Limits to abstractness of underlying representations: insights from Maolin Rukai

A. Background

Rhythmic syncope pattern: vowels are deleted in odd medial syllables counting from the left

- Prefixation causes the position of deleting vowels to shift.
- Examples in (1) and (2)

(1) *Derivation for shrimp*

UR	/ta$_1$ ka$_2$ su$_3$ lu$_4$ ɖu$_5$/	/i$_1$-k- ta$_2$ ka$_3$ su$_4$ lu$_5$ ɖu$_6$/
Syncope	t_kas_luɖu	ik-tak_sul_ɖu:
Stress	tkaslúɖu	iktaksulɖú:
SR	[tkaslúɖu]	[iktaksulɖú:]

(2) More examples of rhythmic syncope

	UR	CITATION	NEGATIVE	GLOSS
a.	/sima/	smá:	ik-simá:	'fat'
b.	/rana/	rná:	ik-raná:	'creek'
c.	/ɖamarɨ/	ɖmárɨ	ik-ɖamrɨ́:	'moon, month'
d.	/timusu/	tmúsu	ik-timśu:	'salt'
e.	/giŋigiŋi/	gŋígŋi	ik-giŋgiŋí:	'longan'
f.	/takasuluɖu/	tkaslúɖu	ik-taksulɖú:	'shrimp'

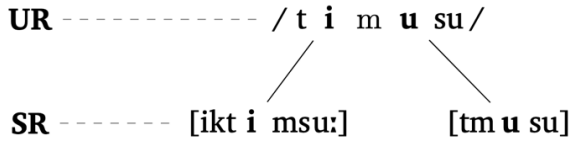
Phonological restrictions on rhythmic syncope:

- Onsetless vowels/vowels in hiatus don't delete (N=194/206, 94%); e.g. ábu (cf. *bú) 'ash'
- Deletion blocked if it would result in…
  - initial geminate Cs (N=25/25; 100%), e.g. tutúku (*ttúku) 'rabbit'
  - medial geminate consonant (N=61/83; 73%); e.g. θleváva (cf. *θlévva) 'rainbow'

B. Theoretical problem

Maolin Rukai rhythmic syncope presents an interesting test case for the learnability of abstract underlying representations.

- In many paradigms, no single allomorph tells us about all the vowels, so the UR must be **composite**, combining information from multiple allomorphs.



Question: how learnable are **composite URs**?

- A taxonomy of UR abstractness from Kenstowicz and Kisseberth (1977):
  - Examples: possible URs given the paradigm [tmusu]~[i-k-timsu:]

	KK hierarchy	
	Levels of the KK hierarchy	**Possible URs for** [tmusu]~[i-k-timsu:]
more concrete	**A: invariant-only** URs can only include segments that are invariant in all allomorphs	/tmsu/
	B: single allomorph all URs must be based on the same surface allomorph (i.e. the same slot in a paradigm)	/tm**u**su/
	C: choosing among allomorphs	/tm**u**su/ or /t**i**msu/
	D: segmentally composite	/t**i**m**u**su/, /tm**u**su/, /t**i**msu/, /tmsu/…
more abstract	**E: featurally composite**	

level required for a traditional morphophonemic analysis of Maolin Rukai

- Abstract URs are challenging for the child learner, because they increase the search space of possible URs

- Note about MR: not all paradigms require composite UR analyses, but the majority of paradigms do. In other words, abstractness of URs poses a real challenge for the child learner of MR.

PREDICTABLE BASE	KK-LEVEL	N	P	*Examples* UR	STEM	NEGATIVE
both	A (invariant)	84	0.08	/**a**b**u**/	**a**b**u**	i-**a**b**u**:
stem	B/C (surface allomorph)	96	0.09	/**a**bak**i**/	**a**bak**i**	ik-**a**bk**i**:
negative	B/C (surface allomorph)	230	0.22	/r**a**n**a**/	rn**a**:	ik-r**a**n**a**:
neither	D (composite)	639	0.61	/t**i**m**u**s**u**/	tm**u**su	ik-t**i**ms**u**:

Question: What can MR tell us about limits on UR abstractness?

- If segmentally composite URs are learnable, we should expect the MR pattern to be diachronically stable.
- The current paper looks at patterns of paradigm restructuring in MR to gain insight into the degree of UR abstractness permitted in the lexicon.

Examples of how paradigm restructuring could occur in MR:

- *Hypothetical KK-A grammar*
  only the invariant segments have been maintained; insert a default vowel (e.g. [ə]) where needed to preserve the syllable structure.

OLD UR	OLD PARADIGM	Restructuring →	NEW UR	NEW PARADIGM
/timusu/	[tmusu]~[i-k-timsuː]		/tmsu/	[tməsu]~[i-k-təmsuː]
/ɖamarɨ/	[ɖmarɨ]~[i-k-ɖamrɨː]		/ɖmrɨ/	[ɖmərɨ]~[i-k-ɖəmrɨː]

- *Hypothetical KK-B grammar*
  Paradigms have leveled towards the stem allomorph, removing Ø~V alternations.

OLD UR	OLD PARADIGM	Restructuring →	NEW UR	NEW PARADIGM
/timusu/	[tmusu]~[i-k-timsuː]		/tmsu/	[tmusu]~[i-k-tmusuː]
/ɖamarɨ/	[ɖmarɨ]~[i-k-ɖamrɨː]		/ɖmrɨ/	[ɖmarɨ]~[i-k-ɖmarɨː]

- *Hypothetical KK-C grammar*
  Paradigms have leveled towards either the stem or negative allomorph.

OLD UR	OLD PARADIGM	Restructuring →	NEW UR	NEW PARADIGM
/timusu/	[tmusu]~[i-k-timsuː]		/tmsu/	[tmusu]~[i-k-tmusuː]
/ɖamarɨ/	[ɖmarɨ]~[i-k-ɖamrɨː]		/ɖmrɨ/	[ɖamrɨ]~[i-k-ɖamrɨː]

C. Data

- 959 paradigms from Hsin (2001) (field data from two consultants, collected 1999-2000, age 74 at time of data collection)
- ~500 Proto-Rukai forms/cognates form other dialects (Li 1977)

Preview of results: two types of paradigm restructuring have occurred

1) "Vowel-matching"
2) Paradigm leveling (removal of Ø~V alternations)

D. Vowel-matching

- In MR, vowels in alternating positions tend to match each other; examples of this are given in (3).

(3) Examples of vowel-matching alternations

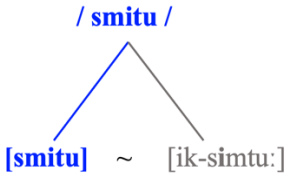
STEM	NEGATIVE
sm**i**tu	i-k-s**i**mtuː
gr**o**masɨ	i-k-g**o**rmasɨː
lm**a**tkɨ	i-k-l**a**mtakɨː

- In Hsin's data, of the 322 paradigms that still require a composite UR, 61% (n=196/322) exhibit this vowel-matching pattern.

- If vowel-matching is a strong enough tendency in the Maga lexicon, it would actually render paradigms with vowel alternation it would actually render paradigms with vowel alternations predictable from just one surface allomorph (KK-B/C).
- Example derivation in (4) for 'lips' smítu~i-k-símtu:

(4) Deriving the negative allomorph from the stem allomorph (rules for illustrative purposes)

Input	smitu (=stem allomorph)
Morphology	i-k-smitu:
Vowel copying	ik-simitu:
Vowel deletion	ik-simtu:
Output	ik-simtu:



- Notably, vowel-matching was not always a strong tendency in MR. Instead, it appears that speakers have restructured paradigms to result in more vowel-matching, rendering forms predictable from a surface allomorph (removing KK-D levels of representation)
- Method for inferring the direction of vowel-matching changes: comparison of Proto-Rukai and MR. Proto-Rukai represents MR before the language developed Ø~V alternations.
- Examples of vowel-matching changes are given in (5)

(5) *Examples of vowel-matching changes between Proto-Rukai and MR*

Proto-Rukai	**expected UR**	**actual UR**	**paradigm**	**gloss**
*samito	/samitu/	/simitu/	smítu~i-k-simtú:	'lips'
*tobakə	/tubakɨ/	/tabakɨ/	tbákɨ~i-k-tabkɨ́:	'shell'
*sinaw	/sinosino/	/sinisino/	u-snisnó:~i-sinsinó:	'wash (clothes)'

- Fig. 1 below shows that there has been an **increase** in proportion of vowel-matching forms from Proto-Rukai to modern Rukai.
  - This increase is greater for paradigms that require composite URs.

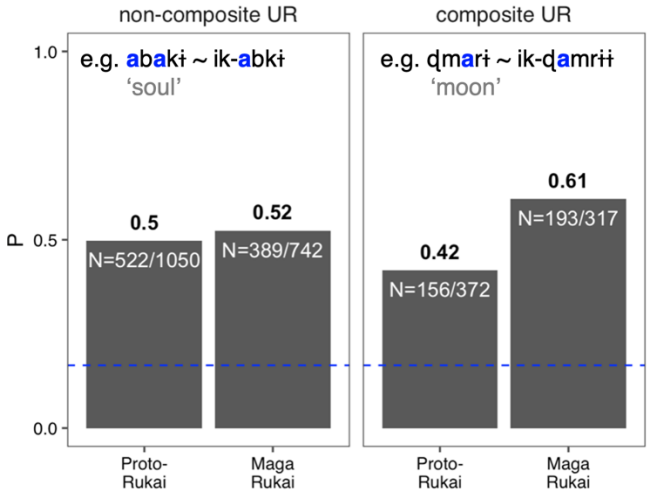


Figure 1: Proportion of vowel-matching (between V1 and V2) in Proto-Rukai vs. Maga Rukai. Dashed line indicates the chance-level rate of vowel-matching alternations.

- Fig. 2: results by vowel. E.g. the sub-figure for /u/ represents forms like /s**u**r**u**gu/ ‘liver’ ([sr**ú**gu]~[i-k-s**u**rgú:]).
  - vowel-matching has increased even for vowels that were *not* historically matching.

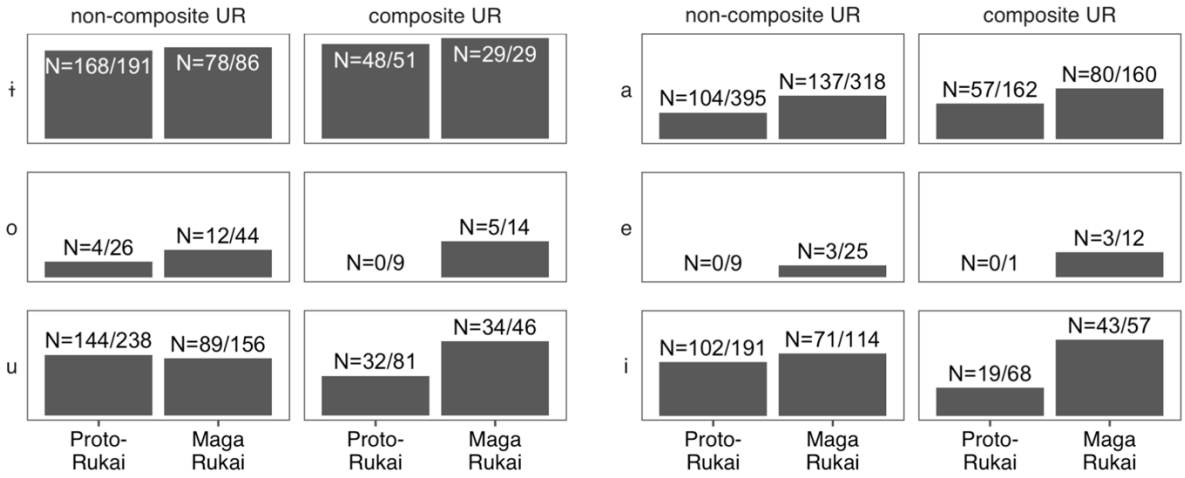


Figure 2: Proportion of vowel-matching in Proto-Rukai vs. Maga Rukai, by vowel

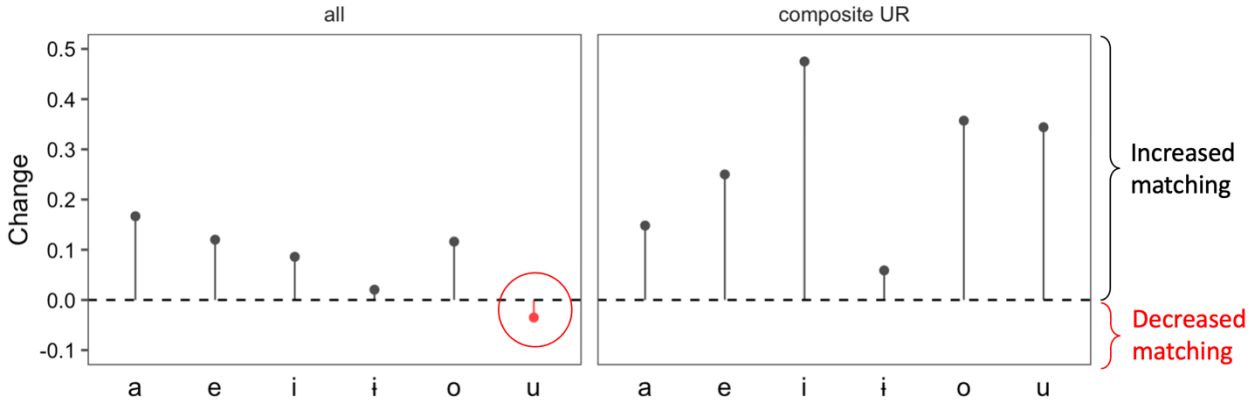


Figure 3: Change in proportion of vowel matching (Maga − Proto-Rukai)

- What about the direction of vowel-matching changes?
- Changes can be based on the stem allomorph (i.e. adopting the vowel quality present in the stem allomorph), or on the negative allomorph.

Base = stem

Proto-Rukai:	*samito	
Expected paradigm:	/samitu/	smitu ~ ik-samtu:
Actual paradigm:	/simitu/	smitu ~ ik-simtu:

Base = negative

Proto-Rukai:	*sinaw	
Expected paradigm:	/sinosino/	u-snosno ~ i-sinsino:
Actual paradigm:	/sinisino/	u-snisno ~ i-sinsino:

- Most changes are based on the unaffixed stem form
- Suggests that learners are biased towards inferring URs from the stem allomorph, in line with **KK-B levels of representation**.

(6) Direction of vowel-matching changes

BASE	N (P)	PROTO-RUKAI	EXPECTED UR	ACTUAL UR
Stem	45 (0.80)	*samito	/samitu/	/simitu/ (smitu~ik-simtu:)
Negative	6 (0.11)	*sinaw	/sinosino/	/sinisino/ (u-snisno~i-sinsino:)
Unclear	5 (0.09)	*tolarə	/tularɨ/	/talura/ (tlura~i-k-talra:)

E. Paradigm leveling

- Paradigms can be leveled, removing Ø~V alternations
- Direction of leveling is *inferred from the syncope pattern* (indirect evidence)
  Hypothetical example using the word for 'lips'
  Regular syncope: [smitu ~ ik-simtu:]
  Leveled to stem: [smitu ~ i-k-smitu:]
  Leveled to negative: [simtu ~ ik-smitu:]
- Additionally, some forms exceptionally fail to undergo syncope. Examples:
  ma-rimúru ~ ik-rimru: (stem)
  plíŋɨ ~ ik-piliŋí: (negative)
  lubili ~ ik-lubili: (both)

- Results are summarized below. General takeaways:
  - leveling towards **both allomorphs,** mostly towards the **more informative allomorph.**
  - In paradigms where neither allomorph is predictable, there is a slight preference for leveling towards the stem.

informative allomorph	**Direction of leveling**	*expected*	*actual*	**n**	**p**
both	not leveled	abu~i-abu:	abu~i-abu:	62	1
stem	→ stem	udali~i-udlí:	udali~i-udali:	31	0.37
	→ negative	iɖípi~i-iɖpí:	íɖpi~i-iɖpí:	2	0.02
	not leveled	abaki~ik-abki	abaki~ik-abki	51	0.61
negative	→ stem	u-kcya:~i-kucya:	u-kcyá:~i-kcyá:	1	0.01
	→ negative	tθo:~ik-teθo:	teθo~ik-teθo:	69	0.42
	not leveled	rna:~ik-rana	rna:~ik-rana	94	0.57
neither	→ stem	blavni~ik-bulvani	blávni~ik-blavni:	34	0.07
	→ negative	ma-dkiri~ik-dikri:	ma-dikri~ik-dikri:	27	0.06
	no syncope	tpulu~i-taplu:	tapulu~i-tapulu:	97	0.20
	not leveled	simtu ~ ik-smitu:	simtu ~ ik-smitu:	322	0.67

Alternative accounts to leveling #1: Non- syncope represents a conservative stage of MR.

- Chen (2008) suggests that syncope is a relatively innovative development, and that paradigms which fail to undergo syncope actually reflect an earlier stage of Maga.
- If so, the cases highlighted below can be treated as conservative variants that haven't undergone syncope yet, rather than leveling.
- Accounts for most irregular paradigms (~75%).

original base	Direction of leveling	paradigm	n	p
both	not leveled	abu~i-abu:	62	1
stem	→ stem	udalɨ~i-udalɨ:	31	0.37
	→ negative	ɨdƥɨ~i-ɨdƥɨ:	2	0.02
	not leveled	abakɨ~ik-abkɨ	51	0.61
negative	→ stem	u-kcya:~i-kcya:	1	0.01
	→ negative	teθo~ik-teθo:	69	0.42
	not leveled	rna:~ik-rana	94	0.57
neither	→ stem	blavnɨ~ik-blavnɨ:	34	0.07
	→ negative	u-θilbi~i-θilbi:	27	0.06
	no syncope	tapulu~i-tapulu:	97	0.20
	not leveled	simtu ~ ik-smitu:	322	0.67

Issues with this account:

- does not explain all cases of leveling
- does not explain why syncope fails to apply at a much higher rate specifically where there is a predictable base in the paradigm.
- Data from the *Austronesian indigenous words and narrations* corpus suggests that non-syncope is the innovative variant.

ILRDC CORPUS	HSIN (2000)	GLOSS
su̲ro:	sró: (cf. i-k-suro:)	'grass'
u-lu̲ŋé:	u-lŋé: (cf. i-luŋé:)	'siwm'
u-tú̲ta	u-ttá: (cf. i-tuta:)	'vomit'
cɨ́ŋ∅lɨ	u-cŋɨlɨ (cf. i-cɨŋlɨ:)	'look'
ƥɨ́k∅si	u-ƥkísi (cf. i-ƥiksi:)	'squeeze'

Alternative accounts to leveling #2: Non- syncope represents is the result of historic long vowels

- Proto-Rukai diphthongs and *VʔV sequences fail to undergo syncope in modern Rukai:

Proto-Rukai		**Maga**	**(cf. regular syncope)**	
*da**ʔa**nə	→	da**n**ɨ	(dnɨ:)	'house'
*p**ay**so	→	p**e**su	(psu:)	'money'
*bə**ʔə**kə	→	b**ɨ**kɨ	(bkɨ:)	'pig'

- However, of the MR words with available protoforms, only 39/109 (36%) stems that fail to undergo syncope have a historical explanation.
- Examples of historic short vowels that fail to undergo the expected syncope pattern:

Proto-Rukai	**MR**	**(cf. expected MR)**	**Gloss**
*d**o**koʔo	d**u**ku	dku:	‘grow (plant)’
*p**ə**kə	p**i**kɨ	pkɨ:	‘house lizard’
*ma-r**i**moro	ma-r**i**múru	ma-rmuru	‘forget’

F.Summing up

- Table (7) shows the degree of abstractness required in Maga lexicon (assuming that vowel-matching forms do not require composite URs):
- Only 16% of forms still require a composite UR

(7) Degree of abstractness in the Maga lexicon (post-restructuring)

Predictable allomorph	KK-level	N	P
both	A	238	0.30
stem	B/C	57	0.07
negative	B/C	173	0.22
either (vow matching)	B/C	196	0.25
neither (no matching)	**D**	**126**	**0.16**

- Removal of composite UR paradigms suggests that speakers are biased against learning KK-D levels of abstract representations
- Directions of leveling suggest that…
    1) Speakers prefer to learn URs that match the stem allomorph (KK-B)
    2) But can learn URs based on both the stem and negative allomorphs, in a way that is driven by informativeness (KK-C).

G. Links

Handout:
https://www.kuojennifer.com/files/presentations/2024_1222_rukai.pdf

Ms. in progress:
https://www.kuojennifer.com/files/presentations/rukai_abstractness_ms.pdf

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Li, Paul Jen-kuei (1977). The internal relationships of Rukai. *Bulletin of the Institute of History and Philology* 48(1). 1–92.