



Implementing and testing theories of syllable structure

Vsevolod Kapatsinski
Indiana University



CUNY Conference on the Syllable, New York, NY, January 17-19, 2008

Abstract

Two main views on the nature of constituency have been proposed. Under the dependency-based view, connections between parts of constituents are stronger than connections that cross constituent boundaries. Under the tree-structural view, a constituent is assigned a node in the tree structure while a non-constituent is not. We show that only the tree-structural view predicts that an association between constituents is easier to form than an association between segment strings that cross constituent boundaries. This prediction is shown to be confirmed experimentally. A general method for examining the nature of constituency is proposed.

Introduction

There is much evidence that in English CVC syllables with lax vowels, e.g., *kʰæt*, the major break is between the onset and the nucleus rather than between the nucleus and the coda.

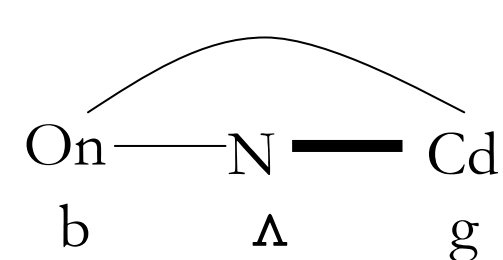
On | N Cd rather than On N | Cd
kʰ | æ t kʰ æ | t

Treiman and Danis (1988), Lee (2006): when English speakers are asked to memorize a list of CVC words, they erroneously combine the rime of one syllable (VC_2) with the onset of another syllable more often than they erroneously combine the body (C_1V) of one syllable with another syllable's coda.

bæʃ dʌg → *bʌg dæʃ* is more common than *bæʃ dʌg* → *dʌʃ bæg*

The question is how should this be represented.

Dependency-based view
(e.g., Vennemann 1988)



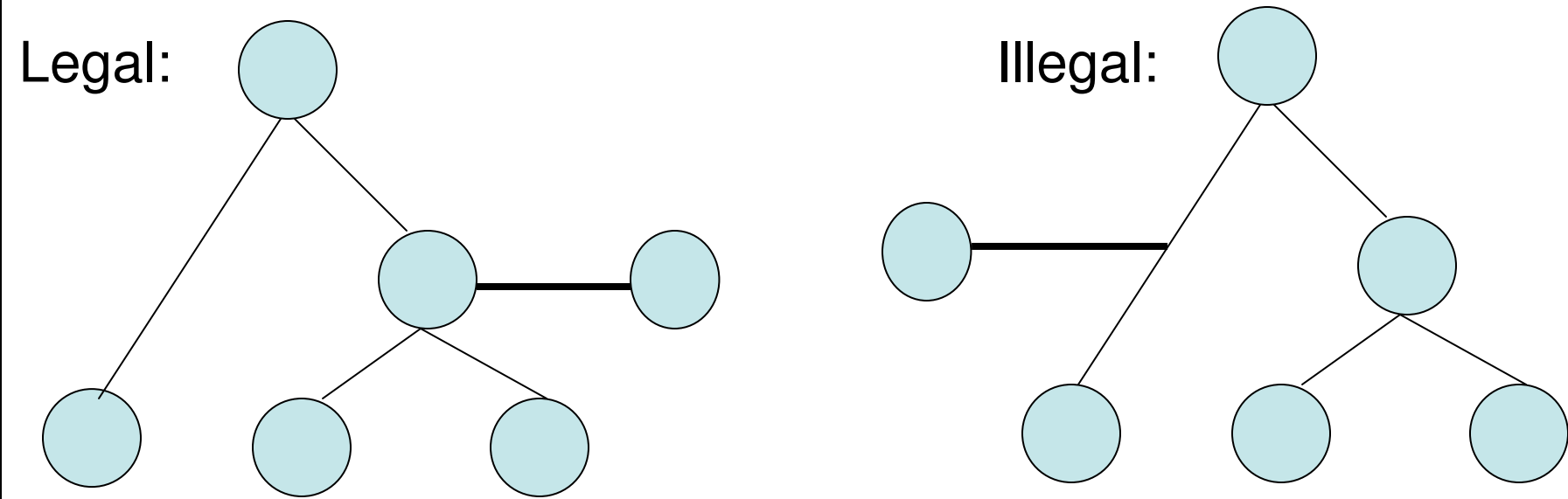
The nucleus-coda connection is stronger than the onset-nucleus connection.

Both of these views capture the idea that the nucleus is more strongly fused with the coda than with the onset. Both predict the serial recall results.

However, under the tree-structural view the rime is allocated a node while the body is not. Under the dependency-based view, neither the rime nor the body are allocated a node.

What does it mean to be allocated a node?

Under both accounts, the syllable is a network. A network is a set of nodes connected by links. A link can only connect two nodes. (In other words, you can only associate units that are salient enough to be parsed out of the signal.)



Thus, a node is something that can be associated with something else.

So, the tree-structural account predicts that associating a rime with something else (e.g., an affix) should be easier than associating the body with something else. The dependency-based account does not make this prediction.

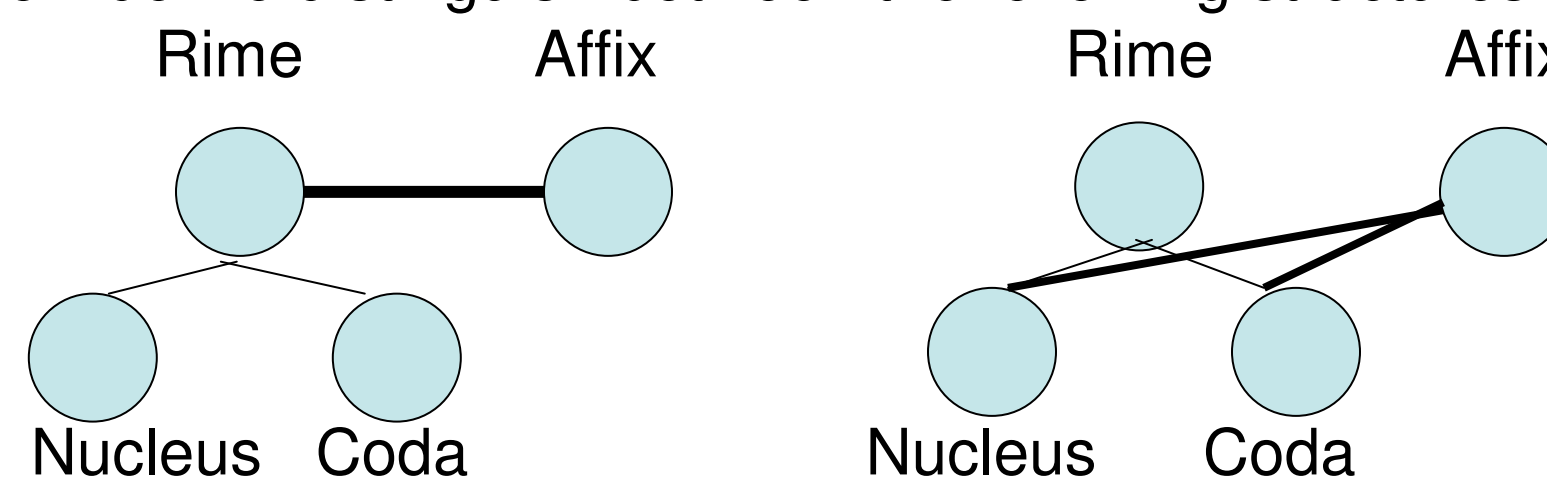
Conclusion

The inherent prediction of the tree-structural theory of constituency is that associations between constituents are easier to learn than associations between strings that are not constituents. The present study confirms this prediction for syllabic constituency and shows that dependency-based theories of constituency cannot account for it. Configural learning, whose defining characteristic is that associations of the whole are not associations of the parts, presents a promising way to assess the nature of linguistic constituency in various domains.

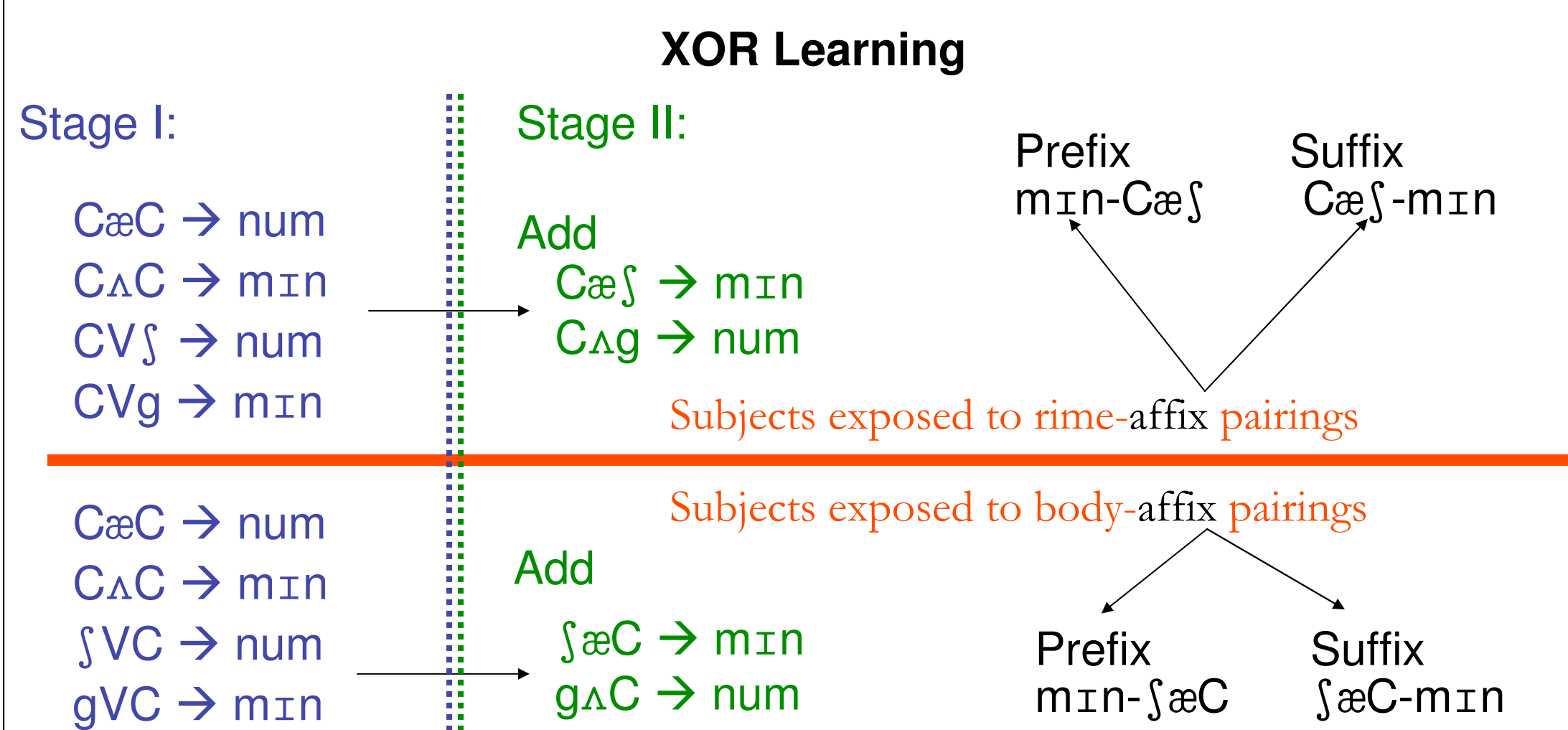
Method

Before we argue that learning rime-affix associations is easier than learning body-affix associations, we need to make sure that the result cannot be ascribed to how easy it is to learn coda-affix associations relative to onset-affix associations.

How do we distinguish between the following structures?



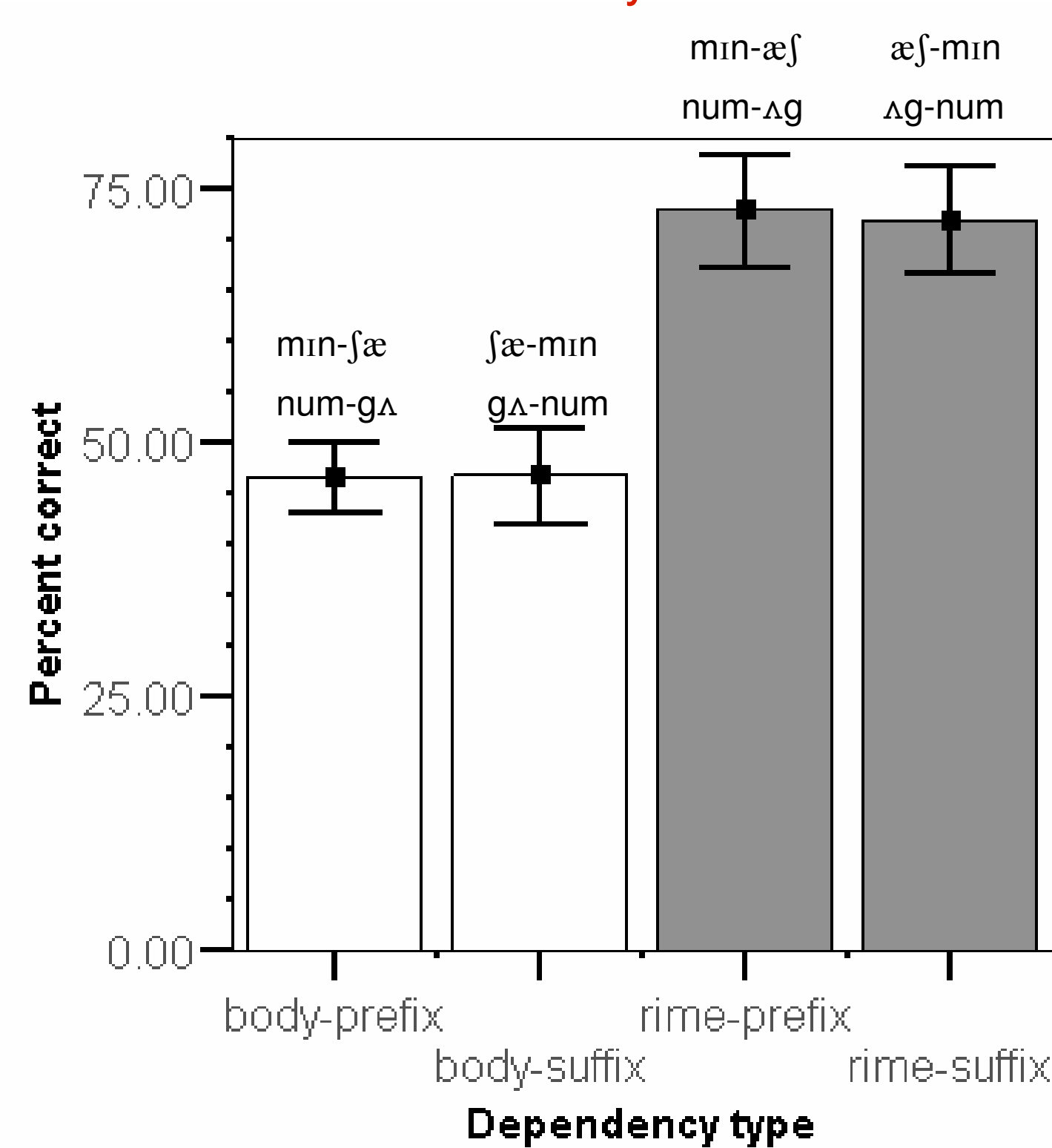
Solution: configural learning. Associations of the whole (rime or body) are not associations of the parts (individual segments). If a whole is paired with one affix, its parts are paired with a different affix, e.g., if /æʃ/ is paired with /num/ than /æC/ would be paired with /mɪn/, as would /Vʃ/.



Results

Rime-affix associations are easier to learn than body-affix associations.

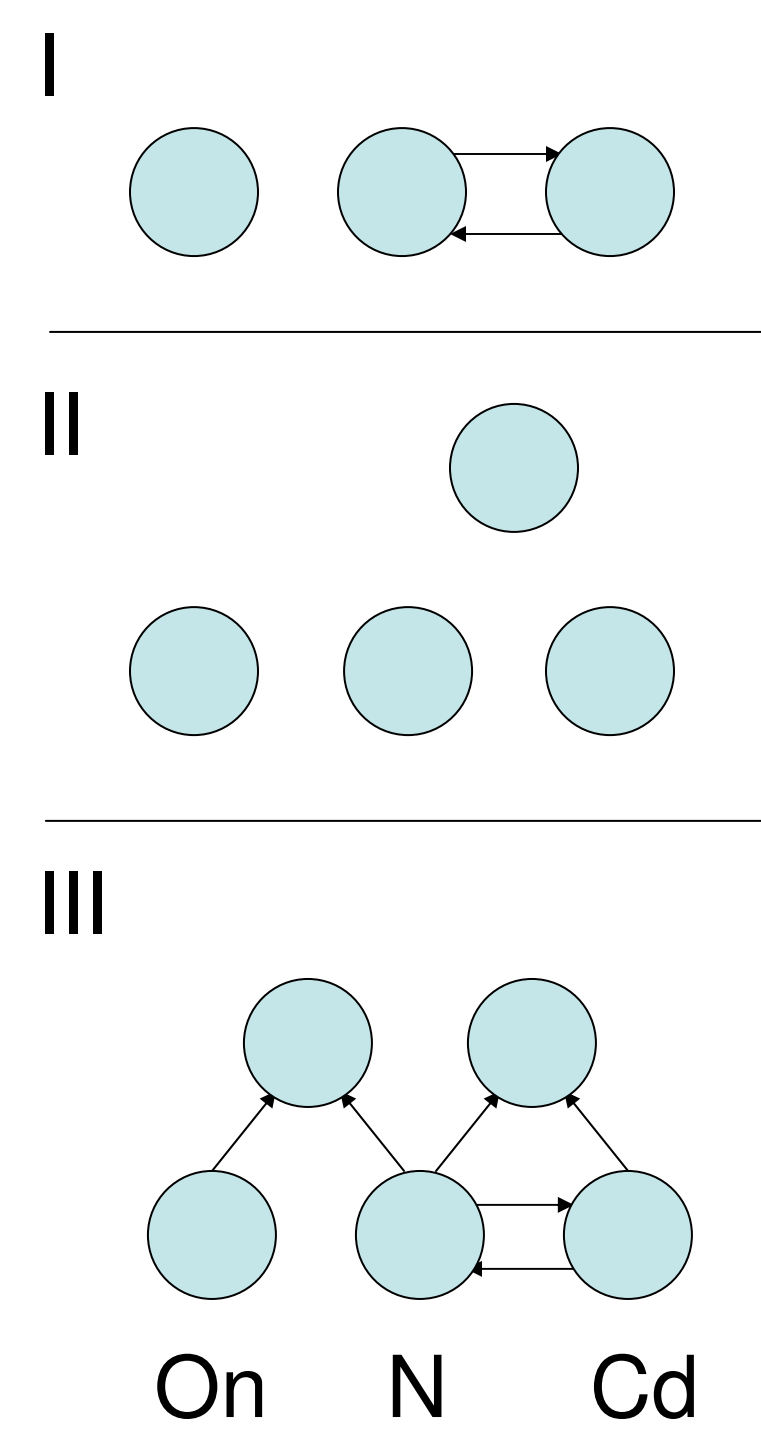
Onset-affix and coda-affix associations were equally easy to learn (64% vs. 65%), so the differences between bodies and rimes are not due to differences between onsets and codas. Accuracy with novel syllables containing familiar rimes was not lower than with familiar (trained) syllables containing familiar rimes (72% vs. 69%). So, subjects really are learning rime-affix and not syllable-affix associations.



Implementing theories of syllable structure

Is it really true that strengths of connections between parts cannot account for the results? Let's implement the competing theories.

Whenever a syllable-affix combination is presented, connections between the affix and all units parsed out of the syllable strengthen proportionally to the activation level of the parsed out units. The activation level of a unit is a function of its salience (likelihood of being parsed out) and the amount of activation it receives from other units. Activation spreads along links in the direction indicated by the arrows.



We want a model in which the rime is easier to associate with affixes than the body but onset-affix and coda-affix associations are equally learnable. Model II satisfies these conditions but the other models do not.

So, strong connections between parts of the rime do not make the rime easier to associate with something else in the present paradigm. They either have no effect (model I) or lower accuracy on rime-affix associations (model III) by increasing interference from segment-affix associations during testing.