

Modeling the Morphophonology of Ancient Greek: A Human-directed Computational Approach

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Global Education and Research Technology Session

Existing richly tagged Greek texts

- Parts of speech (noun, verb, etc.)
- Inflectional categories (case, num., gen., etc.)
- Sense information
- Root/Lemma information

What's Missing?

- **Morphological and phonological processes**
 - Euphony Rules
 - Syllabification
 - Transformations from prefix, stem, and suffix combinations



θεός

- Contraction: $\varepsilon + o \rightarrow ou \rightarrow *θους$
- Original Intervocalic: $\sigma \rightarrow *θεσος$
- $*θεσος \rightarrow -σ \rightarrow θεός$

A Computational Morphophonemic Model

- **Deductive**
 - Establish morphophonemic rules from grammars and texts
 - Encode rules into Haskell
 - Run program against the text

A Computational Morphophonemic Model

- **Inductive**
 - Apply rules to phonological script
 - Represent the derivation of morphological and lexical forms

Four Stages

1. Load Greek corpora
2. Model Greek script
3. Model Greek phonology
4. Model Greek morphology



Patterns

- Human
 - asks questions
 - selects patterns
- Computer
 - finds results
 - applies patterns



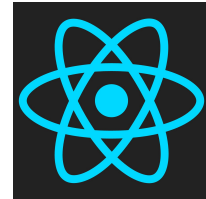
Theory

- Functional programming
- Type theory
 - Foundations of mathematics
 - Programs as proofs

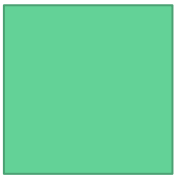


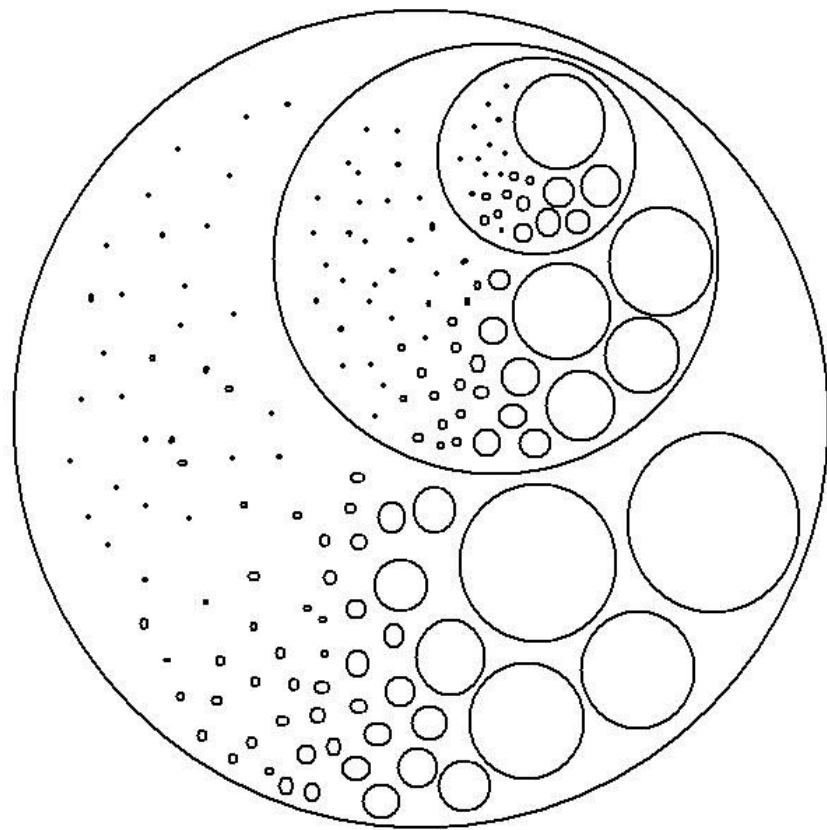
Technology

- Generate data — console app
 - Haskell
- View data — web app
 - JavaScript
 - Facebook React
 - Twitter Bootstrap

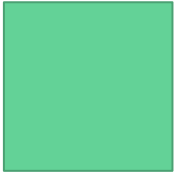


Structure

- List of **Works**
 - Work properties
 - List of **Words**
 - Word properties
 - List of 



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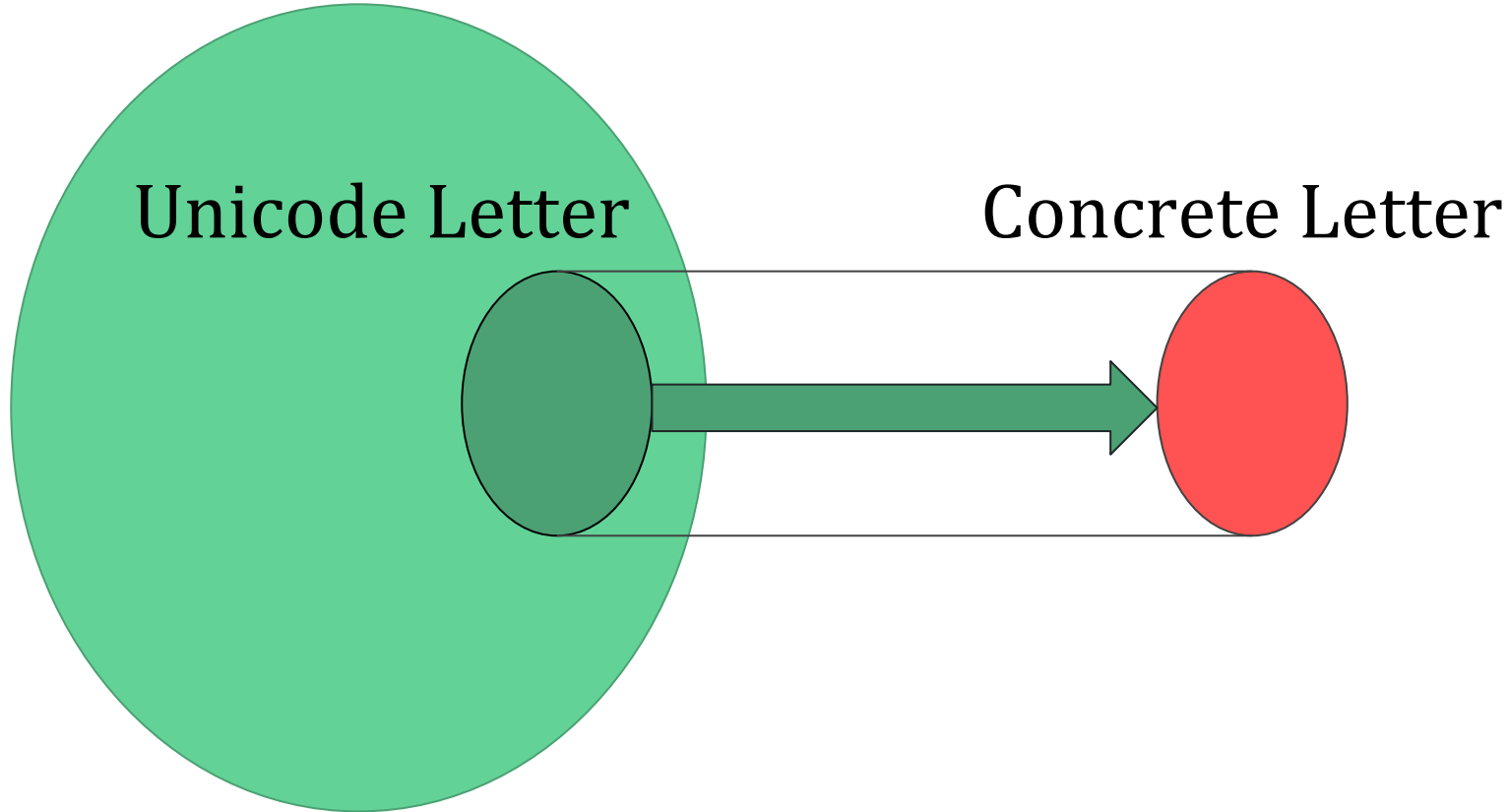
**What is the
green box?**

Word Stages

- Elements of a word change
 - a. Unicode character
 - b. Letter with marks
 - c. Vowel or consonant
 - d. Syllable



Word Stage Transition



Transition

Concrete Letter

A
α
...

Abstract
Letter

α
α
...

Letter
Case

Upper
Lower
...

Final
Form

N/A
N/A
...

Σ
σ
ς
...

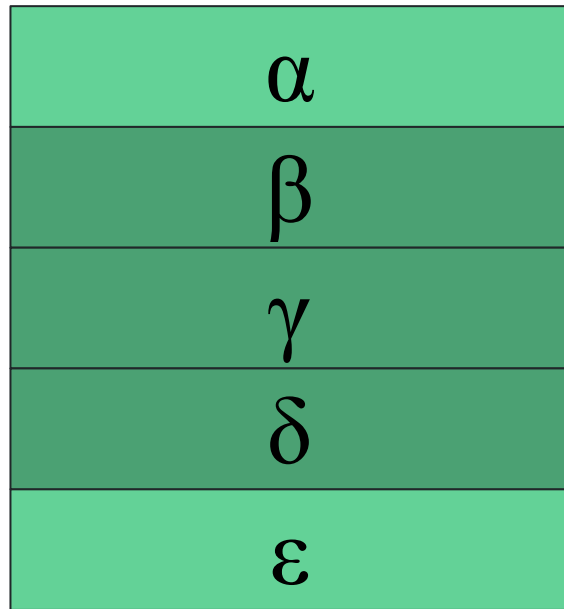
σ
σ
σ
...

Upper
Lower
Lower
...

Not F.
Not F.
Final
...

Transition

Abstract Letter



α

β

γ

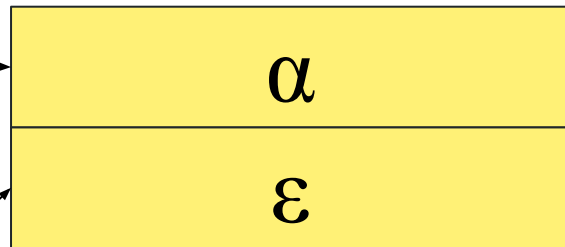
δ

ε



Vowel or Consonant

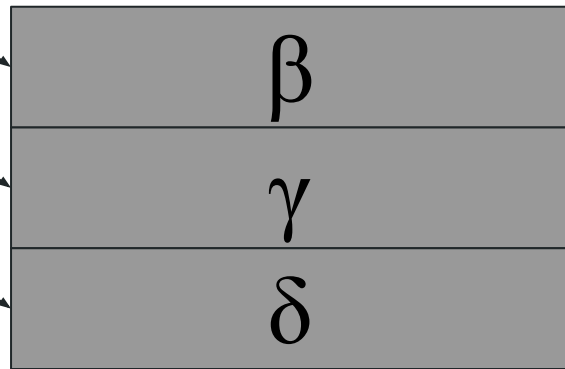
Vowel



α

ε

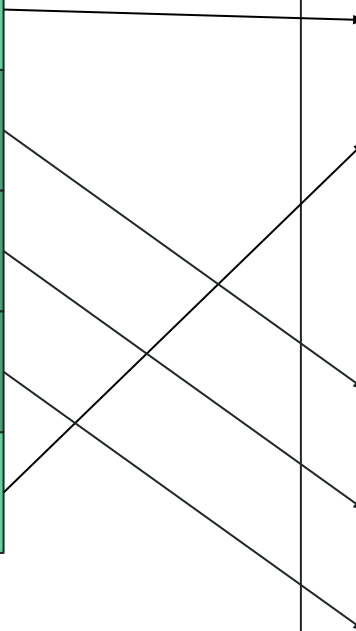
Consonant



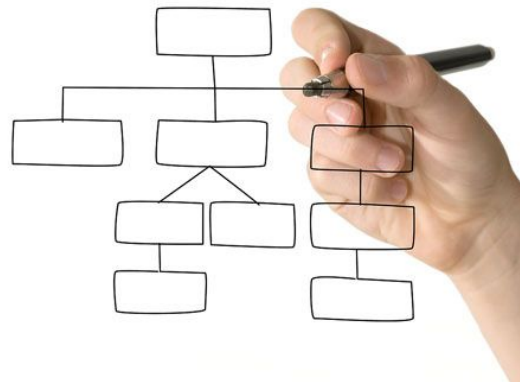
β

γ

δ



Organization



- **Types** — e.g., Letter
 - **Values** — $\alpha, \beta, \gamma, \dots$
 - **Instances** — words with β : Ἰάκωβος, ...
- **Works** — books of the bible, e.g. ΙΑΚΩΒΟΥ
 - **Words** — Ἰάκωβος θεοῦ...
 - **Type, value pairs** — Ἰάκωβος: Letter, β

Next steps

- **Phonology**
- **Morphology**
- **Syntax and Grammar**

Next steps (cont'd)

- **Add more texts**
 - **Perseus**
 - **Papyri.info**
 - **LXX**

Links

- Data website

scott-fleischman.github.io/greek-grammar

- Code (search for “GitHub Greek Grammar”)

github.com/scott-fleischman/greek-grammar