

Scope without
Syntax

Luke Smith

Background

English Data

Model

Scrambling

Rigidity is
Ambiguity

Expansion

References

Scope without Syntax

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Generative syntax has an poor record with scope. . .

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- Scope is often used as a metric understanding the underlying structure of a sentence (is there covert movement? phase edges? etc.)
- Despite this, there's *no really systematic* metric for how scope interacts with the syntax (see the literature in response to Han, Lidz, and Musolino (2007)).
- Scope is highly sensitive to linear order. Minimalist syntacticians either have to deny this or model it as a crazy coincidence (Antisymmetry, or see works like **collins17**).
- Scope is *highly* dependent on context (Chomsky's Aphasia).

This is a social construct!

$$\forall x \exists y, eat(x, y)$$

- We place quantifiers visually to the left. . .
- Corresponding visually to “the place they take scope” .
- Both of these *are metaphors*.
- **YET**, there’s a tendency for some linguists to talk about the notation of formal logic as if it’s somehow psychologically real.
 - We physically move quantifiers in our derivations to get the right “logical form” .
 - Linguistics Wars: does formal logic create language or *vice versa*?

Let's Divorce Scope from Syntax

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English Data

Model

Scrambling

Rigidity is
Ambiguity

Expansion

References

- This is not a new theory of syntax.
- But an account of scope without reference to syntactic structure.
- Why?
 - It's Minimalist™.
 - We can handle the linear order effects and the context dependence of scope.

Typical Scope Data (English)

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Model

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Ambiguity

Expansion

References

- English active sentences tend to be ambiguous:
 - (1) a. Every arrow hit a target. ($\forall > \exists, \exists > \forall$)
b. Some jackass ruins every party. ($\forall > \exists, \exists > \forall$)
- But their passive equivalents tend not to be...
 - (2) a. A target was hit by every arrow. ($\exists > \forall$)
b. Every party is ruined by some jackass. ($\forall > \exists$)
- NB: There are some differences between scopes of universals and existentials. This won't be a part of my analysis, but I'll talk about it later.

Intuitions of the Theory

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Syntax

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Background

English Data

Model

Scrambling

Rigidity is
Ambiguity

Expansion

References

- In the abstract, *all* possible quantifier scope interpretations are possible. . .
- But, given context, the cost of communication and other pragmatic effects, we narrow down on the plausible interpretations.
- Unambiguous sentences are those with one sensible interpretation left, while ambiguous ones have several.
- Interesting empirical correlates, but we'll get into that later.

Implementation: Game Theory

- I'll be using Game Theory for this analysis.
- Game Theory is a way of formalizing decision-making in a **game** where **players** have the opportunity to choose among different **strategies** to achieve different **payoffs**.
- E.g. a game of paper-scissors-rock:
 - Two players
 - Each player has three different strategies: paper, scissors or rock.
 - The winner gets a "payoff" to symbolize victory.

Our Game

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Background

English Data

Model

Scrambling

Rigidity is
Ambiguity

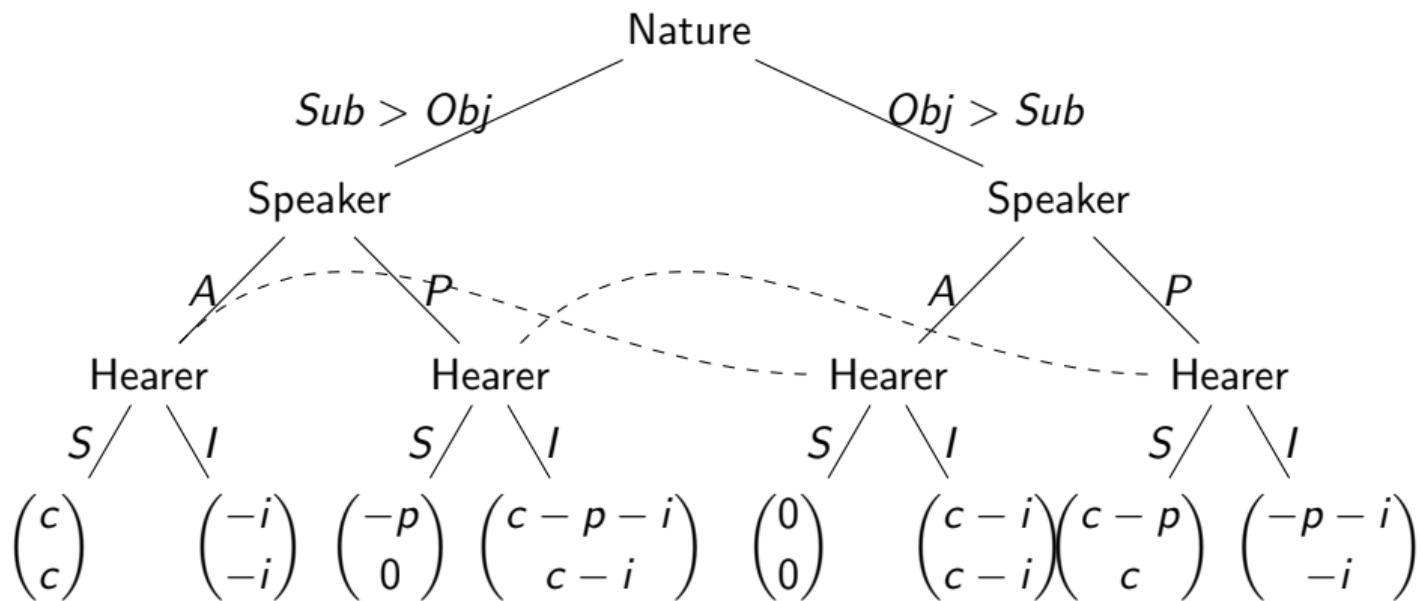
Expansion

References

- Three players: a Speaker, a Hearer and *Nature*
- Goal: the Speaker communicates the correct message to the Hearer.
- Strategies (they happen in this order):
 - Nature has two: it (randomly) decides if the sentence the Speaker produces should have the agent scoping over the patient or *vice versa*.
 - The Speaker, knowing what Nature has decided, decides whether to word a sentence as an *Active* one or a *Passive* one.
 - Lastly, the Hearer, ignorant of Nature's choice, but knowing what the Speaker said, chooses whether to interpret the sentence with a *Surface* scope reading or an *Inverse* scope reading.

- Both the Speaker and Hearer get a payoff of c (for communication) if the Hearer ends up figuring out the right reading from the Speaker's sentence. This is the MacGuffin.
- Certain constructions, like passives are marked. The Speaker's payoff is deduced by $-p$ when he employs a passive.
- Inverse scope is also non-preferred. When the Hearer reconstructs a sentence with inverse scope, both players lose $-i$.

The Entire Game



Meta-game Thinking

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Syntax

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Background

English Data

Model

Scrambling

Rigidity is
Ambiguity

Expansion

References

- Why would the Speaker undergo the cost of passivization unless it improved his position? (i.e. to avoid the inverse scope penalty) *Passivization as signalling*.
- This would seem to indicate that if the Speaker has chosen *Passive*, Nature has chosen $Obj > Sub$.
- But if the Speaker has chosen *Active*, two hypotheses are possible:
 - This is indeed the desired scope order.
 - Inverse scope is the correct interpretation, but the Speaker doesn't mind taking $-i$ because $-p$ is more grave.
- Result: there's only one plausible choice if the Speaker uses a *Passive*, but there are two possibilities if he uses an *Active* (ambiguity).

What if there's another strategy?

- Some languages have free word order, and unlike English can achieve surface scope without marked transformations/additional material.
- These languages are nearly entirely scopally unambiguous and take only surface scope (Karimi 2003).

(3) a. Yek dāneshju hame ketāb-i xānd.

a student all book-IND read

“A student read every book.”

$(\exists > \forall; * \forall > \exists)$

b. Hame ketāb-i yek dāneshju xānd.

all book-IND a student read

“A student read every book.”

$(\forall > \exists; * \exists > \forall)$

In other scrambling languages as well. . .

Scope without
Syntax

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Background

English Data

Model

Scrambling

Rigidity is
Ambiguity

Expansion

References

(4) dass eine Frau jeden liebt
that a woman everybody loves

“... that everyone loves a woman”

(some > every; ??every > some)

(5) dass jeden eine Frau liebt
that everybody a woman loves

“... that everyone loves a woman”

(every > some; ??some > every)

Scramble as an alternative strategy

- We can say that in these languages, Speakers have the additional strategy *Scramble*, which achieves a different word order without the $-p$ cost.
- Let's examine the Speaker's payoffs with this new strategy:

	<i>Sub, S</i>	<i>Sub, I</i>	<i>Obj, S</i>	<i>Obj, I</i>
Active	c	$-i$	0	$c - i$
Passive	$-p$	$c - p - i$	$c - p$	$-p - i$
Scramble	0	$c - i$	c	$-i$

- *Scramble* **dominates** *Passive* as a strategy when it is available.

Scrambling Game

Scope without
Syntax

Luke Smith

Background

English Data

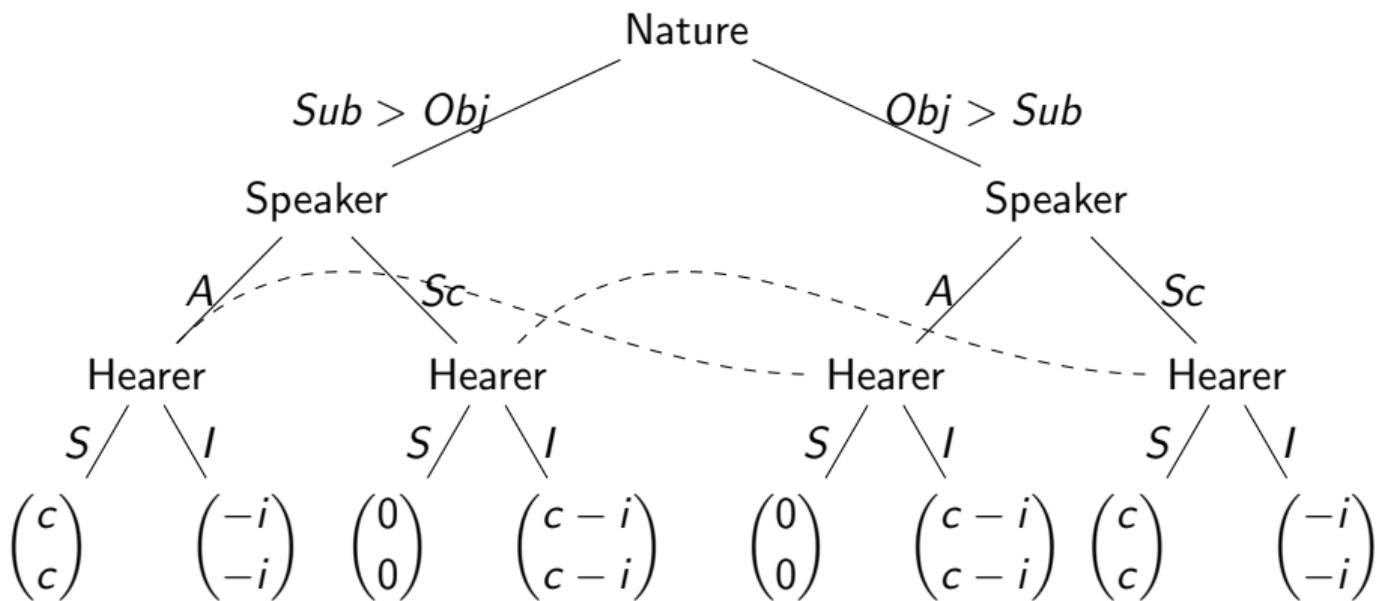
Model

Scrambling

Rigidity is
Ambiguity

Expansion

References



Meta-game Thinking

- There are clear Schelling Points in this game: No matter what Nature chooses, the Speaker and Hearer can *always* get to c, c with no costs.
- The Speaker will want to put the Hearer on track to get to this payoff.
- And the Hearer knows no matter what, this will always be a payoff given by choosing *Surface* (since *Inverse* *always* yields a $-i$).
 - Hearer: Always choose *Surface*
 - Speaker: Always choose what strategy will yield c, c when the Hearer chooses *Surface*.
- No ambiguity ever—every sentence is unambiguous and surface scope.

- From the Game Theoretics of this we can generalize:
 - (6) Word order rigidity \rightarrow ambiguity
 - (7) Word order flexibility \rightarrow disambiguation
- This is not just a “parameter”, but a principle of order independent of formal syntactic properties of languages.
- The Game Theoretics should be constant across *not just* rigid/flexible languages, but across rigid/flexible constructions.

- English negation may only appear *after* a modal:

(8) Billy can not go. (\neg > can; can > \neg)

(9) * Billy not can go.

- But where there are multiple modals, there are different places the negation can appear and there is only one interpretation available, just like the scrambling data:

(10) Billy could not have gone before we arrived. (*not* > *have*)

(11) Billy could have not gone before we arrived. (*have* > *not*)

Chinese local rigidity

- Normally, Chinese exhibits scrambling-style surface scope:

- (12) a. Meigeren dou zhuazou yige nüren.
everyone all arrest a woman
“Everyone arrested a woman.”
- b. (You) yige nüren meigeren dou zhuazou.
(have) a woman everyone all arrest.
“A woman was arrested by everyone.”

- But in certain constructions, which are rigid, ambiguity arises:

- (13) a. Meigeren dou bei yige nüren zhuazou.
everyone all PASS a woman arrest
“Everyone was arrested by a woman.”
- b. *Bei yige nüren meigeren dou zhuazou.
PASS a woman everyone all arrest

Persian local rigidity

- Persian is a scrambling language, but negation is stuck at the end with the ver, being rigid:

(14) Yek dāneshju ān ketāb-rā na-xānd.
 one student that book-ACC not-read
 “A student didn’t read that book.”

- *But*, you do have an amount of flexibility with movement verbs. In those cases, flexibility remove ambiguity.

(15) Billy na-raft hame shahr-i.
 B. not-went all city-IND
 “Billy didn’t go to every city.” ($\neg > \forall$; $*\forall > \neg$)

(16) Billy be hame shahr-i na-raft.
 B. to all city-IND not-went.
 “Billy didn’t go to any city.” ($\forall > \neg$; $*\neg > \forall$)

Rigid Constructions

English main clauses

Persian negation

Typical English negation

Chinese passives

All of these are ambiguous

Flexible Constructions

Main clauses in scrambling languages

Chinese negation

English negation around auxes

English passives*

All of these are non-ambiguous

- This is probably the most prominent empirical statement of my theory; I think it's borne out by typological data.
- Passives as a “bad” strategy.

Toward a General Theory of Quantifier Scope

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Syntax

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Background

English Data

Model

Scrambling

Rigidity is
Ambiguity

Expansion

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- This account is incomplete. Notably it misses:
 - The tendency for universal and existential quantifiers to behave differently.
 - The tendency for some quantifiers of either type to prefer a certain range of scope (wide or narrow).
- On the first point, there have been some attempts (Clark 2012) to implement this in Game Theory.
- The second point can be dealt with in Evolutionary Game Theory, that is, languages have different quantifiers and conventionalize them as preferring one scope or another. This also can tell us *why* different languages have “synonymous” quantifiers.
- Combine my account here with the other two pieces and you would have a phenomenologically complete theory of quantification.



Clark, Robin (2012). *Meaningful Games: Exploring Language with Game Theory*. MIT Press.



Han, Chung-hye, Jeffrey Lidz, and Julien Musolino (2007). “V-raising and grammar competition in Korean: Evidence from negation and quantifier scope”. In: *Linguistic Inquiry* 38.1.



Karimi, Simin (2003). *Word Order and Scrambling*. Blackwell Publishing Ltd.