Exceptional scope of *wh*-expressions

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UCSC Semantics Seminar

Setting the stage

Wh-movement vs. *Wh*-in-situ

English is a *wh*-movement language, but allows *wh*-in-situ.

(1) What does you think Annie likes?

(2) Which professor do you think John introduce to which student?

Mandarin and Japanese are typical *wh*-in-situ languages.

(3) Nǐ juédé Lǐbái xǐhuān shěnme (ne)?
you think LB like what SFP
'What do you think LB like?' Mandarin

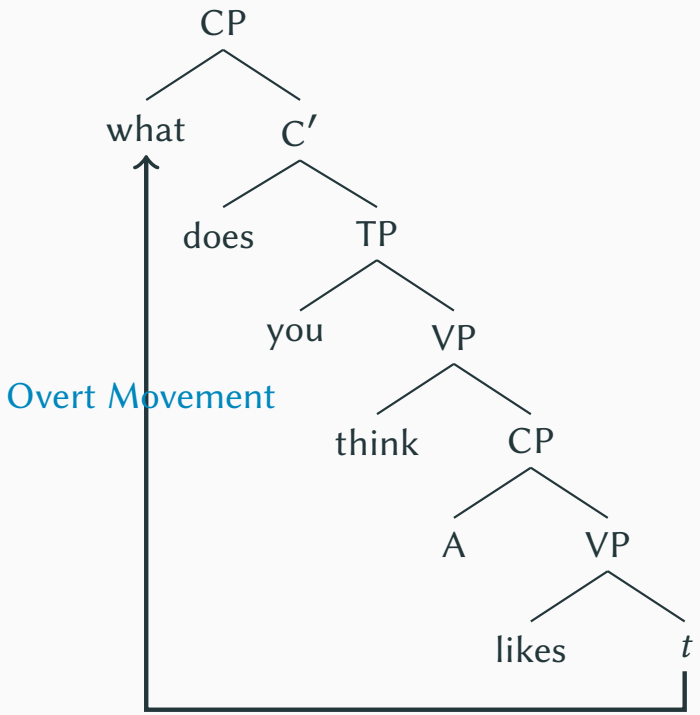
(4) Taro-wa nani-o tazunemasita ka?
Taro-TOP what-ACC asked SFP
'What did Taro ask?' Japanese

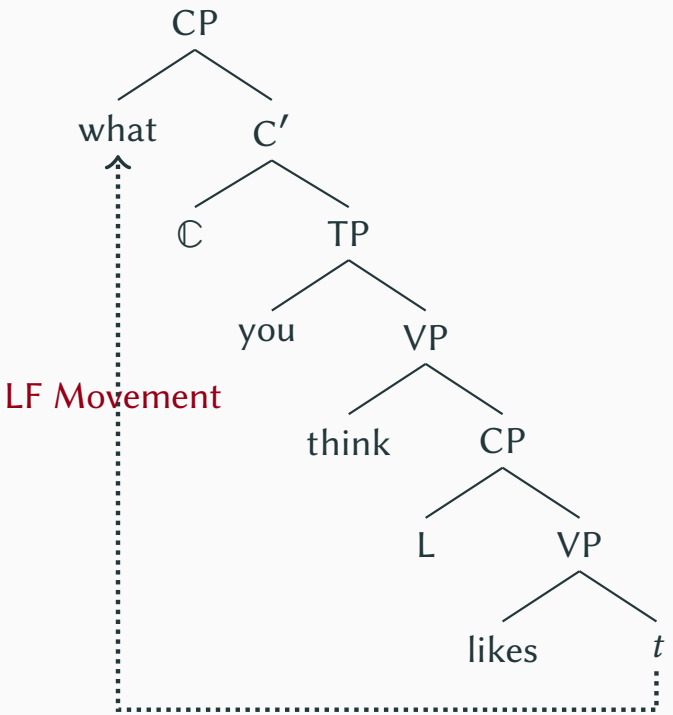
LF movement

Different word orders but the same scope interpretation

(5) What is the thing x such that you think A/L likes x (3)/(1)

Huang (1982)





Islands

Movement → Island effects (Ross 1969)

(6) *Who$_1$ do you read the book [that t_1 writes]?

However, island effects are not observed for in-situ *wh*-expressions.

(7) Nǐ dú-le [shéi xiě de shū]?
you read-ASP who write DE book
'Who is the person x s.t. you read the book written by x?'

(8) Taro-wa [[dare-ga katta] mochi]-o tabemasita ka?
Taro-TOP who-NOM bought rice.cake-ACC ate SFP
'Who is the person x s.t. Taro eat rice cakes bought by x?'

(9) Which student reads [the books that which politician writes]?

Scope taking and islands

Quantifier raising obeys constraints on overt movement (Rodman 1976; May 1977; cf. Huang 1982; Barker 2020).

(10) John has dated [a woman who loves every man]. (*∀ > ∃)

(11) A man said [that everyone had left]. (*∀ > ∃)

(12) [If every relative of mine dies], I'll inherit a fortune. (*∀ > if)

Exceptional scope of indefinites (Fodor & Sag 1982; Reinhart 1997)

(13) [If a famous relative of mine dies], I'll inherit a fortune. (∃ > if)

(14) [Everyone who believed a famous expert on indefinites would be at the conference] was sorely disappointed. (∃ > ∀)

Core issue

How is the exceptional scope of in-situ *wh*-expressions derived?

- Variable binding
- Choice function
- Alternative Semantics
- Scope of alternatives

Variable binding

Multi-functionality

In Mandarin and Japanese, *wh*-expressions may be non-interrogative (Nishigauchi 1986; Cheng 1991).

Existential

(15) Lǐbái kěnéng yùshàng shěnme máfán le.
LB may meet what trouble SFP
'LB may be in trouble.'

(16) Nani-ka karai no-o tabe-tai.
what-KA spicy LN-ACC eat-want
'I want to eat something spicy.'

Multi-functionality

Universal

(17) Shéi dōu lái-le.
who all come-ASP
'Everyone came.'

(18) [Dono gakusei-no okaasan]-mo odotta.
which student-GEN mother-MO danced
'Every student's mother danced.'

A *wh*-determiner denotes a variable, which can be bound by different quantificational operators.

Binding and no movement

A *wh*-determiner is bound by a covert question operator.

- $[\![\text{wh}_1]\!]^g = g_1$
- $[\![\mathbb{Q}\ X]\!]^g = \{[\![X]\!]^{g^{1\to x}} \mid x \in D_e\}$

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(19) Nǐ dú-le [shéi xiě de shū]?
you read-ASP who write DE book
'Who is the person x s.t. you read the book written by x?'

(20) $[\![\ \mathbb{Q}_1$ you read [who$_1$ wrote DE book]$]\!]^g$

$= \{[\![\text{you read the book who}_1\text{ wrote}]\!]^{g^{1\to x}} \mid x \in D_e\}$

$= \{\lambda w.\mathbf{read}_w(\iota y.\mathbf{book}_w(y) \wedge \mathbf{wrote}_w(y)(x) \wedge \mathbf{hmn}_w(x))(\mathbf{you}) \mid x \in D_e\}$

Negation

(21) Lǐbái méi chī shěnme?
LB not eat what
'What did LB not eat?'

(22) $[\![\mathbb{Q}_1 \text{ LB not eat what}_1]\!]^g = \{[\![\text{LB not eat what}_1]\!]^{g^{1\to x}} \mid x \in D_e\}$
$= \{\neg(\mathbf{eat}(x)(\mathbf{lb}) \wedge \mathbf{thing}(x)) \mid x \in D_e\}$

Consequence: The question could admit the answer 'LB didn't eat John'.

Conditional

(23) Which linguist will be angry if we invite which philosopher?

(24) $[\![\mathbb{Q}_{1,2}$ wh-ling$_1$ will be angry if we incite wh-phil$_2]\!]^g$

$= \{[\![$wh-ling$_1$ will be angry if we incite wh-phil$_2]\!]^{g^{1\to x, 2\to y}} \mid x \in D_e, y \in D_e\}$

$= \{\mathbf{if}(\mathbf{phil}(y) \wedge \mathbf{we.invt}(y))(\mathbf{angry}(x) \wedge \mathbf{ling}(x)) \mid x \in D_e, y \in D_e\}$

Consequence: The question could admit the answer 'Chomsky will be angry if we invite Taylor Swift'.

Choice function

Basic idea

A choice function simply takes a set P and returns a member of P.

$$\mathbf{CH} := \{f \mid \forall P \in \mathbf{Dom}(f) : f(P) \in P\}$$

A *wh*-determiner denotes a choice function variable, which is bound by a covert question operator (Reinhart 1998).

- $[\![\text{which}_1]\!]^g = g_1$
- $[\![\mathbb{Q}_1\ X]\!]^g = \{[\![X]\!]^{g^{1\to f}} \mid f \in \mathbf{CH}\}$

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(25) $[\![\mathbb{Q}_1\ \text{LB not eat what}_1]\!]^g = \lambda p \exists f \in \mathbf{CH} : p = [\![\text{LB not eat what}_1]\!]^{g^{1\to f}}$

$= \{\lambda w.\neg \mathbf{eat}_w(f(\mathbf{thing}))(\mathbf{lb}) \mid f \in \mathbf{CH}\}$

Intensional choice functions

An intensional choice function applies to the intension of a set P of type $s \to (e \to t)$ and select an element from the extension of P in a given world.

$$\mathbf{CH}_w := \{f \mid \forall P \in \mathrm{Dom}(f) : f(P) = P(w)\}$$

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(26) Which linguist will be angry if we invite which philosopher?

Relative to the actual world w_0, the question denotes:

$$\{\mathbf{if}(\mathbf{invite}(f(\lambda w.\mathbf{phil}_w))(\mathbf{we}))(\mathbf{angry}(x)) \mid f \in \mathbf{CH}_{w_0}, x \in \mathbf{ling}_{w_0}\}$$

Pair-list reading

(27) Měi-gè nǚhái dōu xǐhuān tā māmā zuò de nǎ-dào cài?
every-CL girl all like she mother do MOD which-CL dish?
'For every girl, which dish that her mother cooks does she like?'

Choice function analysis:

$$\{\ \textbf{every.g}(\lambda x.\textbf{like}(f(\underbrace{\lambda y.\textbf{dish}(y) \wedge \textbf{cook}(y)(\textit{x}\textbf{-s-mom})}_{\text{the domain of } f}))(x)) \mid f \in \textbf{CH}\}$$

Consequence: Suppose that Annie, Becky, and Cindy are sisters, this question may not admit a pair-list answer (Geurts 2000).

Alternative Semantics

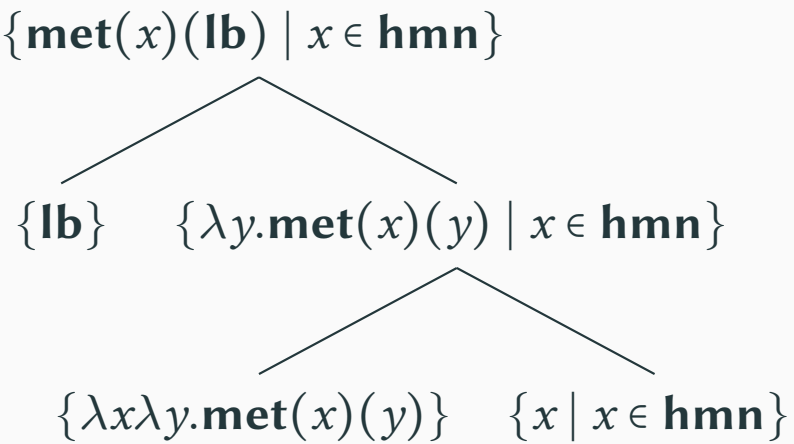
Basic idea

Wh-expressions are sets of alternatives (Shimoyama 2006).

- $[\![\text{who}]\!]^{w_0} = \{x \mid x \in \textbf{human}_{w_0}\}$

Point-wise functional application

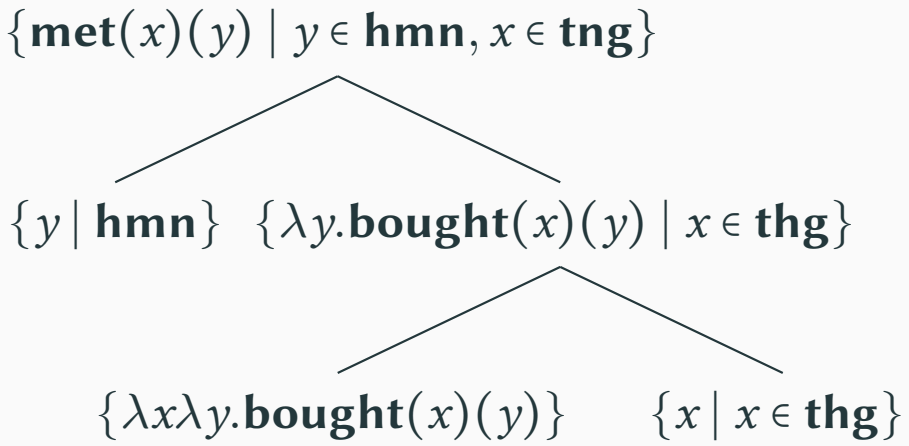
$$\frac{F : (a \to b) \to t \qquad X : a \to t}{F \bullet X = \{f(x) \mid f \in F, x \in X\} : b \to t}$$



Derivation of 'LB met who?'

Multiple-*wh* questions

(28) Who bought what?



Consequence: a *wh*-expression cannot take scope across another *wh*-expression.

Scoping out of *wh*-islands

A *wh*-expression can take scope across an embedded *wh*-question (Baker 1970; Karttunen 1977; Dayal 1996).

(29) Which student knows when Jenny bought which book?

a. Peter does.

b. Peter knows when Jenny bought *War & Peace*, Annie knows when Jenny bought *Pride & Prejudice*.

Scope of alternatives

Lift

Lift: turning a proper name into a scope-taker

$$\uparrow(x) = \lambda f.f(x) \qquad\qquad \uparrow: a \to (a \to b) \to b$$

$\uparrow$ is a 'good' type shifter because it has a minimal effect:

- preserves structure across type domains
- does not add bits of meaning in unprincipled ways

Lifting alternatives

Turning an individual to a scope-taker that takes scope over a set of propositions

$$\uparrow(x) = \lambda f_{e \to \{s \to t\}}.f(x)$$

Turning a set of individuals to a scope-taker (Charlow 2019):

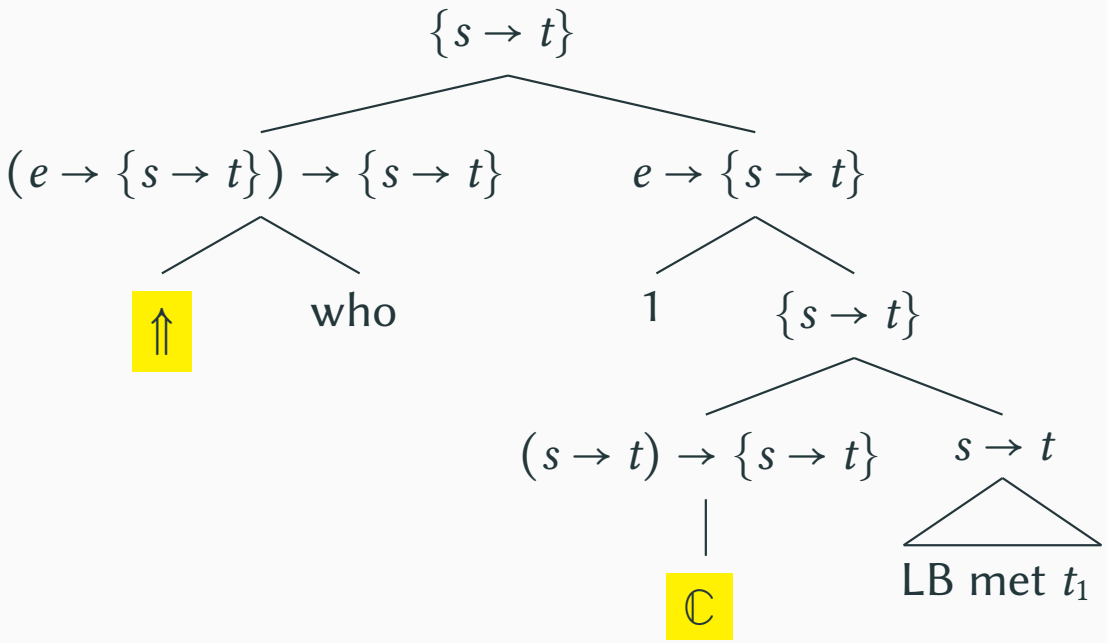
$$\Uparrow A = \lambda f_{e \to \{s \to t\}} \bigcup \{f(x) \mid x \in A\} \qquad \Uparrow : \{e\} \to (e \to \{s \to t\}) \to \{s \to t\}$$

Applying $\Uparrow$ to a *wh*-expression:

(30) $\Uparrow [\![\text{who}]\!]^{w_0} = \lambda f. \bigcup \{f(x) \mid x \in [\![\text{who}]\!]^{w_0}\}$

$= \lambda f \lambda p \exists x \in [\![\text{who}]\!]^{w_0}.f(x)(p)$ (This is Karttunen!)

Scope taking of alternatives



This is LF movement!

Polymorphism

$\uparrow$ is polymorphic. What about $\Uparrow$ and $\mathbb{C}$?

- $\Uparrow(A) = \lambda f \bigcup \{f(x) \mid x \in A\}$ $\quad\quad$ $\Uparrow : \{a\} \to (a \to \{b\}) \to \{b\}$
- $\eta(x) = \{x\}$ $\quad\quad$ $\eta : a \to \{a\}$

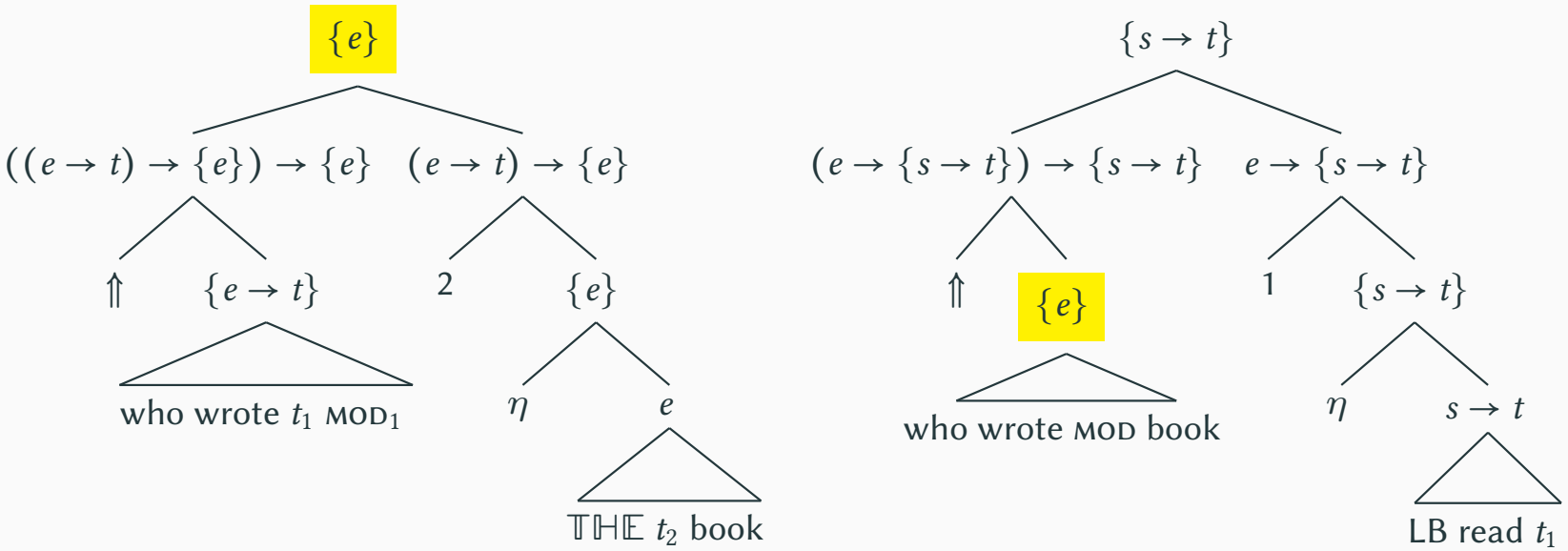
Charlow (2019)

The combination of $\Uparrow$ and η allow alternatives to scope at any position.

Moving islands

A *wh*-expression can take scope within an island, and then the island itself takes scope (see also Nishigauchi 1986; Kotek 2019).

(31) Nǐ dú-le [shéi xiě de shū]?
you read-ASP who write DE book
'Who is the person x s.t. you read the book written by x?'



$$\{\mathbf{read}(\iota y.\mathbf{book}(y) \wedge \mathbf{wrote}(y)(x))(\mathbf{lb}) \mid x \in \mathbf{hmn}_{w_0}\}$$