Computational restrictions on iterative prosodic processes

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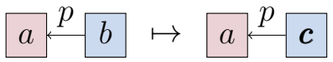
Overview

- **Goal**: Computational characterizations lead to restrictive, testable, and learnable theories of phonology (Heinz, 2018).
- **Question**: what are the computational requirements of **iterative prosody**?
- **Result**: Local (with recursion)!

Logical maps

- Logic: output defined over input (Courcelle, 1994)

$$c(x) \stackrel{\text{def}}{=} b(x) \wedge a(p(x))$$



- Local = Quantifier Free: no $\exists, \forall$ (Chandlee and Lindell, forthcoming)
- Recursion = Least Fixed Point (LFP) operators (Libkin 2004)
- Local recursion = QF-LFP reference information from the output string
- Implicit Recursion = *implicit definitions*; Rogers 1997
- Use *either* predecessor (p) or successor (s)

Quantifier Free syllabification

Simple non-directional syllabification is local (Strother-Garcia, 2019)

- To find a nucleus → use a window of size 4
- Window of segment + predecessor + 2 segments that follow
- Don't need any quantifiers (QF ∼ ISL functions)
- Contrast with global non-local OT (Prince and Smolensky, 2004)

Least Fixed Point: Local recursion

Example: $baaa \quad \mapsto \quad bbbb$

= a's following a b are outputted as b

- Not local on the input
- Local on output: $a \rightarrow b$ when b before a on output

Implicit definition: $b'(x) \stackrel{\text{d}}{=} b(x) \vee b'(p(x))$

- Given an input element x,
- it is mapped to a b in the output
- when it is a b in the input or
- it is preceded by a b in the output.

Iterative stress

- Murinbata: stress 1st σ and every other σ
  $\sigma\sigma\sigma\sigma\sigma\sigma \mapsto \acute{\sigma}\sigma\grave{\sigma}\sigma\grave{\sigma}\sigma\grave{\sigma}$

Formalize...

- $\acute{\sigma}(x) \stackrel{\text{d}}{=} first(x) \vee \acute{\sigma}(p(p(x)))$
- $\sigma\sigma\sigma\sigma\sigma\sigma \mapsto \acute{\sigma}\sigma\acute{\sigma}\sigma\acute{\sigma}\sigma$

Iterative syllabification

Arabic dialects: different epenthesis sites in CC* clusters (Ito, 1989)

- 3C: insert V after C_1 in Iraqi, and C_2 in Cairene.
- 4C: insert V after C_2.

Why?

- Iraqi syllabifies R-to-L, while Cairene L-to-R + a V is added based on a CVC template.

Iraqi (R-to-L)	<katab-t-l-u> .ka.ta.bit.lu.	<katab-t-l-ha> .ka.tab.til.ha.
Cairene (L-to-R)	<katab-t-l-u> .ka.tab.ti.lu	<katab-t-l-ha> .ka.tab.til.ha

QFLFP Characterization

- $L'(x)$ and $R'(x)$ determine L- and R-edges of σ's before resyllabification.
- Resyllabification is only apparent in L-to-R.
- We only show R-to-L parsing

$L'(x) \stackrel{\text{d}}{=}$	$[C(x) \wedge V(s(x))] \vee$	*select C in CV*
	$[C(x) \wedge C(s(x)) \wedge L(s(s(x)))]$	*select C in CC[$_L$*
$i'(x_2) \stackrel{\text{d}}{=}$	$C(x) \wedge L(x) \wedge C(s(x))$	*add V in [$_L$C_C*

For example...

Input	k	a	t	a	b	t	l	u
L' is true at...								
Iteration 0	✓		✓				✓	
Iteration 1	✓		✓		✓		✓	
Interim Output:	k_L	a	t_L	a	b_L	t	l_L	u
$i'(x_2)$					✓			
Output:	k	a	t	a	b i	t	l	u

Discussion

- Provides a testable hypothesis for iterative phonological functions based on computational power
- Highlights output orientation of iterative functions
- What about feet? What about more patterns?

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