Fed counterfeeding with optional processes in Canary Islands Spanish

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Canary Islands Spanish:
Two lenition processes in interaction

(1) Consonant deletion

*cosa**s*** ‘things’ [ˈko.sa]
*hace**r*** ‘to do’ [a.ˈse]
*pape**l*** ‘paper’ [pa.ˈpe]

(2) Vowel apocope

*cos**a*** ‘thing’ [ˈkos]
*Tenerif**e*** [te.ne.ˈɾif]
*perfect**o*** ‘perfect’ [peɾ.ˈfekt]

(3) Interaction

*hij**os*** ‘children’ [ˈih]
*cos**as*** ‘things’ [ˈkos]
*ofert**as*** ‘offers’ [o.ˈfeɾt]

Consonant deletion:

- ❑ optional but well-established
- ❑ no prosodic restrictions,
- ❑ all speakers
- ❑ 55% phrase-internally
- ❑ 92% at phrase edges

Vowel apocope:

- ❑ strictly phrase-final process
- ❑ prosodically-defined positions
- ❑ male speakers
- ❑ 49% on average

Interaction:

fed counterfeeding opacity

perfecto→[perfekt]→*[perfek]
cosas→[kosa]→[kos]→*[ko]

Surface distributions (averaged for 18 speakers, 391 contexts)

Input	Output	Frequency	Input	Output	Frequency
/ˈkosa/ ‘thing’			/ˈkosas/ ‘things’	[ˈko.sas]	8%
	[ˈko.sa]	39%		[ˈko.sa]	55%
	[ˈkos]	61%		[ˈkos]	37%

Serial OT analysis

Serial Markedness Reduction (Jarosz 2014) works

High ranking of Serial Markedness (SM) constraint: *satisfy *FinalC before *UnstrV*

Unexpected (Kavitskaya & Staroverov 2010)! (Appendix)

Analyzing variation

Second SM constraint: *satisfy *UnstrV before *FinalC*

Questions

1. Percentages in experimental data generated with SMR analysis?
2. Both SM constraints necessary?

Fitting experimental data

Three different setups

1. No SM

2. Only SM for capturing fed counterfeeding = 1 SM

3. Both SM constraints = 2 SM

	No SM	1 SM	2 SM
Mean abs error (range)	18 (17.5-18.2)	6 (5.9-6.3)	3 (2.7-3.1)
Error rate (range)	15% (14.9-15.3%)	2% (1.5-1.9%)	2% (2.3-2.5%)

Learning framework

Prickett & Jarosz's (2021) SMR learner

Each setup learned 5 times, results averaged

Results

1. Adding both SM constraints improves fit
2. 2SM model is highly accurate

Conclusion

This fed counterfeeding case:

- works in Serial OT without extra mechanisms (Kavitskaya & Staroverov 2010)
- is numerically well modelled by Serial OT, but model needs extra SM constraint (quantitative “ranking argument”)

Optional processes can cause complex opacity interactions!

Appendix

Serial Markedness Reduction

- Serial Markedness Reduction (Jarosz 2014) = Harmonic Serialism (McCarthy 2008) + Serial Markedness
    - Keeps track of derivations: which markedness constraints are satisfied at which step?

      /pasos/ → [paso] <*FinalC> → [pas] <*FinalC, *UnstrV> (→ [pa] <*FinalC, *UnstrV, *FinalC>)

    - Serial Markedness (SM) constraints block certain derivations

      E.g., SM(*UnstrV,*FinalC): 1 violation if *FinalC is satisfied before *UnstrV

      High-ranked SM(*UnstrV,*FinalC) rules out /pasos/ → [pa] <*FinalC, *UnstrV, *FinalC>

SMR analysis (step 1)

Step 1	**Contig**	**SM(*Final-C, *UnstrV)**	***UnstrV**	***Final-C**	**Max(seg)**	***Compl**	**NoCoda**
Input: pasos <>							
a. ˈpa.sos <>			*	*!			*
b. ˈpass <UnstrV >	*!			*	*	*	**
c. ☞ ˈpa.so <*Final-C>			*		*		

SMR analysis (step 2)

Step 2	**CONTIG**	**SM(*FINAL-C, *UNSTRV)**	***UNSTRV**	***FINAL-C**	**MAX(seg)**	***COMPL**	**NOCODA**
Input: ˈpaso <*FINAL-C>							
a. ˈpa.so <*FINAL-C>			*!				
b. ☞ ˈpas <*FINAL-C, *UNSTRV>				*	*		*

SMR analysis (convergence)

Step 3	CONTIG	SM(*FINAL-C, *UNSTRV)	*UNSTRV	*FINAL-C	MAX(seg)	*COMPL	NOCODA
Input: ˈpas <*FINAL-C, *UNSTRV>							
a. ☞ ˈpas <*FINAL-C, *UNSTRV>				*			*
b. ˈpa <*FINAL-C, *UNSTRV, *FINAL-C>		*!			*		

Second SM constraint

- Underlyingly C-final forms undergo apocope less often than underlyingly V-final forms:
  (/pasos/ →) paso → pas: 40%
  /paso/→ pas: 61%

- We model variation as a statistical distribution over grammars
- This means: there are grammars in which vowel apocope applies in underlyingly V-final forms but not underlyingly C-final forms

- Solution: include constraint SM(*FinalC, *UnstrV) - when it is high, apocope is blocked in underlyingly C-final forms

Second SM constraint

	CONTIG	SM(*FINAL-C, *UNSTRV)	SM(*UNSTRV, *FINAL-C)	*UNSTRV	*FINAL-C	MAX(seg)
Input: (/pasos/ →) ˈpa.so <*FINAL-C>						
a. ☞ ˈpa.so <*FINAL-C>				*		
b. ˈpas <*FINAL-C, *UNSTRV>			*!		*	*
Input: paso <>						
c. ˈpa.so <>				*!		
d. ☞ ˈpas <*UNSTRV>					*	*

Second SM constraint (convergence)

	Contig	SM(*Final-C, *UnstrV)	SM(*UnstrV, *Final-C)	*UnstrV	*Final-C	Max(seg)
Input: (/pasos/ →) ˈpa.so <*Final-C>						
a. ☞ ˈpa.so <*Final-C>				*		
b. ˈpas <*Final-C, *UnstrV>			*!		*	*
Input: ˈpas <*UnstrV>						
c. ☞ ˈpas <*UnstrV>					*	
d. ˈpa <*UnstrV, *Final-C>		*!		*		*

Statistical framework

- Jarosz (2015): Pairwise Ranking Grammars
  - Define probability that pairs of constraints are ranked a certain way (see below)
- Jarosz's (2015) Expectation Driven Learning (EDL) used (which is based on such grammars)
  - Because of existing implementation of SMR from Prickett & Jarosz (2021)

	... >> *Final-C	... >> *UNSTRV	... >> MAX(seg)
*Final-C >> ...		70%	100%
*UNSTRV >> ...	30%		80%
MAX(seg) >> ...	0%	20%	

Incorrect prediction: ~50% chance of vowel apocope in underlyingly V-final & C-final forms

Full results of 1 Serial Markedness model

Input	Output	Frequency, predicted (range)	Frequency, attested
/paso, paharo, metro, oferta/	[ˈpaso,ˈpaharo,ˈmetro,oˈferta]	49 (46-50)	39
	[ˈpas,ˈpahar,ˈmetr,oˈfert]	50 (47-54)	61
	(other)	1 (0-3)	0
/pasos, paharos, metros, ofertas/	[ˈpasos,ˈpaharos,ˈmetros,oˈfertas]	11 (10-12)	8
	[ˈpaso,ˈpaharo,ˈmetro,oˈferta]	44 (43-46)	55
	[ˈpas,ˈpahar,ˈmetr,oˈfert]	43 (40-45)	37
	(other)	2 (1-3)	0

Correct prediction: ~60% apocope in underlyingly V-final forms,
~40% in C-final forms (34/(100-12)=39)

Full results of 2 Serial Markedness model

Input	Output	Frequency, predicted (range)	Frequency, attested
/paso, pahaɾo, metɾo, ofeɾta/	[ˈpaso,ˈpahaɾo,ˈmetɾo,oˈfeɾta]	40 (38-43)	39
	[ˈpas,ˈpahaɾ,ˈmetɾ,oˈfeɾt]	58 (54-61)	61
	(other)	2 (0-5)	0
/pasos, pahaɾos, metɾos, ofeɾtas/	[ˈpasos,ˈpahaɾos,ˈmetɾos,oˈfeɾtas]	12 (10-13)	8
	[ˈpaso,ˈpahaɾo,ˈmetɾo,oˈfeɾta]	52 (49-54)	55
	[ˈpas,ˈpahaɾ,ˈmetɾ,oˈfeɾt]	34 (31-36)	37
	(other)	3 (1-5)	0

Fed counterfeeding: extra machinery needed?

- Kavitskaya & Staroverov (2010): fed counterfeeding leads to ranking paradoxes
  - Requires extra machinery (Previous-step markedness constraints, E-Prec constraints)

- However, this is only true if both processes motivated by **(locally) contextual** constraints
- E.g., in our case this would be:

  *UnstrV#
  *FinalC

input	output	*FINAL-C	*UNSTRV#
/pasos/	ˈpasos	*W	
	☞ˈpaso		*L
/paso/	ˈpaso		*W
	☞ ˈpas	*L	

Paradox:
***Final-C >> *UnstrV#**
BUT
***UnstrV# >> *Final-C**

Fed counterfeeding: no extra machinery needed!

- For the current data, the pro-apocope constraint can be defined in a **context-free** way
  *UnstrV: 1 violation for any unstressed vowel
  - Deletion of non-final vowels blocked by Contiguity, deletion of initial vowels blocked by Max(V)/Initial

- This removes the ranking paradox! No additional machinery needed (*contra* Kavitskaya & Staroverov)

input	output	*FINAL-C	*UNSTRV
/pasos/	ˈpasos	*W	*
	☞ˈpaso		*
/paso/	ˈpaso		*W
	☞ ˈpas	*L	

No paradox:
UnstrV# >> *Final-C
derives both winners