Oops, I Did It Again: A typology of phonological iterativity

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Overview

Some phonological processes have the potential to apply multiple times per word

Is this application simultaneous or iterative?

Relevant to theories of computation, autosegmental representations, locality, optionality, cyclicity, interfaces ...

H1: Always simultaneous (Chomsky and Halle 1968)
H2: Always iterative (Johnson 1972, Kaplan 2008)
H3: Determined by type of process (Jensen and Stong-Jensen 1976, Samuels 2009)
☞ H4: Unpredictable, learned for each process (Howard 1972, Anderson 1974, Archangeli and Pulleyblank 1994)

Typological database under construction, support for H4 from optional processes

Iterativity parameter for rules in Search & Copy framework

What is iterativity/simultaneity?

Many definitions exist

Many only applicable to one theory

We talk about iterative/simultaneous patterns

≔ outputs generatable with iterative/simultaneous rules

Can be independent of the actual mechanism for generating outputs

An example to show why this is useful

What does iterativity/simultaneity look like?

Hypothetical data

[-round] → [+round] / [+round] _

Input: /boteminuli/

Iterativity

bo te mi nu li

↑

[-rd] → [+rd] / [+rd] _

Iterativity

bo te mi nu li

↑

[-rd] → [+rd] / [+rd] _

Iterativity

bo tø mi nu li

↑

[-rd] → [+rd] / [+rd] _

Iterativity

bo tø my nu li

↑

[-rd] → [+rd] / [+rd] _

Iterativity

bo tø my nu li

↑

[-rd] → [+rd] / [+rd] _

Iterativity

bo tø my nu ly

↑

[-rd] → [+rd] / [+rd] _

Iterativity

[botømynuly]

[-rd] → [+rd] / [+rd] _

Note: iterativity has yielded a transparent output

Simultaneity

bo te mi nu li

↑

[-rd] → [+rd] / [+rd] _

Simultaneity

bo te mi nu li

N ↑

[-rd] → [+rd] / [+rd] _

Simultaneity

bo te mi nu li

N Y ↑

[-rd] → [+rd] / [+rd] _

Simultaneity

bo te mi nu li

N Y N ↑

[-rd] → [+rd] / [+rd] _

Simultaneity

bo te mi nu li

N Y N N ↑

[-rd] → [+rd] / [+rd] _

Simultaneity

bo	te	mi	nu	li
N	Y	N	N	Y

[-rd] → [+rd] / [+rd] _

Simultaneity

bo tø mi nu ly

N Y N N Y

[-rd] → [+rd] / [+rd] _

Simultaneity

[botøminuly]

[-rd] → [+rd] / [+rd] _

Note: simultaneity has yielded an opaque output

Classic OT often predicts iterative outputs, but not simultaneous ones

The rule-inspired definitions are highly relevant for e.g. constraint-based theories

Iterative/simultaneous are meaningful in both serial and parallel theories

Previous work: rule-based phonology

"[T]he entire string is first scanned for segments that satisfy the environmental constraints of the rule. After all such segments have been identified in the string, the changes required by the rule are applied simultaneously."

Chomsky and Halle (1968: 348) (H1)

"[T]he output of each step other than the last is the input to the next step" (Johnson 1972: 60) (H2)

"Propagating rules produce a pattern that is alternating or non-alternating. Segmental and tone rules are non-alternating: they apply to produce maximal effects, in feeding (class I) or non-bleeding (class II) order. Stress, glide and vowel deletion rules are alternating: they apply in bleeding order (class III)."

Jensen & Stong-Jensen (1976: 75) (H3)

"There are no necessary and sufficient conditions for determining mode of application in general"

Howard (1972: 342) (H4)

Previous work: Optimality Theory

OT often argued to only allow iterative outputs (Hyman and VanBik 2004, Kisseberth 2007, Vaux and Nevins 2008, Kimper 2011)

"[N]o noniterative phenomenon requires an analysis that explicitly calls for noniterativity"

Kaplan (2008: ix) (H2)

"[N]on-iterative vowel harmony is real /.../ both derivational and optimization-based theories of phonology can account for non-iterative vowel harmony"

McCollum and Kavitskaya (2018: 267), contra Kaplan (2008) (H4?)

Previous work: Search & Copy

"The rules do not apply iteratively to their own outputs"
Mailhot and Reiss (2007: 34) (H1)

"Harmony occurs whenever a new morpheme that needs a value is added /.../ and what makes this process iterative is that a morpheme M_j that has found a value for harmony can then in turn provide a value for a linearly subsequent morpheme M_{j+1}."
Nevins (2010: 28) (H2)

"Whether COPY applies simultaneously or sequentially in Path-type [feature-spreading] processes /.../ is impossible to determine, because the results will be the same either way. For the sake of simplicity and parallelism, though, it is perhaps best to assume that COPY is always iterative."
Samuels (2009: 153) (H3)

Old questions, new data

Typological database of iterativity

Mode of application, directionality, optionality

Mostly compiled from iterativity literature

Numbers on next slide: analyses from literature

Other analyses are often available

Do not take relative frequencies here at face value

Old questions, new data

56 processes in 43 languages (28 subfamilies, 17 families)

28 V, 14 C, 8 stress, 6 tone

Of 36 cases where author argues for a mode of application...

Iterativity	Directionality	Obligatory	Optional
Iterative	Left-to-right	12, e.g. Shona (Vaux 2015)	3, e.g. Shimakonde (Liphola 2001)
	Right-to-left	13, e.g. Eastern Ojibwa (Howard 1972)	2, e.g. Vata (Kaye 1982)
Simultaneous		5, e.g. Kazakh (McCollum and Kavitskaya 2018)	1, e.g. Warao (Howard 1972)

This talk

Ongoing work: go through each case and (re)assess evidence

Part of this ongoing work = today's topic

Focus on a crucial near-minimal pair

Optional right-to-left vowel harmony (within and across morphemes)

Iterative in Tigre, simultaneous in Eastern Andalusian Spanish (EAS)

This is only consistent with H4

Crucial data from optionality

Two types of optionality

Local optionality: evaluated separately for each undergoer

Global optionality: evaluated only once per domain

Often discussed in relation to OT (Vaux 2002, Riggle and Wilson 2005, Kimper 2008, 2011, Kaplan 2016, ...)

Howard (1972): local = iterative, global = simultaneous

Global/simultaneous processes evaluated once

Local/iterative processes evaluated multiple times

Tigre

[tig] Semitic, Afro-Asiatic, Eritrea

Semhar dialect (Faust 2017)

Right-to-left optional [round] harmony

[-round] → [+round] / _ [+round]

[kətəb-ko]~[kətob-ko]~[kotob-ko] ‘I wrote’

No harmony, partial harmony, or full harmony

Tigre: simultaneous

kə təb ko

↑

[-round] → [+round] / _ V_0 [+round]

Tigre: simultaneous

kə təb ko

↑ N

[-round] → [+round] / _ V_0 [+round]

Tigre: simultaneous

kə təb ko

↑ Y N

[-round] → [+round] / _ V_0 [+round]

Tigre: simultaneous

kə təb ko

Y Y N

[-round] → [+round] / _ V_0 [+round]

Do you want to apply harmony?

If Y: [kotobko]
If N: [kətəbko]

Both grammatical, but [kətobko] is never generated

Tigre: iterative

kə təb ko

↑

[-round] → [+round] / _ [+round]

Tigre: iterative

kə təb ko

↑

[-round] → [+round] / _ [+round]

Do you want to apply harmony?
If Y: Next slide
If N: final output will be [kətəbko] (no harmony)

Tigre: iterative

kə tob ko

↑

[-round] → [+round] / _ [+round]

Do you want to apply harmony?
If Y: [kotobko] (full harmony)
If N: [kətobko] (partial harmony)

Tigre: iterative

Predicted outputs:
[kətəb-ko]
[kətob-ko]
[kotob-ko]

This matches the data

Only iterative application works

Simultaneous application fails to generate partial harmony

EAS (Lloret and Jiménez 2007, 2009, Lloret 2018)

[spa] Romance, Indo-European, Spain

Some obligatory processes

Not the focus of our analysis

Input:	/moneðeɾo-s/
Stress	moneˈðeɾo-s
s → h / coda	moneˈðeɾo-h
Laxing / _ h	moneˈðeɾɔ-h
Stressed [ATR] harmony	moneˈðɛɾɔ-h
	‘purse-PL’

EAS (Lloret and Jiménez 2007, 2009, Lloret 2018)

Intermediate form: moneˈðɛɾɔh

[moneˈðɛɾɔh], [mɔnɛˈðɛɾɔh], but not *[monɛˈðɛɾɔh], *[mɔneˈðɛɾɔh] (Lloret and Jiménez 2007)

Pre-tonic vowels: no or full harmony, never partial harmony

[+ATR] → [-ATR] / _ V_0 [-ATR]

Harmony based on trochaic feet? (mone)(ˈðɛɾɔh)?

No, feet can be disharmonic in EAS: re(ˈkɔhe)lɔh ‘pick them!’ (Lloret and Jiménez 2009)

EAS: iterative

mo ne ˈðɛ ɾɔh

↑

[+ATR] → [-ATR] / _ V_0 [-ATR]

Harmony not applicable

EAS: iterative

mo ne ˈðɛ ɾɔh

↑

[+ATR] → [-ATR] / _ V_0 [-ATR]

Harmony not applicable

EAS: iterative

mo ne ˈðɛ ɾɔh

↑

[+ATR] → [-ATR] / _ V_0 [-ATR]

Do you want to apply harmony?

If Y: next slide

If N: we'll come back to this

EAS: iterative

mo nɛ ˈðɛ ɾɔh

↑

[+ATR] → [-ATR] / _ V_0 [-ATR]

Do you want to apply harmony?

If Y: [mɔnɛˈðɛɾɔh] (full harmony)

If N: *[monɛˈðɛɾɔh] (*partial harmony)

EAS: iterative

mo ne ˈðɛ ɾɔh

↑

[+ATR] → [-ATR] / _ V_0 [-ATR]

Do you want to apply harmony?

If Y: *[mɔneˈðɛɾɔh] (*partial harmony)

If N: [moneˈðɛɾɔh] (no harmony)

EAS: iterative

Predicted outputs:

[mɔnɛˈðɛɾɔh]
*[mɔneˈðɛɾɔh]
*[monɛˈðɛɾɔh]
[moneˈðɛɾɔh]

Predicts partial harmony (as in Tigre)

Wrong result for EAS

EAS: simultaneous

mo ne ˈðɛ ɾɔh

↑

[+ATR] → [-ATR] / _ V_0 [-ATR]

EAS: simultaneous

mo ne ˈðɛ ɾɔh

↑ N

[+ATR] → [-ATR] / _ V_0 [-ATR]

EAS: simultaneous

mo ne ˈðɛ ɾɔh

↑ N N

[+ATR] → [-ATR] / _ V_0 [-ATR]

EAS: simultaneous

mo ne ˈðɛ ɾɔh

↑ Y N N

[+ATR] → [-ATR] / _ V_0 [-ATR]

EAS: simultaneous

mo ne ˈðɛ ɾɔh

Y Y N N

[+ATR] → [-ATR] / _ V_0 [-ATR]

Do you want to apply harmony?

If Y: [mɔnɛˈðɛɾɔh] (full harmony)

If N: [moneˈðɛɾɔh] (no harmony)

EAS: simultaneous

Predicted outputs:

[mɔnɛˈðɛɾɔh]
[moneˈðɛɾɔh]

Correctly derives only full or no harmony

No partial harmony

EAS right-to-left [ATR] harmony is simultaneous

Results: discussion

Optional [round] harmony spreading to the left is iterative in Tigre

Optional [ATR] harmony spreading to the left is simultaneous in EAS

No obvious reason why [round] vs. [ATR] would matter

Simultaneous [round] harmony in Kazakh (McCollum and Kavitskaya 2018)

Iterative [ATR] harmony in Vata (Kaye 1982)

(Other analyses may be available, depending on your theoretical assumptions)

Phonological processes are learned as iterative/simultaneous on a case-by-case basis (H4)

How can this be implemented?

Analysis

Search & Copy (Mailhot and Reiss 2007, Samuels 2009, Nevins 2010, ...)

Undergoers of harmony are underlyingly unspecified for the harmonizing feature (roughly Inkelas 1995 archiphonemic underspecification)

They initiate a Search for the closest source of that feature

The feature value of the source is Copied back onto the undergoer

In words with multiple harmonizing vowels, each initiates its own Search

These Searches may terminate at the same source (nearest potential valuator/target)

Analysis

Parameters determine how rules vary

Left-to-right vowel backness harmony:

ς	initiator of Search	[-cons]
γ	target of Search	[αback]
δ	direction of Search	R-to-L
β	beginning of Search	ς

If there is a ς, Search for γ from β in direction δ. If γ is found, terminate Search, and Copy γ to ς

Example: Vowels search right-to-left for [back] specifications, and copy the first one they find

Analysis

We add an iterativity parameter

ι	Mode of application of Search	{Iterative, Simultaneous}

Tigre		EAS	
ς	[-cons]	ς	[-cons]
γ	[+round]	γ	[-ATR]
δ	L-to-R	δ	L-to-R
β	ς	β	ς
ι	Iterative	ι	Simultaneous

Discussion

Iterativity parameter encodes the observed differences

We have argued that mode of application is arbitrary (rule-specific)

A diacritic solution is exactly what is needed

Unless we've missed a generalization!

There are many possible H3s...

We've failed to find a consistent pattern for mode of application

Let us know if you want our database to look for patterns

Discussion

Search & Copy is almost certainly not necessary to account for the data

Other theories can also be modified to parameterize iterativity (but how easily...?)

[iterativity] (meta-)feature (Anderson 1974, Archangeli and Pulleyblank 1994, ...)

“[A] formal mechanism is employed that directly encodes iterativity /.../ [N]o such primitive is accessible to Optimality Theory” (McCollum and Kavitskaya 2018: 259)

In the future: identify how iterativity and simultaneity can be analyzed in other theories, and test any predictive differences

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Thank you!