UNEEXPECTED WIDE/NARROW SCOPE PHENOMENA

1. VARIETIES OF SCOPE

Different types of NPs display different scope taking potential. Relative quantifier scope varies at least across the dimensions defined by the following factors (Reinhart 2006; Szabolcsi 2010):

1. a. Bare plurals (books)
   b. Indefinites (a book, some book)
   c. Numerals (three books, many books)
   d. Distributive GQs (every book, each book)
   e. Modified numerals (exactly five books)
   f. Quantified NPs (at least five books, less than half of the books)
   g. Strong NPs (most books, the book)
   h. Downward entailing NPs (no books, few books)

Base line: wide scope with distributive universals provides standard instances of scope inversion.

2. Two critics saw every movie
   \( \exists_2 \succ \forall / \forall \succ \exists_2 \)

On the other side of the spectrum, bare plurals always take narrow scope (Carlson 1977; ex. b from Ruys & Winter 2010).

3. a. Two critics saw movies
   \( \exists_2 \succ \text{movies}/\neg \text{movies} \succ \exists_2 \)
   b. Every inhabitant from Midwestern cities
   \( \neg \text{midw.cities} \succ \forall \)

Numerals and inverted numerals do not admit inverted scope readings (data sometimes disputed):

4. Some critic saw five movies
   \( \exists_2 \succ \exists_5 / \neg \exists_5 \succ \exists_2 \)
   a. \( \exists x \exists Y [\text{critic}(x) \land \text{movie}(Y) \land |Y| = 5 \land \forall y \in Y \rightarrow \text{saw}(y)(x)] \)
   b. \( \exists Y [\text{movie}(Y) \land |Y| = 5 \land \forall y \in Y \rightarrow \exists x [\text{critic}(x) \land \text{saw}(y)(x)]] \)
   (up to five critics)

5. Two critics saw five movies
   \( \exists_2 \succ \exists_5 / \neg \exists_5 \succ \exists_2 \)
   a. \( \exists X [\text{critic}(X) \land |X| = 2 \land \forall x \in X \rightarrow \exists Y [\text{movie}(Y) \land |Y| = 5 \land \forall y \in Y \rightarrow \text{saw}(y)(x)]] \)
   (two critics, up to 10 movies)
   b. \( \exists Y [\text{movie}(Y) \land |Y| = 5 \land \forall y \in Y \rightarrow \exists X [\text{critic}(X) \land |X| = 2 \land \forall x \in X \rightarrow \text{saw}(y)(x)]] \)
   (five movies, up to ten critics)

6. Some critic saw exactly five movies
   \( \exists_2 \succ \exists_5 / \neg \exists_5 \succ \exists_2 \)

Comparative quantifiers are scope rigid:

7. a. More than one critic saw every movie
   \( \forall \succ \exists_{\succ 1} / \neg \exists_{\succ 1} \succ \forall \)
   b. Every critic saw more than one movie
   \( \forall \succ \exists_{\succ 1} / \neg \exists_{\succ 1} \succ \forall \)

Monotone decreasing NPs do not partake in scope reversal:

8. a. Every critic saw few movies
   b. Every critic saw less than five movies
Indefinites may take unlimited wide scope (Fodor & Sag 1982, see below):

(9) Each teacher overheard the rumor that a student of mine had been called before the dean. $\forall x \exists y \forall z \exists w$

(10) Some reactions
   a. It is necessary to distinguish between existential scope of the plural variable (the ‘$\exists X$’ part) and distributive scope (the ‘$\forall x \in X$’ part) of indefinites.
   b. Not all non-referential NPs are GQs. Indefinites are translated as choice functions or Skolemized choice functions

Szabolcsi (2010: 103) observes that the confusion is partially due to the fact that literature has asked two different questions:

(11) a. For indefinites: in which domain can indefinites remain referentially independent?
    b. For universals: in which domain can universals distribute over other entities, i.e. make other elements referentially independent?

2. INDEFINITES

Indefinites must be interpreted outside restriction with wide scope, and not in-situ (Heim 1982):

(12) If some relative of mine dies, I will inherit a house (Ruys 1992)
   a. $\exists x[(\text{relative of mine}(x) \land \text{die}(x)) \rightarrow \text{I will inherit a house}]
   $ (true if there are non-relatives of mine)
   b. $\exists x[(\text{relative of mine}(x) \land (\text{die}(x) \rightarrow \text{I will inherit a house})]

Numerals cannot be assigned wide scope:

(13) a. If three relatives of mine dies, I will inherit a house (Ruys 1992)
    b. $\exists X[|X|=3 \land [\forall x \in X[\text{friend}(x) \land \text{die}(x) \rightarrow \text{I inherit a house}]]
   $ (total of three houses)

More generally, numerals do not admit scope inversion:

(14) Some critic liked every movie $\exists > \forall / \forall > \exists$

(15) Three critics liked two movies $\exists_3 > \exists_2 / *\exists_2 > \exists_3$
   a. $\exists X[|X|=3 \land \text{critics}(X) \land \forall a \leq X \rightarrow \exists Y[|Y|=2 \land \text{movies}(Y) \land \forall b \leq Y \rightarrow \text{a liked b}]]$
   b. $\exists Y[|Y|=2 \land \text{movies}(Y) \land \forall b \leq Y \rightarrow \exists X[|X|=3 \land \text{critics}(X) \land \forall a \leq X \rightarrow \text{a liked b}]]$

(16) #Three different critics liked two movies

2.1. CHOICE FUNCTIONS

Analysis: Indefinites are existentially closed wide scope choice functions (Kratzer 1998; Reinhart 2006; Ruys 1992; Winter 1997; Matthewson 1999).

(17) Choice function $\text{Def}$
   a. $f_{\text{>et,e}}$ is a choice function (CH) iff $\forall X_{\text{>et,e}} \neq \varnothing \rightarrow f(X) \in X$
   b. $\text{CH}_{\text{>et,e},p} = \lambda f[\forall X[X \neq \varnothing \rightarrow X(f(X))]]$ (Winter 2000: (6))

(18) a. Every boy read a book $\exists f[\text{CH}(f) \land \forall x[\text{boy}(x) \rightarrow f(\text{book})(x)]]$
   b. $\exists f_{\text{>et,e}}[\text{CH}(f) \land \text{die}(f(\text{relatives of mine})) \rightarrow \text{I will inherit a house}]

(19) a. If three relatives of mine dies, I will inherit a house
   b. $\exists f_{\text{>et,e}}[\text{CH}(f) \land \text{die}(f(\text{relatives of mine})) \rightarrow \text{I will inherit a house}]

$\forall > \exists \forall > \exists$
Choice functions vs. simple functions: Why use choice functions ((20)b), and not simple functions? Because a simple, non-restricted function ((20)c) could apply to common noun (book) and return any individual, irrespective whether it satisfies the restrictor denotation or not.

(20) a. A book is on the table
   b. \( \exists \text{CH}(f) \land f(\text{book}) \text{ is on the table} \)
   c. \( \exists f(\text{book}) \text{ is on the table} \)

The empty set problem (aka empty restriction problem): Definition (17) delivers t-conditions that are too weak if the restrictor set is empty (Winter 2000; Reinhart 2006: 96)

(21) a. An American king is living in Utrecht
   b. \( \exists \text{CH}(f) \land f(\text{American king}) \text{ is living in Utrecht} \)

Problem: Definition (17) states that a function is a choice function if the sets it applies to are non-empty. If these restrictor set is empty (American king), the function counts as a choice function by *ex falso quodlibet*, and \( f \) may pick out arbitrary values. As a consequence, (21)a should come out as true as long as there in an individual that satisfies the condition *is living in Utrecht* - irrespective whether this individual is an American king or not.

(22) false for American king

\[
\exists f[[\forall X_{<et>} [X \neq \emptyset \rightarrow f(X) \in X]] \land f(\text{American king}) \text{ is living in Utrecht}]
\]

(Definition of CH)

(Forced) solution I: explicitly restrict choice functions to non-empty sets (see discussion in Winter 2000; Geurts 2000; Reinhart 2006):

(23) \( f_{<et,\emptyset>} \) is a choice function iff \( \forall X_{<et>} \)
   a. \( [X \neq \emptyset \rightarrow f(X) \in X] \land \)
   b. \( [X = \emptyset \rightarrow f(x) = \text{the 'empty' individual which does not satisfy any predicate}] \)

(Forced) solution II: Shift choice function to type of generalized quantifiers (Winter 1997). Again, empty set problem solved by stipulation.

(24) \( f_{<et,=\{\emptyset\}>} \) is a choice function iff
   a. \( f(\emptyset) = \varnothing_{<et,\emptyset>} \land \)
   b. \( \forall X_{<et>} [X \neq \emptyset \rightarrow \exists a[X(a) \land f(X) = \lambda Y[Y(a)]] \)

Moreover, Winter (2000) raises the question why choice functions are translated as indefinites, and not as, say, *most*. Winter derives this fact from conservativity, isomorphism and a third logical property alleged to be universal (*non-triviality*). See Winter (2000) for details.

2.2. INTERMEDIATE SCOPE
Fodor & Sag (1982) observe that indefinites do not sponsor intermediate readings (IR).

(25) Each teacher overheard the rumor that *a student of mine* had been called before the dean.
Abusch (1993/94) notes exceptions to Fodor&Sag’s claim:

(26) Every professor rewarded every student who read some book he had recommended.
\( \forall > \exists > \forall \)

(27) Every one of them moved to Stuttgart because some woman lived there.
\( \forall > \exists > because \)

Abusch combines Kamp/Heim analysis of indefinites with storage account for restriction. The latter is motivated by (Heim’s) observation that the assumption of \( \exists \)-closure at sentence level yields t-conditions that are too weak:

(28) a. If a cat likes a friend of mine I always give it to him.
    b. \( \exists x[(x \text{ is friend of mine } \land x \text{ likes a cat }) \rightarrow I \text{ give that cat to } x] \)  
       (satisfied by models with non-friends \( \text{ [ex falso quodlibet] } \) )

Kratzer: bound variable pronouns facilitate IR. This is unexpected on Abusch’s storage analysis

(29) a. Every professor, rewarded every student who read some book she, had reviewed for the New York Times.
    \( \forall > \exists > \forall \)
    b. Every professor rewarded every student who read some book I had reviewed for the New York Times.
    \( *\forall > \exists > \forall \)

(30) a. Each teacher, overheard the rumor that some student of his, had been called before the dean.
    \( \forall > \exists > \text{rumor} \)
    b. Each teacher overheard the rumor that some student of mine had been called before the dean.
    \( *\forall > \exists > \text{rumor} \)

(31) a. Every professor, got a headache whenever some student he, hated was in class.
    \( \forall > \exists > \text{whenever} \)
    b. Every professor got a headache whenever some student Mary hated was in class.
    \( *\forall > \exists > \text{whenever} \)

2.3. Skolemized choice functions

Choice function analysis of wide/intermediate scope readings (Kratzer 1998, 2003; Reinhart 2006; Ruys 1992; Winter 1997):

(32) a. Indefinites optionally translate as choice functions.
    b. Choice functions yield specific interpretation.
    c. Restrictor argument of the choice function is either explicitly specified by common noun (Reinhart) or contextually determined (Kratzer).

(33) \textit{Choice function} \( \text{Def} \)

For any non-empty \( P \in D_{\neq \varnothing} \) and \( f \in D_{\neq \varnothing} \),
\( f \) is a choice function (CH) iff \( CH(P) \in P. \)  
(Function that applies to a set and picks out a member of that set)

(34) a. \([\text{Every professor}], \text{ rewarded every student who read some book } she, \text{ had reviewed for the New York Times.} \)
    b. \( \forall x,y[[\text{professor(x) } \land \text{ student(y) } \land \text{ read(y, CH(book x had reviewed))} ] \rightarrow \) rewarded(x, y)]

(35) \textit{Scenario:}

Professor A had reviewed book-1 and book-2 and awarded those that read book-1
Professor B had reviewed book-3 and book-4 and awarded those that read book-3
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(36) [some book she had reviewed]  →
   a. CH(books [x][x→Professor A] had reviewed) = CH( {book-1, book-2}) = book-1
   b. CH(books [x][x→Professor B] had reviewed) = CH( {book-3, book-4}) = book-3

Skolemized choice functions: Value of choice function must yield same result for each given restrictor set (irrespective whether restrictor is determined contextually or explicitly).

Problem: If two professors reviewed the same set of book, they might still single out different books for honors credit:

(37) Scenario:
   Professor A had reviewed book-1 and book-2 and awarded those that read book-1
   Professor B had reviewed book-1 and book-2 and awarded those that read book-2

(38) [some book she had reviewed]  →
   a. CH(books [x][x→Professor A] had reviewed) = CH( {book-1, book-2}) = book-n
   b. CH(books [x][x→Professor B] had reviewed) = CH( {book-1, book-2}) = book-n
   where n ∈ {1, 2}

→ CH cannot pick out different books for different professors


(39) Skolemized choice function (sCH)Def
   For any x∈D, non-empty P∈D<e>, and f∈D<e,<<e,t>,e>>,
   f is a Skolemized choice function (sCH) iff sCH(x)(P)∈P

(40) [some book she had reviewed]  →
   a. sCH([x][x→Professor A])(books [x][x→Professor A] had reviewed) =
     = sCH(Professor A) ({book-1, book-2}) = book-1
   b. sCH([x][x→Professor B])(books [x][x→Professor B] had reviewed) =
     = sCH(Professor B) ({book-1, book-2}) = book-2

→ CH may pick out different books for different professors while keeping restrictor constant.

2.4. IMPLICIT VARIABLES
Skolemization by implicit variables with perspectival modifiers (local, different, ...):

(41) a. All these reporters are covering local athletes. (Mitchell 1987; Partee 1989)
    b. ∀x[reporter(x) → cover(x, f(x)(athlete))]

a certain as a perspectival operator (Hintikka 1986):

(42) a. Each husband had forgotten a certain date - his wife’s.
    b. ∀x[husband(x) → had forgotten (x, f(x)(date))]

Implicit variables triggers Intermediate Readings (Ruys 1992):

(43) a. Every professor will rejoice if a certain student of his cheats on the exam.
    b. Every professor will rejoice if a different student cheats on the exam.
    c. Every student will rejoice if another student cheats on the exam.
3. WH-IN-SITU - THE DONALD DUCK PROBLEM

Karttunen (1977): question as sets of true propositions (ignoring intensionality throughout):

(44) Which book did you read
\[ \lambda p. \exists x [\text{book}(x) \land p = \text{you read } x \land p = 1] \]

(45) Which man read which book
\[ \lambda p. \exists x, y [\text{man}(x) \land p = x \text{ bought } y \land \text{book}(y) \land p = 1] \]

DD problem: In downward entailing contexts such as (46)a, the restrictor must not be scoped out. Otherwise, t-conditions of (46)a are too weak (Reinhart 1997; see also Heim 1982):

(46) Who will be offended if we invite which philosopher
a. \[ \lambda p. \exists x, y [\text{human}(x) \land p = \text{we invite } y \land \text{philosopher}(y) \land x \text{ is offended}] \]
   (Possible answer by ex falso: Donald Duck)
b. \[ \lambda p. \exists x, y [\text{human}(x) \land \text{philosopher}(y) \land p = \text{we invite } y \rightarrow x \text{ is offended}] \]

DD-problem with indefinites (Heim 1982):

(47) If we invite some philosopher, Max will be offended
a. \[ \exists x [[\text{we invite}(x) \land \text{philosopher}(x)] \rightarrow \text{Max will be offended}] \]
b. \[ \exists x [\text{philosopher}(x) \land [\text{we invite}(x) \rightarrow \text{Max will be offended}]] \]

DD-problem with indefinite in restriction of universals and within scope of negation:

(48) Max did not consider the possibility that some politician is corrupt
a. \[ \exists x [\neg \text{Max consider the possibility that } x \text{ is corrupt } \land \text{politician}(x)] \]
   (Would come out as true if there are corrupt non-politicians.)
b. \[ \exists x [\text{politician}(x) \land \neg [\text{Max consider the possibility that } x \text{ is corrupt}]] \]

For discussion of further developments see Szabolcsi (2010), among many others.

References


Liu, F.-h. 1990. Scope Dependency in English and Chinese. Diss, UCLA.


