(Non-)specificity across languages: constancy, variation, *v*-variation

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Plan

1. Introduction

2. Desiderata

3. The Framework

4. Applications

5. Epistemic Indefinites

6. Conclusion

Outline

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A wealth of Indefinites

Cross-linguistically, we witness a wealth of indefinite forms:

English: *some*, *any*, *no*, . . .

Italian: *qualcuno*, *qualunque*, *nessuno*, *(un) qualche*, . . .

Dutch: *iets*, *enig*, *wie dan ook*, *niets*, . . .

German: *ein*, *irgendein*, . . .

Russian: *koe-*, *-to*, *-nibud*, . . .

Spanish: *algún*, *cualquiera*, *ningun*, . . .

Náhuatl/Mexicano (Tuggy 1979): *yeka*, *sente*, *olgo*, . . .

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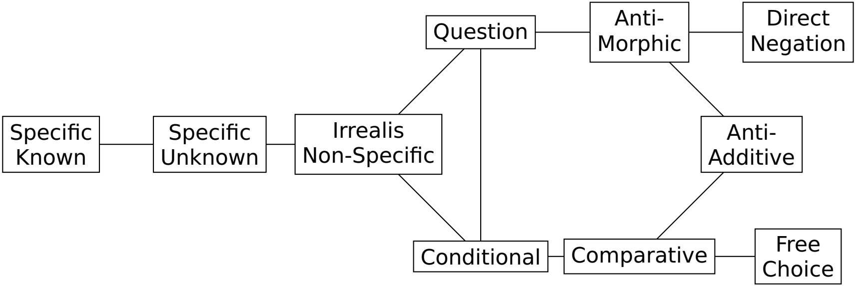
Today's focus: scopal (specific vs non-specific) and epistemic (known vs unknown) uses of indefinites.

Haspelmath Map

Haspelmath (1997)'s map: a useful typological tool to capture the functional distribution of indefinites:



Haspelmath's map

Specific Known, Specific Unknown and Non-Specific

We focus on three main uses in the area of (non)specificity:

(1) 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.

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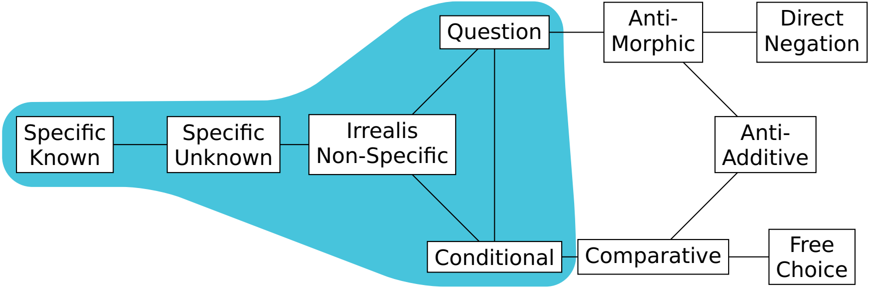
Specific vs non-specific: indefinites marked for specificity tend to presuppose the existence of their referent, and they can have discourse referents.

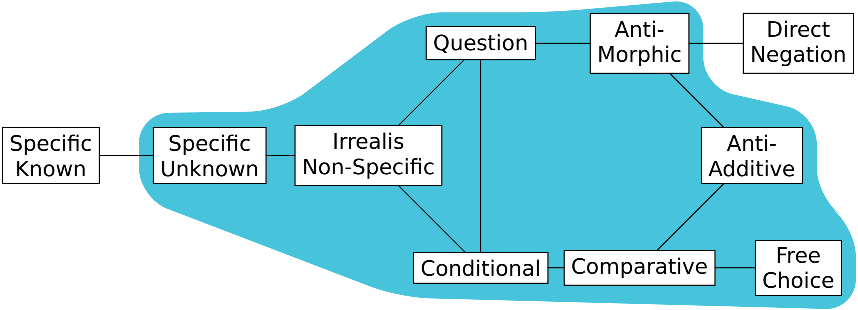
Known vs unknown: indefinites marked for (un)known signal that the speaker does (not) know the identity of the referent.

Haspelmath Map



English *someone*

Haspelmath Map



German *irgend-*

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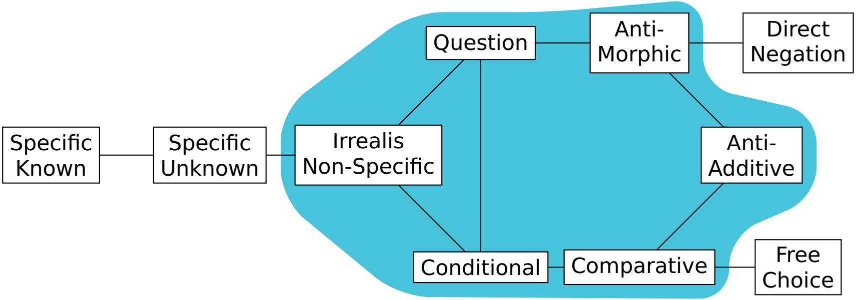

Russian *nibud'*

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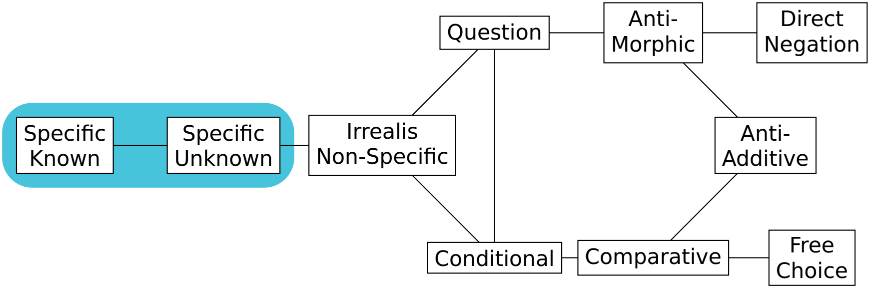

Kazakh *älde*

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Our Goals

(1) the logical characterization of the specific known (SK), specific unknown (SU) and non-specific (NS) uses;

(2) a formal account of the variety of marked indefinites encoding SK, SU, and NS; and their properties.

(3) a formal account of the contribution of epistemic indefinites (*irgend-*).

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Main idea: Indefinites are sensitive to *dependence* and *non-dependence* relationships in their value assignments. (building on insights from Brasoveanu and Farkas 2011; Farkas and Brasoveanu 2020).

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Implementation: Two-sorted team semantics with dependence atoms.

Marked Indefinites

Possible **marked indefinites** based on Specific Known (SK), Specific Unknown (SU) and Non-specific (NS):

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*

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Why non-specific have a restricted distribution (unavailable in episodic contexts)?

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How to characterize the obligatory ignorance inferences typical of epistemic indefinites?

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Why diachronically non-specific indefinites tend to turn into epistemic ones?

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Why (vi) is unattested and (vii) rare?

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What scope configurations are possible for marked indefinites (e.g. narrow, intermediate, wide)?

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

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Here, we use a **two-sorted** framework (a model is a triple $M = \langle D, W, I \rangle$):

(i) possible worlds introduced as second sort of entities (special variables v_1, v_2 for worlds which can be quantified over);

(ii) v as designated variables over worlds, representing alternative ways things might be (epistemic possibilities).

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Language:

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

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Team:
Given a model $M = \langle D, W, I \rangle$ and a sequence of variables $\vec{z}$, a team T over M with domain $Dom(T) = \vec{z}$ is a set of assignment functions mapping world variables to elements of W and individual variables to elements of D.

Teams as information states

Teams represent information states of speakers.

In initial teams only factual information is represented.

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

The world variable v captures the speaker's epistemic possibilities.

Teams where v receives only one value are teams of *maximal information*.

v
v_1
v_2
...
v_n

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v	x
v_1	a
v_2	a
$\ldots$	a
v_n	a

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v	x	w
v_1	a	w_1
v_2	a	w_2
$\dots$	a	$\dots$
v_n	a	w_n

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v	x	w	y
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v_2	a	w_2	b_2
$\dots$	a	$\dots$	$\dots$
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$\ldots$	a	$\ldots$	$\ldots$	$\ldots$
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v_2	a	w_2	b_2	$\dots$
$\dots$	a	$\dots$	$\dots$	$\dots$
v_n	a	w_n	b_n	$\dots$

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

Universal Extension

$$T[y] = \{i[d/y] : i \in T \text{ and } d \in D\}$$

A **universal extension** of a team T with y, denoted by $T[y]$, amounts to consider all assignments that differ from the ones in T only with respect to the value of y.

v	T
v_1	i_1
v_2	i_2

v	y	$T[y]$
v_1	d_1	i_{11}
v_1	d_2	i_{12}
v_2	d_1	i_{21}
v_2	d_2	i_{22}

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

Strict Functional Extension

$$T[h/y] = \{i[h(i)/y] : i \in T\}, \text{for some function } h : T \rightarrow D$$

A **strict functional extension** of a team T with y, denoted by $T[h/y]$, amounts to assign only one value to y for each original assignment in T.

v	T
v_1	i_1
v_2	i_2

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

v	y	$T[h_1/y]$
v_1	$\longrightarrow d_1$	i_{12}
v_2	$\longrightarrow d_1$	i_{21}

v	y	$T[h_2/y]$
v_1	$\longrightarrow d_2$	i_{12}
v_2	$\longrightarrow d_2$	i_{21}

x	y	$T[h_3/y]$
v_1	$\longrightarrow d_1$	i_{12}
v_2	$\longrightarrow d_2$	i_{21}

x	y	$T[h_4/y]$
v_1	$\longrightarrow d_2$	i_{12}
v_2	$\longrightarrow d_1$	i_{21}

Lax Functional Extension

$T[f/y] = \{i[d/y] : i \in T \text{ and } d \in f(i)\}$, for some function $f : T \to \wp(D) \setminus \{\varnothing\}$

A **lax functional extension** of a team T with y, denoted by $T[h/y]$, amounts to assign one or more values to y for each original assignment in T.

v	T
v_1	i_1
v_2	i_2

v		y	$T[f/y]$
v_1	$\longrightarrow$	d_2	i_{12}
v_2	$\longrightarrow$	d_1	i_{21}
	$\searrow$	d_2	i_{22}

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

Semantic Clauses

$M, T \models P(x_1, \ldots, x_n)$	$\Leftrightarrow$	$\forall j \in T : \langle j(x_1), \ldots, j(x_n) \rangle \in I(P^n)$
$M, T \models \phi \wedge \psi$	$\Leftrightarrow$	$M, T \models \phi$ and $M, T \models \psi$
$M, T \models \phi \vee \psi$	$\Leftrightarrow$	$T = T_1 \cup T_2$ for teams T_1 and T_2 s.t. $M, T_1 \models \phi$ and $M, T_2 \models \psi$
$M, T \models \forall y \phi$	$\Leftrightarrow$	$M, T[y] \models \phi$, where $T[y] = \{i[d/y] : i \in T \text{ and } d \in D\}$
$M, T \models \exists_{\text{strict}} y \phi$	$\Leftrightarrow$	there is a function $h : T \rightarrow D$ s.t. $M, T[h/y] \models \phi$, where $T[h/y] = \{i[h(i)/y] : i \in T\}$
$M, T \models \exists_{\text{lax}} y \phi$	$\Leftrightarrow$	there is a function $f : T \rightarrow \wp(D) \backslash \{\varnothing\}$ s.t. $M, T[f/y] \models \phi$, where $T[f/y] = \{i[d/y] : i \in T \text{ and } d \in f(i)\}$
$M, T \models dep(\vec{x}, y)$	$\Leftrightarrow$	for all $i, j \in T : i(\vec{x}) = j(\vec{x}) \Rightarrow i(y) = j(y)$
$M, T \models var(\vec{x}, y)$	$\Leftrightarrow$	there is $i, j \in T : i(\vec{x}) = j(\vec{x})$ & $i(y) \neq j(y)$

Dependence Atoms

Dependence atoms (Väänänen 2007; Galliani 2015) model dependency patterns between variables' values:

Dependence Atom:

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Variation Atom:

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

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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

$dep(x, y)$ ✓

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$dep(xy, z)$ ✗

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$dep(x, y)$ ✓ $var(x, z)$ ✓

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$dep(x, y)$ ✓ $var(x, z)$ ✓

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

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Dependence atoms (Väänänen 2007; Galliani 2015) model dependency patterns between variables' values:

Dependence Atom:

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

Variation Atom:

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

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

$dep(x, y)$ ✓ $var(x, z)$ ✓

$dep(\emptyset, l)$ ✓ $var(\emptyset, x)$ ✓

$dep(xy, z)$ ✗ $var(x, y)$ ✗

Outline

1. Introduction

2. Desiderata

3. The Framework

4. Applications

5. Epistemic Indefinites

6. Conclusion

Indefinites as Existentials

We propose that:

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

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Dependence atoms can be used to model the **scope** behaviour of indefinites, by specifying how their value (co-)varies with other operators.

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Dependence atoms can be used to model the **scope** behaviour of indefinites, by specifying how their value (co-)varies with other operators.

(For scope, our system parallels Brasoveanu and Farkas (2011)'s treatment).

Application I: Exceptional Scope

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

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

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

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

v	x	z	y
v_1	...	...	b_1
v_1	...	...	b_1
v_1	...	...	b_1
v_1	...	...	b_1

WS: $dep(v, y)$

v	x	z	y
v_1	a_1	...	b_1
v_1	a_1	...	b_1
v_1	a_2	...	b_2
v_1	a_2	...	b_2

IS: $dep(vx, y)$

v	x	z	y
v_1	a_1	c_1	b_1
v_1	a_2	c_2	b_2
v_1	a_3	c_3	b_3
v_1	a_4	c_4	b_4

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v_1	a_2	c_2	b_2
v_1	a_3	c_3	b_3
v_1	a_4	c_4	b_4

NS: $dep(vxz, y)$

But how to account for the known vs unknown contrast?

Application II: Specific Known, Specific Unknown, Non-specific

constancy	$dep(\emptyset, x)$	v	x
		...	d_1
		...	d_1
variation	$var(\emptyset, x)$	v	x
		...	d_1
		...	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

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constancy	$dep(\emptyset, x)$	v	x
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		$\ldots$	d_1
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		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
v_1	$\ldots$	d_1
v_2	$\ldots$	d_1

Application II: Specific Known, Specific Unknown, Non-specific

constancy	$dep(\varnothing, x)$	v	x
		$\ldots$	d_1
		$\ldots$	d_1
variation	$var(\varnothing, x)$	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 Unknown:
v-constancy $dep(v, x)$ +
variation $var(\varnothing, x)$

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

Application II: Specific Known, Specific Unknown, Non-specific

constancy	$dep(\emptyset, x)$	$\begin{array}{cc} v & x \\ \hline \ldots & d_1 \\ \hline \ldots & d_1 \end{array}$
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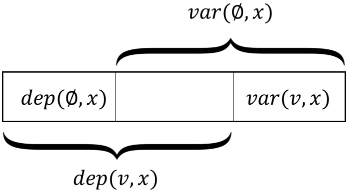
v-variation	$var(v, x)$	$\begin{array}{cc} v & x \\ \hline v_1 & d_1 \\ \hline v_1 & d_2 \end{array}$

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

$$\begin{array}{ccc} v & \ldots & x \\ \hline v_1 & \ldots & d_1 \\ \hline v_1 & \ldots & d_2 \end{array}$$

Application III: 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	✓	✗	✓	$dep(\varnothing, x) \veebar var(v, x)$	unattested
(vii) specific unknown	✗	✓	✗	$dep(v, x) \wedge var(\varnothing, x)$	Kannada -*oo*



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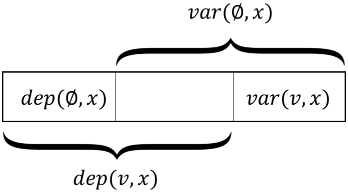

(vii) specific unknown: increased complexity

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(iv) epistemic	✗	✓	✓	$var(\emptyset, x)$	German *-irgend*
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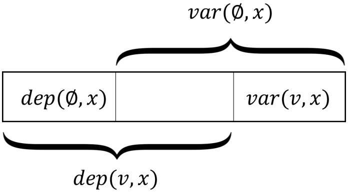

(vii) specific unknown: increased complexity

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

Application IV: 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:

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

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

(4) *Ivan hotel spet' kakuju-nibud' pesniu.*
Ivan want-PAST sing-INF which-indef. song.

Ivan wanted to sing some song [non-specific].

Application IV: Licensing of non-specific indefinites

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

v
v_1

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

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

v
v_1

v	x
v_1	a_1

Application IV: Licensing of non-specific indefinites

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

$$\forall y\ \phi$$

v
v_1

v	y
v_1	b_1
	b_2

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

v
v_1

v	y
v_1	b_1
	b_2

v	y	x
v_1	b_1	a_1
	b_2	a_2

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

v
v_1

v	y
v_1	b_1
	b_2

v	y	x
v_1	b_1	a_1
	b_2	a_2

But indefinites can also be licensed by modals.

Modality

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

(5) You must/can take nibud-book (non-specific).

a. $\forall w \exists_s x(\phi \wedge var(v, x))$

b. $\exists_l w \, \exists_s x(\phi \wedge var(v, x))$

v	w	x
v_1	w_1	a_1
	w_2	a_2

Supporting

v	w	x
v_1	w_1	a_1
	w_2	a_1

Non-supporting

Application V: Epistemic Indefinites and ignorance inference

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

(6) *Irgendjemand hat angerufen.*
irgend-someone has called.

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

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(6)	*Irgendjemand*	*hat*	*angerufen.*
	irgend-someone	has	called.

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

Ignorance inferences are typically undefeasible:

(7)	*Irgendjemand*	*hat*	*angerufen.*	*#Rat mal*	*wer*
	irgend-someone	has	called.	guess	who?

‘Someone called. #Guess who?

(Kratzer and Shimoyama 2002; Alonso-Ovalle and Menéndez-Benito 2010; Alonso-Ovalle and Menéndez-Benito 2017; Jayez and Tovena 2006; Aloni and Port 2015; Chierchia 2013)

Application V: Epistemic Indefinites and ignorance inference

(8) *Irgendjemand hat angerufen.*
irgend-someone has called.

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

Recall that epistemic indefinites trigger $var(\varnothing, x)$:

$$\exists_s x(\phi(v,x) \land var(\varnothing, x))$$

v	x
v_1	a_1
v_2	a_2

Supporting

v	x
v_1	a_1
v_2	a_1

Non-supporting

Final Proposal

We propose that:

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(iii) An unmarked/plain indefinite $\exists_s x$ in **syntactic scope** of $O_{\vec{z}}$ allows all $dep(\vec{y}, x)$, with $\vec{y}$ included in $v\vec{z}$:

$$O_{z_1} \ldots O_{z_n} \exists_s x(\phi \wedge dep(\vec{y}, x))$$

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$$O_{z_1} \dots O_{z_n} \exists_s x(\phi \wedge dep(\vec{y}, x))$$

(iv) **Marked indefinites** trigger the obligatory activation of particular dependence or variation atoms.

Final Proposal

$$O_{z_1} \ldots O_{z_n} \exists_s x(\phi \wedge \ldots)$$

Plain: $dep(\vec{y}, x)$, where $\vec{y} \subseteq v\vec{z}$

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 $\vec{z} \subseteq \{v\}$

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 $\vec{z} = \emptyset$

Application VI: Interaction with Scope

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

	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 $dep(v, x) \wedge var(\emptyset, x)$	✗	✓	✗	✗

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unmarked	✓	✓	✓	✓
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non-specific $var(v, x)$	✗	✗	✓	✓
epistemic $var(\emptyset, x)$	✗	✓	✓	✓
specific known $dep(\emptyset, x)$	✓	✗	✗	✗
specific unknown $dep(v, x) \wedge var(\emptyset, x)$	✗	✓	✗	✗

Note that non-specific indefinites also allow intermediate readings (Partee 2004):

(9) *Možet byt', Maša xočet kupit' kakuju-nibud' knigu.*
may be, Maša want buy which-indef. book.

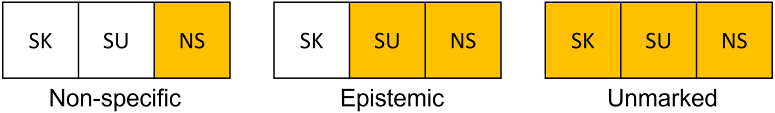
a. Narrow Scope: It may be that Maša wants to buy some book.

b. Intermediate Scope: It may be that there is some book which Maša wants to buy.

c. #Wide-scope: There is some book such that it may be that Maša wants to buy it.

Application VII: From non-specific to epistemic

Frequent diachronic tendency: **non-specific > epistemic**
(e.g. French *quelque* (Foulet 1919) and German *irgendein* (Port and Aloni 2015))



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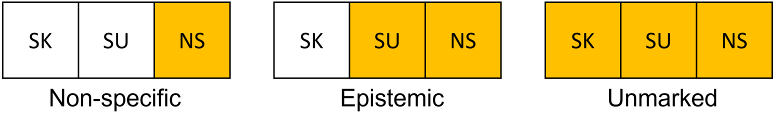

Haspelmath (1997)'s explanation: weakening of functions from the right (non-specific) of the functional map to the left (specific).

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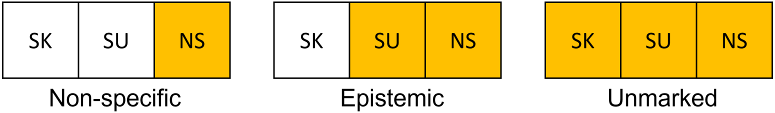

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But then why diachronically we do not observe the change from (b) to (c)?

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(11) **Weakening of functions (a) > (b) > (c)**

(a) non-specific: $var(v, x)$

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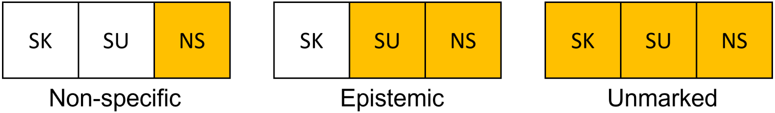

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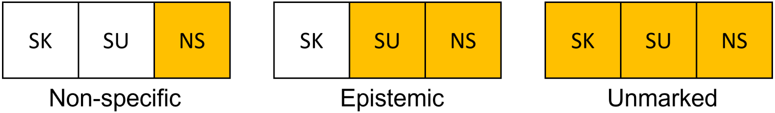

This framework makes the notion of weakening precise in terms of **logical entailment** between atoms.

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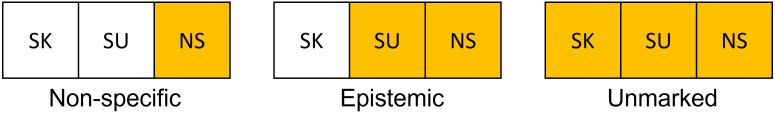

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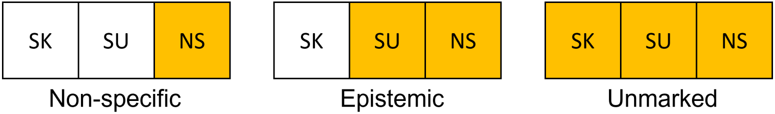

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We have 'atomic weakening' from non-specific to epistemic: $var(v, x)$ entails $var(\emptyset, x)$.

But no further 'atomic weakening' triggering the acquisition of SK. (Note also that $var(\emptyset, x) \wedge dep(\emptyset, x) \models \bot$).

To get unmarked from epistemic, we would need $var(\emptyset, x) \mathbin{\vee\!\!\!/} dep(\emptyset, x)$, which trivializes the dependence conditions (arguably a complex operation).

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 (non-)specificity.

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

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Basic Data

(12) **Undefeasible Ignorance Inference**
Maria ha sposato un qualche dottore (#cioè Ugo).
Maria has married un qualche doctor (#namely Ugo)
'Maria married some doctor, namely Ugo.'

(13) **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.'

(14) **NPI** (only for some EIs, e.g. German *irgend-*)
Niemand hat irgendeine Frage beantwortet.
Nobody has irgend-one question answered.
'Nobody answered any question.'

(15) **Free Choice** (only for some 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'.

Basic Strategy

We have proposed that epistemic indefinites trigger $var(\subseteq \{v\}, x)$. This already gives us ignorance inferences and co-variation (non-specific) readings.

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Our strategy for the remaining desiderata:

Basic Strategy

We have proposed that epistemic indefinites trigger $var(\subseteq \{v\}, x)$. This already gives us ignorance inferences and co-variation (non-specific) readings.

Our strategy for the remaining desiderata:

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

Basic Strategy

We have proposed that epistemic indefinites trigger $var(\subseteq \{v\}, x)$. This already gives us ignorance inferences and co-variation (non-specific) readings.

Our strategy for the remaining desiderata:

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

(ii) To account for free choice, we generalize the variation atom to express the cardinality of the variation and to allow for splitting.

Generalized Variation

$M, T \models var_n(\vec{y}, x)$ 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 $T_{i,\vec{y}} = \{j \in T : i(\vec{y}) = j(\vec{y})\}$

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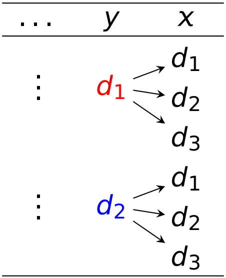
Example: with $D = \{d_1, d_2, d_3\}$, $var_{|D|}(y, x)$:



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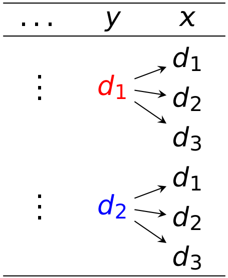

Note: $var(\varnothing, x)$ is equivalent to $var_2(\varnothing, x)$.

German *Irgend-*

Irgend-indefinites associate with $var_2(\subseteq v, x)$.

(16) *Jeder*$_y$ *hat irgendein*$_x$ *Buch gelesen.*
everyone has irgendein book read.

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

b. co-variation:
$\forall y \exists_s x\, (\phi \wedge dep(vy, x) \wedge var_2(v, x))$

v	y	x
	d_1	b_1
v_1	d_2	b_1
	d_3	b_1
	d_1	b_2
v_2	d_2	b_2
	d_3	b_2

(49a)

v	y	x
	d_1	b_1
v_1	d_2	b_2
	d_3	b_1
	d_1	b_2
v_2	d_2	b_2
	d_3	b_1

(49b)

German *Irgend-*

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

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

b. non-specific:
$\forall w \exists_s x\, (\phi \wedge dep(vy, x) \wedge var_2(v, x))$

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

$var_{|D|}(v, x)$ models **free choice** (full non-specificity), possibly triggered by prosodic prominence. For $D = \{a, b, c\}$:

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

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(17) *Mary musste$_w$ irgendeinen$_x$ Mann heiraten.*
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a. specific unknown:
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	w_1	a
v_2	w_2	b
	w_3	c

In general, we can show that:

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

Negation and Implication

We adopt an intensional notion of negation, along the lines of Brasoveanu and Farkas (2011).

(18) **Intensional Negation**

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

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(18) **Intensional Negation**

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(19) **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'' s.t. $X' \subset X'' \subseteq X$, it holds $M, X'' \not\models \phi$), we have $M, X' \models \psi$

[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.]

Negation and Epistemic Indefinites

EIs under negation behave like NPI (e.g., *any*).

In our framework, EIs under negation as in (20) are supported only if the initial team is $\{w_\varnothing\}$. (In $w_\varnothing$ John read no book, in w_a John read only book a, and so on.)

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

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

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

(a) Supporting Team

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

(b) Non-Supporting Team

[maximal teams of antecedent in blue]

Negation and Specific Indefinites

For (21), specific indefinites under negation are supported by $\{w_\emptyset\}$ (John read no book), but also by $\{w_a\}$ (John read book a and not b) or $\{w_b\}$.

We predict that (21) is false only for the case of $\{w_{ab}\}$.

[The antecedent of (21a) is supported by more than one maximal team, due to different constant values of x induced by $dep(\emptyset, x)$, but for the second reading only one is supporting.]

(21) John does not have some-SK book.

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

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

(a) Supporting Team

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

(b) Supporting Team

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

(c) Non-Supporting Team

[In (c), if $x \mapsto b$, 3rd and 4th row are the max team of the antencedent]

Outline

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4. Applications

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Conclusion

Some directions of future research:

(a) Explore language-specific distinctions in the domain of specificity;

(b) Expand our team-based analysis to other areas of the map (e.g. NPI);

(c) Integrate our framework with conceptual covers;

(d) Model epistemic modals vs root modals in a team-based system;

(e) Develop a dynamic version of our logic (including dependence atoms).

(f) . . .

Conclusion

THANK YOU!

Conclusion

THANK YOU!

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References

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