Introduction

- Input-output mappings can be classified hierarchically by computational complexity (Chomsky 1956).
- All attested phonological mappings are a proper subset of the class of regular input-output mappings (Heinz & Lai 2011).
- (Un)attestedness of certain phonological patterns can be attributed to computational complexity of input-output mappings (Heinz & Lai 2013, Jardine 2016).
- Sour-grapes-like spreading; spread phonological property throughout domain or not at all (Padgett 1995; Wilson 2003).

<table>
<thead>
<tr>
<th>Weakly Deterministic</th>
<th>Regular</th>
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<tr>
<td>Right Subseq.</td>
<td>Left Subseq.</td>
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Proposals

Different sour-grapes-like patterns characterized by different degrees of computational complexity:

1) **False sour grapes** (attested) is relatively less complex due to zone of predictability local to potential triggers of spreading.

2) **True sour grapes** (unattested) has no zone of predictability and is relatively more complex.

Computational Complexity

- Input-output mapping of strings can be described by transformational rules or by finite state transducers.
- Properties of rules/transducers indicate computational complexity of input-output mappings.
- All regular mappings can be decomposed into left and right subsequential mappings (those with unbounded amount of material on only one side of the target) (Elgot & Mezei 1965).

- Weakly deterministic mappings (Heinz & Lai 2013) can be decomposed into left- and right-subsequential functions that:
  - Do not change the number of symbols in a string.
  - Are alphabet-preserving (do not introduce new symbols).

Copperbelt Bemba Tone Spreading

- Copperbelt Bemba (Bantu; Zambia) exhibits ternary and unbounded spreading of H tones (Bickmore & Kula 2013).
- Final H spreads unboundedly to following tone bearing units:
  - /bá-ka-fik-a/> [bá-ka-fik-a] ‘they will hate’
  - Non-final H spreads only to two additional tone bearing units:
  - /bá-ka-londolol-a kó/> [bá-ká-londolol-á kó] ‘they will introduce’
  - Previous claim: sour-grapes-like unbounded tone spreading in Copperbelt Bemba is not weakly deterministic (Jardine 2016).
  - Whether H triggers unbounded spreading is not known until rest of word is scanned for presence of following blocking H.

- Copperbelt Bemba: H spreading to two following tone bearing units provides predictable substring that can be used to mark up final H as successful trigger of unbounded tone spreading.

- **Zone of predictability:** predictable substring local to potential trigger of spreading that can be utilized for mark-up.

- **True sour grapes:** no zone of predictability local to potential trigger results in mapping that is not weakly deterministic.
- Potential undergoer U preceded at any distance by trigger T assimilates to the trigger:

  \[ T \ U \ U \ # \rightarrow T \ T \ T \ T \ # \]

  - If blocker B appears anywhere after a trigger T, no potential undergoes U assimilate to the trigger:

  \[ T \ U \ B \ # \rightarrow T \ U \ U \ B \ # \]

  - Successful mark-up strategy must distinguish unsuccessful triggers \( T_S \) (T followed by blocker) from successful triggers \( T_T \) (T not followed by blocker):

  \[ T \rightarrow T_S/(__)(U,T)B \rightarrow T_T/(__)(U,T),# \]

  - Left to right transducer triggers spreading from M and all symbols in M surface as T:

  \[ U \rightarrow T/(M(U),T)_0 \rightarrow M \rightarrow T \ T \ T \]

  - But without zone of predictability local to potential trigger, there is no mark-up substring M that we can use while maintaining contrastiveness of underlying M before blockers:

  \[ MU(U)_0B \rightarrow MU(U)_0B \rightarrow TTR(T)_0B \rightarrow MU(U)_0B \rightarrow NU(U)_0B \rightarrow NU(U)_0B \]

  **True sour grapes** spreading cannot be rendered weakly deterministic using a zone of predictability.

True Sour Grapes Spreading

- **True sour grapes**: no zone of predictability local to potential trigger results in mapping that is not weakly deterministic.
- Potential undergoer U preceded at any distance by trigger T assimilates to the trigger:

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  **True sour grapes** spreading cannot be rendered weakly deterministic using a zone of predictability.

Conclusion & Future Work

- Main claim: sour-grapes-like patterns of spreading are only attested if they involve zones of predictability, rendering their mappings weakly deterministic.
- Copperbelt Bemba tone spreading represents a case of weakly deterministic **false sour grapes** spreading.
- Possible additional cases of false sour grapes:
  - Tutrughu ATR harmony (McCullum et al. 2018).
  - Tuyuca nasal harmony? (Barnes 1996).
- Open questions for future work:
  - Do learners (and learning algorithms) make use of zones of predictability?
  - How do zones of predictability affect computational complexity of other phonological processes?
References


