Indefinites

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Structures for Semantics 2021-2022
12 May 2022

What is an indefinite?

The indefiniteness of indefinites

Historically, the focus has been on *definites*. Indefinites were simply elements which were *not definites*.

From a philosophical-logical perspective, Russell (1905) advocated that indefinites are simple existentials, while definites come with a uniqueness requirement.

(1) a. Some man is in Rome.

b. $\exists x(Mx \wedge Rx)$

(2) a. The man is in Rome.

b. $\exists x(Mx \wedge Rx \wedge \forall y(My \rightarrow x = y))$

From a linguistic perspective, in old descriptive grammars pronouns were classified according to different criteria (personal, demonstrative, relative, interrogative, . . .). Indefinite pronouns were ‘the rest’.

The importance of indefinites

As we will see, the study of indefinites actually led to seminal results in philosophy of language, formal semantics, the syntax-semantics interface, typology, historical linguistics, and psycholinguistics.

Philosophy of language: Donnellan (1978); Fodor and Sag (1982); King (1988)

Formal semantics: Heim (1982); Kamp and Reyle (1993); Reinhart (1997); Kratzer (1998); Farkas (2002); Alonso-Ovalle and Menéndez-Benito (2010)

Typology: Haspelmath (1997)

Historical linguistics: Gianollo (2018); Aloni (2021)

Psycholinguistics: Krämer (2000); Unsworth, Gualmini, and Helder (2008); Ionin, Choi, and Liu (2021)

A Complex Linguistic Landscape

Expression encoding indefiniteness form a **heterogeneous landscape**:

Indefinite article: a morpheme which accompanies a noun and signals indefiniteness (e.g. English *a man*).
Note: many languages do not have neither indefinite nor definite articles!

Indefinite pronoun: a pronoun (i.e., a grammatical item which replaces a noun phrase). An example is the English *some* series (*some*-one, *some*-thing. *some*-where, . . .).

Other indefinite determiners: determiners derived from a series of pronouns (e.g. English *some man*), lexical items like *a certain*, expressions like *one*, ...

This variety makes comprehensive theories difficult to achieve.

Take a look at the *World Atlas of Language Structures*:
Indefinite articles: `https://wals.info/chapter/38`
Definite articles: `https://wals.info/chapter/37`
Indefinite pronouns: `https://wals.info/chapter/46`

Indefinites vs Definites

For today, we will assume the following.

(3) a. Sue likes *a book, some book, a certain book*.

b. Sue likes *this book, these books, the book*.

(3a) contains examples of determiner phrases which are headed by an **indefinite** determiner.

(3b) contains examples of determiner phrases which are headed by a **definite** determiner.

But still, what distinguishes definites from indefinites?

Outline

Today's Readings

Barbara Partee (1986). "Noun Phrase Interpretation and Type-Shifting Principles". In: *Studies in Discourse Representation Theory and the Theory of Generalized Quantifiers*. Ed. by Jeroen Groenendijk, Dick De Jongh, and Martin Stokhof. Dordrecht: Foris, pp. 115–143

Maria Aloni and Marco Degano (2022). *(Non-)specificity across languages: constancy, variation, v-variation*. Ms., University of Amsterdam

Outline

Existential Force: Classical GQT

In classical *generalized quantifier theory* (Montague 1973; Barwise and Cooper 1981; Keenan and Stavi 1986), indefinites are a subtype of GQ which are **non-unique**, as opposed to definites, which are **unique**:

(4) a. a man / some man $\mapsto \lambda P \exists x (Mx \wedge Px)$

b. the man $\mapsto \lambda P \exists x \forall y ((My \leftrightarrow x = y) \wedge Px)$

c. every man $\mapsto \lambda P \forall x (Mx \rightarrow Px)$

Barwise and Cooper (1981)'s generalized definition for definiteness:

D is *definite* iff for all $A \subseteq E$ for which $D(A)$ is defined, there is a non-empty set B such that $D(A) = \{X \subseteq E | B \subseteq X\}$. (In other words, $D(A)$ is the principal filter generated by B.)

<u>Note:</u> In GQT indefinites are **quantificational** elements.

Anaphoric Potential: Dynamic Treatments

Karttunen (1973), Heim (1982): indefinites are **novel**, while definites are **familiar**.

(5) a. A book$_x$ is on the table. It$_x$/The book$_{x/?y}$/A book$_{\#x/y}$ is black.

b. Every book$_x$ is on the table. It$_{\#x/y}$ is black.

(6) a. Every farmer who owns a donkey$_x$ feeds it$_x$.

b. Every farmer who owns every donkey$_x$ feeds it$_{y/\#x}$.

Question: How would you translate (5) and (6). Why is this a problem?

(7) a. A book$_x$ is on the table. It$_x$ is black.

b. $\exists x(Bx \wedge Tx) \wedge Bx$

(8) a. Every farmer who owns a donkey$_x$ feeds it$_x$.

b. $\forall y((Fy \wedge \exists x(Dx \wedge Oyx)) \rightarrow Ryx)$

In Dynamic Semantics (G&S, Dekker, Aloni), indefinites are existentials with **non-standard quantificational properties**:

(9) a. $\exists x\phi \wedge \psi \equiv \exists x(\phi \wedge \psi)$

b. $\exists x\phi \rightarrow \psi \equiv \forall x(\phi \rightarrow \psi)$

In DRT and Heim's file-change semantics, indefinites lack a quantificational force of their own. They are treated like **variables**, which depend on other quantifiers in the sentence (cf. existential disclosure Dekker 1993).

Indefinites and Freedom of Scope

A salient property of indefinites is their ability to take **scope freely** over several operators:

(10) a. Sue likes every book which concerns an important war.

b. Sue likes a book which concerns every important war.

(11) a. If a panda comes to the party, Kola the bear will be happy.

b. If every panda comes to the party, Kola the bear will be happy.

In (10a) and (11a), the indefinite can take scope freely (even outside its syntactic boundaries). By contrast, universals are clause bound.

(12) If a panda comes to the party, Kola will be happy.

a. $\exists x(P(x) \wedge C(x, p)) \rightarrow H(k)$

b. $\exists x(P(x) \wedge (C(x, p) \rightarrow H(k)))$

(13) If every panda comes to the party, Kola will be happy.

a. $\forall x(P(x) \wedge C(x, p)) \rightarrow H(k)$

b. $\#\forall x(P(x) \wedge (C(x, p) \rightarrow H(k)))$

Question: which readings can EMG generate ?

By S8, it would overgenerate and predict all readings.

Extraction from conditional adjuncts is syntactically not possible:

(14) *Who if comes to the party, Kola will be happy?

Exceptional Scope: Ambiguity Thesis

Fodor and Sag (1982) treat wide-scope indefinites as referring expressions (e.g. like a proper name):

(15) If a panda comes to the party, Kola will be happy.

a. $\exists x(P(x) \wedge C(x,p)) \rightarrow H(k)$ [quantificational]

b. $\mathbf{P}(\mathbf{x}) \wedge C(x,p) \rightarrow H(k)$ [referential]

Indefinites are **ambiguous** between a referential and a quantificational reading, as opposed to universals.

Question: Consider (16). Why is this problematic for the ambiguity thesis?

(16) Every$_x$ student read every$_y$ paper that a$_z$ professor recommended.

a. Narrow Scope (NS): $\forall x / \forall y / \exists z$

b. Intermediate Scope (IS): $\forall x / \exists z / \forall y$

c. Wide Scope (WS): $\exists z / \forall x / \forall y$

Exceptional scope: Choice Functional Approaches

In choice-functional approaches (Reinhart 1997; Winter 1997) an indefinite denotes a variable ranging over **choice functions**.

This variable is then bound by an existential quantifiers which can be **freely inserted** in the interpretation procedure.

(17) Every$_x$ student read every$_y$ paper that a$_z$ professor recommended.

a. Narrow Scope (NS):
$\forall x \forall y \exists f((S(x) \wedge A(y) \wedge W(f(P), y)) \rightarrow R(x, y))$

b. Intermediate Scope (IS):
$\forall x \exists f \forall y((S(x) \wedge A(y) \wedge W(f(P), y)) \rightarrow R(x, y))$

c. Wide Scope (WS):
$\exists f \forall x \forall y((S(x) \wedge A(y) \wedge W(f(P), y)) \rightarrow R(x, y))$

Exercise

Consider the sentences (18) and (19) below. Can the choice-functional account presented above capture all the readings associated with such sentences?

(18) It is not the case that every linguist studied every solution some problem might have.

(19) If every student manages to understand some area, nobody will fail the exam.

Exceptional scope: Other accounts

- Kratzer (1998), Matthewson (1998): indefinites are ambiguous (as in Fodor & Sag): narrow scope readings are quantificational, intermediate and wide scope readings are obtained by relativizing the choice function to other variables (e.g. a Skolem function f_x).
- Abusch (1993): indefinites analyzed as existentials enter the semantic composition in a free way (implemented via a quantifier Cooper storage mechanism)
- Schwarzschild (2002): indefinites are quantificational existentials. Exceptional scope is obtained by pragmatic restriction of the denotation of the existential to a singleton.
- Charlow (2020): Alternative Semantics analysis of indefinites and scope taking.

Exceptional scope: Independence Logics

Brasoveanu and Farkas (2011) use tools from Independence-Friendly logic to analyze scope effects as **relations between variables**.

Indefinites are interpreted **in-situ** and they can be interpreted **(in)dependently** of other variables.

Syntactic configuration is relevant to determine the variables which an existential can covary with.

The interpretation function is of the form $[[-]]^{M,G,V}$, where G is a **set of assignments** and V the set of variables introduced by previous operators.

Exceptional scope: Independence Logics

(20) Every$_x$ student read every$_y$ paper that a$_z$ professor recommended.

a. Narrow Scope (NS): $\forall x \forall y \exists^{\{x,y\}} z \phi(x, y, z)$

b. Intermediate Scope (IS): $\forall x \forall y \exists^{\{x\}} z \phi(x, y, z)$

c. Wide Scope (WS): $\forall x \forall y \exists^{\varnothing} z \phi(x, y, z)$

$\exists^U z$ means the values of z are (possibly) different for any different value assigned to the variables in U. If $U = \varnothing$, then value of z is fixed.

Indefinites & Predication

In some cases, indefinites behave semantically like **predicates:**

(21) a. John is a linguist.

b. $L(j)$

Note that here we focused on singular NPs. The landscape is much more complex (bare plurals, partitive constructions, strong vs weak indefinites, . . .)

Outline

Partee's Type Shifting Principles

Three main uses of indefinites NPs and NPs in general.

(22) a. Referential: John/the man/a man/*every man walked in. He looked tired.

b. Predicative: Alfred is John/the man/a man/*every man.

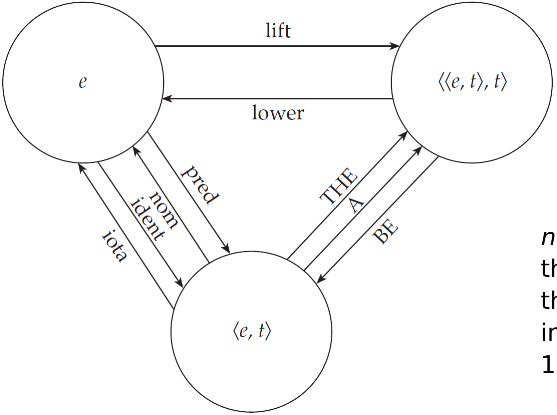
c. Quantificational: John/the man/a man/every man likes pasta.

In MG, (22) have all the same higher type ($\langle\langle e, t\rangle, t\rangle$). Partee (1986) assumes three basic types for NPs:

John	referential	j	e
A man	predicative	man	$\langle e, t\rangle$
Every man	quantificational	$\lambda P \forall x(man(x) \rightarrow P(x))$	$\langle\langle e, t\rangle, t\rangle$

Basic strategy: All NPs have meanings of type $\langle\langle e, t\rangle, t\rangle$, while only some NPs can have meanings of types e and/or $\langle e, t\rangle$, obtained by **type-shifting** rules.

Partee's Triangle



lift	$j \mapsto \lambda P P(j)$
lower	$lower(lift(j)) = j$ maps a principal ultrafilter on to its generator
ident	$j \mapsto \lambda x(x = j)$
iota	$P \mapsto \iota x P(x)$

nom maps properties onto their entity-correlates if these exist. *pred* is its inverse. (from Chierchia 1984)

BE, *A* and *THE* are 'natural' type shifting functors.

The type-shifters *BE* and *A*

$$BE : \lambda T \lambda x(T(\lambda y(y = x)))$$

BE satisfies some natural mathematical proprieties. It is an homomorphism from $\langle\langle e,t\rangle,t\rangle$ to $\langle e,t\rangle$, viewed as Boolean structures:

$BE(T_1 \cap T_2) = BE(T_1) \cap BE(T_2)$
$BE(T_1 \cup T_2) = BE(T_1) \cup BE(P_2)$
$BE(\neg T_1) = \neg BE(T_1)$

In many languages there is no direct expression for predication like the English *be*. *BE* is not the meaning of English *be*, but rather a type-shifting functor that is applied to an NP occurring in a $\langle e,t\rangle$ position.

$$A : \lambda P \lambda Q \exists x(P(x) \wedge Q(x)) \text{ [the inverse of } BE]$$

The case of indefinites

(23) **Quantificational**

a. A man is happy.
b. $A(man)(happy)$
c. $\exists x\,(man(x) \wedge happy(x))$

(24) **Predicative**

a. John is a man.
b. $BE(A(man))(\lambda XX(j))$
c. $man(j)$

(25) a.*John is every man.

b. $BE(every\ man) \equiv \lambda x \forall z(man(z) \rightarrow z = x)$ (This makes sense only if there is just one man!)

What about referential uses? The case of *the* or *John* is easy:

(26) a. John is at home. **He** eats.

b. $LOWER(\lambda XX(j)) = j$

But an indefinite like *a man* is not a principal filter!

We can employ Heim's treatment of indefinites as free variables: $\lambda P P(x_n^*)$ plus the separate condition $man(x_n)$.

$$\lambda P P(x_n^* \wedge man(x_n))$$

Partee's type-shifiting operators had a tremendous influence in the field of formal semantics (Chierchia 1998; De Swart 2001; Krifka 2003; Aloni 2007; Landman 2008; Charlow 2020).

Outline

A wealth of Indefinites

There is a wealth of indefinite forms which go beyond *a man* or *some man*:

- English: *some*, *any*, *no*, . . .
- Italian: *qualcuno*, *qualunque*, *nessuno*, *(un) qualche*, . . .
- Dutch: *iets*, *enig*, *wie dan ook*, *niets*, . . .
- German: *ein*, *irgendein*, . . .
- Russian: *koe-*, *-to*, *-nibud*, *ni-*, . . .
- . . .

Why so much variety in indefinite forms (less so in definite or universal forms)?

What is their common core? What is specific to each of them?

An example: Epistemic Indefinites

Plan indefinites can give rise to different pragmatic effects, including **ignorance inferences**:

(26) Plain Indefinite *Jemand*

a. *Jemand* *hat* *angerufen.*
Someone has called.

b. Conventional meaning: Someone has called.

c. Ignorance inference: The speaker does not know who called.

(27) Epistemic Indefinite *Irgendjemand*

a. *Irgendjemand* *hat* *angerufen.*
Irgend-someone has called.

b. Conventional meaning: Someone has called and the speaker does not know who called.

Interlude: Hamblin semantics for indefinites

Kratzer and Shimoyama (2002) develop a Hamblin semantics to capture the variety of indefinite forms.

Indefinites 'introduce' sets of propositional alternatives.

Alternatives are then bound by propositional operators: [∃], [∀], [Q], [¬].

Different indefinites associate with different operators:

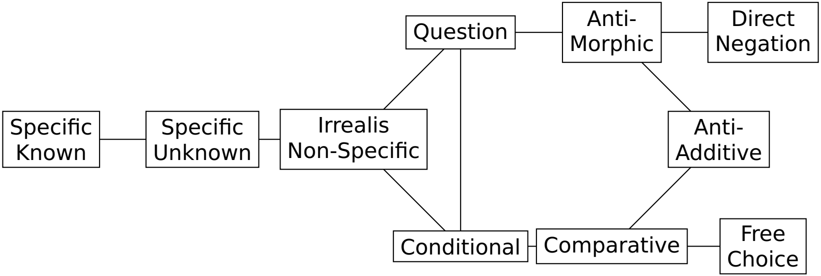
d_1 fell	d_2 fell	d_3 fell

(28) a. [∃] (someone fell)
b. [∀] (anyone$_{FC}$ fell)
c. [Q] (who fell)
d. [¬] (anyone$_{NPI}$ fell)

Outline

Haspelmath Map

Haspelmath (1997) proposed a map which captures the functional distribution of indefinites:



Haspelmath's map

Specific Known, Specific Unknown and Non-Specific

Today we focus on the *Specific Known* (SK), *Specific Unknown* (SU) and *Non-Specific* (NS) uses:

(29) a. Specific known: Someone called. I know who.

b. Specific unknown: Someone called. I do not know who.

c. Non-specific: John wants to go somewhere else.

Specific indefinites *usually* presuppose the existence of the referent and they can have discourse referents.

What is a function ?

Syntactic component: the indefinite must be grammatical in the syntactic context the function specifies.

Semantic component: the indefinite must have the semantics the function specifies.

English *someone* can exhibit SK uses:

(30) Someone did it. I know who.

Russian *-nibud* does not exhibit SK because it is ungrammatical in episodic sentences:

(31)*	*Ivan*	*včera*	*kupil*	*kakuju-nibud'*	*knigu.*
	Ivan	yesterday	bought	which-indef.	book.

'Ivan bought some book [non-specific] yesterday.'

German *irgend-* does not exhibit SK because it cannot have the meaning specificied by the function.

(32)	*Irgendein*	*Student*	*hat*	*angerufen.*	*#Rat*	*mal*	*wer?*
	some	student	has	called.	#guess		who?

'Some student called. #Guess who?

Marked Indefinites

Possible **marked indefinites** based on these functions:

type	functions			example
	sk	su	ns	
(i) unmarked	✓	✓	✓	Italian *qualcuno*
(ii) specific	✓	✓	✗	Georgian *-ghats*
(iii) non-specific	✗	✗	✓	Russian *-nibud*
(iv) epistemic	✗	✓	✓	German *irgend-*
(v) specific known	✓	✗	✗	Russian *koe-*
(vi) SK + NS	✓	✗	✓	unattested
(vii) specific unknown	✗	✓	✗	Kannada *-oo*

Our Goals

We develop a two-sorted team semantics which accounts for:

(a) the specific known, specific unknown and non-specific uses;

(b) the variety of marked indefinites mentioned before;

(c) the licensing of non-specific indefinites;

(d) the ignorance effects of epistemic indefinites;

(e) the relationship between scope and marked indefinites;

(f) the diachronic pathway from non-specific to epistemic;

(g) the contribution of epistemic indefinites (*irgend-*).

Licensing of non-specific indefinites

Non-specific indefinites are **ungrammatical in episodic sentences** and they need an operator (e.g. a universal quantifier or a modal) which licenses them:

(33)*	*Ivan*	*včera*	*kupil*	*kakuju-nibud'*	*knigu.*
	Ivan	yesterday	bought	which-indef.	book.

‘Ivan bought some book [non-specific] yesterday.’

Ignorance inferences in epistemic indefinites

Epistemic indefinites (e.g. Italian *un qualche*, German *irgend-*, . . .) signal speaker's **lack of knowledge**.

(34) *Una qualche persona ha chiamato.*
A some person has called.

‘Someone called. **The speaker does not know who**.’

(35) *Irgendein Student hat angerufen. #Rat mal wer?*
Some student has called. #guess who?

‘Some student called. #Guess who?

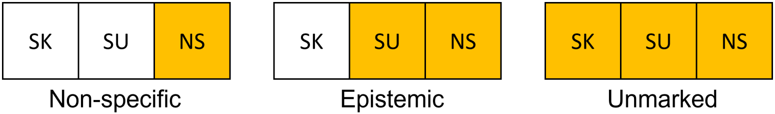
From non-specific to epistemic

Frequent diachronic tendency: **non-specific** indefinites turn to **epistemic** indefinites (i.e. they acquire SU uses).

Examples are French *quelque* (Foulet 1919) and German *irgendein* (Port and Aloni 2015).

Haspelmath (1997)'s explanation: weakening of functions from the right (non-specific) of the functional map to the left (specific).

(36) **Weakening of functions (c) > (b) > (a)**
(a) epistemic + specific known = unmarked
(b) non-specific + specific unknown = epistemic
(c) non-specific



But then why diachronically we do not observe the change from (b) to (a) ?

The Framework: Language & Team

In team semantics, formulas are interpreted wrt *sets* of evaluation points (*teams*) and not single evaluation points.

Language:

$$\phi ::= P(\vec{x}) | \phi \vee \psi | \phi \wedge \psi | \exists_{strict} x \phi | \exists_{lax} x \phi | \forall x \phi | dep(\vec{x}, \vec{y}) | var(\vec{x}, \vec{y})$$

Team:
Given a first-order model $M = \langle D, I \rangle$ and a sequence of variables $\vec{v}$, a team T over M with domain $Dom(T) = \vec{v}$ is a set of variable assignments from $\vec{v}$ to $Dom(M) = D$.

The Framework: Semantic Clauses

$M, T \models P(x_1, \ldots, x_n) \iff \forall j \in T : \langle j(x_1), \ldots, j(x_n)\rangle \in I(P^n)$

$M, T \models \phi \wedge \psi \iff M, T \models \phi$ and $M, T \models \psi$

$M, T \models \phi \vee \psi \iff T = T_1 \cup T_2$ for two teams T_1 and T_2 s.t. $M, T_1 \models \phi$ and $M, T_2 \models \psi$

$M, T \models \forall y \phi \iff M, T[/y] \models \phi$, where $T[/y] = \{i[d/y] : i \in T$ and $d \in D\}$

$M, T \models \exists_{\text{strict}} y \phi \iff$ there is a function $h : T \to D$ s.t. $M, T[h/y] \models \phi$, where $T[h/y] = \{i[h(i)/y] : i \in T\}$

$M, T \models \exists_{\text{lax}} y \phi \iff$ there is a function $f : T \to \wp(D) \setminus \{\emptyset\}$ s.t. $M, T[f/y] \models \phi$, where $T[f/y] = \{i[d/y] : i \in T$ and $d \in f(i)\}$

Illustrations - Universal Extension

$M, T \models \forall y \phi \Leftrightarrow M, T[/y] \models \phi$, where $T[/y] = \{i[d/y] : i \in T \text{ and } d \in D\}$

T	x
i_1	d_1
i_2	d_2

$T[/y]$	x	y
i_{11}	d_1	d_1
i_{12}	d_1	d_2
i_{21}	d_2	d_1
i_{22}	d_2	d_2

($D = \{d_1, d_2\}$. Universal extensions are unique.)

Illustrations - Strict Functional Extension

$M, T \models \exists_{\text{strict}} y\phi \Leftrightarrow$ there is a function $h : T \to D$ s.t. $M, T[h/y] \models \phi$, where $T[h/y] = \{i[h(i)/y] : i \in T\}$

T	x
i_1	d_1
i_2	d_2

$T[h/y]$	x	y
i_{12}	d_1	d_2
i_{21}	d_2	d_1

(With $D = \{d_1, d_2\}$ we have 4 possible strict functional extensions)

Illustrations - Lax Functional Extension

$M, T \models \exists_{\text{lax}} y\phi \Leftrightarrow$ there is a function $f : T \rightarrow \wp(D) \backslash \{\emptyset\}$ s.t.
$M, T[f/y] \models \phi$, where
$T[f/y] = \{i[d/y] : i \in T \text{ and } d \in f(i)\}$

T	x
i_1	d_1
i_2	d_2

$T[f/y]$	x	y
i_{12}	d_1	d_2
i_{21}	d_2	d_1
i_{22}	d_2	d_2

(With $D = \{d_1, d_2\}$ we have 9 possible lax functional extensions)

Dependence Atoms

Dependence atoms (Väänänen 2007; Galliani 2015) impose conditions of dependence on the variable's values across different assignments:

Dependence Atom:

$$M, T \models dep(\vec{x}, \vec{y}) \Leftrightarrow \text{ for all } i, j \in T : i(\vec{x}) = j(\vec{x}) \Rightarrow i(\vec{y}) = j(\vec{y})$$

Variation Atom:

$$M, T \models var(\vec{x}, \vec{y}) \Leftrightarrow \text{ there is } i, j \in T : i(\vec{x}) = j(\vec{x}) \,\&\, i(\vec{y}) \neq j(\vec{y})$$

T	x	y	z	l
i	a_1	b_1	c_1	d_1
j	a_1	b_1	c_2	d_1
k	a_3	b_2	c_3	d_1

$dep(x, y)$ $\quad$ $var(x, z)$

$dep(\varnothing, l)$ $\quad$ $var(\varnothing, x)$

Indefinites as Existentials & Syntactic Scope

Indefinites are **strict existentials** ($\exists_{\text{strict}} x$).

They are interpreted *in-situ*.

An unmarked indefinite $\exists x$ in **syntactic scope** of $O_{\vec{z}}$ allows all $dep(\vec{y}, x)$, with $\vec{y}$ included in $\vec{z}$.

$$\forall w \ldots \forall y \ldots \exists x \, (\phi \wedge dep(\vec{y}, x))$$

(We will claim that marked indefinites come with particular restrictions on dependence and variation atoms)

Exceptional Scope

(38) Every kid$_x$ ate every food$_z$ that a doctor$_y$ recommended.

a. WS [$\exists y/\forall x/\forall z$]: $\forall x \forall z \exists y(\phi \wedge dep(\emptyset, y))$

b. IS [$\forall x/\exists y/\forall z$]: $\forall x \forall z \exists y(\phi \wedge dep(x, y))$

c. NS [$\forall x/\forall z/\exists y$]: $\forall x \forall z \exists y(\phi \wedge dep(xz, y))$

x	z	y
...	...	b_1
...	...	b_1
...	...	b_1
...	...	b_1

WS: $dep(\emptyset, y)$

x	z	y
a_1	...	b_1
a_1	...	b_1
a_2	...	b_2
a_2	...	b_2

IS: $dep(x, y)$

x	z	y
a_1	c_1	b_1
a_1	c_2	b_2
a_2	c_1	b_3
a_2	c_2	b_4

NS: $dep(xz, y)$

Adding Worlds

To capture the epistemic readings (known vs unknown), we use a **two-sorted** framework with v as designated variable for the actual world. A model is a triple $M = \langle W, D, I \rangle$

Teams represent information states of speakers. In initial teams only factual information is represented (no discourse information).

Initial Team: A team T is *initial* iff $Dom(T) = \{v\}$.

A sentence is **felicitous/grammatical** if there is an initial team which supports it.

Specific Known, Specific Unknown, Non-specific

constancy	$dep(\emptyset, x)$	v	x
		$\ldots$	d_1
		$\ldots$	d_1
variation	$var(\emptyset, x)$	v	x
		$\ldots$	d_1
		$\ldots$	d_2
v-constancy	$dep(v, x)$	v	x
		v_1	d_1
		v_2	d_2
v-variation	$var(v, x)$	v	x
		v_1	d_1
		v_1	d_2

Specific Known:
constancy $dep(\emptyset, x)$

v	$\ldots$	x
$\ldots$	$\ldots$	d_1
$\ldots$	$\ldots$	d_1

Specific Known, Specific Unknown, Non-specific

		v	x
constancy	$dep(\varnothing, x)$	$\ldots$	d_1
		$\ldots$	d_1
		v	x
variation	$var(\varnothing, x)$	$\ldots$	d_1
		$\ldots$	d_2
		v	x
v-constancy	$dep(v, x)$	v_1	d_1
		v_2	d_2
		v	x
v-variation	$var(v, x)$	v_1	d_1
		v_1	d_2

Specific Unknown:
v-constancy $dep(v, x)$ +
variation $var(\varnothing, x)$

v	$\ldots$	x
v_1	$\ldots$	d_1
v_2	$\ldots$	d_2

Specific Known, Specific Unknown, Non-specific

constancy	$dep(\emptyset, x)$	v	x
		$\dots$	d_1
		$\dots$	d_1
variation	$var(\emptyset, x)$	v	x
		$\dots$	d_1
		$\dots$	d_2
v-constancy	$dep(v, x)$	v	x
		v_1	d_1
		v_2	d_2
v-variation	$var(v, x)$	v	x
		v_1	d_1
		v_1	d_2

Non-specific:
v-variation $var(v, x)$

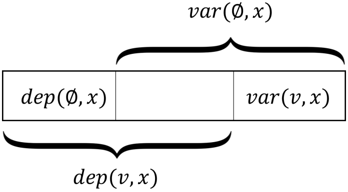
v	$\dots$	x
v_1	$\dots$	d_1
v_1	$\dots$	d_2

Variety of Indefinites

type	functions			requirement	example
	sk	su	ns		
(i) unmarked	✓	✓	✓	none	Italian *qualcuno*
(ii) specific	✓	✓	✗	$dep(v, x)$	Georgian *-ghats*
(iii) non-specific	✗	✗	✓	$var(v, x)$	Russian *-nibud*
(iv) epistemic	✗	✓	✓	$var(\varnothing, x)$	German *-irgend*
(v) specific known	✓	✗	✗	$dep(\varnothing, x)$	Russian *-koe*
(vi) SK + NS	✓	✗	✓	$dep(\varnothing, x) \vee var(v, x)$	unattested
(vii) specific unknown	✗	✓	✗	$dep(v, x) \wedge var(\varnothing, x)$	Kannada *-oo*

(vii) specific unknown: increased complexity

(vi) SK + NS: violation of connectedness (Gardenfors 2014; Enguehard and Chemla 2021)



(We will revise these requirements in light of our discussion about scope)

Licensing of non-specific indefinites

Non-specific indefinites cannot occur freely in episodic sentences, but they need an operator to be licensed.

Recall that non-specific indefinites trigger v-variation: $var(v, x)$.

v
v_1
v_2

Licensing of non-specific indefinites

Non-specific indefinites cannot occur freely in episodic sentences, but they need an operator to be licensed.

Recall that non-specific indefinites trigger v-variation: $var(v, x)$.

$$\exists x \; (\phi \wedge var(v, x))$$

v
v_1
v_2

v	x
v_1	a_1
v_2	a_2

Licensing of non-specific indefinites

Non-specific indefinites cannot occur freely in episodic sentences, but they need an operator to be licensed.

Recall that non-specific indefinites trigger v-variation: $var(v, x)$.

$$\forall y\ \phi$$

v
v_1
v_2

v	y
v_1	b_1
v_1	b_2
v_2	b_1
v_2	b_2

Licensing of non-specific indefinites

Non-specific indefinites cannot occur freely in episodic sentences, but they need an operator to be licensed.

Recall that non-specific indefinites trigger v-variation: $var(v, x)$.

$$\forall y \exists x\ (\phi \wedge var(v, x))$$

v
v_1
v_2

v	y
v_1	b_1
v_1	b_2
v_2	b_1
v_2	b_2

v	y	x
v_1	b_1	a_1
v_1	b_2	a_2
v_2	b_1	a_1
v_2	b_2	a_2

But indefinites can also be licensed by modals.

Modality

We can analyze modals as **(lax) quantifiers** ($\Diamond_w \sim \exists_{lax} w$) modulo an accessibility relation.

(39) a. You can take nibud-book (non-specific).

b. $\Diamond_w \exists x(\phi \wedge var(v, x))$

c. $\exists_{lax} w\,(Rvw \wedge \exists x(\phi \wedge var(v, x)))$

v	w	x
v_1	w_1	a_1
v_1	w_2	a_2
v_2	w_1	a_1

Epistemic Indefinites and ignorance inference

(40) *Una qualche persona ha chiamato.*
A some person has called.

'Someone called. **The speaker does not know who**.'

$$\exists x(\phi(v, x) \wedge var(\varnothing, x))$$

v	x
v_1	a_1
v_2	a_2
...	...

Interaction with Scope

Marked indefinites trigger the activation of particular atoms.

We integrate them with the dependence atoms for scope, accounted by $dep(\vec{y}, x)$.

$$\exists x(\phi \wedge \ldots)$$

Plain: $dep(\vec{y}, x)$

SK: $dep(\vec{y}, x)$ with $\vec{y} = \emptyset$

Specific: $dep(\vec{y}, x)$ with $\vec{y} \subseteq \{v\}$

Epistemic: $dep(\vec{y}, x) \wedge var(\vec{z}, x)$ with $\vec{z} = \emptyset$

Non-specific: $dep(\vec{y}, x) \wedge var(\vec{z}, x)$ with $\vec{z} = v$

SU: $dep(\vec{y}, x) \wedge var(\vec{z}, x)$ with $\vec{y} = v$ and $\vec{z} = \emptyset$

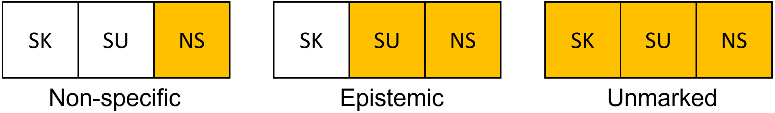
Illustration

$$\forall z \forall y \exists x\, \phi$$

	WS-K $dep(\emptyset, x)$	WS-U $dep(v, x)$	IS $dep(vy, x)$	NS $dep(vyz, x)$
unmarked	✓	✓	✓	✓
specific $dep(\subseteq v, x)$	✓	✓	✗	✗
non-specific $var(v, x)$	✗	✗	✓	✓
epistemic $var(\emptyset, x)$	✗	✓	✓	✓
specific known $dep(\emptyset, x)$	✓	✗	✗	✗
specific unknown $dep(v, x) \wedge var(\emptyset, x)$	✗	✓	✗	✗

From non-specific to epistemic

(41) **Weakening of functions (c) > (b) > (a)**
(a) epistemic + specific known = unmarked
(b) non-specific + specific unknown = epistemic
(c) non-specific



This framework makes the notion of weakening precise in terms of **logical entailment** between atoms.

We have weakening from non-specific to epistemic: $var(v, x)$ entails $var(\varnothing, x)$.

But no further 'atomic weakening' triggering the acquisition of SK. (In fact, $var(\varnothing, x) \not\models dep(\varnothing, x)$).

Interim Conclusion

We have developed a **two-sorted team semantics** framework accounting for indefinites.

In this framework, **marked indefinites** trigger the obligatoriness of dependence or variation atoms, responsible for their scopal and epistemic interpretations.

We have applied the framework to characterize the **typological variety of indefinites** in the case of specificity.

We have then showed how this system can be used to explain several **properties and phenomena** associated with (non)-specific indefinites.

Outline

Epistemic Indefinites

Basic facts about EIs we want to account for:

(i) They trigger an obligatory **ignorance inference** (undefeasible in episodic contexts);

(ii) They allow for non-specific (**co-variation**) uses;

(iii) Some EIs behave as **NPI under negation**;

(iv) Some EIs (e.g. German *irgend-*) also admit **Free Choice** uses.

Data

(41) **Undefeasible Ignorance Inference**

Un qualche studente ha chiamato. #Indovina chi?
un qualche Student has called. guess who?

'Some (unknown) student has called. # Guess who?

(42) **Co-Variation**

Todos los profesores están bailando con algún estudiante.
all the professors are dancing with algún student.

'Every professor is dancing with some student.'

(43) **NPI** (only for a subset of EIs, e.g. German *irgend-*)

Niemand hat irgendeine Frage beantwortet.
Nobody has irgend-one question answered.

'Nobody answered any question.'

(44) **Free Choice** (only for a subset of EIs, e.g. German *irgend-*)

Mary muss irgendeinen Arzt heiraten.
Mary must irgend-one doctor marry.

'Mary must marry a doctor, any doctor is a permissible option'.

The Conceptual Covers Approach

(45) John is reading *irgendein*-book

A Conceptual Cover is a set of individual concepts (functions from worlds to individuals) that ‘cover’ the domain of quantification.

(46) a. $\{\lambda w\ \text{left}_w(x),\ \lambda w\ \text{right}_w(x)\}$ Ostension

b. $\{\lambda w\ \text{new}_w(x),\ \lambda w\ \text{old}_w(x)\}$ Description

c. $\{\lambda w\ \textit{Moby Dick},\ \lambda w\ \textit{Ulysees}\}$ Naming

Aloni and Port (2015): modal logic where variables range over elements of pragmatically selected conceptual covers *n*, *m* (modelling different methods of identifications):

Specific: speaker can identify on one method (e.g. description) $\Rightarrow \exists x_n \Box \phi$
Unknown: but not on one other (e.g. naming) $\Rightarrow \neg \exists x_m \Box \phi$

The implicature approach

EIs trigger an anti-singleton constraint on their domain of quantification.

$$[\![\text{irgendein}]\!] = \lambda f \lambda P_{\langle e,t\rangle} \lambda Q_{\langle e,t\rangle}\ |f(P)| > 1 \wedge \exists x (f(P)(x) \wedge Q(x))$$

(47) John is in *irgendein*-room. $f(room) = \{\text{A, B, C}\}$

a. John is in {A, B, C}.

b. John is in {A}.

c. John is in {B}.

d. John is in {C}.

The alternatives in (47 b-d) are stronger than the assertion. Maxim of Quantity leads to ignorance inference (see different implementations in Kratzer and Shimoyama 2002; Alonso-Ovalle and Menéndez-Benito 2010; Chierchia 2013).

In downward-entailing environments, the competitors are weaker than the assertion.

Exercise

How can the Implicature Approach account for co-variation cases like (48) ?

(48) Every student is reading some-(epistemic) book

Epistemic Indefinites: Generalized Variation

Previously, we have assumed that epistemic indefinites trigger $var(\emptyset, x)$.

To account for NPI uses, we adopt an intensional notion of negation.

To account for free choice, we generalize the variation atom to express the cardinality of the variation and to allow for splitting:

$M, T \models var_n(\vec{y}, x)$ iff $\forall d \in D^* \subseteq D$ with $|D^*| \geq n,$ for all $i \in T,$ there is a $j \in T_{i,\vec{y}}$ s.t. $j(x) = d,$ where $T_{i,\vec{y}} = \{j \in T : i(\vec{y}) = j(\vec{y})\}$

Note: $var(\emptyset, x)$ is equivalent to $var_2(\emptyset, x)$.

Epistemic Indefinites: German *Irgend*- (1)

We assume that *irgend* associate with $var_2(\emptyset, x)$.

Non-specific readings are obtained via dependency atoms assuming a domain ≥ 2.

$var_{|D|}(v, x)$ models **free choice** (full non-specificity), possibily triggered by prosodic prominence.

Intuitively, $var_{|D|}(v, x)$ allows for splitting. For $D = \{a, b, c\}$:

v	w	x
v_1	w_1	a
v_1	w_2	b
v_1	w_3	c
v_2	w_1	a
v_2	w_2	b
v_2	w_3	c

We can show that:

$$\Box_w \exists x\, (\phi \wedge var_{|D|}(v, x)) \rightsquigarrow \forall x (\Diamond_w\, \phi)$$

Epistemic Indefinites: German *Irgend-* (2)

(49) a. *Jeder$_y$ Student hat irgendein$_x$ Buch gelesen.*
every student has irgendein book read.

b. specific unknown:
$\forall y \exists x\, (\phi \wedge dep(v, x) \wedge var_2(\emptyset, x))$

c. non-specific:
$\forall y \exists x\, (\phi \wedge dep(vy, x) \wedge var_2(\emptyset, x))$

(50) *Mary musste$_w$ irgendeinen$_x$ Mann heiraten.*
Mary had-to irgend-one man marry.

a. specific unknown:
$\forall w \exists x\, (\phi \wedge dep(v, x) \wedge var_2(\emptyset, x))$

b. free choice:
$\forall w \exists x\, (\phi \wedge dep(vw, x) \wedge var_{|D|}(v, x))$

The case of negation

Plainly adding negation is problematic, because dependence atoms cannot be directly negated.

(51) a. John has some[specific-known] book.

b. $\exists x\,(\phi \wedge dep(\emptyset, x))$

(52) a. John does not have a book.

b. $\exists x(\text{book}(x) \wedge \neg\text{have}(j, x))$

c. $\neg\exists x(\text{book}(x) \wedge \text{have}(j, x))$

How to deal with negation and dependence atoms ?

The case of negation

We adopt an intensional notion of negation

(53) **Intensional Negation**

$$\neg\phi(v) \Leftrightarrow \forall w(\phi(w) \rightarrow v \neq w)$$

Dependence Logics (Yang 2014; Abramsky and Väänänen 2009) employ different notions of implication (material, intuitionistic, linear and maximal). Here we adopt (a version of) the maximal implication.

(54) **Semantic Clause for Implication**

$M, X \models \phi \rightarrow \psi \Leftrightarrow$ for **some** $X' \subseteq X$ s.t. $M, X' \models \phi$ and X' is maximal (i.e. for all $X'' \subseteq X$, if $M, X'' \models \phi$, then $X'' \subseteq X'$), we have $M, X' \models \psi$

The case of negation

(55) a. John does not have *irgend*-book (epistemic).

b. $\forall w(\exists x(\phi(x,w) \wedge var(\varnothing,x)) \rightarrow v \neq w)$

c. $\exists x(\phi(x,w) \wedge var(\varnothing,x))$

v	w	x
$w_\varnothing$	$w_\varnothing$	a
$w_\varnothing$	w_a	a
$w_\varnothing$	w_b	b
$w_\varnothing$	w_{ab}	b

(a)

v	w	x
$w_\varnothing$	$w_\varnothing$	b
$w_\varnothing$	w_a	a
$w_\varnothing$	w_b	b
$w_\varnothing$	w_{ab}	a
w_a	$w_\varnothing$	a
$\mathbf{w_a}$	$\mathbf{w_a}$	$\mathbf{a}$
w_a	w_b	b
w_a	w_{ab}	b

(b)

Maximal Teams for (55c)

The case of negation

(56) a. John does not have some-specific book (specific known).

b. $\forall w(\exists x(\phi(x,w) \wedge dep(\emptyset,x)) \rightarrow v \neq w)$

c. $\exists x(\phi(x,w) \wedge dep(\emptyset,x))$

v	w	x
$w_{\emptyset}$	$w_{\emptyset}$	a
$w_{\emptyset}$	w_a	a
$w_{\emptyset}$	w_b	a
$w_{\emptyset}$	w_{ab}	a
w_a	$w_{\emptyset}$	a
w_a	w_a	a
w_a	w_b	a
w_a	w_{ab}	a

(c)

v	w	x
$w_{\emptyset}$	$w_{\emptyset}$	b
$w_{\emptyset}$	w_a	b
$w_{\emptyset}$	w_b	b
$w_{\emptyset}$	w_{ab}	b
w_a	$w_{\emptyset}$	b
w_a	w_a	b
w_a	w_b	b
w_a	w_{ab}	b

(d)

Maximal Teams for (56c)

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