Distributivity and *same*

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1 Introduction

Barker (2007) proposes a compositional semantics for sentence-internal *same*, as in:

(1) John and Mary read the same book.

The basic idea is that *same* is a scope-taking adjective whose trace is a choice function:

(2) [[John and Mary] [same λf [read the f book]]]
"There is a choice function f such that John and Mary each read f(book)."

- *same* moves between its antecedent (e.g. *John and Mary*) and the rest of the sentence
- Since *same* takes scope between the antecedent and the rest of the sentence, it can access the meanings of both ("parasitic scope")

Barker's entry for *same* quantifies over a function f which maps any set to a singleton of one of the members of that set. The definite article then refers to that member. Thus, f is essentially a choice function.

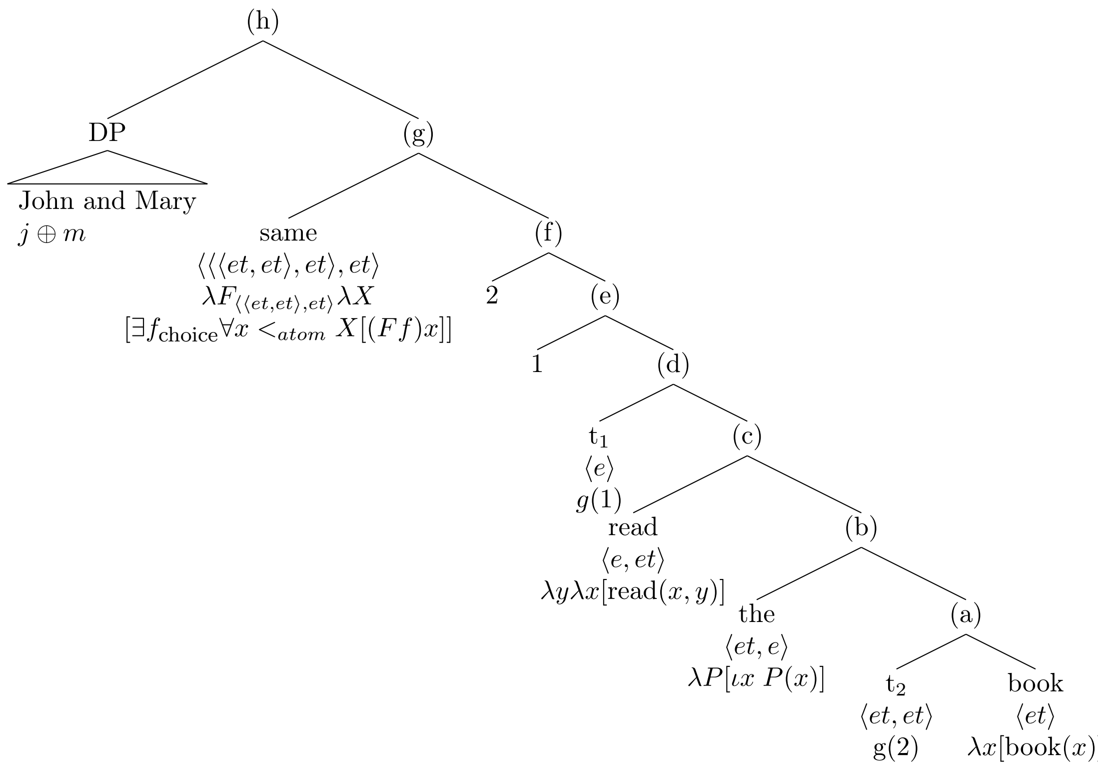
(3) $[\![\text{same}]\!] = \lambda F_{\langle\langle et,et\rangle,et\rangle} \lambda X \exists f_{\text{choice}} \forall x [x <_{atom} X \rightarrow (Ff)x]$

Above:

- F = [same λf [read the f book]]
- X = [John and Mary]

See Figure 1 for illustration.

*Thanks to Chris Barker and Anna Szabolcsi for asking me a question that prompted me to do this work. Thanks also to Mike Solomon for helpful discussion.



(a) $f(\text{book})$

(b) $\iota y[y \in f(\text{book})]$

(c) $\lambda x[\text{read}(x, \iota y[y \in f(\text{book})])]$

(d) $\text{read}(x, \iota y[y \in f(\text{book})])$

(e) $\lambda x[\text{read}(x, \iota y[y \in f(\text{book})])]$

(f) $\lambda f \lambda x[\text{read}(x, \iota y[y \in f(\text{book})])]$

(g) $\lambda X[\exists f_{\text{choice}} \forall x <_{atom} X[\text{read}(x, \iota y[y \in f(\text{book})])]]$

(h) $[\exists f_{\text{choice}} \forall x <_{atom} j \oplus m\ [\text{read}(x, \iota y[y \in f(\text{book})])]]$
"There is a choice function f which picks out a book y, and every atomic part of the sum *John and Mary* read y."

Figure 1: A derivation of "John and Mary read the same book" in Barker's framework.

2 A puzzle for Barker's account

As Barker notes, his account has problems with the denotations of distributive noun phrases like *each student*:

(4) Each/every student read the same book.

Barker's entry for *same* requires as one of its arguments the plural individual associated with its antecedent, but this individual is not explicitly provided by the standard translations of generalized quantifiers other than plural noun phrases.

(5) a. $[\![\text{John and Mary}]\!] = j \oplus m$
b. $[\![\text{each/every student}]\!] = \lambda P\, \forall x[\text{student}(x) \rightarrow P(x)]]$

What Barker would need instead is something like this:

(6) $[\![\text{each/every student}]\!] = \sigma x[\text{student}(x)]$ "the sum of all students"

Goal of this talk:

- Making *each/every* and *same* work together
- More generally: investigate the double nature of *each/every* – generalized quantifier or plural individual?

3 Red herring 1: maximal individuals

Barker notes that some DPs usually regarded as distributive are in fact also OK with collective predicates.

(7) a. Everyone read the same book.
b. Everyone gathered in the living room.

This, he says, provides evidence for the following entry:

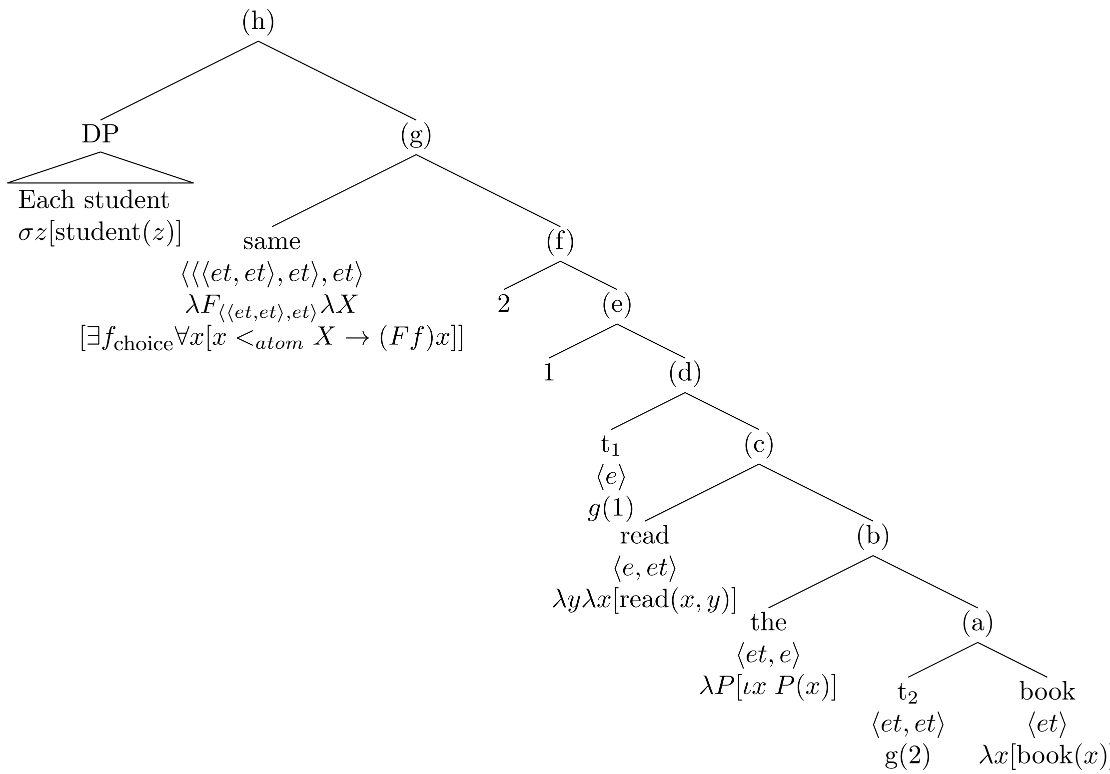
(8) $[\![\text{everyone}]\!] = \sigma x[\text{person}(x)]$ "the sum of all people"

This entry can combine with *same* in the same way *John and Mary* does in Figure 1. We can assign (9) the correct truth conditions (see Figure 2).

(9) Each/every student read the same book.

But then (10a) should be OK too, and interpretable as (10b):

(10) a. *Each/every student gathered in the living room.
b. gathered-in-the-living-room($\sigma z[\text{student}(z)]$)
"The students gathered in the living room."



(a) $f(\text{book})$

(b) $\iota y[y \in f(\text{book})]$

(c) $\lambda x[\text{read}(x, \iota y[y \in f(\text{book})])]$

(d) $\text{read}(x, \iota y[y \in f(\text{book})])$

(e) $\lambda x[\text{read}(x, \iota y[y \in f(\text{book})])]$

(f) $\lambda f \lambda x[\text{read}(x, \iota y[y \in f(\text{book})])]$

(g) $\lambda X[\exists f_{\text{choice}} \forall x[x <_{atom} X \rightarrow [\text{read}(x, \iota y[y \in f(\text{book})])]]]$

(h) $[\exists f_{\text{choice}} \forall x[x <_{atom} \sigma z[\text{student}(z)] \rightarrow [\text{read}(x, \iota y[y \in f(\text{book})])]]]$
"There is a choice function f which picks out a book y, and every atomic part of the sum of all students read y."

Figure 2: A derivation of "Each student read the same book" in Barker's framework.

4 Red herring 2: maximal individuals plus covers

Barker's suggestion: build contextual covers into the lexical entry of *same*, and assume that *each* forces the cover to be atomic.

(11) a. Old: $\lambda F_{\langle\langle et,et\rangle,et\rangle}\lambda X[\exists f_{\text{choice}}\forall x <_{atom} X[(Ff)x]]$
b. New: $\lambda F_{\langle\langle et,et\rangle,et\rangle}\lambda X[\exists f_{\text{choice}}\forall x \in \text{Cov}(X)[(Ff)x]]$

Problem: Any sentence that does not contain *same* has the same status on both accounts. So we still don't know how (10a) should be ruled out.

Interim summary: The nature of the problem

- Either we treat *each person* as a generalized quantifier, but then we cannot combine it with Barker's entry for *same*.
- Or we treat *each person* on a par with *everyone*, as referring to the sum of all people, but then we lose the distinction between the two.

I will now sketch two alternative ways out of the problem.

5 First solution: Mike Solomon, p.c.

Mike Solomon (p.c.) suggested to me that we could raise the type of *same* so it expects a generalized quantifier (see also Solomon (2009)):

(12) $[\![\text{same}]\!] = \lambda F_{\langle\langle et,et\rangle,et\rangle}\lambda Q_{\langle et,t\rangle}[\exists f_{\text{choice}}\ Q(\lambda x[(Ff)x])]$

This indeed works (see Figure 3):

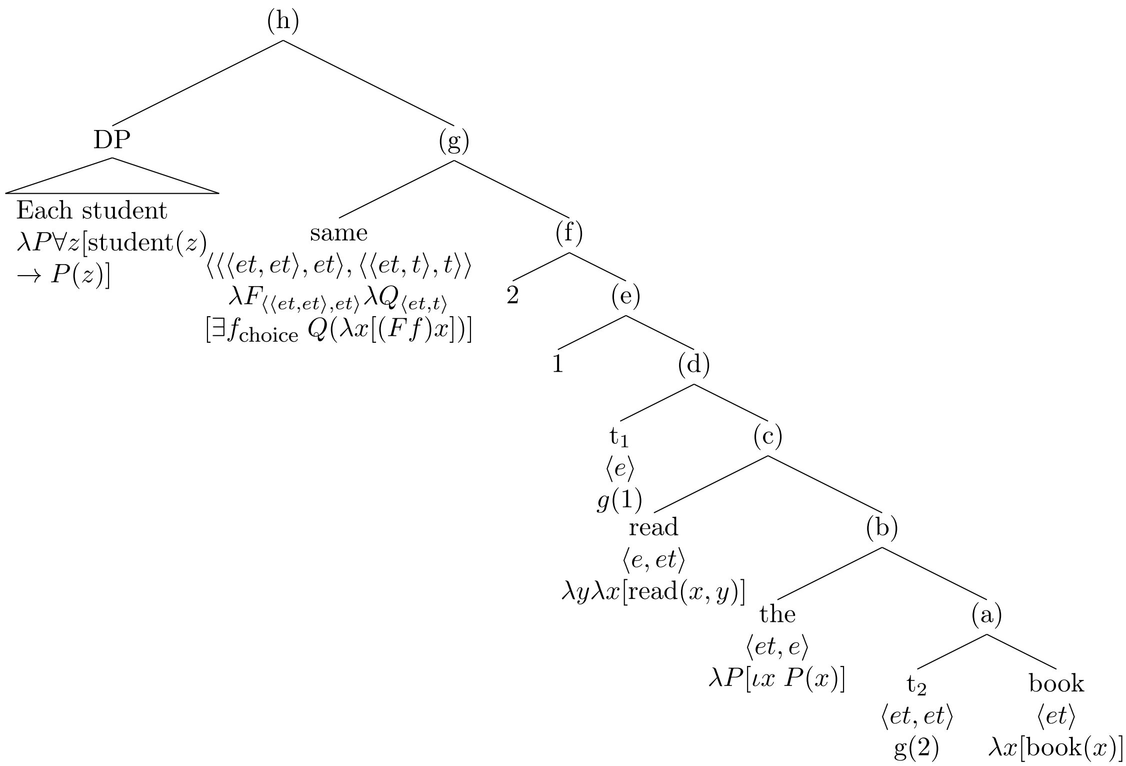
(13) [[Each student read the same book]]
$= \exists f_{\text{choice}}\forall x[\text{student}(x) \rightarrow [\text{read}(x, \iota y[y \in f(\text{book})])]]$
"There is a choice function f which picks out a book y, and each student read y."
= "There is a book that every student read."

But as Mike pointed out, it leads to the wrong result with *no student*:

(14) [[No student read the same book]][1]
$= \exists f_{\text{choice}}\neg\exists x[\text{student}(x) \wedge [\text{read}(x, \iota y[y \in f(\text{book})])]]$
"There is a choice function f which picks out a book y, and no student read y."
= "There is a book that no student read."

Problem: This is too weak; what this sentence means is that every student read a different book. (Note: it is not clear whether the following solution will extend to *no student*. This is work in progress.)

[1]Based on an attested example: *No student learns the same way. If no student learns the same way, none of my teaching tools will reach every student.* `http://www.thenhier.ca/en/content/lessons-toronto-renegade-history-student-history-teacher` Accessed March 10, 2011.



(a) $f(\text{book})$

(b) $\iota y[y \in f(\text{book})]$

(c) $\lambda x[\text{read}(x, \iota y[y \in f(\text{book})])]$

(d) $\text{read}(x, \iota y[y \in f(\text{book})])$

(e) $\lambda x[\text{read}(x, \iota y[y \in f(\text{book})])]$

(f) $\lambda f \lambda x[\text{read}(x, \iota y[y \in f(\text{book})])]$

(g) $\lambda Q[\exists f_{\text{choice}}\ Q(\lambda x[\text{read}(x, \iota y[y \in f(\text{book})])])]$

(h) $\exists f_{\text{choice}} \forall x[\text{student}(x) \rightarrow [\text{read}(x, \iota y[y \in f(\text{book})])]]$
"There is a choice function f which picks out a book y, and every student read y."

Figure 3: A derivation of "Each student read the same book" in Barker's framework, with Mike Solomon's solution.

6 Second solution: Copy theory

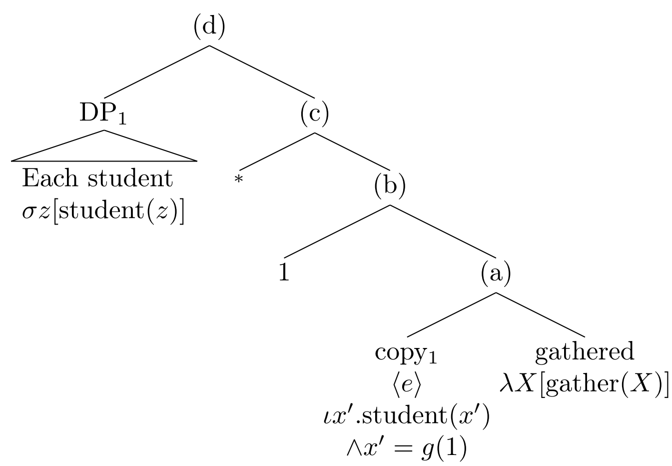
Idea:

- Analyze *each student* and *every student* as $\sigma x[\text{student}(x)]$. Keep Barker's original entry for *same*. This gives the right semantics to *Each student read the same book.* No change here.
- Rule out **Each student gathered* by copy theory (Fox, 1999, 2002), according to which traces (or "lower copies") of DPs are semantically contentful and are interpreted by a special semantic rule (what Fox calls Trace Conversion).

Champollion (2010) provides independent evidence that we need to translate *every student* as $\sigma x[\text{student}(x)]$ because this explains why it can take part in cumulative readings (see also Kratzer, 2000).

(15) a. Three teachers supervised every student.
b. $\exists X$ [three-teachers$(X)\wedge$
$\langle X, \underline{\sigma y.\ \text{student}(y)}\rangle \in {}^{**}\lambda X'\lambda Y$ [supervise$(X', \iota y'.\text{student}(y') \wedge y' = Y)$]]

Sentences like **Each student gathered* can be ruled out as shown in Figure 4.



(a) gather$(\iota x'.\text{student}(x') \wedge x' = x)$

(b) λx[gather$(\iota x'.\text{student}(x') \wedge x' = x)$]

(c) ${}^{*}\lambda x$[gather$(\iota x'.\text{student}(x') \wedge x' = x)$]

(d) $\sigma z[\text{student}(z)] \in {}^{*}\lambda x$[gather$(\iota x'.\text{student}(x') \wedge x' = x)$]
"The sum of students consists of one or more x, such that x is a student and x gathered."

Figure 4: Ruling out **Each student gathered* with the copy theory.

7 *Same* without distributivity

It is possible to leave the lexical entry for *same* exactly as in Barker's original proposal. We have seen this in Figure 5. Alternatively, we can also assume that distributivity is introduced by a separate operator, the star operator from Link (1983) (Figure 6):

(16) a. $[\![\text{same}]\!]$ (old) $= \lambda F \lambda X \exists f_{\text{choice}} \forall x [x <_{atom} X \rightarrow (Ff)x]$ $= (3)$
b. $[\![\text{same}]\!]$ (new) $= \lambda F \lambda X \exists f_{\text{choice}} [(Ff)X]$

Arguments for removing distributivity from *same*:

- it is the presence of *each* and not the presence of *same* that makes examples with collective predicates unacceptable:

  (17) a. #Each student gathered around the same table.
  b. #Each student gathered around the table.

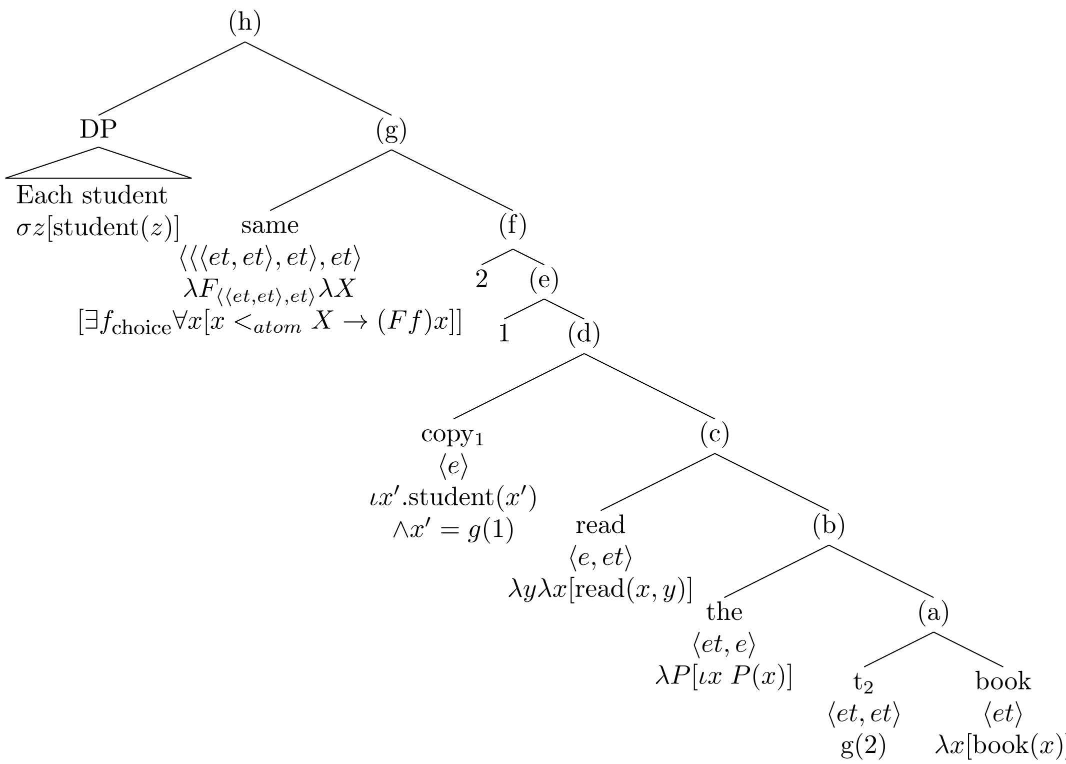
- *Same* by itself does not make a sentence with a collective predicate unacceptable:

  (18) a. The ten students gathered around the table.
  b. The ten students gathered around the same table. (see Figure 7)

8 Open questions

- The introduction of copy theory along with the trace conversion rule is a significant change to the Heim/Kratzer-style framework. Can this change be reproduced in the type-logical grammar which Barker also uses to implement his account?
- Any differences that may exist between *every student* and *each student* are not captured on the present account.
- Barker (2007) discusses adverbial as well as adnominal *each*. It is not clear how adverbial *each* fits within what I have presented here.
- The account in Section 6 relies on the assumption that all quantifiers obligatorily move, even those in subject position. When these quantifiers are subjects, this assumption is not independently motivated as far as the semantics is concerned, though it could be motivated syntactically by the VP-internal subject hypothesis.
- While it is clear how to model *each student* as a referring expression, it is not clear how to do this with other quantifiers, such as negative quantifiers (*no student*) or comparative quantifiers (*more men than women*, Anna Szabolcsi p.c.). This drawback is shared by all accounts presented here.

Suggestions welcome! `champoll@gmail.com`



(a) $f(\text{book})$

(b) $\iota y[y \in f(\text{book})]$

(c) $\lambda x[\text{read}(x, \iota y[y \in f(\text{book})])]$

(d) $\text{read}(\iota x'.\text{student}(x') \wedge x' = x, \iota y[y \in f(\text{book})])$

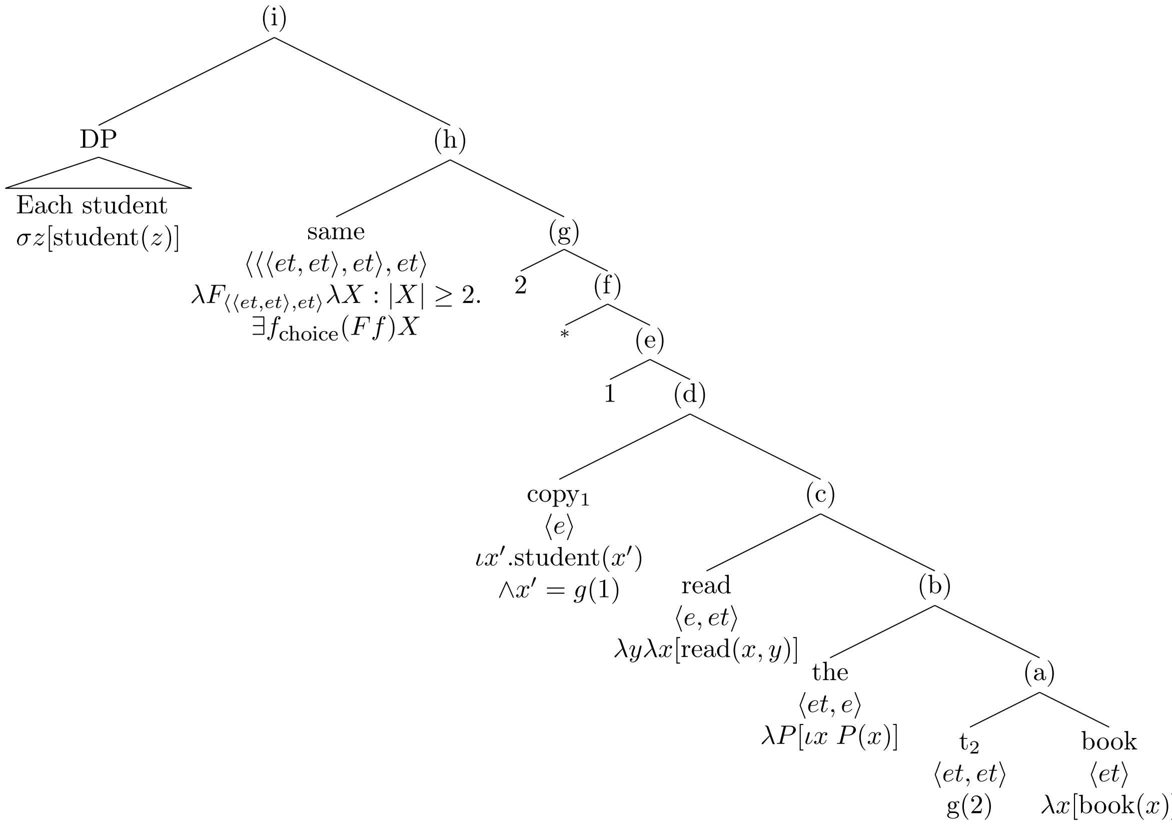
(e) $\lambda x[\text{read}(\iota x'.\text{student}(x') \wedge x' = x, \iota y[y \in f(\text{book})])]$

(f) $\lambda f\lambda x[\text{read}(\iota x'.\text{student}(x') \wedge x' = x, \iota y[y \in f(\text{book})])]$

(g) $\lambda X[\exists f_{\text{choice}}\forall x[x <_{atom} X \rightarrow [\text{read}(\iota x'.\text{student}(x') \wedge x' = x, \iota y[y \in f(\text{book})])]]]$

(h) $[\exists f_{\text{choice}}\forall x[x <_{atom} \sigma z[\text{student}(z)] \rightarrow [\text{read}(\iota x'.\text{student}(x') \wedge x' = x, \iota y[y \in f(\text{book})])]]]$

Figure 5: A derivation of "Each student read the same book" in Barker's framework, with Champollion (2010) imported.



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(e) $\lambda x[\text{read}(\iota x'.\text{student}(x') \wedge x' = x, \iota y[y \in f(\text{book})])]$

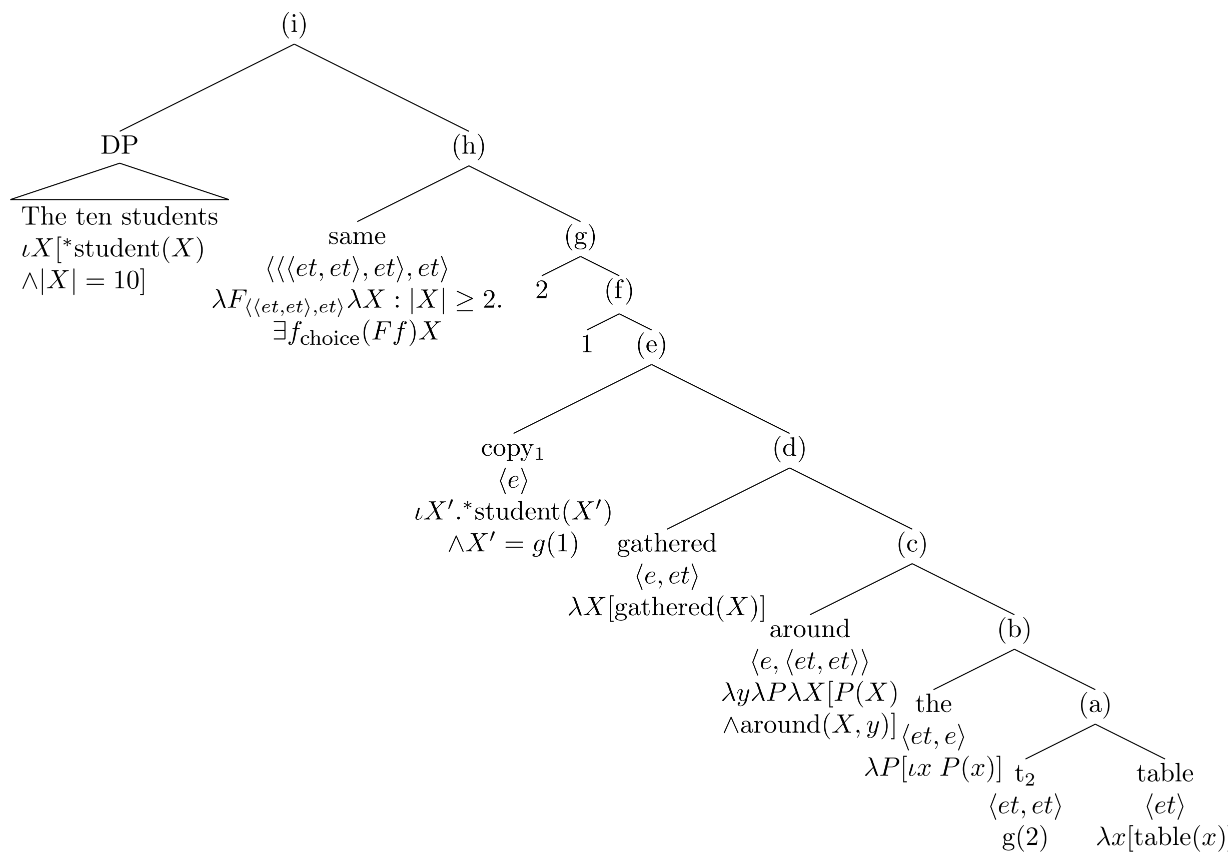
(f) ${}^*\lambda x[\text{read}(\iota x'.\text{student}(x') \wedge x' = x, \iota y[y \in f(\text{book})])]$

(g) $\lambda f{}^*\lambda x[\text{read}(\iota x'.\text{student}(x') \wedge x' = x, \iota y[y \in f(\text{book})])]$

(h) $\lambda X : |X| \geq 2[\exists f_{\text{choice}} X \in {}^*\lambda x[\text{read}(\iota x'.\text{student}(x') \wedge x' = x, \iota y[y \in f(\text{book})])]]$

(i) $|\sigma z[\text{student}(z)]| \geq 2 :$
$[\exists f_{\text{choice}}[\sigma z[\text{student}(z)] \in {}^*\lambda x[\text{read}(\iota x'.\text{student}(x') \wedge x' = x, \iota y[y \in f(\text{book})])]]]$

Figure 6: Removing distributivity from *same*.



(a) $f(\text{table})$

(b) $\iota y[y \in f(\text{table})]$

(f) $\lambda X[\text{gather}(\iota X'.{}^{*}\text{student}(X') \wedge X' = X) \wedge \text{around}(\iota X'.{}^{*}\text{student}(X') \wedge X' = X, \iota y[y \in f(\text{table})])$

(g) $\lambda f \lambda X[\text{gather}(\iota X'.{}^{*}\text{student}(X') \wedge X' = X) \wedge \text{around}(\iota X'.{}^{*}\text{student}(X') \wedge X' = X, \iota y[y \in f(\text{table})])]$

(h) $\lambda X : |X| \geq 2[\exists f_{\text{choice}}[\text{gather}(\iota X'.{}^{*}\text{student}(X') \wedge X' = X) \wedge \text{around}(\iota X'.{}^{*}\text{student}(X') \wedge X' = X, \iota y[y \in f(\text{table})])]]$

(i) $[\exists f_{\text{choice}}[\text{gather}(\iota X'.{}^{*}\text{student}(X') \wedge X' = \iota X[{}^{*}\text{student}(X) \wedge |X| = 10]) \wedge \text{around}(\iota X'.{}^{*}\text{student}(X') \wedge X' = \iota X[{}^{*}\text{student}(X) \wedge |X| = 10], \iota y[y \in f(\text{table})])]]$

Note: We can rewrite (i) more simply as $\exists X[X = \iota X[{}^{*}\text{student}(X) \wedge |X| = 10] \wedge \exists f_{\text{choice}}[\text{gather}(X) \wedge \text{around}(X, \iota y[y \in f(\text{table})])]]$.

Figure 7: The ten students gathered around the same table.

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