MANDARIN CHINESE WH-INDEFINITE SCOPE BY MIXED QUOTATION

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1. Systematic type-lifting

The semantic analogue of cartography. Annoyingly, the worst case to generalize to keeps getting worse. Today, 2 worse cases: inverse scope; mixed quote.

	syntax	extensional semantics	a. possible worlds	b. alternative sets	c. generalized quantifiers
(1)	DP ::= Bush	$[\![\text{Bush}]\!] : e$	$[\![\text{Bush}]\!] : \langle \underline{s}, e \rangle$	$[\![\text{Bush}]\!] : \langle e, \underline{t} \rangle$	$[\![\text{Bush}]\!] : \langle\langle e, \underline{t}\rangle, \underline{t}\rangle$
(2)	(DP\S)/DP ::= seeks	$[\![\text{seeks}]\!] : \langle e, \langle e, t\rangle\rangle$	$[\![\text{seeks}]\!] : \langle \underline{s}, \langle e, \langle e, t\rangle\rangle\rangle$ $[\![\text{seeks}]\!] : \langle \underline{s}, \langle \langle \underline{s}, e\rangle, \langle e, t\rangle\rangle\rangle$	$[\![\text{seeks}]\!] : \langle\langle e, \langle e, t\rangle\rangle, \underline{t}\rangle$ $[\![\text{seeks}]\!] : \langle\langle\langle e, \underline{t}\rangle, \langle e, t\rangle\rangle, \underline{t}\rangle$	$[\![\text{seeks}]\!] : \langle\langle\langle e, \langle e, t\rangle\rangle, \underline{t}\rangle, \underline{t}\rangle$ $[\![\text{seeks}]\!] : \langle\langle\langle\langle e, \underline{t}\rangle, \underline{t}\rangle, \langle e, t\rangle\rangle, \underline{t}\rangle, \underline{t}\rangle$
(3)	$A ::= A/B \;\; B$	$[\![A]\!] = [\![A/B]\!]([\![B]\!])$	$[\![A]\!](w) = [\![A/B]\!](w)([\![B]\!](w))$ $[\![A]\!](w) = [\![A/B]\!](w)([\![B]\!])$	$[\![A]\!] = \{\, l(r) \mid l \in [\![A/B]\!],\, r \in [\![B]\!] \,\}$ $[\![A]\!] = \{\, l([\![B]\!]) \mid l \in [\![A/B]\!] \,\}$	$[\![A]\!](c) = [\![A/B]\!](\lambda l.\, [\![B]\!](\lambda r.\, c(l(r))))$ ~~$[\![A]\!](c) = [\![B]\!](\lambda r.\, [\![A/B]\!](\lambda l.\, c(l(r))))$~~ $[\![A]\!](c) = [\![A/B]\!](\lambda l.\, c(l([\![B]\!])))$
(4)	$A ::= B \;\; B\backslash A$	$[\![A]\!] = [\![B\backslash A]\!]([\![B]\!])$	$[\![A]\!](w) = [\![B\backslash A]\!](w)([\![B]\!](w))$ $[\![A]\!](w) = [\![B\backslash A]\!](w)([\![B]\!])$	$[\![A]\!] = \{\, r(l) \mid l \in [\![B]\!],\, r \in [\![B\backslash A]\!] \,\}$ $[\![A]\!] = \{\, r([\![B]\!]) \mid r \in [\![B\backslash A]\!] \,\}$	$[\![A]\!](c) = [\![B]\!](\lambda l.\, [\![B\backslash A]\!](\lambda r.\, c(r(l))))$ ~~$[\![A]\!](c) = [\![B\backslash A]\!](\lambda r.\, [\![B]\!](\lambda l.\, c(r(l))))$~~ $[\![A]\!](c) = [\![B\backslash A]\!](\lambda r.\, c(r([\![B]\!])))$

	syntax	monadic semantics
(5)	DP ::= Bush	$[\![\text{Bush}]\!] : \mathbb{M}e$
(6)	(DP\S)/DP ::= seeks	$[\![\text{seeks}]\!] : \mathbb{M}\langle e, \langle e, t\rangle\rangle$ $[\![\text{seeks}]\!] : \mathbb{M}\langle \mathbb{M}e, \langle e, t\rangle\rangle$
(7)	$A ::= A/B \;\; B$	$[\![A]\!] = [\![A/B]\!] \star \lambda l.\, [\![B]\!] \star \lambda r.\, \eta(l(r))$ $[\![A]\!] = [\![A/B]\!] \star \lambda l.\, \eta\big(l([\![B]\!])\big)$
(8)	$A ::= B \;\; B\backslash A$	$[\![A]\!] = [\![B]\!] \star \lambda l.\, [\![B\backslash A]\!] \star \lambda r.\, \eta(r(l))$ $[\![A]\!] = [\![B\backslash A]\!] \star \lambda r.\, \eta\big(r([\![B]\!])\big)$

A *monad* is a triple $(\mathbb{M}, \eta, \star)$, where ...
(Moggi 1991; Wadler 1992; Shan 2001)

Left identity	$\eta(a) \star q = q(a)$
Right identity	$m \star \eta = m$
Associativity	$(m \star q) \star r = m \star \lambda a.\, q(a) \star r$

a. possible worlds b. alternative sets c. generalized quantifiers

$\mathbb{M}$ is a map from types to types. Roughly, it specifies how to lift types.

(9) $\mathbb{M}\alpha = \langle \underline{s}, \alpha\rangle$ $\mathbb{M}\alpha = \langle \alpha, \underline{t}\rangle$ $\mathbb{M}\alpha = \langle\langle \alpha, \underline{t}\rangle, \underline{t}\rangle$

η (pronounced 'unit') is a unary function that maps values of type α to values of type $\mathbb{M}\alpha$, for every type α. Roughly, it specifies how to lift ordinary values trivially.

(10) $\eta(a)(w) = a$ $\eta(a) = \{a\}$ $\eta(a)(c) = c(a)$

$\star$ (pronounced 'bind') is a binary function that maps values of type $\mathbb{M}\alpha$ and values of type $\langle \alpha, \mathbb{M}\beta\rangle$ to values of type $\mathbb{M}\beta$, for every type α and every type β. Roughly, it specifies how lifted values compose with each other.

(11) $(m \star q)(w) = q(m(w))(w)$ $m \star q = \bigcup_{a \in m} q(a)$ $(m \star q)(c) = m(\lambda a.\, q(a)(c))$

Generalize to monads for parsimony and modularity: A type-lifting is like an operating system. Worry about it only rarely: at landing sites and islands.

(12) Bush thinks Cheney loves nobody.

(13) Landing: $s : \langle\langle t, \underline{t}\rangle, \underline{t}\rangle \longrightarrow s(\lambda x.\, x) : t \longrightarrow \lambda c.\, c(s(\lambda x.\, x)) : \langle\langle t, \underline{t}\rangle, \underline{t}\rangle$

In worse cases, operating systems need to be nested (Barker and Shan 2008).

Inverse scope in Chinese is also rare (Huang 1982; Aoun and Li 1993).

(14) meige xuesheng dou mai-le yiben shu
every student all bought one book
'Every student bought a book.'

2. Mandarin Chinese wh-indefinites

(Li 1992; Lin 1996, 1998, 2002, 2004) Existential force:

(15) ta méi/bu chi shenme
he not eat what
'He didn't/doesn't eat anything.'

(16) ta henshao chi shenme
he seldom eat what
'He seldom eats anything.'

(17) ta haoxiang chi-le shenme de-yangzi
he seem ate what
'It seems he ate something.'

(18) yaoshi ta chi-le shenme, jiu dei fu qian
if he ate what then must pay money
'If he ate anything, he must pay.'

Licensed by nonveridical context:

(19) *ta chi-le shenme
he ate what
'He ate something.'

(20) *měi-ge/henduo ren dou chi-le shenme
every/many person all ate what
'Everyone/many people ate something.'

Scope ambiguity:

(21) ta haoxiang méi/bu chi shenme de-yangzi
he seem not eat what
'It seems he didn't/doesn't eat something.'
a. *$\exists >$ seem $> \neg$ b. seem $> \exists > \neg$ c. seem $> \neg > \exists$

(22) haoxiang yaoshi shei zou, Lisi jiu yie yao zou de-yangzi
seem if who leave Lisi then also want leave
'It seems that, if someone leaves, Lisi will also leave.'
a. *$\exists >$ seem $>$ if b. seem $> \exists >$ if c. seem $>$ if $> \exists$

(23) haoxiang měi-ge/henduo ren dou chi-le shenme de-yangzi
seem every/many person all ate what
'It seems everyone/many people ate something.'
a. *$\exists >$ seem $> \forall$/many b. seem $> \exists > \forall$/many
c. seem $> \forall$/many $> \exists$

(24) yaoshi měi-ge/henduo ren dou chi-le shenme, wo jiu fangxin le
if every/many person all ate what I then eased
'If everyone/many people ate something, I will be at ease.'
a. *$\exists >$ if $> \forall$/many b. if $> \exists > \forall$/many c. if $> \forall$/many $> \exists$

Account: type-lift multiple times.

(25) DP ::= Bush $\quad [\![\text{Bush}]\!] : \mathbb{M}'\mathbb{M}e$

(26) (DP\S)/DP ::= seeks
$$\begin{cases} [\![\text{seeks}]\!] : \mathbb{M}'\mathbb{M}\langle \quad e, \langle e, t\rangle\rangle \\ [\![\text{seeks}]\!] : \mathbb{M}'\mathbb{M}\langle \quad \mathbb{M}e, \langle e, t\rangle\rangle \\ [\![\text{seeks}]\!] : \mathbb{M}'\mathbb{M}\langle \mathbb{M}'\mathbb{M}e, \langle e, t\rangle\rangle \end{cases}$$

(27) $A ::= A/B \;\; B$
$$\begin{cases} [\![A]\!] = [\![A/B]\!] \star' \lambda L.\, [\![B]\!] \star' \lambda R.\, \eta'(L \star \lambda l.\, R \star \lambda r.\, \eta(l(r))) \\ [\![A]\!] = [\![A/B]\!] \star' \lambda L.\, [\![B]\!] \star' \lambda R.\, \eta'(L \star \lambda l.\, \eta(l(R))) \\ [\![A]\!] = [\![A/B]\!] \star' \lambda L.\, \eta'(L \star \lambda l.\, \eta(l([\![B]\!]))) \end{cases}$$

(28) $A ::= B \;\; B\backslash A$
$$\begin{cases} [\![A]\!] = [\![B]\!] \star' \lambda L.\, [\![B\backslash A]\!] \star' \lambda R.\, \eta'(L \star \lambda l.\, R \star \lambda r.\, \eta(r(l))) \\ [\![A]\!] = [\![B]\!] \star' \lambda L.\, [\![B\backslash A]\!] \star' \lambda R.\, \eta'(R \star \lambda r.\, \eta(r(L))) \\ [\![A]\!] = [\![B\backslash A]\!] \star' \lambda R.\, \eta'(R \star \lambda r.\, \eta(r([\![B]\!]))) \end{cases}$$

Intuition: weak quantification is fossil. (21b) 'It seems he not-eat something.'

- ordinary scope-taking must use inner (weak) type-lifting;
- wh-indefinites can use outer (strong) type-lifting;
- *haoxiang* 'seem' and *yaoshi* 'if' can be landing sites for outer (and hence also inner) type-lifting.
(Why? Because they introduce hypothetical modal contexts?)

(29) Landing:
$$\begin{aligned} & s : \langle\langle\langle\langle t, \underline{t}\rangle, \underline{t}\rangle, \underline{t}'\rangle, \underline{t}'\rangle \\ \longrightarrow \quad & \lambda C.\, s(\lambda X.\, C(X(\lambda x.\, x))) : \langle\langle t, \underline{t}'\rangle, \underline{t}'\rangle \\ \longrightarrow \quad & s(\lambda X.\, X(\lambda x.\, x)) : t \\ \longrightarrow \quad & \lambda c.\, c(s(\lambda X.\, X(\lambda x.\, x))) : \langle\langle t, \underline{t}\rangle, \underline{t}\rangle \\ \longrightarrow \quad & \lambda C.\, C(\lambda c.\, c(s(\lambda X.\, X(\lambda x.\, x)))) : \langle\langle\langle\langle t, \underline{t}\rangle, \underline{t}\rangle, \underline{t}'\rangle \underline{t}'\rangle \end{aligned}$$

Thus, sometimes 'intermediate scope' is unavailable:

(30) haoxiang měi-ge/henduo ren dou bu yuanyi gen shei shuohua
seem every/many person all not willing with who speak
de-yangzi

'It seems everyone/many people are unwilling to speak to someone.'
a. *∃ > seem > ∀/many > ¬ b. seem > ∃ > ∀/many > ¬
c. ??seem > ∀/many > ∃ > ¬ d. seem > ∀/many > ¬ > ∃

(31) haoxiang měi-ge/henduo ren dou henshao gen shei shuohua
seem every/many person all seldom with who speak
de-yangzi

'It seems everyone/many people seldom speak to someone.'
a. *∃ > seem > ∀/many > seldom b. seem > ∃ > ∀/many > seldom
c. *seem > ∀/many > ∃ > seldom d. seem > ∀/many > seldom > ∃

However, sometimes 'intermediate scope' is available:

(32) haoxiang yaoshi wo bu chi shenme, ta jiu bu zuo le de-yangzi
seem if I not eat what he then not make

'It seems that, if I don't eat something, he will stop cooking (it).'
a. *∃ > seem > if > ¬ b. seem > ∃ > if > ¬
c. seem > if > ∃ > ¬ d. seem > if > ¬ > ∃

(33) yaoshi ta haoxiang bu chi shenme de-yangzi, (que you bu shuoming
if he seem not eat what seem but also not explain
shi shenme dongxi ta bu chi), na wo yie zhi neng danxin le
be what thing he not eat that I also only can worry

'If he seems to not eat something, (yet doesn't explain what it is that he doesn't eat), then I can only worry.'
a. *∃ > if > seem > ¬ b. if > ∃ > seem > ¬ (*)
c. if > seem > ∃ > ¬ d. if > seem > ¬ > ∃ (*)

(34) wo bu yuanyi shuo yaoshi měi-ge ren dou zhichi shei, wo jiu
I not willing say if every person all support who I then
zhichi ta
support he

'I am unwilling to say that, if everyone supports someone, then I will support that person.'
a. *∃ > ¬ > if > ∀ b. ??¬ > ∃ > if > ∀
c. ¬ > if > ∃ > ∀ d. *¬ > if > ∀ > ∃

It seems *henshao* is a bit stronger than ordinary:

(35) ta haoxiang henshao bu yuanyi gen shei shuohua de-yangzi
he seem seldom not willing with who speak

'He seems seldom unwilling to speak to someone.'
a. *∃ > seem > seldom > ¬ b. seem > ∃ > seldom > ¬
c. seem > seldom > ∃ > ¬ d. seem > seldom > ¬ > ∃

(36) tamen haoxiang henshao shuo yaoshi shei zou, tamen jiu zou
they seem seldom say if who leave they then leave
de-yangzi

'They seem to seldom say that, if someone leaves, they will also leave.'
a. *∃ > seem > seldom > if b. *seem > ∃ > seldom > if
c. seem > seldom > ∃ > if d. seem > seldom > if > ∃

(37) yaoshi nimen henshao ba měi-ben shu dou jiaogei shei baoguan, na
if you.pl seldom every book all give who store that
jiu bu yong zhe-me da de xiangzi le
then not use this-much big box

'If you seldom give every book to someone for storage, then you don't need a box this big.'
a. *∃ > if > seldom > ∀ b. ?if > ∃ > seldom > ∀
c. if > seldom > ∃ > ∀ d. if > seldom > ∀ > ∃

3. Mixed quotation

(Davidson 1979) Mix mention and use—two dimensions (Potts 2007):

(38) Quine says quotation 'has a certain anomalous feature'.
a. (mention) *has a certain anomalous feature* is used to mean some f.
b. (use) Quine says quotation f.

(39) Bush is proud of his 'eckullectic' reading list.
a. (mention) *eckullectic* is used to mean some f.
b. (use) Bush is proud of his f(reading list).

(40) Cheney's reading list is far more 'eckullectic', not to mention longer.
a. (mention) *eckullectic* is used to mean some f.
b. (use) Cheney's reading list is far more f, not to mention longer.

Why *Bush's use*? Anaphora/presupposition resolved in parse (Geurts and Maier 2003). More fossil.

What is *using to mean*? Utterance subevents (type u), but not hierarchical; possibly hypothetical or generic. Intuition: decoding Gödel numbers; interpreting programs; curating meanings from other minds (elm, Aristotle).

Syntactic categories matter:

(41) a. *Bush said his reading list ‘eckullectic’.
b. *Quine’s ‘has a certain anomalous feature’ is trivial.

(42) a. Gli uomini italiani mi sembrano molto carini
the.MASC.PL men Italian.MASC.PL to.me look.3PL very cute.MASC.PL
‘Italian men look very cute to me.’

b. Ken ha detto letteralmente che le persone italiane ‘mi sembrano molto carine/*carini’
Ken has said literally that the.FEM.PL people Italian.FEM.PL to.me look.3PL very cute.FEM.PL/*cute.MASC.PL
‘Ken has said literally that Italian people ‘mi sembrano molto carine/carini’.’

(43) a. *Bush said his reading list eclectic.
b. *Quine’s constitutes a knockdown argument is trivial.
c. *Bush met the king of France.

Not pure quotes coerced:

(44) a. She decided to ‘no comment’ the question.
b. It is a very ‘what the hell’ movie.

(45) a. Bush expected his speech to win over ‘few, if any’ Democrats.
b. *Bush expected his speech to win over ‘needles in a haystack’ Democrats.
c. It is a very ‘needles in a haystack’ movie.

Semantic unquotation:

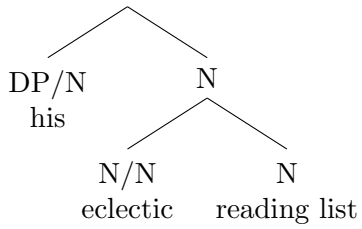
(46) a. Bush boasted of ‘my [eclectic] reading list’.
b. The politician admitted that she ‘lied my way into [her job]’.
c. Gripped by paranoia, Ralph ‘wanted to find [the spy] and kill him’.

Quoting categories embed quoted categories (e.g., $'$ for Bush English). Quoting contents are quoted characters (Kaplan 1989).

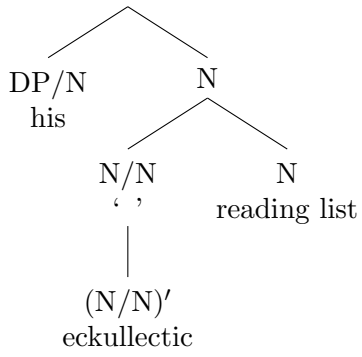
	syntax	a. possible-worlds semantics	b. monadic semantics
(47)	$(\mathrm{N}/\mathrm{N})' ::= \text{eckullectic}$	$[\![(\mathrm{N}/\mathrm{N})']\!] = (\!|\text{eckullectic}|\!) : \langle s, \langle u, \langle s, \langle\langle s, \langle\langle s, e\rangle, t\rangle\rangle, \langle\langle s, e\rangle, t\rangle\rangle\rangle\rangle\rangle$	$[\![(\mathrm{N}/\mathrm{N})']\!] = (\!|\text{eckullectic}|\!) : \mathbb{M}\langle u, \mathbb{M}\langle\mathbb{M}\langle\mathbb{M}e, t\rangle, \langle\mathbb{M}e, t\rangle\rangle\rangle$
(48)	$\mathrm{N}' ::= \text{reading list}$	$[\![\mathrm{N}']\!] = (\!|\text{reading list}|\!) : \langle s, \langle u, \langle s, \langle\langle s, e\rangle, t\rangle\rangle\rangle$	$[\![\mathrm{N}']\!] = (\!|\text{reading list}|\!) : \mathbb{M}\langle u, \mathbb{M}\langle\mathbb{M}e, t\rangle\rangle$
(49)	$A ::= \text{‘}A'\text{’}$	$[\![A]\!](w) = [\![A']\!](w)(\text{Bush English})(w)$	$[\![A]\!] = [\![A']\!] \star \lambda h.\, h(\text{Bush English})$
(50)	$A' ::= (A/B)'\ B'$	$[\![A']\!](w)(i) = (\!|A ::= A/B\ B|\!)(w)(i)\big([\![(A/B)']\!](w)(i), [\![B']\!](w)(i)\big)$	$[\![A']\!] = (\!|A ::= A/B\ B|\!) \star \lambda h.$ $[\![(A/B)']\!] \star \lambda l.\, [\![B']\!] \star \lambda r.\, \eta\big(\lambda i.\, h(i)(l(i), r(i))\big)$
(51)	$A' ::= B'\ (B\backslash A)'$	$[\![A']\!](w)(i) = (\!|A ::= B\ B\backslash A|\!)(w)(i)\big([\![B']\!](w)(i), [\![(B\backslash A)']\!](w)(i)\big)$	$[\![A']\!] = (\!|A ::= B\ B\backslash A|\!) \star \lambda h.$ $[\![B']\!] \star \lambda l.\, [\![(B\backslash A)']\!] \star \lambda r.\, \eta\big(\lambda i.\, h(i)(l(i), r(i))\big)$
(52)	$A' ::= [A]$	$[\![A']\!](w)(i) = \lambda w'.\, [\![A]\!](w)$	$[\![A']\!] = [\![A]\!] \star \lambda x.\, \eta\big(\lambda i.\, \eta(x)\big)$

Pass between normal and Bush English by quotation and unquotation:

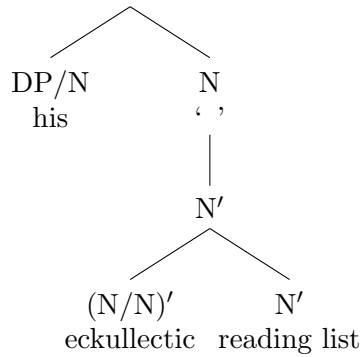
(53) a. his eclectic reading list



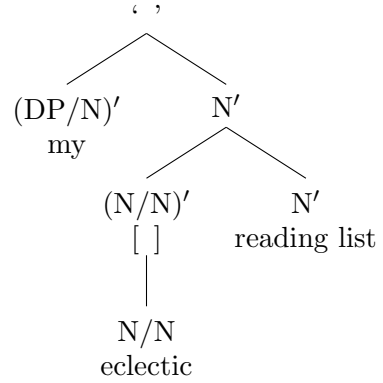
b. his ‘eckullectic’ reading list



c. his ‘eckullectic reading list’



d. ‘my [eclectic] reading list’



4. Mixed quotation with quantifiers

Quantifying over utterance contexts:

(54) a. Every day, I would promise to finish the paper 'tomorrow'.
b. Danes and Norwegians eat 'frokost' at different times.

Quantification in the quoting language:

(55) Every boy$_i$ claimed to like 'the gift [a relative of his$_i$] gave me'.

Inverse scope arises from quotation by *haoxiang* 'seem' and *yaoshi* 'if':

(56) 'Every student bought [a book]'.
$\exists > \forall$

(21b) ta haoxiang‘ méi/bu chi [shenme] 'de-yangzi
he seem not eat what
seem $>$ $\exists$ $>$ $\neg$

(22b) haoxiang‘ yaoshi [shei] zou, Lisi jiu yie yao zou 'de-yangzi
seem if who leave Lisi then also want leave
seem $>$ $\exists$ $>$ if

(23b) haoxiang‘ měi-ge/henduo ren dou chi-le [shenme] 'de-yangzi
seem every/many person all ate what
seem $>$ $\exists$ $>$ $\forall$/many

(24b) yaoshi‘ měi-ge/henduo ren dou chi-le [shenme] ' wo jiu fangxin le
if every/many person all ate what I then eased
if $>$ $\exists$ $>$ $\forall$/many

(32b) haoxiang‘ yaoshi wo bu chi [shenme], ta jiu bu zuo le 'de-yangzi
seem if I not eat what he then not make
seem $>$ $\exists$ $>$ if $>$ $\neg$

(32c) haoxiang yaoshi‘ wo bu chi [shenme] ' ta jiu bu zuo le de-yangzi
seem if I not eat what he then not make
seem $>$ if $>$ $\exists$ $>$ $\neg$

5. Modular type-lifting

Opacity: type-check each monad separately from each other and the general monadic semantics.

Compositionality: lift types repeatedly, each time possibly by a different monad.

Dynamic semantics: simulate pragmatics.

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