

The Prosody of Paths

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The goal of this talk is to articulate and defend an output-oriented phonological analysis of a restriction that is traditionally situated in the syntax: Path Containment (Pesetsky 1982). By studying the optimal application of processes in the phrasal phonology of Mandarin (AN), I will argue that the prosody must be leveraged in a transparent and surface-oriented way **to reflect the paths of certain types of syntactic movements.**

Our results will ultimately fit into the interface paradigm of Match Theory (Selkirk 2009), but they will seem at first blush to demand a deep rethinking of syntax-prosody mapping. So to start from the preliminaries:

- **Prosodic Structure:** (Nespor & Vogel 1986, Itô & Mester 1992, 2007)
 - Phonological strings are parsed into hierarchical constituent structures, built from abstract constituents along the prosodic hierarchy ($\sigma > FT > \omega > \phi > \iota$).
 - Prosodic structure is built in a parallel/global phonological evaluation, where it is subjected to ranked and violable output-oriented phonological constraints.
- **Syntax-Prosody Mapping:** (Selkirk 1984, 2009, Truckenbrodt 1999)
 - When phonological strings are produced with broad-focus/regular speech rate, phonological diagnostics can reveal an “optimal” pattern of prosodic phrasing.
 - This optimal pattern of phrasing is partially shaped by interface constraints that force the preservation of specific kinds of syntactic information.

My first goal today will be to argue for a new kind of interface constraint: WRAP(CHAIN). Our ultimate target here: to connect this constraint with independent output restrictions to explain a ban on crossing paths of movement in Mandarin—which looks a bit like this:

- (1) a. $[\text{OUTER WHAT SUBJECT}]$ do you know $[\text{INNER WHO}]$ to talk to ____I about ____O ?
-
- b. $[\text{INNER WHO}]$ do you know $[\text{OUTER WHAT SUBJECT}]$ to talk to ____I about ____O ?

Map:

1. Background
2. WRAP(CHAIN)
3. Path Containment

Clause-Internal Prosodic Organization

To detect higher structure, we'll rely on a classical methodology (Nespor & Vogel 1986):

- Prosodic constituents define the domains of application for segmental processes.
- Introspective judgments about these processes → reveal higher-level constituency.

Between the v + o:

(Brodtkin 2025a)

1. COALESCENCE: /ai ae, ao au/ → [e, o]

(7)	{ π	v	o	}	{ π	x	}
	néte ^H	i	kandáo ^H		di	wangáe ^H	
	na-itai	i	kandao		di	bangae	
	3ERG- <i>seek</i>	3ABS	<i>scythe</i>			<i>in PLACE</i>	
	'She's looking for the scythe in Banggae.'						

2. GLOTTAL DELETION: intervocalic /ɲ ʔ/ → [Ø]

(8)	{ π	v	o	}	{ π	x	}
	nakáros ^H	i	iripáʔi ^H		di	rewatáʔa ^H	
	na-karaʔus	i	iripaʔi		di	rebataʔa	
	3ERG- <i>scratch</i>	3ABS	<i>NAME</i>			<i>in PLACE</i>	
	'She scratched Ripa'i in Rebata'a.'						

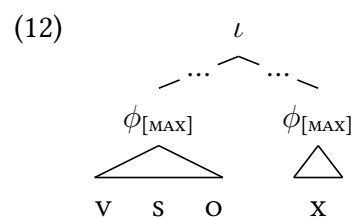
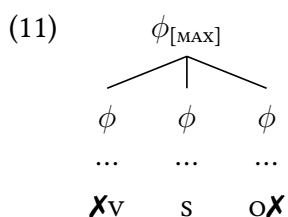
3. VOICED OBSTRUENT LENITION: intervocalic /b d d̥ ʒ g/ → [w ɪ j ʃ]

(9)	{ π	v	o	}	{ π	x	}	{ π	x	}
	nasáka ^H	i	waláo ^H		do	álla ^H		ó ^H		
	na-saka	i	balao		do	allo		o		
	3ERG- <i>catch</i>	3ABS	<i>mouse</i>			<i>that day</i>		<i>PRT</i>		
	'They caught the mouse on that day.'									

Between the v, s, + o:

(10)	{ $\phi_{[MAX]}$	v	s	o	}	{ $\phi_{[MAX]}$	x	}
	néte ^H	i	irípe ^H	waláo ^H		díon ^H		
	na-itai	i	iripaʔi	balao		dion		
	3ERG- <i>seek</i>	3ABS	<i>NAME</i>	<i>mouse</i>		<i>there</i>		
	'Ripa'i is looking for the mouse there.'							

Proposal: all of these processes are blocked at the edges of the $\phi_{[MAX]}$ (Itô & Mester 2007)



2. Wh-Movement

Mandar has a process of WH-movement that raises WH-words into the left periphery.

- DP WH-movement only targets ABS DPS; triggers the loss of ABS AGR;
- DP WH-words always form ϕ s; usually monosyllabic (Brodtkin 2025b).

WH-movement of the O:

(13)	{ $\phi_{[MAX]}$	WH _O	v	s	t _O	}	{ $\phi_{[MAX]}$	X	}
		né	na ^H túme ^H	iripáʔi ^H	_____		díon ^H		
		nai	na-tumae	ripaʔi	t _{nai}		dion		
		who	3ERG-propose	NAME	t _{who}		there		
		‘Who did Ripa’i propose to _____ there?’							

WH-movement affects the distribution of $\phi_{[MAX]}$ s.

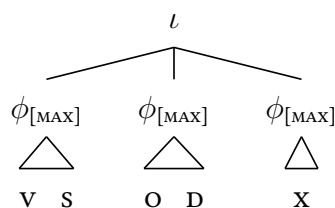
- When the *voiceP* contains four ω s, it is typically split up into two maximal ϕ s. (Brodtkin 2025a: the maximum number of ω s in the $\phi_{[MAX]}$ in Mandar = three.)

(14)	{ $\phi_{[MAX]}$	v	s	}	{ $\phi_{[MAX]}$	O	D	}	{ $\phi_{[MAX]}$	X	}
		natappása ^H	ĩ	iripáʔi ^H	báju ^H	yúru ^H	dío ^H				
		na-tappasaj	i	iripaʔi	bađzu	guru	dio				
		3ERG-wash for	3ABS	NAME	shirt	teacher	there				
		‘Ripa’i washed a shirt for the teacher there.’									

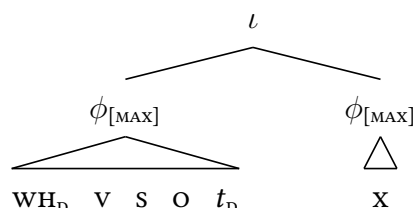
- When WH-movement targets the last word of a vsOD string: the parse changes.

(15)	{ $\phi_{[MAX]}$	WH _D	v	s	O	t _D	}	{ $\phi_{[MAX]}$	X	}
		né	na ^H tappása ^H	ĩripe ^H	wáju ^H	_____	dío ^H			
		nai	na-tappasaj	iripaʔi	bađzu	t _{nai}	dio			
		who	3ERG-wash for	NAME	shirt	t _{who}	there			
		‘Who did Ripa’i wash a shirt for _____ there?’								

(16) Without Wh-Movement



(17) Wh-Movement of the Dative DP



A Change in Prosody

WH-movement always triggers the same pattern of prosodic restructuring in Mandarin:

The path from a WH-word to its trace is parsed into a single ϕ .

This is distinct from the phonology of contrastive focus in the language (Appendix A).

WH-movement in embedded clauses:

- (18) $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$
 néssa^H ĭ iripá?i^H mwa? nalattfári^H ĭ yúru^H d̥ʒála^H waláo^H
 naissan̩ i iripa?i mua? na-lattfari i guru d̥ʒala balao
 knows 3ABS NAME C 3ERG-throw at 3ABS teacher net mouse
 ‘Ripa’i knows that the teacher threw a net at the mouse.’

- (19) $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$
 néssa^H ĭ iripá?i^H né na^Hlattfári^H yúru^H jála^H _____
 naissan̩ i iripa?i nai na-lattfari guru d̥ʒala t_{nai}
 knows 3ABS NAME who 3ERG-throw at teacher net t_{who}
 ‘Ripa’i knows who the teacher threw a net at ____.’

WH-movement from embedded clauses:

- (20) $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$
 nahára^H i iripá?i^H gumóra^H i imína^H ditánna^H lo?dian̩^H
 nahara? i iripa?i gumora i imina ditanna lo?dian̩
 3ERG-hope 3ABS NAME scream 3ABS NAME when seeing the ring
 ‘Ripa’i hopes that Mina will scream when she sees the ring.’

- (21) $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$
 né na^Hhára^H irípe^H yumóra^H _____ ditánna^H lo?dian̩^H
 nai na-hara? ripa?i gumora t_{nai} ditanna lo?dian̩
 who 3ERG-hope NAME scream t_{who} when seeing the ring
 ‘Who does Ripa’i hope ____ will scream when they see the ring?’

WH-movement of adjuncts:

- (22) $\{\phi_{[MAX]}$ $\}$
 píra^H ĭ natappása^H ĭrípe^H wáju^H yúru^H _____
 piran̩ i na-tappasan̩ iripa?i badʒu guru t_{piran̩}
 when 3ABS 3ERG-wash for NAME shirt teacher t_{when}
 ‘When did Ripa’i wash the shirts for the teacher ____?’

The Ban on Crossing Paths

In finite clauses, these quantifiers raise out of their associated nominals to adjoin to the v (forming minimal ϕ s with the v).

When *nasang* “all” raises out of the s:

- (31) $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$
- | | | | | | | |
|------------------|---------------------------|------------------------|---------------------------|-------------------|---------------------|----------------------|
| nálljan | nása^H ĩ | yúru ^H | _____ | búku ^H | ıóttor ^H | diyéna? ^H |
| na-allian | nasan i | guru | <i>t_{nasang}</i> | buku | dottor | digena? |
| 3ERG-buy for all | 3ABS teacher | <i>t_{all}</i> | | book | doctor | earlier |
- ‘All the teachers bought [+FIN] books for the doctors earlier.’

Quantifier Movement also triggers the Wrapping Effect (though the wrapping ϕ s are slightly misaligned).

When *nasang* “all” raises out of the D:

- (32) $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$
- | | | | | | | |
|------------------|---------------------------|-------------------|-------------------|------------------------|---------------------------|----------------------|
| nálljan | nása^H ĩ | yúru ^H | wúku ^H | ıóttor ^H | _____ | diyéna? ^H |
| na-allian | nasan i | guru | buku | dottor | <i>t_{nasang}</i> | digena? |
| 3ERG-buy for all | 3ABS teacher | book | doctor | <i>t_{all}</i> | | earlier |
- ‘The teacher bought [+FIN] books for all the doctors earlier.’

Quantifier Movement can occur within the path of WH-movement:

- (33) $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$
- | | | | | | | | |
|-----------|--------------------------|--------------------------|--------------------|----------------------------|---------------------------|------------------------|-------------------------|
| né | na ^H tappásal | lé?ba^H | irípe ^H | sandzúta ^H | _____ | _____ | tón djólo? ^H |
| nai | na-tappasan | le?ba? | iripa?i | sandzuta | <i>t_{le?ba?}</i> | <i>t_{nai}</i> | taun diolo? |
| who | 3ERG-wash for exactly | NAME | a million | <i>t_{exactly}</i> | <i>t_{who}</i> | | year last |
- ‘Who did Ripa’i launder [+FIN] exactly \$1,000,000 for _____ last year?’

But Quantifier Movement cannot cross the path of WH-movement:

- (34) $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$ \times
- | | | | | | | | |
|------------|--------------------------|------------------------|-------|-----------|----------------------------|---------|---------|
| nai | na-mat-tappasal | le’ba’ | _____ | sanjuta | _____ | iripa’i | manini? |
| who | will-AF-wash for exactly | <i>t_{who}</i> | | a million | <i>t_{exactly}</i> | NAME | later |
- INTENDED: ‘Who will launder [+FIN] exactly \$1,000,000 for Ripa’i later?’

Questions:

- (35) a. Why are nested paths ok?
 b. Why are crossing paths banned?
 c. How does the language rescue “crossing-path” derivations?

Covert Movement

Part 3: “how are crossing derivations really handled?”

Answer: when Quantifier Movement should cross the path of WHM, it “fails to occur.”

(41) $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$ \times $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$

né	na ^H mattappásas	_____	_____	sandžúta ^H	lé?ba^H	iripá?i ^{H}}	maníni ^{H}}
nai	na-man-tappasaj	<i>t_{nai}</i>		sandžuta	le?ba?	iripa?i	manini
who	will-AF-wash for	<i>t_{who}</i>		a million	exactly	NAME	later

‘Who will launder [+FIN] exactly \$1,000,000 for Ripa’i later?’

First impression: a crisis of modularity:

- Syntactic movement (= QM) should not be constrained by output phonology.
- If QM really “fails to occur” in this context: crossing must be blocked in the syntax.

But: the movement still seems to occur.

In the non-finite clauses that lack Quantifier Movement, quantifiers scope beneath NEG.

(42) Mau **ndang** napelambi sola-u **nasang**,
 Though NEG 3ERG-visit friend-1GEN all
 ‘Though all my friends didn’t visit [-FIN],’ → ✓NOT > ALL, ✗ALL > NOT

In finite clauses, Quantifier Movement opens up a second scopal possibility:

(43) **Ndang** i napelambi **nasas** sola-u _____,
 NEG 3ABS 3ERG-visit all friend-1GEN *t_{all}*
 ‘All my friends didn’t visit [+FIN].’ → ✓NOT > ALL, ✓ALL > NOT

The high-scope reading persists when Quantifier Movement is “blocked” by WH-movement:

(44) Nai mu-sanga **ndang** map-pelambi _____ sola-na **nasang**?
 who 2ERG-think NEG AF-visit *t_{who}* friend-3GEN all
 ‘Who do you think didn’t visit [+FIN] all of their friends?’ → ✓ALL > NOT

Analysis: Quantifier Movement occurs in the syntax even when it crosses paths w/ WHM. Movement creates copies, and phonology chooses which copies to realize (Bošković 2001). Pronouncing the lower copy of QM → an output-optimizing strategy to avoid crossing ϕ s.

(45) Who do they think **NEG** visited **all** who their friends **all**?

Result: an output analysis of suspended movement—and the ban on Crossing Paths.

4. Conclusions

Stepping back from the specifics, we arrive at three central conclusions.

First, we might extend a phonological analysis to path containment effects elsewhere:

- (46) a. $\{\phi_{WH1}$ WHAT SUBJECT do you know $\{\phi_{WH2}$ WHO to talk to $__\}_{WH2}$ about $__\}_{WH1}$?
- b. $\{\phi_{WH1}$ WHO do you know $\{\phi_{WH2}$ WHAT SUBJECT to talk to $__\}_{WH1}$ about $__\}_{WH2}$?

This would be a great coup for Minimalism—allowing for the elimination of linear order, PATHS, the PATH MODULE, and an irreducibly representational constraint from the syntax.

We may also already have the foundations of a case in English:

- (47) a. $\{\phi$ I need **a/*to** visit Sulawesi $\}$.
- b. $\{\phi$ Who do you need t $\}$ $\{\phi$ **to/*a** visit Sulawesi $\}$?

Second, we might try to derive other restrictions on movement from output prosody. A phonological island effect:

- (48) a. Wait, wait, tell me one more time...
- b. $\{ \downarrow \dots \}$
What would you get sick [sɪk] if you ate t ?
- c. $\{ \downarrow \dots \}$ $\{ \downarrow \dots \}$
*What would you get sick [sɪk'] if you ate t ?

Third, we should take seriously the possibility that many more types of movement—and perhaps many more syntactic relationships—are systematically reflected in output prosody.

- This conclusion fits together with the emerging recognition that prosodic phrasing is mobilized to reflect other syntactic relationships: adjunction, Japanese WH-C.
- This theoretical step, in turn, opens up a new world of research at the S-P interface:
 - on the identity of the relevant syntactic relationships,
 - on the cross-linguistic shape of their phonologization,
 - on their interaction with output-oriented pressures, and
 - on their manifestation in “production prosody.”

Appendix A: The Phonology of Focus

No work has been done on the phonetic manifestation of any kind of focus in Mandarin. But our segmental diagnostics for the $\phi_{[MAX]}$ reveal some phonological generalizations:

1. Information focus (“whether or not an item has been mentioned in the discourse”) has no effect on patterns of prosodic constituency. For a given phonological string, the broad-focus parse will be identical whether every constituent is new or given. (N.b.: Féry & Ishihara 2011 claim that information focus has only phonetic effects and does not affect prosodic constituency in German and Japanese, too.)
2. Contrastive focus (“identificational focus, narrow focus”) has a phonology:
 - Contrastive foci must always be right-aligned in a $\phi_{[MAX]}$ (usually accomplished by changing the distribution of ϕ s, not by moving foci).
 - Contrastive foci must be right-aligned in the first $\phi_{[MAX]}$ in the ι (earlier $\phi_{[MAX]}$ boundaries are deleted, except in cases of 2nd-occurrence focus).
 - In the space after a contrastive focus, the usual pattern of phrasing emerges.

Examples:

- (49) $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$
- | | | | | | | | | |
|----------------------|----------------------|---------|-------------------------|-------------|-------------------|--------------------|--------------------|-------|
| néssa ^H ĩ | iripá?i ^H | mwa? | nalattǰári ^H | i | yúru ^H | dǰála ^H | waláo ^H | |
| naissan̩ | i | iripa?i | mua? | na-lattǰari | i | guru | dǰala | balao |
| knows | 3ABS | NAME | C | 3ERG-throw | 3ABS | teacher | net | mouse |
- ‘Ripa’i knows that the teacher threw a net at the mouse.’

- (50) $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$
- | | | | | | | | | |
|------------------------------|------|----------------------|------|-------------------------|------|-------------------|--------------------|--------------------|
| naissan̩ ^H | i | iripá?i ^H | mwa? | nalattǰári ^H | i | yúru ^H | dǰála ^H | waláo ^H |
| naissan̩ | i | iripa?i | mua? | na-lattǰari | i | guru | dǰala | balao |
| knows | 3ABS | NAME | C | 3ERG-throw | 3ABS | teacher | net | mouse |
- ‘Ripa’i KNOWS that the teacher threw a net at the mouse.’

- (51) $\{\phi_{[MAX]}\}$ $\{\phi_{[MAX]}\}$
- | | | | | | | | | |
|----------------------|--------------------|---------|-------------------------|-------------|-------------------|-------------------------|--------------------------|-------|
| néssa ^H ĩ | irípe ^H | mwa? | nalattǰári ^H | i | yúru ^H | jála^H | baláo^H | |
| naissan̩ | i | iripa?i | mua? | na-lattǰari | i | guru | dǰala | balao |
| knows | 3ABS | NAME | C | 3ERG-throw | 3ABS | teacher | net | mouse |
- ‘Ripa’i knows that the teacher threw A NET at THE MOUSE.’

Appendix B: Toward a Typology of Movements

The real case for our analysis emerges from two further generalizations about movement.

First: the remaining movements are parameterized for wrapping in Mandar.

1. Weak quantifiers preferentially move to preverbal positions + trigger wrapping:

(52) $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$
 mánde^H i waláo^H mé?di wáta?^H diyena?^H,
 maŋ-ande i balao mai?di bata? digena?
 ANTIP-eat 3ABS mouse a lot of corn earlier
 ‘The mouse ate a lot of corn earlier’ (contact register)

(53) $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$
 mé?di nánde^H wálo^H — wáta?^H diyena?^H
 mai?di na-ande balao *t_{mai?di}* bata? digena?
 a lot of 3ERG-eat mouse *t_{a lot of}* corn earlier
 ‘The mouse ate a lot of corn earlier’ (natural Mandar)

2. Scrambling: definite arguments can scramble to the right, yielding orders like vos.

Brodtkin 2025a shows that (i) this is movement + (ii) scrambled DPS $\rightarrow \phi_{[MAX]}$ s.

(54) $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$
 nasáka^H i — waláo^H iripá?i^H
 na-saka i *t_{iripa?i}* balao iripa?i
 3ERG-catch 3ABS *t_{NAME}* mouse NAME
 ‘Ripa’i caught the mouse.’

3. Topicalization: referential xPs can be topicalized to the left. Brodtkin (submitted)

shows that (i) this is movement + (ii) topicalized xPs $\rightarrow \iota$ s. (Test: nasal assimilation)

(55) $\{\iota$ $\}$ $\{\iota$ $\}$
 itim búlaŋ,^H póle^H i irámas^H sola wenéna^H —
 itij bulaŋ pole i iramaŋ sola baine-na
 that month come 3ABS NAME with wife-3GEN
 ‘That month, Ramang came with his wife.’

4. Pivot Raising: under specific prosodic circumstances, ABS DPS shift to a position that

falls between auxiliaries and the verb. No wrapping.

(56) $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$
 púra^H i iripá?i^H mánde állo^H —
 pura i iripa?i maŋ-ande allo
 finished 3ABS NAME ANTIP-eat midday
 ‘Ripa’i is finished having lunch.’

5. Pronoun Raising: unstressed pronouns move through a series of positions in finite clauses, ultimately ending up in 2P. No wrapping.

(57) $\{\phi_{[MAX]}$ \downarrow $\}$ $\{\phi_{[MAX]}$ \downarrow $\}$

púra ^H	ma	jáu ^H	mánde ^H	_____	jépaʔ ^H
pura	maʔ	iau	maŋ-ande	t _{iau}	dʒepaʔ
finished	PFV.1ABS	1SG	ANTIP-eat	t _{1SG}	tortilla

‘I’m done eating tortillas.’

6. Preposition Raising: unstressed stranded prepositions move left in the *voicer*. No wrapping.

(58) $\{\phi_{[MAX]}$ $\}$ $\{\phi_{[MAX]}$ $\}$

naláttjar ^H	i	iripáʔi ^H	bátaʔ ^H	lo	ri	jáli ^H
na-lattjar	i	iripaʔi	bataʔ	lao	di	iali
3ERG-throw	3ABS	NAME	corn	toward	to	NAME

‘Ripa’i threw the corn at Ali.’

(59) $\{\phi_{[MAX]}$ \downarrow $\}$ $\{\phi_{[MAX]}$ \downarrow $\}$

naláttjar ^H	i	láo ^H	irípe ^H	wátaʔ ^H	_____
na-lattjar	i	lao	iripaʔi	bataʔ	t _{lao}
3ERG-throw	3ABS	toward	NAME	corn	t _{toward}

‘Ripa’i threw the corn at him.’

Second: the correlation between wrapping effects and crossing constraints = perfect.

- The movements that force wrapping → unable to cross paths with each other. (WH-movement, Focus-Fronting, Amount Movement, Quantifier Movement)
- The movements that don’t force wrapping → can cross each other/everything else (Scrambling, Topicalization, Pivot Raising, Pronoun Raising, Preposition Raising)

MOVEMENT	WRAPPED BY ϕ ?	CROSSING CONSTRAINT?
WH-Movement	✓	✓
Quantifier Movement	✓	✓
Amount Movement	✓	✓
(60) Scrambling	✗	✗
Topicalization	✗	✗
Pivot Raising	✗	✗
Pronoun Raising	✗	✗
Preposition Raising	✗	✗

References: find them online at: <https://tinyurl.com/brodtkinyaledomains>