Evidence for Classifying Metathesis Patterns as Subsequential

**keywords:** metathesis, local, long-distance, finite state machines, subsequential relation

This paper presents a computational analysis of local and long-distance metathesis. We show that local metathesis is *subsequential* and that if long-distance metathesis is interpreted as occurring across arbitrarily long distances, it is non-regular. As we discuss, the significance of this result is that 1) it provides a tighter computational bound on the set of possible phonological patterns, and 2) it has implications from a learnability perspective, since subsequential relations are identifiable in the limit from positive data.

A local metathesis pattern (in SPE, Chomsky and Halle 1968) would be represented with transformational rules like $AB \rightarrow BA / \_\_\_\_$; two adjacent segments surface in the opposite order. A classic example is from Rotuman, in which a word-final CV sequence surfaces as VC after a vowel (example from Blevins and Garrett 1998):

(1) tiko $\rightarrow$ tiok ‘flesh’

A long-distance pattern, on the other hand, is represented by a rule like $ABC \rightarrow CBA / \_\_\_$, where B is a string of one or more segments. An example is an optional process in Cuzco Quechua, in which sonorants metathesize across an intervening vowel (example from Hume 2000, who cites Davidson 1977):

(2) yuraq $\rightarrow$ ruyaq ‘white’

Johnson (1972) and Kaplan and Kay (1994) have shown that phonological patterns describable with rewrite rules like $A \rightarrow B / C \_\_D$ (where C and D are regular expressions) are regular. Using the formalism of finite state machines (FSMs), we will show that local metathesis is not only regular, but subsequential. A subsequential FSM is deterministic on the input, and local metathesis patterns can be described with such a machine. In addition, if the intervening string of a long-distance metathesis pattern is bounded, meaning it is of a known and finite length, then that pattern can also be described by a subsequential FSM. Since subsequential relations are a proper subclass of regular relations, this result is evidence for a stronger hypothesis than that of Johnson (1972) and Kaplan and Kay (1994): namely that phonological patterns are subregular (Heinz 2007, 2009, Magri 2010, Heinz 2010).

There remains, however, the question of *unbounded* long-distance metathesis patterns - for example, the first and last segments of the word switch positions regardless of how much material intervenes. Such patterns are neither subsequential, nor even regular. Many long-distance metathesis patterns have been identified (Blevins and Garrett 1998): one example comes from Bova, a dialect of Greek spoken in Southern Italy, in which a non-word-initial prevocalic liquid moves to the word-initial syllable (compared to Classical Greek) (example from Blevins and Garrett 2004):

(3) gambrós $\rightarrow$ grambó ‘son-in-law’
What is striking about the survey of such patterns is that many, such as Bova, are diachronic (Buckley, in press), and those that are synchronic appear to be bounded to at most one intervening segment. Though it is premature to state this conclusion as absolute, our work indicates the importance of further investigation into long-distance metathesis patterns to prove or falsify such a claim.

Furthermore, we anticipate that local and bounded long-distance metathesis patterns belong to a proper subclass of subsequential patterns. Koirala and Heinz (2010) define Strictly Local subsequential patterns and show that epenthesis, deletion, and local assimilation and dissimilation patterns fall into this class.

The implications of our results include the identification of a universal (and theory independent) property of metathesis, a pattern type marginalized in Kaplan and Kay’s study. In addition, the restriction of phonological patterns to the subsequential class is significant from the learning perspective, because subsequential learnability has a general solution (Oncina et al 1993) and has been studied in the domain of phonology (Gildea and Jurafsky 1996).

References
Koirala, Cesar and Jeffrey Heinz. 2010. Strictly Local Relations. Ms.