}(z)(y)(b_1), \ldots, \lambda y. \lambda z. \text{tell}(z)(y)(b_n) \} : \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \}
\]

\[
= \{ \{ \lambda z. \text{tell}(z)(\text{John})(b_1), \ldots, \lambda z. \text{tell}(z)(\text{John})(b_n) \} : \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \}
\]

Finally,

(62) \[\text{[certain boys told John certain secrets]} = \]

\[
\{ \{ g_1(h_1), \ldots, g_n(h_n) \} \subseteq D_t : \{ h_1, \ldots, h_n \} \in \mathcal{P}(\text{boys}) \land |\{ h_1, \ldots, h_n \}| > 1 \land \}
\]

\[
\{ g_1, \ldots, g_n \} \subseteq \{ \lambda z. \text{tell}(z)(\text{John})(b_1), \ldots, \lambda z. \text{tell}(z)(\text{John})(b_n) \} : \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \}
\]

\[
= \{ \{ \text{tell}(h_1)(\text{John})(b_1), \ldots, \text{tell}(h_n)(\text{John})(b_n) \} : \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \}
\]

(63) \[\exists q. q \in \{ \{ \text{tell}(h_1)(\text{John})(b_1), \ldots, \text{tell}(h_n)(\text{John})(b_n) \} : \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \}
\]

\[
\land \{ h_1, \ldots, h_n \} \in \mathcal{P}(\text{boys}) \land |\{ h_1, \ldots, h_n \}| > 1 \}
\]

\[
\iff \exists b_1 \ldots b_n. \exists h_1 \ldots h_n. \{ b_1 \ldots b_n \} \in \mathcal{P}(\text{books}) \land |\{ b_1, \ldots, b_n \}| > 1 \land \{ h_1, \ldots, h_n \} \in \mathcal{P}(\text{boys}) \land |\{ h_1, \ldots, h_n \}| > 1 \land \text{tell}(h_1)(\text{John})(b_1) \ldots \land \text{tell}(h_n)(\text{John})(b_n)
\]

This interpretation states that there is a non-singleton set of boys and a non-singleton set of secrets, such that each boy told John one or more of those secrets, and together they told the whole set of secrets. This is the dependent plural reading, which is indeed attested.

Now, we can replace John with a singular indefinite, and calculate the interpretation in a similar way:

(64) Certain Boys told a girl certain secrets.
The goal is to show that in the current system this sentence cannot receive the unattested interpretation under which e.g. boy A told one girl secret X, boy B told a different girl secret Y etc. This unattested reading consists in a scopeless interpretation of the certain plural with respect to the subject combined with a narrow scope reading of the singular indefinite.

The interpretation of (64) proceeds as follows:

\[ [\text{a girl}] = \{x \subseteq D_e : \{x \in \mathcal{P} \text{(girls)} \} \wedge \{a_1(m_1), \ldots, a_n(m_n) \subseteq D_{et} : \{m_1, \ldots, m_n \} \in \{x \in \mathcal{P} \text{(girls)} \} \wedge \{a_1, \ldots, a_n \} \in \{ \{\lambda y. \lambda z. \text{tell}(z)(y)(b_1), \ldots, \lambda y. \lambda z. \text{tell}(z)(y)(b_n) \} : \{b_1, \ldots, b_n \} \in \mathcal{P} \text{(secrets)} \wedge \{|\{b_1, \ldots, b_n \}| > 1 \} \} \}
\]

Finally, we get the following interpretation for (64):

\[ [\text{certain boys told a girl certain secrets}] = \{g_1(h_1), \ldots, g_n(h_n) \subseteq D_t : \{h_1, \ldots, h_n \} \in \mathcal{P} \text{(boys)} \wedge \{|\{h_1, \ldots, h_n \}| > 1 \wedge \{g_1, \ldots, g_n \} \in \{ \{\lambda z. \text{tell}(z)(m)(b_1), \ldots, \lambda z. \text{tell}(z)(m)(b_n) \} : \{m \in \mathcal{P} \text{(girls)} \wedge \{b_1, \ldots, b_n \} \in \mathcal{P} \text{(secrets)} \wedge \{|\{b_1, \ldots, b_n \}| > 1 \} \}
\]

After existential closure:

\[ \exists q. q \in \{ \{\text{tell}(h_1)(m)(b_1), \ldots, \text{tell}(h_n)(m)(b_n) \} : \{b_1, \ldots, b_n \} \in \mathcal{P} \text{(secrets)} \wedge \{|\{b_1, \ldots, b_n \}| > 1 \wedge \{m \in \mathcal{P} \text{(girls)} \wedge \{h_1, \ldots, h_n \} \in \mathcal{P} \text{(boys)} \wedge \{|\{h_1, \ldots, h_n \}| > 1 \} \wedge q = 1 \} \wedge q = 1 \iff \exists b_1 \ldots b_n. \exists h_1 \ldots h_n. \{b_1 \ldots b_n \} \in \mathcal{P} \text{(books)} \wedge \{|\{b_1, \ldots, b_n \}| > 1 \wedge \{m \in \mathcal{P} \text{(girls)} \wedge \{h_1, \ldots, h_n \} \in \mathcal{P} \text{(boys)} \wedge \{|\{h_1, \ldots, h_n \}| > 1 \wedge \text{tell}(h_1)(m)(b_1) \wedge \ldots \wedge \text{tell}(h_n)(m)(b_n) \}
\]

This formula states that there is a non-singleton set of boys, a girl and a non-singleton set of secrets, such that each boy told that girl one or more secrets, and together they told the girl all the secrets from the set. This corresponds to a wide scope reading of the indefinite a girl, which is predicted to exist.
At this stage, this is the only reading derivable in the proposed system. To derive a narrow-scope interpretation for the singular indefinite in (64), we will call \( \delta \), which enforces a scopal interpretation:

\[
[\delta] = \lambda P \subseteq D_{\langle(\langle et\rangle)\rangle_t} : \{ f \in D_{\langle(\langle et\rangle)\rangle_t} : f = \{ \lambda x. \exists p. p \in P \land \forall p'. p' \in p \rightarrow p'(x) \} \}
\]

I will assume that this operator can be freely inserted into the syntactic tree. To get a narrow-scope interpretation for the singular indefinite in (64), \( \delta \) has to be inserted below the subject quantifier, i.e. adjoined to the VP told a girl secrets:

\[
[\delta \text{ tell a girl certain secrets}] =
\begin{align*}
&= \{ f : f = \{ \lambda x. \exists p. p \in \{ \lambda z. \text{tell}(z)(m)(b_1), \ldots, \lambda z. \text{tell}(z)(m)(b_n) \} : \{ m \} \in \mathcal{P}(\text{girls}) \land \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \} \land \forall p'. p' \in p \rightarrow p'(x) \} \\
&= \{ \lambda x. \exists b_1 \ldots b_n. \exists m. \{ m \} \in \mathcal{P}(\text{girls}) \land \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \} \land \text{tell}(x)(m)(b_1) \land \ldots \land \text{tell}(x)(m)(b_n) \}
\end{align*}
\]

Then the whole sentence will receive the following interpretation:

\[
[\text{certain boys } \delta \text{ tell a girl certain secrets}]
\begin{align*}
&= \{ f_1(d_1), \ldots, f_n(d_n) \} \subseteq D_t : \{ d_1, \ldots, d_n \} \in \mathcal{P}(\text{boys}) \land |\{ d_1, \ldots, d_n \}| > 1 \land \\
&\{ f_1, \ldots, f_n \} \subseteq \{ \lambda x. \exists b_1 \ldots b_n. \exists m. \{ m \} \in \mathcal{P}(\text{girls}) \land \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land \\
&|\{ b_1, \ldots, b_n \}| > 1 \} \land \text{tell}(x)(m)(b_1) \land \ldots \land \text{tell}(x)(m)(b_n) \}
\end{align*}
\]

\[
= \{ \exists b_1 \ldots b_n. \exists m. \{ m \} \in \mathcal{P}(\text{girls}) \land \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \} \land \text{tell}(d_1)(m)(b_1) \land \ldots \land \text{tell}(d_n)(m)(b_n) \\
\exists b_1 \ldots b_n. \exists m. \{ m \} \in \mathcal{P}(\text{girls}) \land \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \} \land \text{tell}(d_1)(m)(b_1) \land \ldots \land \text{tell}(d_n)(m)(b_n) \\
: \{ d_1, \ldots, d_n \} \in \mathcal{P}(\text{boys}) \land |\{ d_1, \ldots, d_n \}| > 1 \}
\]

After existential closure:

\[
\exists d_1 \ldots d_n. \{ d_1, \ldots, d_n \} \in \mathcal{P}(\text{boys}) \land |\{ d_1, \ldots, d_n \}| > 1 \land \forall d_m \in \{ d_1, \ldots, d_n \}. \exists b_1 \ldots b_n. \exists m. \{ m \} \in \\
\mathcal{P}(\text{girls}) \land \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \land \text{tell}(d_m)(m)(b_1) \land \\
\ldots \land \text{tell}(d_m)(m)(b_n) \\
\exists d_1 \ldots d_n. \{ d_1, \ldots, d_n \} \in \mathcal{P}(\text{boys}) \land |\{ d_1, \ldots, d_n \}| > 1 \land \forall d_m \in \{ d_1, \ldots, d_n \}. \exists b_1 \ldots b_n. \exists m. \{ m \} \in \\
\mathcal{P}(\text{girls}) \land \{ b_1, \ldots, b_n \} \in \mathcal{P}(\text{secrets}) \land |\{ b_1, \ldots, b_n \}| > 1 \land \text{tell}(d_m)(m)(b_1) \land \\
\ldots \land \text{tell}(d_m)(m)(b_n) \\
\]

This formula states that there is a non-singleton set of boys, and for each of those boys there is a girl and a non-singleton set of secrets, such that the boy told the girl all the secrets from that set. This interpretation correspond to another possible
reading of (64). Under this interpretation the singular indefinite receives a narrow scope with respect to the subject. But crucially, the dependent plural in this case must also be interpreted scopally - each boy must tell a *plurality* of secrets, so this is again not the unattested dependent plural reading.

A scopeless reading of the dependent plural in combination with a narrow scope reading of the singular indefinite proves to be unattainable in the current system, and thus correctly ruled out.

4.5 Long-distance Dependencies

The proposed mechanism of *Plural Friendly Hamblin FA* allows to propagate the plurality associated with the dependent up the tree, without any locality restrictions, until it reaches the licensor.

(73) Mary, Jane, and Bill want Ann to meet certain phonologists.

(74) \[ \{ \{ x_1 \text{ wants Ann to marry } p_1, \ldots, x_n \text{ wants Ann to meet } p_n \} \subseteq D_f : \{ x_1, \ldots, x_n \} = \{ \text{Mary, Jane, Bill} \} \land \{ p_1, \ldots, p_n \} \in \mathcal{P}(\text{phonologists}) \land \{|p_1, \ldots, p_n| > 1\} \]

(75) Mary, Jane, and Bill will only return to Russia in the government repeals certain laws.

(76) \[ \{ \{ x_1 \text{ will only return to Russia in the government repeals } l_1, \ldots, x_n \text{ will only return to Russia in the government repeals } l_n \} \subseteq D_f : \{ x_1, \ldots, x_n \} = \{ \text{Mary, Jane, Bill} \} \land \{ l_1, \ldots, l_n \} \in \mathcal{P}(\text{laws}) \land \{|l_1, \ldots, l_n| > 1\} \]

4.6 Open Question: A Unified Theory of Dependent Plurals

Bare plurals can, in some contexts, have readings similar to certain NPs:

Suppose Mary and Jane are to be shown one movie together. Mary wants to watch *Rambo*, Jane wants to watch *Rocky*, and Bill want to watch *Indiana Jones*. Then the following is true:

(77) Mary, Jane, and Bill want to watch american films.

Suppose Bob wants Bill to marry Ann, who happens to be a phonologist, and Kate wants Bill to marry Jane, who also happens to be a phonologist. The the following is true:

(78) Bob and Kate want Bill to marry phonologists.

Suppose Mary said: "I was born in Moscow", and Jane said: "I was born in Los Angeles". Then the following is true:
Mary and Jane said that they were born in big cities.

Suppose Bob would be very upset if Bill married Ann, who happens to be a millionaire, and Kate would be very upset if Bill married Jane, who also happens to be a millionaire. Then the following is true (according to some judgements):

(Surprisingly) Bob and Kate would be very upset if Bill married millionaires.

These wide scope readings can be derived in the same way, by assuming that bare plurals can denote sets of non-singleton alternatives.

But bare plurals also have dependent narrow-scope readings:

Suppose Mary said: "I was born in a big city", and Jane said: "I was born in a big city". Then the following is true:

Mary and Jane said that they were born in big cities.

Suppose Bill, Mary and Jane are to be shown one movie each separately. And they all want to watch some american movie, and it doesn’t matter which one.

Mary, Jane and Bill / most students will only be happy if they watch american films.

These readings cannot be straightforwardly derived in the current system. Bare plurals seem to be world/situation-dependent in a way that certain NPs are not. I leave this for future research.

References

