

Extending TSL to Account for Interactions of Local and Non-Local Constraints



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Introduction

Formal language theory can be used to describe the complexity of linguistic processes. Recent research suggests that unbounded dependencies in phonotactics can all be captured by the class of tier-based strictly local (TSL) languages [4]. However, there are patterns that cannot be described with a TSL account [6].

In this work I show that:

- these patterns are still subregular
- they fit in an extension of TSL obtained by relaxing constraints on the tier-projection mechanism.

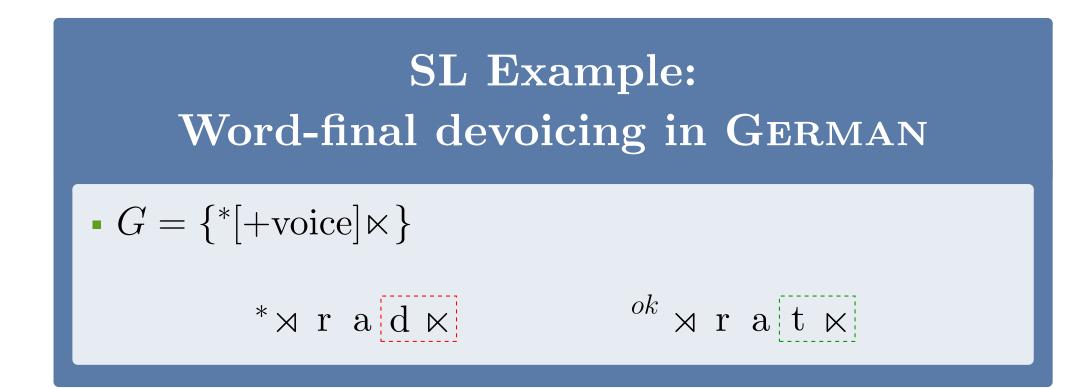
Subregular Complexity

Regular languages can be decomposed into a hierarchy of nested classes of decreasing complexity — the **subregular hierarchy** [4,7, i.a.].

	Regular	Monadic Second-Order Logic
	\bigcup	
Locally Threshold Testable	Star Free	First-Order Logic
Locally Testable	Piecewise Testable	Propositional Logic
U	U	
Strictly C TSL Local	Strictly Piecewise	Conjunction of Negative Literals
S/\triangleleft	< /<+	

The Subregular Hypothesis:

- Phonology is **subregular** [3]
- Local phonotactic dependencies are **strictly local** (SL)



What about unbounded dependencies?

- Unbounded dependencies are not SL
- Idea: Select a subset of segments and enforce constraints only over those.

TSL Grammars

Tier-based Strictly Local grammars:

• A projection function E_T :

• Strictly k-local constraints over T.

TSL Example: Sibilant harmony in AARI • $G = \langle T = \{ \int, 3, s, z \}, S = \{ *3s, *3z * \int s, * \int z, *s \int, *z \int, *s 3, *z 3 \} \rangle$ 3 a: e r **f** e 3 a: e r s e

Limits of TSL. Sibilant Harmony in Samala [1]:

- 1) Unbounded sibilant harmony
- a. /k-su-sojin/ ksusojin "I darken it"
- 2) $/s/\rightarrow [\int]$ when preceding (adjacent) [t, n, l]
- b. /**s-n**i?/ **∫**ni?

c. /s-net-us/

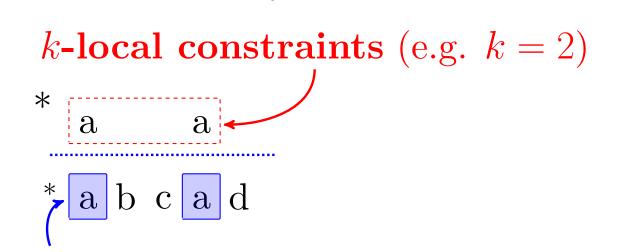
- "his neck"
- 3) Sibilant harmony overides palatalization
- "he does it to him"

snetus

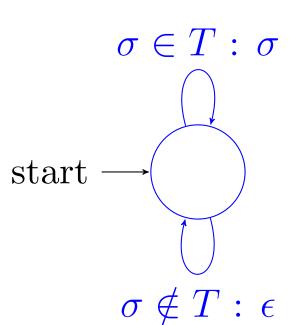
SH in SAMALA is not TSL [6] • $G_1 = \langle T = \{ s, f, n, t, l \}, S = \{ *sf, *fs \} \rangle$ * k s u f o j i n ok k J u J o j i n • $G_2 = \langle T = \{ s, f, n, t, l \} , S = \{ s, *f, *f, *sn, *st, *sl \} \rangle$ * ----ok nok jn i? * s n i ? • $G_3 = \langle T = \{ s, f, n, t, l \}, S = \{ *sf, *sf, *sf, *st, *sl \} \rangle$ oks n e t u s

Structure Sensitive TSL

TSL languages are characterized by:



1-local projection function

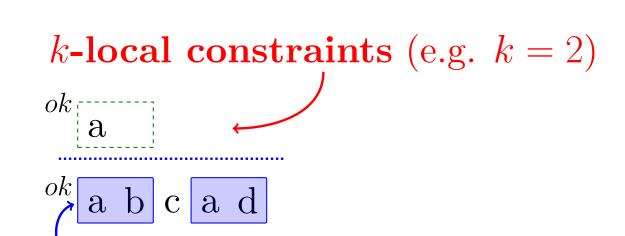


But:

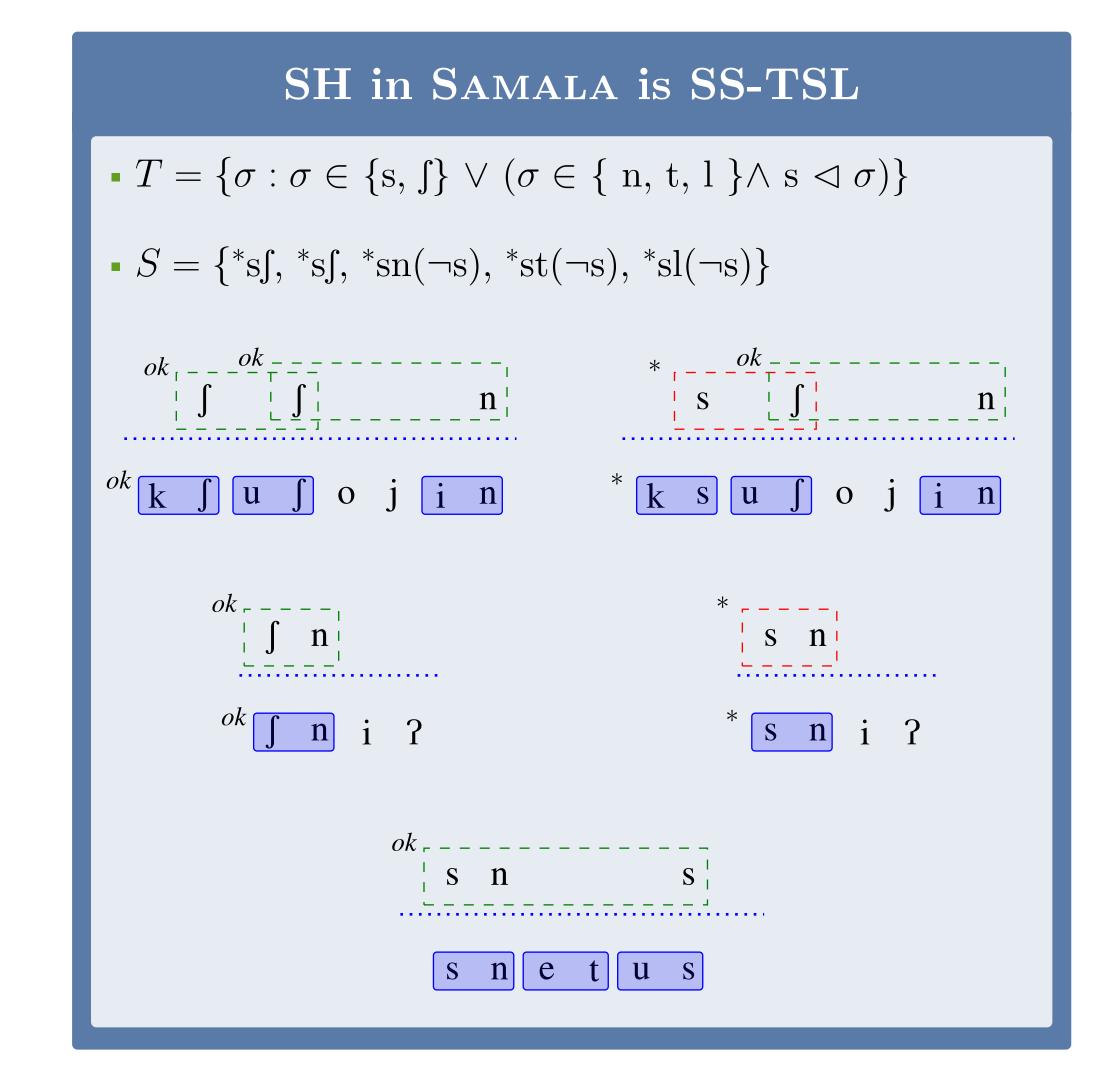
- E_T is blind to essential information in the input string
- We want tier-projection to depend on *n*-local properties Idea:

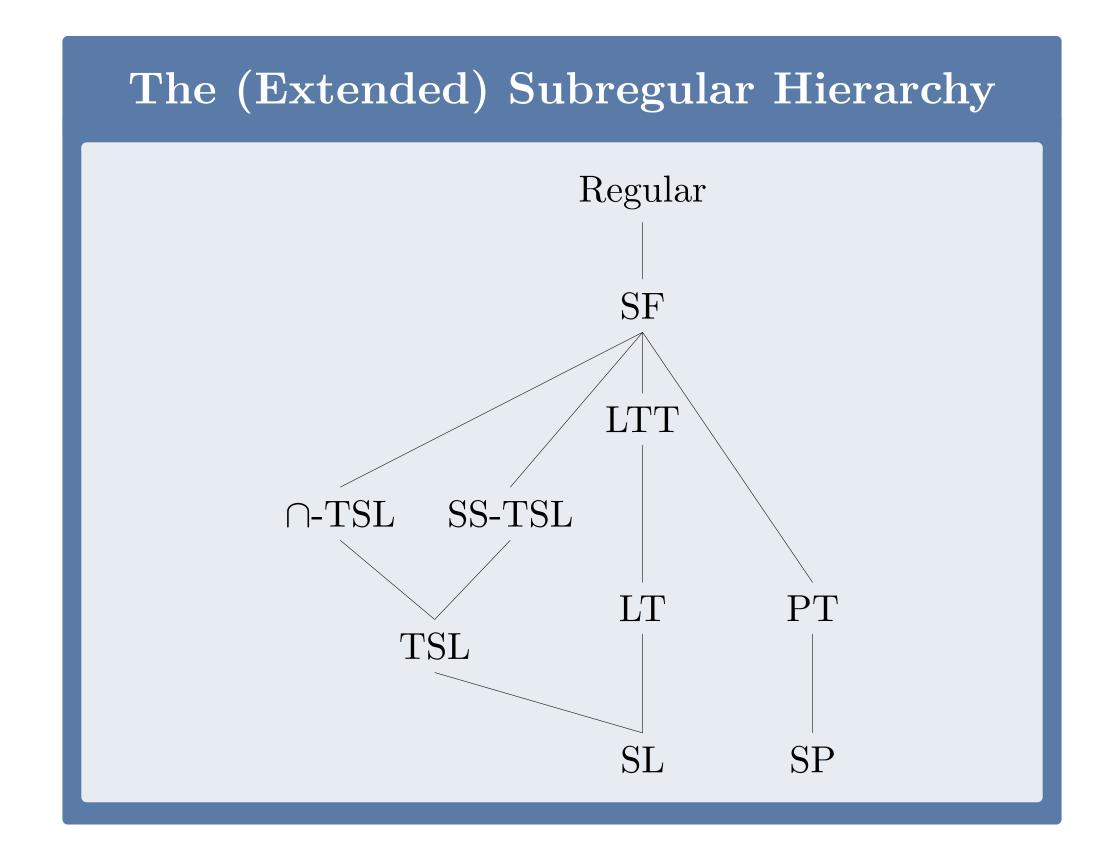
• E_T is an Input Strictly 1-Local function [2]

• We can to push the locality of E_T higher than 1



n-local projection (e.g. n=2)





SS-TSL Languages:

- First order definable with $\triangleleft \Rightarrow$ Still Subregular
- Gold Learnable fixed k, n

SS-TSL: Where Else?

- Culminativity patterns [3]
- Unbounded tone plateauing [5]
- Nasal harmony in YAKA [7]

Conclusion

In This Poster

- Subregular hypothesis: Phonology is SL + SP + TSL
- but there are still patterns that are unaccounted for!
- SS-TSL as a promising extension of TSL.

Future Work

- Further study of the TSL neighborhood
- Learning algorithms, AGL experiments, ...

References

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