

RIGHT NODE RAISING AND FLEXIBLE CYCLIC LINEARIZATION

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SYNC

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Overview

- **Question:** How do we linearize (assign linear order to) right node raising (RNR) constructions such as (1)?
 1. Darius found and Jasmine took the book?
- **Claim:** RNR constructions can be linearized through an extension of Fox & Pesetsky's (2005) Cyclic Linearization, which I term Flexible Cyclic Linearization

Contents

1. Theoretical background and assumptions
2. The problem: RNR under Cyclic Linearization
3. The solution: RNR under Flexible Cyclic Linearization
4. Consequences of the proposal
5. Conclusion

THEORETICAL BACKGROUND AND ASSUMPTIONS

Assumptions

- In right node raising, the constituent is shared between the conjuncts (without rightward movement)
 1. Darius found and Jasmine took the book?
[_{CP} [_{&P} [_{TP} Darius found [_{DP} the book]_{*i*}] and [_{TP} Jasmine took [_{DP} the book]_{*i*}]]]

Cyclic Linearization (CL)

- Transfer of syntax to PF happens in **phases**: CP, vP, maybe DP
- At PF, **linearization** occurs, establishing ordering relations between the terminal nodes of the syntactic object
- Linearization obeys the property of **Order Preservation**: when a phase is linearized, new orderings are added, but orderings from previous phases are never deleted
 - New orderings must be compatible with previously established orderings

Example: Cyclic linearization

2. What did Darius find?

[_{CP} what_i did Darius [_{vP} what_i Darius find what_i]]

what < Darius	what < find
	Darius < find

Table 1: Ordering relations established in the vP phase of (2).

- To avoid unlinearizable orderings (e.g., *what* < *what*), Fox & Pesetsky assume that **only the most recent Merge of a constituent counts for linearization**

Example: Cyclic linearization

2. What did Darius find?

$[_{CP} \text{ what}_i \text{ did Darius } [_{vP} \text{ what}_i \text{ Darius find what}_i]]$

what < did	what < Darius	what < find
	did < Darius	did < find
		Darius < find

Table 2: Ordering relations established in the CP phase of (2). Ordering statements established in the vP phase are in bold.

RNR UNDER CYCLIC LINEARIZATION

I. Darius found and Jasmine took the book.

$[_{CP} [_{\&P} [_{TP} \text{Darius} [_{VP} \text{Darius found} [_{DP} \text{the book}]_i]] [_{\&'} \text{and} [_{TP} \text{Jasmine} [_{VP} \text{Jasmine took} [_{DP} \text{the book}]_i]]]]]$

Darius < found	Darius < the	Darius < book
	found < the	found < book
		the < book

Table 3. Ordering relations established during the linearization of $[_{VP} \text{Darius found the book}]$.

Jasmine < took	Jasmine < the	Jasmine < book
	took < the	took < book
		the < book

Table 4. Ordering relations established during the linearization of $[_{VP} \text{Jasmine took the book}]$.

Darius < found	Darius < and	Darius < Jasmine	Darius < took	Darius < the	Darius < book
	found < and	found < Jasmine	found < took	found < the	found < book
	the < and	the < Jasmine	the < took	the < the	the < book
	book < and	book < Jasmine	book < took	book < the	book < book
		and < Jasmine	and < took	and < the	and < book
			Jasmine < took	Jasmine < the	Jasmine < book
				took < the	took < book

Table 5. Ordering relationships established during the CP phase of (1) under Cyclic Linearization. Orderings in bold were established in an earlier phase. Orderings in red are unlinearizable.

- There are a number of unlinearizable orderings:
 - *the < the; book < book* (reflexive)
 - *the < and* but *and < the; etc.* (symmetric)
- Because there is no way of determining which Merge of *the book* happened first, there is no principled way to resolve these orderings

RNR UNDER FLEXIBLE CYCLIC LINEARIZATION

Flexible Cyclic Linearization

- **Flexible Cyclic Linearization (FCL):** Ordering statements may be deleted in the phase in which they arise as necessary to linearize the structure
- Flexible Cyclic Linearization is compatible with Order Preservation, which requires that orderings established in previous phases must be respected
- Where a constituent surfaces is determined by:
 - Order Preservation
 - linearizability (no reflexive, symmetric, or non-transitive orderings)
 - economy? (the less orderings removed, the better)

I. Darius found and Jasmine took the book.

[_{CP} [_{&P} [_{TP} Darius [_{VP} Darius found [_{DP} the book]_i]]] and [_{TP} Jasmine [_{VP} Jasmine took [_{DP} the book]_i]]]]

Darius < Darius	Darius < found	Darius < and	Darius < Jasmine	Darius < took	Darius < the	Darius < book
		found < and	found < Jasmine	found < took	found < the	found < book
		the < and	the < Jasmine	the < took	the < the	the < book
		book < and	book < Jasmine	book < took	book < the	book < book
			and < Jasmine	and < took	and < the	and < book
			Jasmine < Jasmine	Jasmine < took	Jasmine < the	Jasmine < book
					took < the	took < book

Table 6. Ordering relationships established during the CP phase of (I) under Flexible Cyclic Linearization. Orderings in bold were established in an earlier phase.

- The following statements are deleted for violating Order Preservation
 - the < Jasmine
 - the < took
 - book < Jasmine
 - book < took
 - book < the

I. Darius found and Jasmine took the book.

$[_{CP} [_{\&P} [_{TP} \text{Darius} [_{VP} \text{Darius found} [_{DP} \text{the book}]_i]]]$ and $[_{TP} \text{Jasmine} [_{VP} \text{Jasmine took} [_{DP} \text{the book}]_i]]]$

Darius < Darius	Darius < found	Darius < and	Darius < Jasmine	Darius < took	Darius < the	Darius < book
		found < and	found < Jasmine	found < took	found < the	found < book
		the < and			the < the	the < book
		book < and				book < book
			and < Jasmine	and < took	and < the	and < book
			Jasmine < Jasmine	Jasmine < took	Jasmine < the	Jasmine < book
					took < the	took < book

Table 7. Ordering relationships established during the CP phase of (I) under Flexible Cyclic Linearization. Ordering statements in bold were established in an earlier phase. Ordering statements that violate Order Preservation have been removed.

- The following statements are deleted because they are reflexive
 - Darius < Darius
 - the < the
 - book < book
 - Jasmine < Jasmine

I. Darius found and Jasmine took the book.

$[_{CP} [_{\&P} [_{TP} \text{Darius} [_{VP} \text{Darius found} [_{DP} \text{the book}]_i]]] \text{ and } [_{TP} \text{Jasmine} [_{VP} \text{Jasmine took} [_{DP} \text{the book}]_i]]]]]$

	Darius < found	Darius < and	Darius < Jasmine	Darius < took	Darius < the	Darius < book
		found < and	found < Jasmine	found < took	found < the	found < book
		the < and				the < book
		book < and				
			and < Jasmine	and < took	and < the	and < book
				Jasmine < took	Jasmine < the	Jasmine < book
					took < the	took < book

Table 8. Ordering relationships established during the CP phase of (I) under Flexible Cyclic Linearization. Orderings in bold were established in an earlier phase. Reflexive orderings statements and ordering statements that violate Order Preservation have been removed.

- One of each of the following pairs of symmetric ordering statements must be deleted

the < and
book < and

and < the
and < book

- If we delete the orderings in the second column (keeping the ones in the first column), then we will be left with non-transitive orderings, such as:
 - “the < and” and “and < took” but “took < the”
 - “book < and” and “and < took” but “took < book”
- Thus, we delete the orderings in the first column, and keep the orderings in the second column

I. Darius found and Jasmine took the book.

$[_{CP} [_{\&P} [_{TP} \text{Darius} [_{VP} \text{Darius found} [_{DP} \text{the book}]_i]]]$ and $[_{TP} \text{Jasmine} [_{VP} \text{Jasmine took} [_{DP} \text{the book}]_i]]]$

	Darius < found	Darius < and	Darius < Jasmine	Darius < took	Darius < the	Darius < book
		found < and	found < Jasmine	found < took	found < the	found < book
						the < book
			and < Jasmine	and < took	and < the	and < book
				Jasmine < took	Jasmine < the	Jasmine < book
					took < the	took < book

Table 9. Ordering relationships established during the CP phase of (I) under Flexible Cyclic Linearization. Orderings in bold were established in an earlier phase. Ordering statements that will be deleted are not shown.

- After deleting the indicated orderings (underlined and in red), we derive the observed order: *Darius found and Jasmine took the book*

CONSEQUENCES OF THE PROPOSAL

Consequence I: Refining the right edge condition

- Wilder (2008) proposes a **right edge condition** on coordinate structures:
 - If a shared constituent surfaces in the final conjunct (as in RNR), then gaps corresponding to the shared constituent must surface at the right edge of the conjuncts at which they appear

Consequence I: Refining the right edge condition

- But what is the right edge?
- Syntactic view: Roughly speaking, the right edge of a constituent is the most embedded constituent that it dominates
- PF view (under (F)CL): A string σ is at the right edge of a phase if there are no other strings τ in the phase such that $\sigma < \tau$
- PF view (under Wilder's proposal): A gap is at the right edge of a conjunct if, were the conjunct to be uttered as its own sentence, the constituent to which the gap corresponds would be pronounced at the end of that sentence

Consequence I: Refining the right edge condition

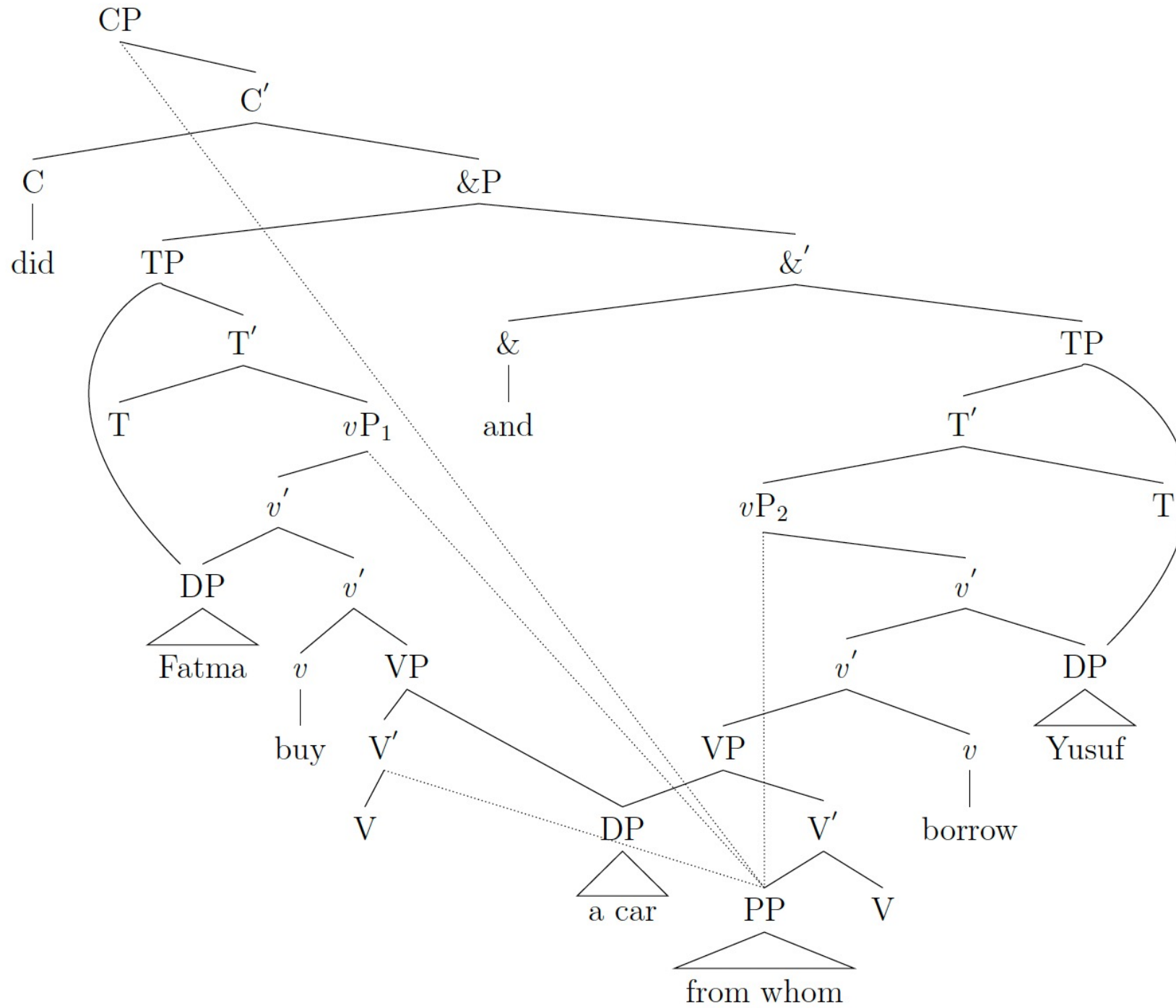
- In right node raising, the shared string is linearized at the end of the second conjunct because it is linearized at the end of both vP phases
 - This is a consequence of Order Preservation
- The placement of the shared string is a result of Order Preservation, a PF constraint, so we predict that the right edge condition is a PF constraint
 - Indeed, the right edge condition is a subcase of Order Preservation

Consequence I: Refining the right edge condition

- We can determine which formulation (syntactic or PF) is correct by examining cases where the syntactic right edge and the PF right edge are not aligned
- Such a case can be observed when across-the-board (ATB) movement and right node raising co-occur:

3. From whom did Fatma buy and Yusuf borrow a car?

$[_{CP} [_{PP} \text{from whom}]_i \text{ did } [_{\&P} [_{TP} \text{Fatma } [_{VP} [_{PP} \text{from whom}]_i \text{ Fatma buy } [_{DP} \text{a car}]_j [_{PP} \text{from whom}]_i]] \text{ and } [_{TP} \text{Yusuf } [_{VP} [_{PP} \text{from whom}]_i \text{ Yusuf borrow } [_{DP} \text{a car}]_j [_{PP} \text{from whom}]_i]]]]]$



3. From whom did Fatma buy and Yusuf borrow a car?

[_{CP} [_{PP} from whom]_i did [_{&P} [_{TP} Fatma [_{VP} [_{PP} from whom]_i Fatma buy [_{DP} a car]_j [_{PP} from whom]_i]]] and [_{TP} Yusuf [_{VP} [_{PP} from whom]_i Yusuf borrow [_{DP} a car]_j [_{PP} from whom]_i]]]]

from < Fatma	from < buy	from < a	from < car	from < from	from < whom
whom < Fatma	whom < buy	whom < a	whom < car	whom < from	whom < whom
	Fatma < buy	Fatma < a	Fatma < car	Fatma < from	Fatma < whom
		buy < a	buy < car	buy < from	buy < whom
			a < car	a < from	a < whom
				car < from	car < whom

Table 10. Ordering relations established during the linearization of [_{VP} [from whom]_i Fatma buy a car [from whom]_i].

- The following statements are deleted for being reflexive
 - $\text{from} < \text{from}$
 - $\text{whom} < \text{whom}$

3. From whom did Fatma buy and Yusuf borrow a car?

$[_{CP} [_{PP} \text{from whom}]_i \text{ did } [_{\&P} [_{TP} \text{Fatma } [_{VP} [_{PP} \text{from whom}]_i \text{ Fatma buy } [_{DP} \text{a car}]_j [_{PP} \text{from whom}]_i]]] \text{ and } [_{TP} \text{Yusuf } [_{VP} [_{PP} \text{from whom}]_i \text{ Yusuf borrow } [_{DP} \text{a car}]_j [_{PP} \text{from whom}]_i]]]]]$

from < Fatma	from < buy	from < a	from < car		from < whom
whom < Fatma	whom < buy	whom < a	whom < car	whom < from	
	Fatma < buy	Fatma < a	Fatma < car	Fatma < from	Fatma < whom
		buy < a	buy < car	buy < from	buy < whom
			a < car	a < from	a < whom
				car < from	car < whom

Table 11. Ordering relations established during the linearization of $[_{VP} [\text{from whom}]_i \text{ Fatma buy a car } [\text{from whom}]_i]$. Reflexive ordering statements have been removed.

- One of each of the following pairs of symmetric ordering statements must be deleted

from < whom

from < Fatma

from < buy

from < a

from < car

whom < Fatma

whom < buy

whom < a

whom < car

whom < from

Fatma < from

buy < from

a < from

car < from

Fatma < whom

buy < whom

a < whom

car < whom

- To derive the observed surface order, we must assume that the orderings in the second column are deleted
 - Because of a universal constraint? (movement should be observable)
 - Because of a parameter? (overt vs. covert movement)

3. From whom did Fatma buy and Yusuf borrow a car?

$[_{CP} [_{PP} \text{from whom}]_i \text{ did } [_{\&P} [_{TP} \text{Fatma } [_{VP} [_{PP} \text{from whom}]_i \text{ Fatma buy } [_{DP} \text{a car}]_j [_{PP} \text{from whom}]_i]]] \text{ and } [_{TP} \text{Yusuf } [_{VP} [_{PP} \text{from whom}]_i \text{ Yusuf borrow } [_{DP} \text{a car}]_j [_{PP} \text{from whom}]_i]]]]]$

from < Fatma	from < buy	from < a	from < car		from < whom
whom < Fatma	whom < buy	whom < a	whom < car		
	Fatma < buy	Fatma < a	Fatma < car		
		buy < a	buy < car		
			a < car		

Table 12. Ordering relations established during the linearization of $[_{VP} [\text{from whom}]_i \text{ Fatma buy a car } [\text{from whom}]_i]$. Ordering statements that will be deleted are not shown.

3. From whom did Fatma buy and Yusuf borrow a car?

[_{CP} [_{PP} from whom]_i] did [_{&P} [_{TP} Fatma [_{VP} [_{PP} from whom]_j Fatma buy [_{DP} a car]_j [_{PP} from whom]_i]]] and [_{TP} Yusuf [_{VP} [_{PP} from whom]_i Yusuf borrow [_{DP} a car]_j [_{PP} from whom]_i]]]

from < Yusuf	from < borrow	from < a	from < car	from < from	from < whom
whom < Yusuf	whom < borrow	whom < a	whom < car	whom < from	whom < whom
	Yusuf < borrow	Yusuf < a	Yusuf < car	Yusuf < from	Yusuf < whom
		borrow < a	borrow < car	borrow < from	borrow < whom
			a < car	a < from	a < whom
				car < from	car < whom

Table 13. Ordering relations established during the linearization of [_{VP} [from whom]_i Yusuf borrow a car [from whom]_i].

- The following statements are deleted for being reflexive
 - $\text{from} < \text{from}$
 - $\text{whom} < \text{whom}$

3. From whom did Fatma buy and Yusuf borrow a car?

[_{CP} [_{PP} from whom]_i did [_{&P} [_{TP} Fatma [_{VP} [_{PP} from whom]_j Fatma buy [_{DP} a car]_j [_{PP} from whom]_{i,j}]] and [_{TP} Yusuf [_{VP} [_{PP} from whom]_i Yusuf borrow [_{DP} a car]_j [_{PP} from whom]_{i,j}]]]]

from < Yusuf	from < borrow	from < a	from < car		from < whom
whom < Yusuf	whom < borrow	whom < a	whom < car	whom < from	
	Yusuf < borrow	Yusuf < a	Yusuf < car	Yusuf < from	Yusuf < whom
		borrow < a	borrow < car	borrow < from	borrow < whom
			a < car	a < from	a < whom
				car < from	car < whom

Table 14. Ordering relations established during the linearization of [_{VP} [from whom]_i Yusuf borrow a car [from whom]_j]. Reflexive ordering statements have been removed.

- One of each of the following pairs of symmetric ordering statements must be deleted

from < whom

from < Yusuf

from < borrow

from < a

from < car

whom < Yusuf

whom < borrow

whom < a

whom < car

whom < from

Yusuf < from

borrow < from

a < from

car < from

Yusuf < whom

borrow < whom

a < whom

car < whom

- Once again, we must assume that orderings in second column are deleted

3. From whom did Fatma buy and Yusuf borrow a car?

[_{CP} [_{PP} from whom]_i did [_{&P} [_{TP} Fatma [_{VP} [_{PP} from whom]_j Fatma buy [_{DP} a car]_j [_{PP} from whom]_i]]] and [_{TP} Yusuf [_{VP} [_{PP} from whom]_i Yusuf borrow [_{DP} a car]_j [_{PP} from whom]_i]]]]

from < Yusuf	from < borrow	from < a	from < car		from < whom
whom < Yusuf	whom < borrow	whom < a	whom < car		
	Yusuf < borrow	Yusuf < a	Yusuf < car		
		borrow < a	borrow < car		
			a < car		

Table 15. Ordering relations established during the linearization of [_{VP} [from whom]_i Yusuf borrow a car [from whom]_j]. Ordering statements that will be deleted are not shown.

from < did	from < Fatma	from < buy	from < and	from < Yusuf	from < borrow	from < a	from < car	from < from	from < whom
whom < did	whom < Fatma	whom < buy	whom < and	whom < Yusuf	whom < borrow	whom < a	whom < car	whom < from	whom < whom
	did < Fatma	did < buy	did < and	did < Yusuf	did < borrow	did < a	did < car	did < from	did < whom
	Fatma < Fatma	Fatma < buy	Fatma < and	Fatma < Yusuf	Fatma < borrow	Fatma < a	Fatma < car	Fatma < from	Fatma < whom
			buy < and	buy < Yusuf	buy < borrow	buy < a	buy < car	buy < from	buy < whom
			a < and	a < Yusuf	a < borrow	a < a	a < car	a < from	a < whom
			car < and	car < Yusuf	car < borrow	car < a	car < car	car < from	car < whom
				and < Yusuf	and < borrow	and < a	and < car	and < from	and < whom
				Yusuf < Yusuf	Yusuf < borrow	Yusuf < a	Yusuf < car	Yusuf < from	Yusuf < whom
						borrow < a	borrow < car	borrow < from	borrow < whom

Table 16. Ordering relations established during the linearization of CP phase of (3). Ordering statements in bold were established during a previous phase.

- The following statements are deleted for violating Order Preservation

whom < from

Fatma < from

Fatma < whom

buy < from

buy < whom

a < Yusuf

a < borrow

a < from

a < whom

car < Yusuf

car < borrow

car < a

car < from

car < whom

Yusuf < from

Yusuf < whom

borrow < from

borrow < whom

from < did	from < Fatma	from < buy	from < and	from < Yusuf	from < borrow	from < a	from < car	from < from	from < whom
whom < did	whom < Fatma	whom < buy	whom < and	whom < Yusuf	whom < borrow	whom < a	whom < car		whom < whom
	did < Fatma	did < buy	did < and	did < Yusuf	did < borrow	did < a	did < car	did < from	did < whom
	Fatma < Fatma	Fatma < buy	Fatma < and	Fatma < Yusuf	Fatma < borrow	Fatma < a	Fatma < car		
			buy < and	buy < Yusuf	buy < borrow	buy < a	buy < car	buy < from	buy < whom
			a < and			a < a	a < car		
			car < and				car < car		
				and < Yusuf	and < borrow	and < a	and < car	and < from	and < whom
				Yusuf < Yusuf	Yusuf < borrow	Yusuf < a	Yusuf < car		
						borrow < a	borrow < car		

Table 17. Ordering relations established during the linearization of CP phase of (3). Ordering statements in bold were established during a previous phase. Ordering statements that violate Order Preservation have been removed.

- The following statements are deleted for being reflexive
 - from $<$ from
 - whom $<$ whom
 - Fatma $<$ Fatma
 - a $<$ a
 - car $<$ car
 - Yusuf $<$ Yusuf

from < did	from < Fatma	from < buy	from < and	from < Yusuf	from < borrow	from < a	from < car		from < whom
whom < did	whom < Fatma	whom < buy	whom < and	whom < Yusuf	whom < borrow	whom < a	whom < car		
	did < Fatma	did < buy	did < and	did < Yusuf	did < borrow	did < a	did < car	did < from	did < whom
		Fatma < buy	Fatma < and	Fatma < Yusuf	Fatma < borrow	Fatma < a	Fatma < car		
			buy < and	buy < Yusuf	buy < borrow	buy < a	buy < car		
			a < and				a < car		
			car < and						
				and < Yusuf	and < borrow	and < a	and < car	and < from	and < whom
					Yusuf < borrow	Yusuf < a	Yusuf < car		
						borrow < a	borrow < car		

Table 18. Ordering relations established during the linearization of CP phase of (3). Ordering statements in bold were established during a previous phase. Reflexive orderings statements and ordering statements that violate Order Preservation have been removed.

- One of each of the following pairs of symmetric ordering statements must be deleted

from < did

did < from

from < and

and < from

whom < did

did < whom

whom < and

and < whom

and < a

a < and

and < car

car < and

- If we delete the orderings in the first column (keeping the ones in the second column), then we will be left with non-transitive orderings, such as:
 - “and < from” and “from < Fatma” but “Fatma < and”
 - “and < whom” and “whom < Fatma” but “Fatma < and”
 - “a < and” and “and < Yusuf” but “Yusuf < a”
 - “car < and” and “and < Yusuf” but “Yusuf < car”
- Thus, we delete the orderings in the second column, and keep the orderings in the first column

from < did	from < Fatma	from < buy	from < and	from < Yusuf	from < borrow	from < a	from < car		from < whom
whom < did	whom < Fatma	whom < buy	whom < and	whom < Yusuf	whom < borrow	whom < a	whom < car		
	did < Fatma	did < buy	did < and	did < Yusuf	did < borrow	did < a	did < car		
		Fatma < buy	Fatma < and	Fatma < Yusuf	Fatma < borrow	Fatma < a	Fatma < car		
			buy < and	buy < Yusuf	buy < borrow	buy < a	buy < car		
							a < car		
				and < Yusuf	and < borrow	and < a	and < car		
					Yusuf < borrow	Yusuf < a	Yusuf < car		
						borrow < a	borrow < car		

Table 19. Ordering relations established during the linearization of CP phase of (3). Ordering statements in bold were established during a previous phase. Ordering statements that will be deleted are not shown.

Refining the right edge condition

- After deleting the indicated orderings, we end up with the observed surface order: *From whom did Fatma buy and Yusuf borrow a car*
- The RNR-ed constituent [a car] does not appear at the syntactic right edge of the first conjunct—that position is occupied by [from whom]
- As predicted, the right edge condition is not a constraint on syntactic representations

Consequence 2: An RNR-ed string need not be a constituent

- Because right node raising is a result of PF operations (linearization) rather than syntactic ones, we predict that the shared string *need not* be a constituent
- This prediction is borne out by sentences such as the following:
 4. Who(m) did João bake and Pedro ice a cake for?
[_{CP} who_i did [_{&P} [_{TP} João [_{VP} who_i João bake [a cake]_j [for who_{i,j,k}]]] and [_{TP} Pedro [_{VP} who_i Pedro ice [a cake]_j [for who_{i,j,k}]]]]]]

An RNR-ed string need not be a constituent

- Under most analyses, *a cake for* is not a constituent
- This shows that an RNR-ed string is not necessarily a constituent
- Strongly suggests that right node raising does not involve movement (as I've assumed), since movement (Merge) targets constituents

Conclusion

- Flexible Cyclic Linearization...
 - allows us to linearize parallel structures (such as right node raising)
 - allows us to (mostly) avoid stipulating where a string is pronounced
 - makes correct predictions about the behavior of RNR constructions

Open questions

- How can FCL help us analyze other constructions?
- How can we resolve “perfectly” symmetric orderings in a principled way?
- Are there cases in which economy (i.e., number of deletions) affects the outcome of linearization?

Thank you

- Jason Kandybowicz
- Matt Pearson
- The audience at CIRCL
- Everybody who provided acceptability judgments

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