Wide Scope Indefinites

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1 Presuppositional indefinites

The idea of presuppositional indefinites was popular in the 90s (Diesing 1992, Cresti 1995, Yeom 1998, Van Geenhoven 1998). Convincing evidence for their existence comes from projection facts (von Fintel 1998).

The following examples are due to von Fintel 1998: Indefinite subjects of individual level predicates are presuppositional.

(1) a. Are some mistakes in this manuscript major?
b. Are there any major mistakes in this manuscript?

(2) a. Are some ghosts speakers of Dutch?
b. Are some speakers of Dutch ghosts?

(3) I'm not sure yet whether there are any mistakes at all in this book manuscript, but we can definitely not publish it...
a. ... #if some mistakes are major.
b. ... if some major mistakes are found.
c. ... if there turn out to be some major mistakes in there.

(4) a. If some ghosts were Dutch, Holland would be a strange place.
b. If some Dutchmen were ghosts, Holland would be a strange place.

(5) I don't really know whether ghosts exist or not, but one thing I'm sure of is that Holland would be a strange place...
a. ... #if some ghosts were Dutch.
b. ... if some Dutchmen were ghosts.

Stage-level predicates don't force the presuppositional reading of their indefinite subject, but they presumably optionally allow for it.

The crucial data in von Fintel 1998 all involve *some NP*, but his observation generalises to other forms of indefinites as well.

1.1 *A NP*

A NP has a generic reading with an individual-level predicate, but not always, and does give rise to a presuppositional reading:

(6) a. Is a mistake in this manuscript major?
b. Does this manuscript contain a major mistake?

(7) a. Does a ghost in Holland speak Dutch?
b. Is there a Dutch speaker that is a ghost?

(8) I'm not sure yet whether there are any mistakes at all in this book manuscript, but we can definitely not publish it if a mistake is major.

1.2 Bare numerals

(9) a. Are two failed modules in this transcript in Linguistics?
b. Are there two failed modules in Linguistics in this transcript?

(10) I'm not sure yet whether there are any mistakes at all in this book manuscript, but we can definitely not publish it if two mistakes are major.

2 Presuppositional indefinites and their scope: an informal sketch

It's often considered that presuppositional indefinites presuppose that the NP extension (domain of quantification) is non-empty (Diesing 1992, Enç 1991, Portner & Yabushita 2001).

Van Geenhoven 1998 distinguishes two presuppositional indefinites:

1. An indefinite presupposing a particular domain ('covert partitive').
2. An indefinite presupposing a particular discourse referent. This gives rise to exceptional wide scope readings via presupposition projection.

We'll mainly talk about 2. in what follows, so let's call them presuppositional indefinites. We'll say 'covert partitives' to mean 1.

As we saw last time, Van Geenhoven's theory is not so great, but that's largely due to the theory of presupposition she assumed. In her theory:

- the presuppositions of presuppositional indefinites are always accommodated;
- there is a (potential) issue of intermediate accommodation with quantifiers.

We'll pursue the same idea as Van Geenhoven 1998 but we will implement it in a different theory of presupposition projection, according to which presuppositions are backgrounded information that projects in a particular way (and distinct from anaphora).

Advantages:

- No need to make the uncomfortable assumption that the presuppositions of presuppositional indefinites are always accommodated.
- Better account of interactions with quantifiers.
- Compositional derivations for functional readings.

2.1 What does it mean to presuppose a discourse referent?

The presupposition of a presuppositional indefinite is just existential. But crucially the existential presupposition introduces a discourse referent, and the assertion predicates something about it, e.g. (I'll omit the presuppositions about *the manuscript*):

(11) A mistake in this manuscript is major.
  a. Presupposition: There is a mistake x in this manuscript.
  b. Assertion: x is major.

Note that this presupposition can but need not be accommodated. It will be simply satisfied if it is already common ground that there is a mistake in the manuscript in question.

For Van Geenhoven 1998, the presupposition of a presuppositional indefinite is obligatorily accommodated, because otherwise it would be anaphoric on an accessible discourse referent!

In order for our theory to work, we have to assume that presuppositions can have dynamic effects. For Heim 1982, 1983 and many others, presuppositions are static and have no dynamic effects.

Elliott & Sudo 2021 argue that presuppositions can have dynamic effects based on examples like (12) (see also Beaver 1992, Mayr & Sudo 2022).

(12) a. None of the authors is aware/noticed that there is a mistake in this paper. But it is major.
  b. None of the authors said/suspects that there is a mistake in this paper. #But it is major.

2.2 Wide scope via projection

Because presuppositions project out of *if*-clauses and questions:

(13) Is a mistake in this manuscript major?
  a. Presupposition: There is a mistake x in this manuscript.
  b. Assertion: Is x major?

(14) If a mistake in this manuscript is major, then we can't submit it.
  a. Presupposition: There is a mistake x in this manuscript.
  b. Assertion: If x is major, then we can't submit it.

These are wide scope readings, but the wide scope comes about via presupposition projection.

This is essentially the same idea as Van Geenhoven 1998 (also Cresti 1995), but our implementation will make different predictions for interactions with quantifiers.

2.3 Covert partitive readings

We have no reason to exclude the covert partitive readings:

(15) A mistake in this manuscript is major.
  a. Presupposition: The set D of mistakes in this manuscript is non-empty.

b. Assertion: There is $x \in D$ that is major.

This is almost indistinguishable from (11). But the two readings are clearly distinct for (16).

(16) Two mistakes in this manuscript is major.

(17) Presuppositional indefinite reading
   a. Presupposition: There is X such that $X = y \sqcup z$ and y and z are mistakes in the manuscript.
   b. Assertion For each $x \sqsubseteq X$, x is major.

(18) Covert partitive reading
   a. Presupposition: The set D of mistakes in this manuscript is non-empty.
   b. Assertion: There is $X \in D$ such that $X = y \sqcup z$ and each of y and z is major.

Similarly:

(19) If two mistakes in this manuscript are major, we cannot submit it.

(20) Presuppositional indefinite reading
   a. Presupposition: There is X such that $X = y \sqcup z$ and y and z are mistakes in the manuscript.
   b. Assertion: If each $x \sqsubseteq X$ is major, then we cannot submit the manuscript.

(21) Covert partitive reading
   a. Presupposition: The set D of mistakes in this manuscript is non-empty.
   b. Assertion: If there is $X \in D$ such that $X = y \sqcup z$ and each of y and z is major, we cannot submit the manuscript.

2.4 Quantifiers

For Van Geenhoven 1998, when a presuppositional indefinite occurs in the scope of a quantifier, it has to be (locally) accommodated.
In our theory, that's not the case. Consider:

(22) Every professor recommended a classic paper about indefinites.

Presuppositions project universally from the scope of *every*.

(23) a. Every professor reread *Syntactic Structures*.
   b. Everyone visited Paris again.
   c. Every professor quit smoking.

Then we expect (22) to presuppose:

(24) For every professor, there is a classic paper about indefinites.

But the quantification here is vacuous (we'll consider cases where it's not vacuous immediately below). Given that the domain of *every* is presupposed to be non-empty, (24) will be true iff there is a classic paper about indefinites.

Cf. the following equivalence in Predicate Logic:

(25) $\exists x[A(x)] \wedge \forall y[A(y) \rightarrow \exists z[B(z)]] \quad \equiv \quad \exists x[A(x)] \wedge \exists z[B(x)]$

Similarly, the presupposition of (26) involves vacuous quantification.

(26) Everyone is unhappy that there is a mistake in the manuscript.

So overall, the reading of (22) will be:

(27) a. Presupposition: (For every professor) there is a classic paper x about indefinites.
b. Assertion: Every professor recommended x.

That's the wide scope reading. Also, the definite version of the sentence:

(28) Every professor recommended the classic paper about indefinites.
a. Presupposition: (For every professor) there is a unique (contextually salient) classic paper about indefinites x.
b. Assertion: Every professor recommended x.

This will work with *no* as well:

(29) No professor recommended a classic paper about indefinites.

Presuppositions project in the same way in the scope of *no*.

(30) a. No professor reread *Syntactic Structures*.
b. No one visited Paris again.
c. No professor quit smoking.

So (29) will have the same presupposition as (22), and the overall meaning will be:

(31) a. Presupposition: (For every professor) there is a classic paper x about indefinites.
b. Assertion: No professor recommended x.

Let's focus on these two quantifiers for now. We can talk about others when we have our theory of indefinites (and other existential quantifiers).

2.5 Projection out of restrictors

Presupposition projection out of the restrictors of quantifiers is less often discussed (but see Beaver 2001). What do the following sentences presuppose?

(32) a. Every professor who reread *Syntactic Structures* instantaneously became 100 times smarter.
b. Every professor who quit smoking has no intention to retire.

Do these presuppose that every professor has read *Syntactic Structures*/used to smoke? That doesn't sound right.

Notice that *every* has an existence presupposition that the domain of quantification

is not empty.[1]

(33) Every funny semanticist overslept this morning.
   a. Presupposition: The set D of funny semanticists is non-empty.
   b. Assertion: Each $x \in D$ overslept this morning.

The presupposition triggers we are discussing are all distributive predicates, so they apply distributively/universally to the members of the domain. So let's assume that the presupposition projects universally with respect to the domain:

(34) a. Presupposition: The maximal set D such that:
      (i) each $x \in D$ has read *Syntactic Structures* before; and
      (ii) each $x \in D$ is a professor who reread *Syntactic Structures*
      is non-empty.
   b. Assertion: Each $x \in D$ instantaneously became 100 times smarter.

(35) a. Presupposition: The maximal set D such that:
      (i) each $x \in D$ used to smoke; and
      (ii) each $x \in D$ is a professor who quit smoking
      is non-empty.
   b. Assertion: Each $x \in D$ has no intention to retire.

These seem reasonable to me.
Similarly for *no*.

(36) No professor who quit smoking retired.
   a. Presupposition: The maximal set D such that:
      (i) each $x \in D$ used to smoke; and
      (ii) each $x \in D$ is a professor who quit smoking
      is non-empty.
   b. Assertion: No $x \in D$ retired.

Turning now to presuppositional indefinites:

(37) Every student who cited a classical paper on indefinites got an A.

When the indefinite is read non-presuppositionally, the reading will be:

(38) a. Presupposition: The maximal set D of students such that each $x \in D$ cited a classical paper y on indefinites is non-empty.
   b. Assertion: Each $x \in D$ got an A.

If it's presuppositional, then it universally projects through the distributivity operator:

(39) a. Presupposition: The maximal set D such that:
      (i) for each $x \in D$, there is a classical paper y on indefinites; and
      (ii) each $x \in D$ is a student who cited y
      is non-empty.

[1] Presumably due to the competition with *the* and *both*, it typically implies that there are more than two elements in the domain.

b. Assertion: Each $x \in D$ got an A.

In (39a-i), the universal quantification is vacuous. Consequently, it's equivalent to:

(40) a. Presupposition: The maximal set D such that there is a classical paper y on indefinites such that each $x \in D$ is a student that cited y is non-empty.
b. Assertion: Each $x \in D$ got an A.

2.6 Intermediate scope reading via quantificational subordination

What if the quantification in the presupposition is *not* vacuous?

(41) Every professor recommended a paper about indefinites that they wrote.

If the indefinite with a bound pronoun is presuppositional, the predicted presupposition is. Ignoring the existence presupposition:

(42) For every professor, there is a paper about indefinites that they wrote.

Here, the quantification is not vacuous thanks to the bound pronoun *they*. So the overall meaning will be:

(43) a. Presupposition: For every professor, there is a paper x about indefinites that they wrote.
b. Assertion: Every professor recommended x.

What does x in the assertion stand for? We liken this to *quantificational subordination*:

(44) Every student submitted a term paper. Every student will send **it** to a journal later.

The way *it* is interpreted can be dependent on *every student*.
And we claim that that's what happens in (43) too. Then it will effectively mean:

(45) a. Presupposition: For every professor, there is a paper x about indefinites that they wrote.
b. Assertion: Every professor recommended the paper x about indefinites that they wrote.

Now we can account for the intermediate scope readings of the following examples with full presupposition projection.

(46) Every professor rewarded every student who read a book he had recommended.
(Abusch 1993: p. 90)

Assuming that the indefinite is presuppositional:

(47) a. Presupposition: The maximal set D such that
(i) for each $x \in D$, there is a non-empty set D' such that;
A. for each $y \in D'$, there is a book z that x recommended; and
B. for each $y \in D'$, y read z; and

(ii) each $x \in D$ is a professor
is non-empty.

b. Assertion: Each $x \in D$ rewarded each $y \in D'$.

Remarks:

- The universal quantification in (47a-i-A.) is vacuous, so we can eliminate the universal quantifier there, letting the indefinite take scope over *every student*.
- Due to the bound variable, the universal quantification in (47a-i) is non-vacuous.
- D' in the assertion is interpreted via quantificational subordination, so we get a (potentially) different D' for different x.

This is the intermediate scope reading. Note that all the scopal work is in the presupposition.

2.7 Non-global accommodation

But for some cases, we need non-global accommodation, namely, cases of intermediate scope readings where the wide scope operator is one that anaphora cannot be dependent on, e.g., *negation*.

(48) Prof Smith did not reward every student who read a book he had recommended.

(49) Not every linguist studied every conceivable solution that some problem might have. (Chierchia 2001: p. 60)

So the issue is similar in nature to the issue for Schwarzschild 2002 and Kratzer 1998, but unlike them, we could at least account for these examples with non-global accommodation of the presupposition of the presuppositional indefinite.

2.8 Functional readings

(50) *Context: Every student in my syntax class has one weak point—John doesn't understand Case Theory, Mary has problems with Binding Theory, etc. Before the final I say:*

If each student makes progress in some area, nobody will flunk the exam.
(adapted from Schlenker 2006: p. 299)

I propose to account for this example by assuming that nouns can have functional readings. The idea is that *some area* can be interpreted as an indefinite ranging over functions from individuals to areas.

If the functional indefinite is presuppositional, the *if*-clause is interpreted as (51) (ignoring the existence presupposition of *each student*):

(51) Each student makes progress in some area.

a. Presupposition: For each student x, there is a function f from individuals to areas.

b. Assertion: Each student x makes progress in $f(x)$.

The universal quantification in the presupposition is vacuous.
Since presuppositions generally project out of *if*-clauses, the entire sentence means:

(52) a. Presupposition: There is a function f from individuals to areas.
b. Assertion: If each student x progress in $f(x)$, nobody will flunk the exam.

Certain can be analysed as an indefinite that is obligatorily functional and presuppositional.

(53) Each student made progress in a certain area.
a. Presupposition: There is a function f from individuals to areas.
b. Assertion: Each student x made progress in $f(x)$.

A binder is not necessary, but the argument of f could be a free pronoun referring to any discourse referent.

(54) A certain man entered.
a. Presupposition. There is a function f from individuals to men.
b. Assertion: $f(x)$ entered.

2.9

The rest is a formal implementation of the above ideas in a dynamic semantic theory.

- We will rely on Heim's 1982 dynamic theory of presupposition projection, where presuppositions are 'satisfaction conditions'.
- But we tweak the theory so that presuppositions may have dynamic effects (Beaver 1992, Elliott & Sudo 2021, Mayr & Sudo 2022). This is (even) more Stalnakerian the original theory: Assertions and presuppositions are (dynamic) information and they are subject to different pragmatic conditions.
- We also have to enable quantificational subordination. We'll use the idea pioneered by Van den Berg 1996, but crucially implement it in a Heimian dynamic semantics (as in Sudo to appear).

3 Heim's idea of (in)definiteness

3.1 1980s

Heim's 1982 dynamic semantic theory of definite and indefinite noun phrases, *File Change Semantics*, is very influential (and ambitious).
She starts with the intuition that definites and indefinites are semantically very similar (as well as morphosyntactically).

- Classical theory (Russell 1905, e.g.): definites are referring terms, indefinites are existential quantifiers.

(55) a. $[\![\textbf{the cat}]\!]$ = the unique cat
b. $[\![\textbf{a cat}]\!] = \lambda P_{\langle e,t\rangle}$. there is a cat x such that $P(x) = 1$

- File Change Semantics:
  - Definites and indefinites denote 'discourse referents' (variables).
  - Definites denote old discourse referents ('Familiarity Condition'), indefinites new discourse referents ('Novelty Condition').
  - New discourse referents receive quantificational readings via unselective binding by various operators, including Existential Closure (ultimately hidden in connectives and the definition of truth; cf. DRT from last lecture).

This theory was meant to kill three birds with one stone: (i) discourse anaphora, (ii) donkey anaphora, (iii) quantificational variability.

3.2 1990s

However, Heim ended up abandoning File Change Semantics. She never really explained why, but I suspect that there were several reasons for this:

- Unselective binding failed (The 'Proportion Problem'). So the entire theory of quantification in File Change Semantics needed to be reconsidered.
- Heim's 1982 view of definites was not great:
  - She only talked about familiar definites. Unique definites would mar the above parallelism between definites and indefinites somewhat.
  - The issue with definites containing bound variables.

    (56) Every cat looks down on the human that it lives with.

    A definite like this cannot be an old discourse referent in File Change Semantics.
- Her argument for dynamic binding based on uniqueness was significantly weakened by Situation Semantics.

In fact, using Situation Semantics, Heim 1990 develops a static theory of donkey anaphora (see also Elbourne 2005).

Concurrently, Heim further refined her idea about the difference between indefinites and definites (Heim 1991, 2011). She proposed to get rid of the Novelty Condition.

- Indefinites have no semantic conditions about what kind of discourse referents to denote. So 'indefinite' is not really an accurate term for them; they are underspecified for definiteness.
- The principle of *Maximise Presupposition!* requires their definite counterparts to be used whenever they are be felicitous and give rise to the same meaning. This creates the impression that indefinites are required to denote new discourse referents.

A nice consequence of this is that we don't need to say anything about languages without definiteness marking (East Asian languages, Slavic languages, etc.). In these languages, bare noun phrases are used for both new and old discourse referents, because there is no competition with definites. More on this later.

By the time Heim proposed underspecified indefinites that compete with definites, she had given up File Change Semantics. It turns out that dynamic semantics is not necessary to give definites and indefinites the same assertive meaning, but since indefinites are existential quantifiers in a static setting, definites need to be existential quantifiers too (cf. Percus 2006).

(57) a. $[\![\textbf{the cat}]\!] = \lambda P_{\langle e,t\rangle}$: there is exactly one cat. there is a cat x such that $P(x) = 1$
b. $[\![\textbf{a cat}]\!] = \lambda P_{\langle e,t\rangle}$. there is a cat x such that $P(x) = 1$

The main reason why we need a dynamic theory for wide scope indefinites is because we want the presupposition to be able to pass on discourse referents to the assertion, and not because Heim's idea of underspecified indefinites requires it.

Eventually, our dynamic theory will bear some resemblance to (57): Both indefinites and definites introduce new discourse referents, but we keep Heim's idea that they denote discourse referents.

3.3 Other developments

Not everyone renounced dynamic semantics.

- In the literature on presuppositions, File Change Semantics is still one of the standard theories (Heim 1983, Beaver 2001, Rothschild 2011; see Van der Sandt 1992, Geurts 1999 for criticisms). But this literature tends to focus on the propositional aspect of the theory, and doesn't say much about indefinites, anaphora, and quantification.
- European dynamic semanticists remained active, especially the DRT group around Hans Kamp (Kamp & Reyle 1993) and the DPL group in Amsterdam (Groenendijk & Stokhof 1991). In particular, *selective dynamic quantifiers* were invented in the 90s to address the issue of selective quantification in dynamic semantics (Van Eijck & De Vries 1992, Kanazawa 1993, 1994, Van den Berg 1991, Van den Berg 1996, Chierchia 1992, 1995).
- More recent works on anaphora in dynamic semantics: Nouwen 2003, 2007, Brasoveanu 2007, 2008, 2010, Dotlačil 2013, Köpping 2018, Hofmann 2019, Köpping 2019, Hofmann 2022, Mandelkern 2022.

3.4 Towards a neo-Heimian dynamic theory of definitesness/indefiniteness

We'll develop a *neo-Heimian dynamic theory* of definites and indefinites.

Our starting point is Heim's insights:

- Both definites and indefinites denote discourse referents.
- Indefinites encode no semantic conditions as to what discourse referents to denote, but compete with definites via *Maximise Presupposition!*.
- Bare noun phrases in languages without definiteness marking are underspecified for definiteness.

But we will make two major refinements:

- Definites and indefinites always introduce new discourse referents.
- Presuppositions can have dynamic effects on assertions.

We'll deal with wide scope indefinites as presuppositional indefinites.

- Presuppositional indefinites don't need to be always accommodated, unlike in previous theories (Cresti 1995, Yeom 1998, van Geenhoven 1998, Geurts 2000, Jäger 2007, Onea 2015).
- They have weaker presuppositions than definites (so still subject to *Maximise Presupposition!*).

4 A quick review of File Change Semantics

- Sentences denote Context Change Potentials.
- Context Change Potentials are functions over *information states*, which are models of conversational contexts. Context Change Potentials are instructions on how to update conversational contexts.
- Information states are sets of (live) *possibilities*, each of which represents a very specific state of affairs.
- For our purposes, a possibility is a pair of a world w and a total assignment function $g : \mathbb{N} \to D$.[2]
- A *discourse referent* is a placeholder for an individual mentioned in the conversation. Formally, it is just an index $n \in \mathbb{N}$. g stores information about what each discourse referent might represent.
- Instead of representing a possibility as a pair $\langle w, g \rangle$, let's represent it as an extended assignment that assigns w to 0: $g' = g \cup \{\langle 0, w \rangle\}$ (i.e., $g'(0) = w$ and $g'(n) = g(n)$ for all $n \in \mathbb{N}$).

In dynamic semantics, it's common to use the postfix notation. E.g., for any context c, the result of 'updating' c with the Context Change Potential denoted by the sentence *It is raining* is written (instead of $[\![\textbf{it is raining}]\!](c)$):

(58) c[it is raining] $= \{ g \in c \mid$ it is raining in $g(0) \}$

Let's write $c(n)$ for $\{ g(n) \mid g \in c \}$.

- $c(0)$ is the set of possible worlds representing the common ground in context c.
- For any $n \in \mathbb{N}$, $c(n)$ is the set of possible individuals that the discourse referent n is about.
- If for each $w \in c(0)$, $\{ g \in c \mid g(0) = w \}(n) = D$, then this discourse referent carries no information in c. Otherwise, it carries some information.

[2] We assume $0 \notin \mathbb{N}$.

(59) Suppose for each $w \in c(0)$, $\{ g \in c \mid g(0) = w \}(n)$ is a set of cats. Then n is known to be a cat in n. If for some $w \in c(0)$, $\{ g \in c \mid g(0) = w \}(n)$ contains more than one cat, then n can be any of these cats in w. Furthermore, even if it's a singleton for each world in $c(0)$, if these singleton sets are distinct, you don't (yet) know which cat n is. If $c(n)$ is a singleton set, then it is common knowledge exactly what it represents.

Discourse referents account for discourse anaphora. A pronoun, for example, simply denotes a discourse referent (concrete examples below).

Anaphoric meaning is separate from truth-conditions: (Contextually) truth-conditionally equivalent sentences can differ in anaphoric potentials.

(60) a. Alice has a job, but she hates it.
b. Alice is employed, but #she hates it.

Certain linguistic devices, e.g., noun phrases, are used to talk about discourse referents (more on this below).

Pragmatically, an assertion of S is infelicitous if it is not informative or if it is contradictory.

(61) a. An assertion of S is informative with respect to c iff $c[S](0) \subset c(0)$.
b. An assertion of S is contradictory with respect to c iff $c[S] = \varnothing$.

4.1 Indefinites and definites

Heim 1982 assumes that both indefinites and definites denote discourse referents (*qua* variables). E.g., the following sentences denote the same Context Change Potential.[3]

(62) a. $c[\text{A}_3 \text{ cat is sleeping}] = \{ g \in c \mid g(3) \text{ is a cat in } g(0) \text{ and } g(3) \text{ is sleeping in } g(0) \}$
b. $c[\text{The}_3 \text{ cat is sleeping}] = \{ g \in c \mid g(3) \text{ is a cat in } g(0) \text{ and } g(3) \text{ is sleeping in } g(0) \}$

This is not so crazy, given the truth-conditional equivalence of the following discourses:

(63) a. A_1 dog is barking and a_3 cat is sleeping.
b. There is a_1 dog and a_3 cat. The_1 dog is barking. The_3 cat is sleeping.

In Heim's 1982 File Change Semantics, indefinites and definites are distinguished pragmatically by felicity conditions:

(64) a. Novelty Condition: An indefinite used in c denotes a new discourse referent in c.
b. Familiarity Condition: A definite in c denotes an old discourse referent in c.

(65) a. A discourse referent n is new in c iff for each $w \in c(0)$, $\{ g \mid g(0) = w \}(n) = D$.
b. A discourse referent n is old in c iff it is not new in c (i.e., it carries some

[3] Recall for Heim 1982, assignments are total. This is not necessarily so for other versions of dynamic semantics.

information in c).

Indefinites and definites (including pronouns) are the main devices in File Change Semantics to update discourse referents. We'll ignore the discourse referent for *Alice* to simplify.

(66) a. c[Alice has a_8 job] $= \{ g \in c \mid g(8)$ is a job in $g(0)$ and Alice has $g(8)$ in $g(0) \}$
b. c[Alice is employed] $= \{ g \in c \mid$ Alice has a job in $g(0) \}$

These sentences are truth-conditionally identical, i.e.,

$$c[\text{Alice has } a_8 \text{ job}](0) = c[\text{Alice is employed}](0)$$

, but (66a) is stronger in overall meaning than (66b) (see Sudo to appear).

4.2 Implicit Existential Closure

Indefinites are formally referring terms, just like definites. But they get existential readings:

(67) c[There is a_3 dodo] $= \{ g \in c \mid g(3)$ is a dodo in $g(0) \}$

Due to the Novelty Condition, 3 has to be a new discourse referent in c, and after the utterance:

- 3 will be an old discourse referent carrying the information that it is a dodo in each world in c[There is a_3 dodo](0) (maybe different worlds have different dodos!).

  After this utterance, one can refer back to the discourse referent using a pronoun or a definite description (we ignore presuppositions for now):

  (68) a. c[It_3 is walking] $= \{ g \in c \mid g(3)$ is walking in $g(0) \}$
  b. c[The dodo_3 is walking] $= \{ g \in c \mid g(3)$ is walking in $g(0) \}$

- Furthermore, the utterance will eliminate all $g \in c$ such that in $g(0)$ there is no dodo.

Connectives work nicely, e.g., negation:[4]

(69) c[There isn't a_3 dodo] $= c - c$[There is a_3 dodo]
$= \{ g \in c \mid$ There is no dodo in $g(0) \}$

Because (67) exhausts all possible ways of assigning a dodo to the new discourse referent 3, for each $g \in c$, $g \in$ (67) iff there is a dodo in $g(0)$. If we subtract all of these, we will be left with $g \in c$ such that there is no dodo in $g(0)$.

[4] In a system that uses explicit random assignment like DPL and DRT, this negation won't work; the negation in these systems quantifies over all possible random assignments. In File Change Semantics, random assignment is in a way already done for all new variables.

4.3 Problem of bound pronouns

But there's a problem with this theory, and the problem is about the analysis of definites (Heim 1982: §5.2, Heim 2011).[5] Consider:

(70) Every professor enjoys the$_2$ introductory module they are teaching.

If the definite description denotes an old discourse referent in c, then for each $g \in c$, $g(2)$ is one particular module. Then after updating c with (70), g will remain if every professor in $g(0)$ enjoys that same module in $g(0)$.
But this is not the (only) meaning. We want 2 to be able to change its vary for different professors.
Heim 1982 suggests that definites have existence presuppositions and in this case the existence presupposition is 'locally accommodated'. Then, the sentence is interpreted as:

(71) For every professor x,
x is teaching an$_2$ introductory module and
x enjoys the$_2$ introductory module they are teaching.

But then the sentence should mean the same thing as:

(72) Every professor enjoys an$_2$ undergraduate module they are teaching.

That doesn't seem right. (70) seems to presuppose that every professor is teaching exactly one introductory module, while (72) asserts every professor is teaching at least one introductory module (if the indefinite is non-presuppositional).

5 Definites in dynamic semantics

One (but arguably not the only) way to solve the above problem of definites with bound pronouns is by giving up on the idea that definites denote old discourse referents.

5.1 Unique definites

Heim 1982 also discusses a similar issue for unique definites like (73):

(73) a. The moon is behind us.
b. The president of Russia is unhappy.

These definites can be used even if there's no appropriate old discourse referent. Heim 1982 assumes that they trigger 'accommodation', so they are effectively interpreted as:

(74) a. There is a$_1$ moon. The$_1$ moon is behind us.
b. Russia has a$_2$ president. The$_2$ president of Russia is unhappy.

[5] To appreciate the issue in full form, we need an analysis of *every*. Heim 1982 provides one but she assumes unselective binding, which is known to be problematic. We'll come back to selective generalised quantifiers later.

Let us abandon Heim's theory of definites and assume that unique definites simply denote new discourse referents. But unlike indefinites, they are associated with uniqueness presuppositions.[6]

Following Heim 1982, let us analyse presuppositions as triggering satisfaction conditions (for now).

(75) c[The$_1$ Russian president is unhappy]

$$= \begin{cases} \left\{ g \in c \;\middle|\; \begin{array}{l} g(1) \text{ is the unique Russian} \\ \text{president in } g(0) \text{ and} \\ g(1) \text{ is unhappy in } g(0) \end{array} \right\} & \text{if } 1 \text{ is new in } c \text{ and for each } g \in c, \\ & \quad \text{Russia has exactly one president in } g(0) \\ \# & \text{otherwise} \end{cases}$$

Presuppositions are required to be uninformative/redundant ($\approx$ taken for granted); assertions are required to be informative (and non-contradictory).

5.2 Familiar definites

We can deal with familiar definites as a special case of unique definites, with an unpronounced restriction IDENT^n, which asserts point-wise identity with the discourse referent n (cf. Fox's 2000 Trace Conversion).

(76) c[The$_1$ cat IDENT^5 is sleeping]

$$= \begin{cases} \left\{ g \in c \;\middle|\; \begin{array}{l} g(1) \text{ is the unique cat} \\ \text{identical to } g(5) \text{ in } g(0) \text{ and} \\ g(1) \text{ is unhappy in } g(0) \end{array} \right\} & \text{if } 1 \text{ is new in } c \text{ and for each } g \in c, \\ & \quad \text{there is exactly one cat} \\ & \quad \text{identical to } g(5) \text{ in } g(0) \\ \# & \text{otherwise} \end{cases}$$

Definites often have implicit restrictions.

(77) a. I bought an old car. But the engine was broken.
b. In every city of this state, the mayor is an old man.

5.3 Definites with bound pronouns

This theory can deal with definites containing bound pronouns.

Supposing that every professor is teaching exactly one undergraduate module, the definite description of (70) will simply store a different value in 2, because 2 is no longer an old discourse referent in the present system.

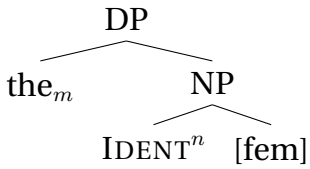
(70) Every professor enjoys the$_2$ undergraduate module they are teaching.

But to solve this completely, we need an analysis of *every*. We'll come back to it.

[6] Coppock & Beaver 2015 argue that definites themselves only presuppose uniqueness but not existence. We only deal with cases where existence inferences arise here.

5.4 Pronouns

(Non-demonstrative) pronouns are obligatorily familiar. They can be analysed as disguised definite descriptions with IDENT^n being part of the restriction (cf. Postal 1966, Elbourne 2005).

(78) she^n_m = 

(79) c[She$^3_8$ is sleeping]

$$= \begin{cases} \left\{ g \in c \;\middle|\; \begin{array}{l} g(8) \text{ is the unique female} \\ \text{identical to } g(3) \text{ in } g(0) \text{ and} \\ g(1) \text{ is sleeping in } g(0) \end{array} \right\} & \text{if } 8 \text{ is new in } c \text{ and for each } g \in c, \\ & \quad \text{there is exactly one female} \\ & \quad \text{identical to } g(3) \text{ in } g(0) \\ \# & \text{otherwise} \end{cases}$$

5.5 Always new

In the current theory, every noun phrase (including quantifiers) introduces a new discourse referent. I will omit the novelty presupposition in what follows.

Alternatively, we might want to pursue a stack-based system with no downdate (see Van Eijck 2001, Nouwen 2003, 2007). But there are some non-trivial compositional complications, so we won't do it here.

6 Indefinites and their anti-presuppositions

We can implement Heim's later idea of underspecified indefinites as follows.

(80) c[A$_5$ cat is sleeping] $= \left\{ g[5 \mapsto e] \;\middle|\; \begin{array}{l} g \in c \text{ and} \\ \text{there is a cat in } g(0) \text{ and} \\ e \text{ is a cat in } g(0) \text{ and} \\ e \text{ is sleeping in } g(0) \end{array} \right\}$

A (unique) definite can be analysed as completely identical to (80), except that it has a uniqueness presupposition (the existence assertion is vacuous):

(81) c[The$_5$ cat is sleeping]

$$= \begin{cases} \left\{ g[5 \mapsto e] \;\middle|\; \begin{array}{l} g \in c \text{ and} \\ \text{there is a cat in } g(0) \text{ and} \\ e \text{ is a cat in } g(0) \text{ and} \\ e \text{ is sleeping in } g(0) \end{array} \right\} & \text{if for each } g \in c, \\ & \text{there is exactly one cat in } g(0) \\ \# & \text{otherwise} \end{cases}$$

6.1 *Maximise Presupposition!*

Semantically, (82) is coherent.

(82) c[A$_9$ president of Russia is unhappy]

$$= \left\{ g[9 \mapsto e] \;\middle|\; \begin{array}{l} g \in c \text{ and} \\ \text{there is a president in Russia in } g(0) \text{ and} \\ e \text{ is a president of Russia in } g(0) \text{ and} \\ e \text{ is unhappy in } g(0) \end{array} \right\}$$

But this sentence is judged as infelicitous.

To explain the infelicity, Heim 1991 postulates a principle (see also Percus 2006, Sauerland 2008, Singh 2011, Grønn & Sæbø 2012, Schlenker 2012, Spector & Sudo 2017, Marty 2017, Anvari 2019, Rouillard & Schwarz 2019; see also Jäger 2007: p. 132).

(83) *Maximize Presupposition*
If S has an alternative T such that S and T have the same assertive meaning but T has a logically stronger presupposition than S, then an utterance of S in context c is infelicitous, if $c[T] \neq \#$.

This renders (82) infelicitous, unless the definite counterpart in (84) denotes $\#$, i.e., either there is more than one Russian president, or there is none.

(84) c[The$_9$ president of Russia is unhappy]

$$= \begin{cases} \left\{ g[9 \mapsto e] \;\middle|\; \begin{array}{l} g \in c \text{ and} \\ \text{there is a president in Russia in } g(0) \text{ and} \\ e \text{ is a president of Russia in } g(0) \text{ and} \\ e \text{ is unhappy in } g(0) \end{array} \right\} & \begin{array}{l} \text{if for each } g \in c, \\ \text{there is exactly one} \\ \text{president of Russia in } g(0) \end{array} \\ \# & \text{otherwise} \end{cases}$$

6.2 No familiar indefinites

Generally, we assume that *a NP* competes with *the NP* with the exactly same NP content (and nothing else).

If the NP contains IDENT^n, the uniqueness presupposition of the familiar definite will always be satisfied. So there's no familiar indefinite.

6.3 Languages without definiteness marking

In the literature it is often assumed that in languages without definiteness marking, e.g., Russian, bare NPs are ambiguous between indefinite and definite readings.

But that's primarily because we didn't have an established way of representing a meaning that is neutral with respect to definiteness. Our system enables it.

(85) kot spit.
cat sleep.IMPERF.3SG.PRES
'(lit.) Cat is sleeping.'

(86) $c[\text{kot}_3\ \text{spit}] = \left\{ g[3 \mapsto e] \;\middle|\; \begin{array}{l} g \in c \text{ and} \\ \text{there is a cat in } g(0) \text{ and} \\ e \text{ is a cat in } g(0) \text{ and} \\ e \text{ is sleeping in } g(0) \end{array} \right\}$

This is the same Context Change Potential as (80).
But crucially, there's no definite counterpart. So unique and familiar uses of bare NPs are possible.

(87) $c[\text{russkij prezident}_3\ \text{spit}] = \left\{ g[3 \mapsto e] \;\middle|\; \begin{array}{l} g \in c \text{ and} \\ \text{there is a Russian president in } g(0) \text{ and} \\ e \text{ is a Russian president in } g(0) \text{ and} \\ e \text{ is sleeping in } g(0) \end{array} \right\}$

(88) $c[[\text{kot } \textsc{ident}^9]_3\ \text{spit}] = \left\{ g[3 \mapsto e] \;\middle|\; \begin{array}{l} g \in c \text{ and} \\ \text{there is a cat in } g(0) \text{ and} \\ e \text{ is a cat in } g(0) \text{ and } e = g(9) \\ e \text{ is sleeping in } g(0) \end{array} \right\}$

But these languages often have ways of marking specificity/definiteness:

- Russian uses word order.
- Japanese and Korean use topic marking (Portner & Yabushita 2001).
- Turkic languages use accusative marking on objects (Differential Object Marking) (Enç 1991).

7 Bi-dimensional dynamic semantics

To account for presuppositional indefinites, we need to give presuppositions dynamic meaning (as in Beaver 1992, Elliott & Sudo 2021, Mayr & Sudo 2022).
For Heim 1982, 1983, presuppositions are simply satisfaction conditions, and carry no new meaning.
We'll represent presuppositions and assertions in different dimensions.

(89) $c(\!(\textbf{The}_1\ \textbf{Russian president is unhappy})\!)$
$= \left\{ g[1 \mapsto e] \;\middle|\; \begin{array}{l} g \in c \text{ and} \\ \text{Russia has exactly one president in } g(0) \text{ and} \\ e \text{ is the unique Russian president in } g(0) \end{array} \right\}$

(90) $c[\![\textbf{The}_1\ \textbf{Russian president is unhappy}]\!]$
$= \{\, g \in c \mid g(1) \text{ is unhappy in } g(0) \,\}$

The update rule is a bit more complex now, encoding the Stalnakerian pragmatic conditions:

(91) $c[S] = \begin{cases} c(\!(S)\!)[\![S]\!] & \text{if for each } g \in c, \text{ for some extension } g' \geqslant g,\ g' \in (\!(S)\!) \\ & \quad \text{and } c(\!(S)\!) \neq c(\!(S)\!)[\![S]\!] \neq \varnothing \\ \# & \text{otherwise} \end{cases}$

7.1 Presuppositional indefinites

Presuppositional indefinites are just like definites, except for the uniqueness presuppposition.

(92) $c((\textbf{A}_2\ \textbf{cat is sleeping})) = \{\, g[2 \mapsto e] \mid g \in c \text{ and } e \text{ is a cat in } g(0) \,\}$

(93) $c[\![\textbf{A}_2\ \textbf{cat is sleeping}]\!] = \{\, g \in c \mid g(2) \text{ is sleepping in } g(0) \,\}$

A non-presuppositional indefinite looks like;

(94) $c((\textbf{A}_2\ \textbf{cat is sleeping})) = c$

(95) $c[\![\textbf{A}_2\ \textbf{cat is sleeping}]\!] = \{\, g[2 \mapsto e] \mid g \in c \text{and } e \text{ is a sleeping cat in } g(0) \,\}$

7.2 Presupposition projection

We won't explicitly deal with the issue of presupposition projection itself here. But the current system is not so different from the standard theory, because the same satisfaction condition is required.

8 Distributive quantification and quantificational subordination

In order to implement quantificational subordination, we will make use of plural information states (Van den Berg 1996). This is usually not implemented in a Heimian setup but I've worked it out in Sudo to appear. But we have to adapt it to the current bi-dimensional setting.

A context is now a pair $\langle w, A\rangle$ of a possible worlds w and a set of assignments A (we no longer put the world in the assignments).

Abbreviations:

(96) a. $A[n \mapsto e] \coloneqq \{\, a[n \mapsto e] \mid a \in A \,\}$
b. $c[n \mapsto e] \coloneqq \{\, \langle w, A[n \mapsto e]\rangle \mid \langle w, A\rangle \in c \,\}$
c. $B \leqslant A$ iff for each $b \in B$, there is $a \in A$ such that $b \leqslant a$.

(97) $c((\textbf{Every}^n_m\ \phi\ \psi))$

$$= \left\{ \langle w, A\rangle \;\middle|\; \begin{array}{l} M = \{\, e \in D \mid \text{for some } B', \langle w, B'\rangle \in c[n \mapsto e][\phi] \,\}\text{; and} \\ M \text{ is not empty; and} \\ A \subseteq \bigcup_{e \in M} \{\, B' \mid \langle w, B'\rangle \in c[x \mapsto e][\phi] \,\}\text{; and} \\ \text{for some } B \text{ such that } \langle w, B\rangle \in c, \\ \quad B \leqslant A \text{ and} \\ \quad \text{for each } b \in B, \text{ for each } e \in D, \text{ there is exactly one } a \in A \text{ such} \\ \qquad \text{that } a(x) = e \text{ and } b \leqslant a\text{; and} \\ \text{for each } a \in A,\ a(m) = \bigsqcup M \end{array} \right\}$$

(98) $c[\![\textbf{Every}^n_m\ \phi\ \psi]\!]$

$$= \left\{ \langle w, A\rangle \;\middle|\; \begin{array}{l} M = \{\, m \mid m \sqsubseteq_a b(m) \,\} \text{ for some } b \in B \text{ such that } \langle w, B\rangle \in c\text{; and} \\ R = \{\, e \in D \mid \text{for some } B',\ \langle w, B'\rangle \in c[n \mapsto e][\phi][\psi] \,\}\text{; and} \\ M \subseteq R\text{; and} \\ A \subseteq \bigcup_{e\in R} \{\, B' \mid \langle w, B'\rangle \in c[x \mapsto e][\phi][\psi] \,\}\text{; and} \\ \text{for some } B \text{ such that } \langle w, B\rangle \in c, \\ \quad B \leqslant A \text{ and} \\ \quad \text{for each } b \in B\text{, for each } e \in D\text{, there is exactly one } a \in A \text{ such} \\ \quad\quad \text{that } a(x) = e \text{ and } b \leqslant a\text{; and} \\ \text{for each } a \in A,\ a(n) = \bigsqcup R \end{array} \right\}$$

[...]

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