

Agent-based simulations of affix change: Interacting mechanisms under social dynamics

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Affix change under social dynamics

- Affix change through **social dynamics**: situation with at least two heterogeneous groups (e.g. language contact, dialect contact, groups within community)
- Often **interactions between mechanisms**
- **Agent-based models**: Computer simulations of populations of speakers
 - Individual is focal point, study population behaviour
 - Unintrusive, testing in reality not always feasible
 - Modelling makes hypotheses explicit
- Two **case studies**:
 - **Phonotactic mechanisms** in **contact-induced morphological simplification** in Alorese
 - **Conversational priming** and spread of innovations (Lithuanian dialects)

Phonological mechanisms in contact-induced morphological simplification in Alorese

Contact-induced morphological simplification

Language contact involving adult speakers could lead to morphological simplification (Wray & Grace, 2007; Lupyán & Dale, 2010; Trudgill, 2011)

But what are **actuating factors** (Weinreich et al., 1968) on contact-induced change? Why does it happen in one language and not in another?

- **Specific sociodemographics** of contact scenario (Sankoff, 2004; Ross, 2013)
- Could **phonotactic factors** play a role?
 1. Phonology itself can be affected by contact (Napoleão de Souza & Sinnemäki, 2022; Blaxter, 2017; Blevins, 2017)
 2. Phonological and morphological complexity show positive correlation (Easterday et al., 2021)
 3. Phonology of language (e.g. Germanic stress shift for Scandinavian) can be pre-condition for contact-induced morphological simplification (Kusters, 2003)
 4. Consonant clusters are cross-linguistically difficult to learn (Carlisle et al., 2001)

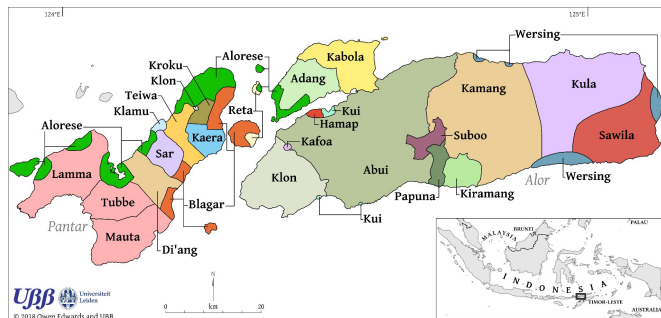
Our hypothesis: **The phonotactics of a language, specifically syllable structure (and more specifically avoidance of consonant clusters) could be a factor in the morphological simplification of that language under contact.**

Case study: Alorese

- Alor & Pantar islands, Eastern Indonesia
 - **Alorese** (Austronesian)
 - Contact with Papuan Alor-Pantar languages (Timor-Alor-Pantar family)
- Alorese **lost verbal subject marking** compared to sister language Lamaholot (Klamer, 2020)
 - Some verbs express subject using prefix, others using suffix
 - Alorese lost suffixes, while prefixes are retained
- Could **adult language contact** (Lupyan & Dale, 2010), in combination with **phonotactic mechanisms**, have caused **morphological simplification**?



(photo: Yunus Sulistyono)



(map: Owen Edwards and UBB)

	Lamaholot (Lewoingu)		Alorese
	A/S prefix (on 20 verbs)	S Suffix	A/S prefix (on 8 verbs)
1SG	<i>k-</i>	<i>-kən</i>	<i>k-</i>
2SG	<i>m-</i>	<i>-ko, -no</i>	<i>m-</i>
3SG	<i>n-</i>	<i>-na, -nən</i>	<i>n-</i>
1PL.EXCL	<i>m-</i>	<i>-kən</i>	<i>m-</i>
1PL.INCL	<i>t-</i>	<i>-te</i>	<i>t-</i>
2PL	<i>m-</i>	<i>-ke/-ne</i>	<i>m-</i>
3PL	<i>r-</i>	<i>-ka</i>	<i>r-</i>

Alorese: Phonotactic factors?

prefix

suffix

n-enung

3SG-drink

'she drinks'

hitun-na

count-3SG

'he counts'

Lewoingu Lamaholot (Nishiyama & Kelen, 2007)

n-enung

3SG-drink

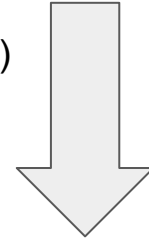
'she drinks'

hitun-∅

count-3SG

'he counts'

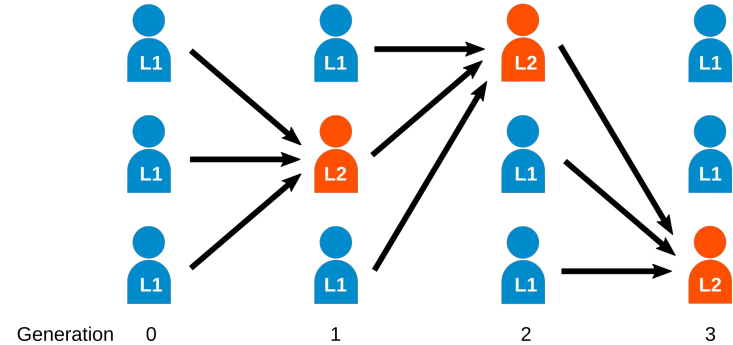
Alorese (Klamer, 2011)



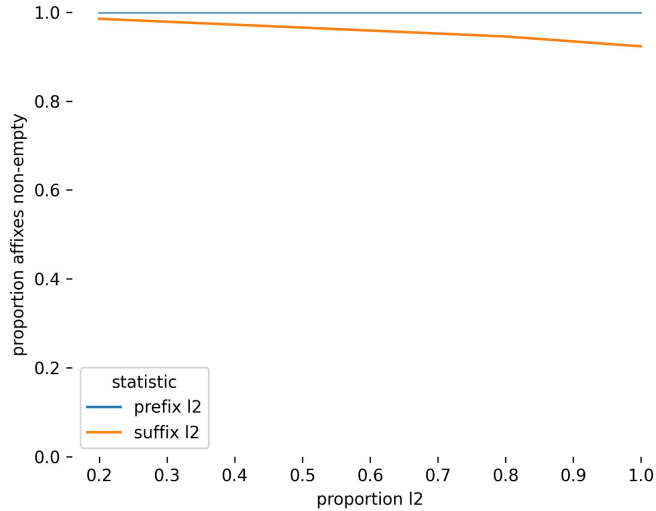
- All prefixing verbs are vowel-initial: phonotactic factor at play?
- Some **suffixing verbs+suffix** create **consonant cluster** ($\frac{1}{3}$ of verbs in grammar)
- **Consonant clusters discouraged** in Alorese (Klamer, 2011; Nagaya, 2011) and contact languages (Schapper, 2014)
- Could **avoidance of consonant clusters** during **incomplete L2 transmission** be a **factor in contact-induced morphological simplification**?

Agent-based model

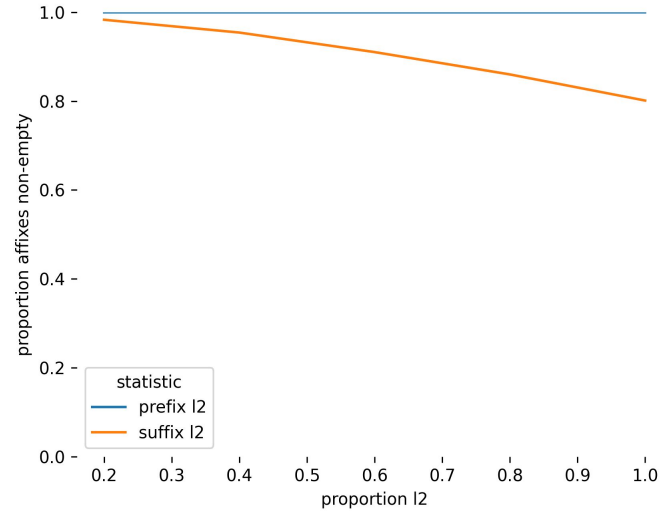
- Agent-based model of intergenerational transmission (cf. Kusters, 2003):
 - **L1 speakers initialised with full morphology:** get language faithfully transmitted
 - **L2 speakers learn language through interaction** with previous generation (L1 & L2)
- Language game (Steels, 1998)
 - **Meanings:** lexical concepts of verbs + person (e.g. to go-2SG, to have-3SG)
 - **Signals:** verb affixes (e.g. k-, t-, -ko)
 - Listener saves affix when communicative success
- Test mechanisms:
 - **Phonotactic reduction** mechanism: L2 speakers drop full affix in production when consonant cluster arises
hitun-~~de~~
CVCVC-CV
 - **Generalisation** mechanism (affix prior): use distribution over affixes from all concepts during production, instead of just this concept
- Evaluate model for different proportions of L2 speakers: find relationship between **adult language contact**, **phonotactic reduction** and **generalisation**



Results: Phonotactic reduction and generalisation



No generalisation



Generalisation 10%

With generalisation, phonotactic reduction gives morphological simplification with increasing L2

Intermediate conclusions

- **Some evidence for simplifying effect of phonotactic reduction** in Alorese, but not very strong
- Model surprisingly **resilient to strong reduction mechanism** (through **meaning** in model)
- **Generalisation needed to spread** empty affix \emptyset from verbs with consonant clusters to verbs without consonant clusters

Conversational priming in Lithuanian dialects

In the context of the project *Conversational priming in language change* (Universität zu Köln)

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Hypothesis

 Not much research on the role of **conversation** in language change

 As the prime habitat for language, conversation must provide **infrastructures for linguistic innovations** to spread from one speaker to another

HYPOTHESIS:

 ***Conversational priming in repetitional responses*** leads to faster spread of innovative forms

Conversational priming: in repetitional responses ("Do you want coffee?" -"I do."), some linguistic items are primed and predicted to change faster (Gipper, 2020)

Subject marking as clear test case with contrasting predictions:

- Conversational priming works only on third person: other persons as contrast
- Frequency makes opposite prediction:
3SG most conservative (Diessel, 2007) vs 3SG most innovative
(conversational priming)

Conversational priming: Asymmetries in repetitional responses

(Yurakaré, Isolate, Bolivia)

(1) A: **adojla balip**
bali-p
go -2PL.SBJ
'Did you (pl.) walk?'

No priming
Deictic shift, no reuse of person marker

B: **adojla balitu**
a-dojjo=la bali-tu
go -1PL.SBJ
'We walked.'

(2) A: **dulawla**
dula-w=la
make -3PL.SBJ=COMM
'Did they build it?'

Priming
Repeat may force B to **copy form** from A.
Priming facilitates reuse, repetition boosts priming (Gipper 2020)

B: **dulaw**
dula-w
make -3PL.SBJ
'They built it.'

Spread of innovations through priming?

PREDICTION

In languages with person marking, if an innovation occurs, third person markers will diffuse faster than first and second person markers.

Inspiration for model: Lithuanian dialects Zietela and Lazūnai

3SG/PL is only form that changes in innovative dialect, caused by priming?



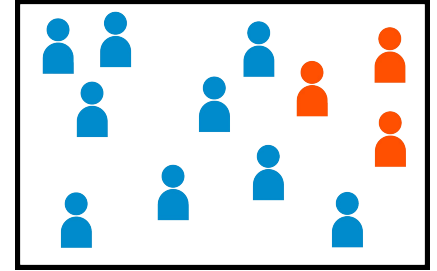
Zietela, Belarus (Wikipedia)

<i>eīti</i> 'to go'	Zietela (conservative)	Lazūnai (innovative)
inf.	eīti	eīti
1SG	eimù	eimù
2SG	eimì	eimì
3SG=PL	eīti	eīma
1PL	eīmam	eīmam
2PL	eīmat	eīmat

Agent-based model

Computer model of repeats in conversations (cf. general models of innovation spread: Pierrehumbert et al. 2014; Josserand et al. 2021)

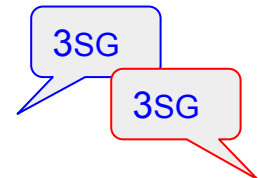
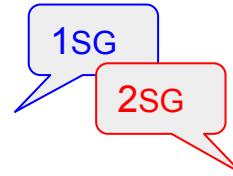
- Interaction in population of agents: **conservator** (0% innovative form) vs. **innovator** (90% innovative form) agents
- Meanings: **1SG**, **2SG**, **3SG**
- Forms: **conservative** vs. **innovative**
- Probability increase of form during both production and perception



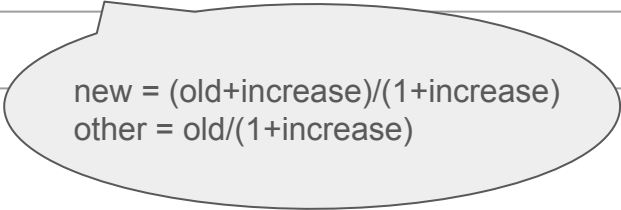
Priming:

If person different (1/2SG) → Sample form from own distribution

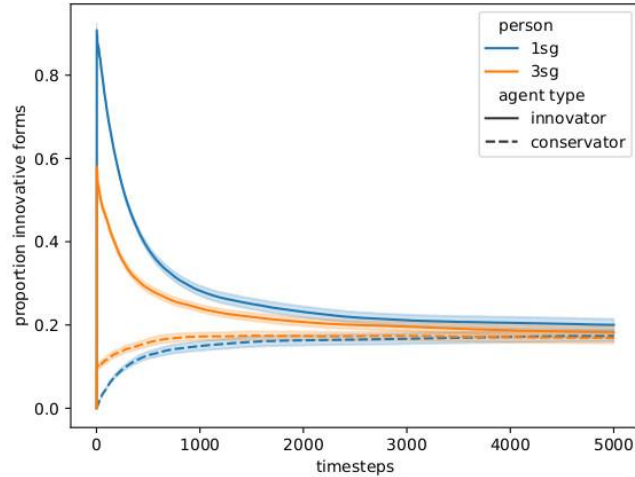
If person same (3SG) → **Use same form as questioner**



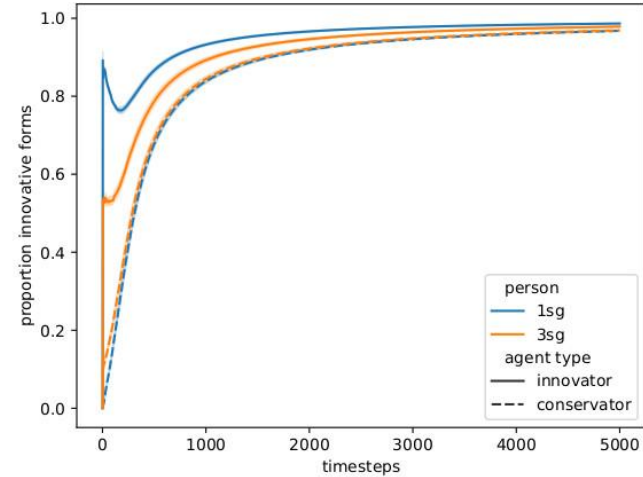
Interaction

Speaker A	Speaker B
<ul style="list-style-type: none">• Randomly sample person (1/2/3SG) to talk about• Sample form to use from probability distribution• Send form• Increase sent form	
 <p>new = $(old+increase)/(1+increase)$ other = $old/(1+increase)$</p>	<ul style="list-style-type: none">• Increase received form
	<ul style="list-style-type: none">• Determine person to answer (1→2, 2→1, 3→3)• If person different (=1/2SG):<ul style="list-style-type: none">○ Sample form from probability distribution• If person same (=3SG):<ul style="list-style-type: none">○ Use same form as questioner• Send form• Increase sent form
<ul style="list-style-type: none">• Increase received form	

Results basic model



Basic model

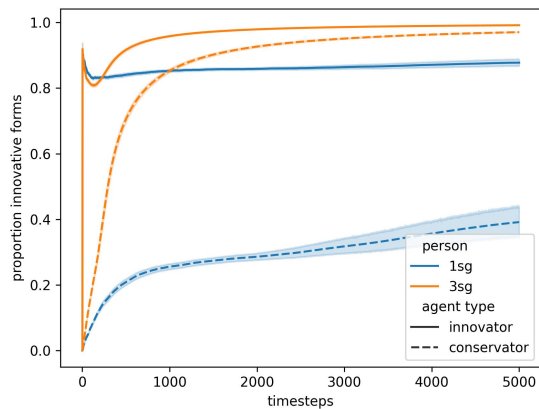


Basic model + favour innovative

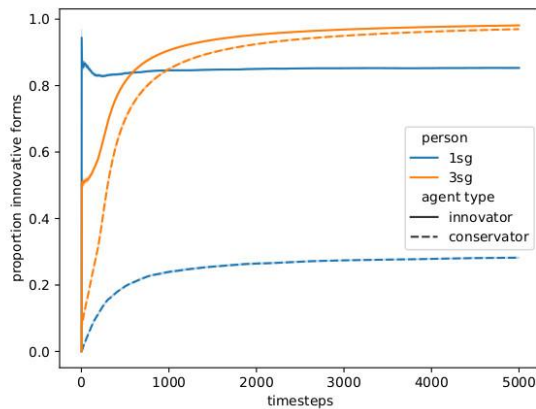
- **Priming (3SG) converges faster than non-priming (1SG)**
- Model converges to population mean (differential equations)
- Favouring the innovative form gives more realistic dynamic (S-curve; Blythe & Croft, 2012)

Conversational priming versus frequency

- Work in progress: contrast conversational priming with frequency
 - Most frequent 3SG (Seržant & Moroz, 2022) would be most conservative
 - Can conversational priming counter this?
- Frequency implemented by forgetting mechanism: frequent concepts overcome forgetting
- Tentative conclusion: **Conversational priming does not counter frequency, but speeds up existing processes**



3SG freq 50%
No conv priming



3SG freq 50%
Conv priming

Conclusion

Agent-based models can shed light on **interacting mechanisms** behind **affix change** in situations of **social dynamics**:

- **Phonotactic mechanisms**, in combination with **adult language contact**, could lead to morphological simplification
- **Conversational priming** could lead to faster spread of innovations, once invented by other mechanisms

Contact us if you have questions or ideas! peter.dekker@ai.vub.ac.be

Kiitos kaikille!