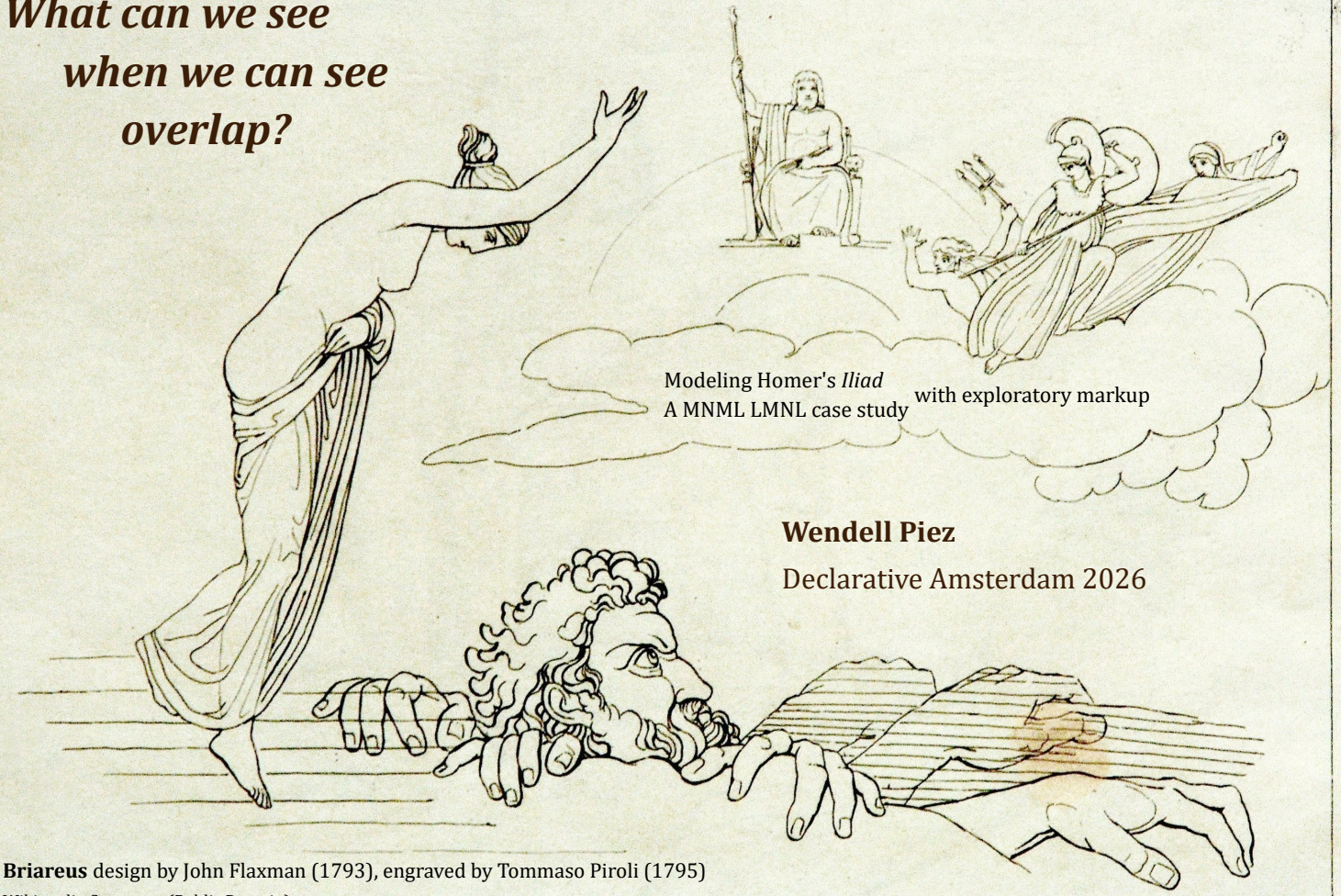
What can we see when we can see overlap?



Modeling Homer's *Iliad*
A MNML LMNL case study
with exploratory markup

Wendell Piez

Declarative Amsterdam 2026

Briareus design by John Flaxman (1793), engraved by Tommaso Piroli (1795)
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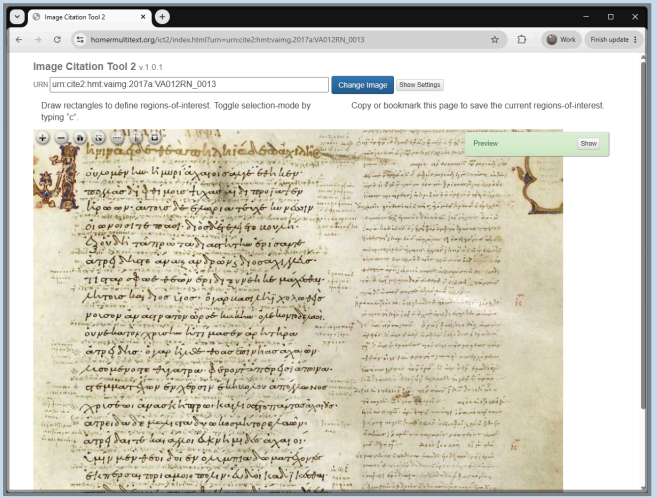
ΡΑΨΩΔΙΑ Α

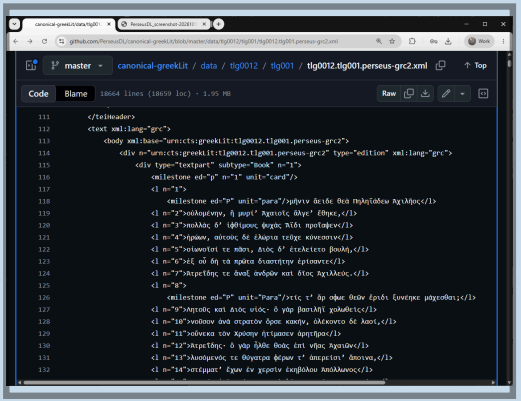
μῆνιν ἄειδε θεὰ Πηληϊάδεω Ἀχιλῆος
οὐλομένην, ἣ μυρί' Ἀχαιοῖς ἄλγε' ἔθηκε,
πολλὰς δ' ἰφθίμους ψυχὰς Ἄϊδι προΐαψεν
ἡρώων, αὐτοὺς δὲ ἑλώρια τεῦχε κύνεσσιν
οἰωνοῖσί τε πᾶσι, Διὸς δ' ἐτελείετο βουλή,
ἐξ οὗ δὴ τὰ πρῶτα διαστήτην ἐρίσαντε
Ἀτρεΐδης τε ἄναξ ἀνδρῶν καὶ δῖος Ἀχιλλεύς.
τίς τ' ἄρ σφωε θεῶν ἔριδι ξυνέηκε μάχεσθαι;
Λητοῦς καὶ Διὸς υἱός· ὃ γὰρ βασιλῆϊ χολωθεὶς
νοῦσον ἀνὰ στρατὸν ὄρσε κακήν, ὀλέκοντο δὲ λαοί,
οὕνεκα τὸν Χρύσην ἠτίμασεν ἀρητῆρα
Ἀτρεΐδης· ὃ γὰρ ἦλθε θοὰς ἐπὶ νῆας Ἀχαιῶν
λυσόμενός τε θύγατρα φέρων τ' ἀπερείσι' ἄποινα,
στέμματ' ἔχων ἐν χερσὶν ἑκηβόλου Ἀπόλλωνος
χρυσέῳ ἀνὰ σκήπτρῳ, καὶ λίσσετο πάντας Ἀχαιούς,
Ἀτρεΐδα δὲ μάλιστα δύω, κοσμήτορε λαῶν·
Ἀτρεΐδαι τε καὶ ἄλλοι ἐϋκνήμιδες Ἀχαιοί,
ὑμῖν μὲν θεοὶ δοῖεν Ὀλύμπια δώματ' ἔχοντες
ἐκπέρσαι Πριάμοιο πόλιν, εὖ δ' οἶκαδ' ἱκέσθαι·
παῖδα δ' ἐμοὶ λύσαιτε φίλην, τὰ δ' ἄποινα δέχεσθαι,
ἁζόμενοι Διὸς υἱὸν ἑκηβόλον Ἀπόλλωνα.
ἔνθ' ἄλλοι μὲν πάντες ἐπευφήμησαν Ἀχαιοὶ
αἰδεῖσθαί θ' ἱερῆα καὶ ἀγλαὰ δέχθαι ἄποινα·
ἀλλ' οὐκ Ἀτρεΐδῃ Ἀγαμέμνονι ἤνδανε θυμῷ,
ἀλλὰ κακῶς ἀφίει, κρατερὸν δ' ἐπὶ μῦθον ἔτελλε·
μή σε γέρον κοίλῃσιν ἐγὼ παρὰ νηυσὶ κιχείω
ἢ νῦν δηθύνοντ' ἢ ὕστερον αὖτις ἰόντα,
μή νύ τοι οὐ χραίσμῃ σκῆπτρον καὶ στέμμα θεοῖο·
τὴν δ' ἐγὼ οὐ λύσω· πρίν μιν καὶ γῆρας ἐπεισιν
ἡμετέρῳ ἐνὶ οἴκῳ ἐν Ἄργεϊ τηλόθι πάτρης
ἱστὸν ἐποιχομένην καὶ ἐμὸν λέχος ἀντιόωσαν·
ἀλλ' ἴθι μή μ' ἐρέθιζε σαώτερος ὥς κε νέηαι.
ὣς ἔφατ', ἔδεισεν δ' ὃ γέρων καὶ ἐπείθετο μύθῳ·
βῆ δ' ἀκέων παρὰ θῖνα πολυφλοίσβοιο θαλάσσης·
πολλὰ δ' ἔπειτ' ἀπάνευθε κιὼν ἠρᾶθ' ὁ γεραιὸς
Ἀπόλλωνι ἄνακτι, τὸν ἠΰκομος τέκε Λητώ·
κλῦθί μευ ἀργυρότοξ', ὃς Χρύσην ἀμφιβέβηκας
Κίλλαν τε ζαθέην Τενέδοιό τε ἶφι ἀνάσσεις,
Σμινθεῦ εἴ ποτέ τοι χαρίεντ' ἐπὶ νηὸν ἔρεψα,
ἢ εἰ δή ποτέ τοι κατὰ πίονα μηρί' ἔκηα
ταύρων ἠδ' αἰγῶν, τὸ δέ μοι κρήηνον ἐέλδωρ·
τίσειαν Δαναοὶ ἐμὰ δάκρυα σοῖσι βέλεσσιν.
ὣς ἔφατ' εὐχόμενος, τοῦ δ ἔκλυε Φοῖβος Ἀπόλλων,
βῆ δὲ κατ' Οὐλύμποιο καρήνων χωόμενος κῆρ,
τόξ' ὤμοισιν ἔχων ἀμφηρεφέα τε φαρέτρην·
ἔκλαγξαν δ' ἄρ' ὀϊστοὶ ἐπ' ὤμων χωομένοιο,
αὐτοῦ κινηθέντος· ὃ δ' ἤϊε νυκτὶ ἐοικώς.
ἕζετ' ἔπειτ' ἀπάνευθε νεῶν, μετὰ δ' ἰὸν ἔγηκε·
δεινὴ δὲ κλαγγὴ γένετ' ἀργυρέοιο βιοῖο·
οὐρῆας μὲν πρῶτον ἐπῴχετο καὶ κύνας ἀργούς,
αὐτὰρ ἔπειτ' αὐτοῖσι βέλος ἐχεπευκὲς ἐφιεὶς
βάλλ· αἰεὶ δὲ πυραὶ νεκύων καίοντο θαμειαί.



Screenshot from Homer Multitext Project
Showing a page from the 10th century CE (Iliad Venetus A)
https://www.homermultitext.org/ict2/index.html

Topic of interest: Encoding Homer's *Iliad*

PerseusDL TEI encoded *Iliad*
Available for reuse under CC-BY-SA - thank you Perseus project!
https://github.com/PerseusDL/canonical-greekLit/



```
[BOOK [n}1{]}
[para}[prayer [to}Calliope{]}[l [n}1.1{]}μῆνιν ἄειδε θεὰ Πηληϊάδεω Ἀχιλῆος{l]
[l [n}1.2{]}οὐλομένην, ἣ μυρί’ Ἀχαιοῖς ἄλγε’ ἔθηκε,{l]
[l [n}1.3{]}πολλὰς δ’ ἰφθίμους ψυχὰς Ἄϊδι προΐαψεν{l]
[l [n}1.4{]}ἡρώων, αὐτοὺς δὲ ἑλώρια τεῦχε κύνεσσιν{l]
[l [n}1.5{]}οἰωνοῖσί τε πᾶσι, Διὸς δ’ ἐτελείετο βουλή,{l]
[l [n}1.6{]}ἐξ οὗ δὴ τὰ πρῶτα διαστήτην ἐρίσαντε{l]
[l [n}1.7{]}Ἀτρεΐδης τε ἄναξ ἀνδρῶν καὶ δῖος Ἀχιλλεύς.{l]{prayer]{para]
[para}[l [n}1.8{]}τίς τ’ ἄρ σφωε θεῶν ἔριδι ξυνέηκε μάχεσθαι;{l]
[l [n}1.9{]}Λητοῦς καὶ Διὸς υἱός· ὸ γὰρ βασιλῆϊ χολωθεὶς{l]
[l [n}1.10{]}νοῦσον ἀνὰ στρατὸν ὄρσε κακήν, ὀλέκοντο δὲ λαοί,{l]
[l [n}1.11{]}οὕνεκα τὸν Χρύσην ἠτίμασεν ἀρητῆρα{l]
[l [n}1.12{]}Ἀτρεΐδης· [scene [set}Achaian ships{]}ὸ γὰρ ἦλθε θοὰς ἐπὶ νῆας Ἀχαιῶν{l]
[l [n}1.13{]}λυσόμενός τε θύγατρα φέρων τ’ ἀπερείσι’ ἄποινα,{l]
[l [n}1.14{]}στέμματ’ ἔχων ἐν χερσὶν ἑκηβόλου Ἀπόλλωνος{l]
[l [n}1.15{]}χρυσέῳ ἀνὰ σκήπτρῳ, καὶ λίσσετο πάντας Ἀχαιούς,{l]
[l [n}1.16{]}Ἀτρεΐδα δὲ μάλιστα δύω, κοσμήτορε λαῶν·{l]
[speech [by}Chryses{][to}Agamemnon, Menelaus, Achaians{]}
[l [n}1.17{]}Ἀτρεΐδαι τε καὶ ἄλλοι ἐϋκνήμιδες Ἀχαιοί,{l]
[l [n}1.18{]}ὑμῖν μὲν θεοὶ δοῖεν Ὀλύμπια δώματ’ ἔχοντες{l]
[l [n}1.19{]}ἐκπέρσαι Πριάμοιο πόλιν, εὖ δ’ οἴκαδ’ ἱκέσθαι·{l]
[l [n}1.20{]}παῖδα δ’ ἐμοὶ λύσαιτε φίλην, τὰ δ’ ἄποινα δέχεσθαι,{l]
[l [n}1.21{]}ἁζόμενοι Διὸς υἱὸν ἑκηβόλον Ἀπόλλωνα.{l]{speech]{para]
[para}[l [n}1.22{]}ἔνθ’ ἄλλοι μὲν πάντες ἐπευφήμησαν Ἀχαιοὶ{l]
[l [n}1.23{]}αἰδεῖσθαί θ’ ἱερῆα καὶ ἀγλαὰ δέχθαι ἄποινα·{l]
[l [n}1.24{]}ἀλλ’ οὐκ Ἀτρεΐδῃ Ἀγαμέμνονι ἤνδανε θυμῷ,{l]
[l [n}1.25{]}ἀλλὰ κακῶς ἀφίει, κρατερὸν δ’ ἐπὶ μῦθον ἔτελλε·{l]
[speech [by}Agamemnon{][to}Chryses{]}
[l [n}1.26{]}μή σε γέρον κοίλῃσιν ἐγὼ παρὰ νηυσὶ κιχείω{l]
[l [n}1.27{]}ἢ νῦν δηθύνοντ’ ἢ ὕστερον αὖτις ἰόντα,{l]
[l [n}1.28{]}μή νύ τοι οὐ χραίσμῃ σκῆπτρον καὶ στέμμα θεοῖο·{l]
[l [n}1.29{]}τὴν δ’ ἐγὼ οὐ λύσω· πρίν μιν καὶ γῆρας ἔπεισιν{l]
[l [n}1.30{]}ἡμετέρῳ ἐνὶ οἴκῳ ἐν Ἄργεϊ τηλόθι πάτρης{l]
[l [n}1.31{]}ἱστὸν ἐποιχομένην καὶ ἐμὸν λέχος ἀντιόωσαν·{l]
[l [n}1.32{]}ἀλλ’ ἴθι μή μ’ ἐρέθιζε σαώτερος ὥς κε νέῃαι.{l]{speech]{para]
[para}[l [n}1.33{]}ὣς ἔφατ’, ἔδεισεν δ’ ὸ γέρων καὶ ἐπείθετο μύθῳ·{l]{scene]
[scene [set}seashore{]}[l [n}1.34{]}βῆ δ’ ἀκέων παρὰ θῖνα πολυφλοίσβοιο θαλάσσης·{l]
[l [n}1.35{]}πολλὰ δ’ ἔπειτ’ ἀπάνευθε κιὼν ἠρᾶθ’ ὸ γεραιὸς{l]
[l [n}1.36{]}Ἀπόλλωνι ἄνακτι, τὸν ἠϋκομος τέκε Λητώ·{l]
[prayer [to}Apollo{][by}Chryses{]}
[l [n}1.37{]}κλῦθί μευ ἀργυρότοξ’, ὃς Χρύσην ἀμφιβέβηκας{l]
```

What are we trying to achieve?

Exploratory Markup

Unrealized potentials
of declarative text encoding

Describing data with tags
regarding overlap as normal

... We can tag freely as we go ...

A schema is an object of study
(not a binding commitment)
“More like guidelines”

Markup first, hierarchies later

Depicted: TextPad® Text Editor by Helios Software Solutions
Configured for MNML LMNL
With syntax coloring, validation and operations support
Tools use **Laminator** XProc pipelines under XML Calabash or Morgana-IIIse (both Java)

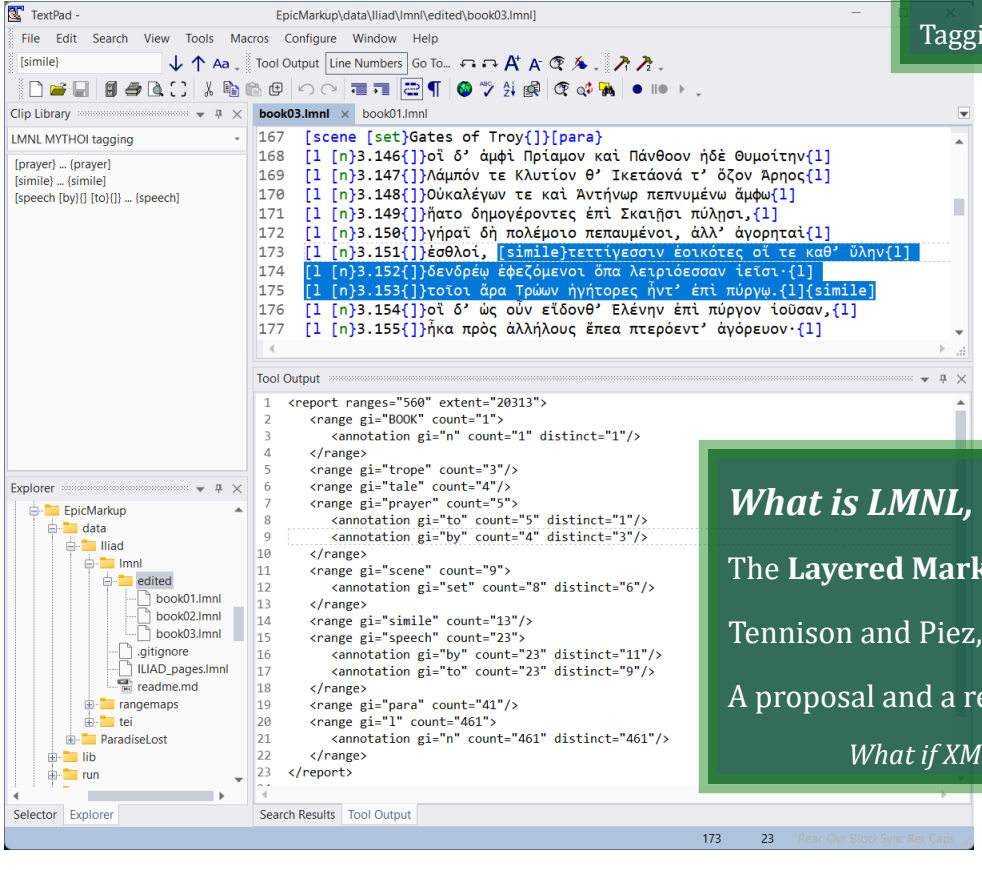
What makes LMNL nice for this

No necessary commitment to any hierarchy

(Many hierarchies, or none, implicit and concurrent)

Outlines can emerge when nothing is forced

Tagging can be even more descriptive



Any plain-text (UTF-8) editor works well
For example, a **Bluefish** configuration is available
The tools also work on the command line
Or as an XProc application ...
... and a SaxonJS-based platform is contemplated

What is LMNL, anyway?

The **Layered Markup and Annotation Language**

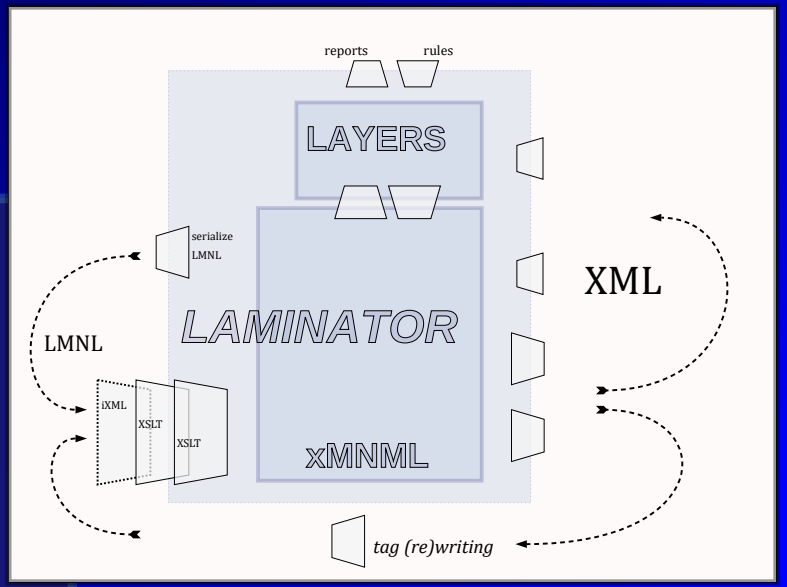
Tennison and Piez, 2002 (Extreme Markup Languages)

A proposal and a research project

What if XML had no end-tag matching rule?

Laminator

https://github.com/wendellpiez/Laminator



How it works

An Invisible XML grammar plus handful of XSLTs

Glued together with XProc+iXML

LMNL syntax is read in via iXML parse plus XSLT x 2

XML can be ingested directly, or convert to LMNL

Results can be expressed in LMNL or XML syntax

Works with any XML idiom for expressing overlap

Data flows are adaptable

problem domain

tagging semantics

data set

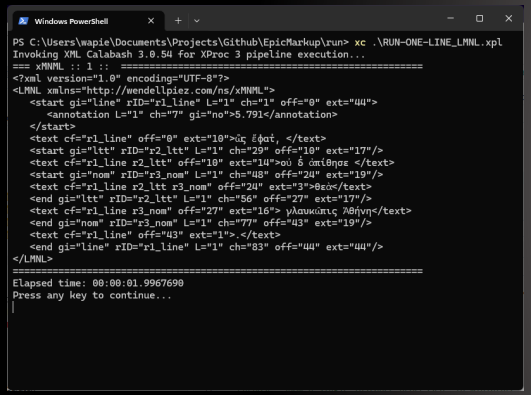
LMNL inputs

Made by hand

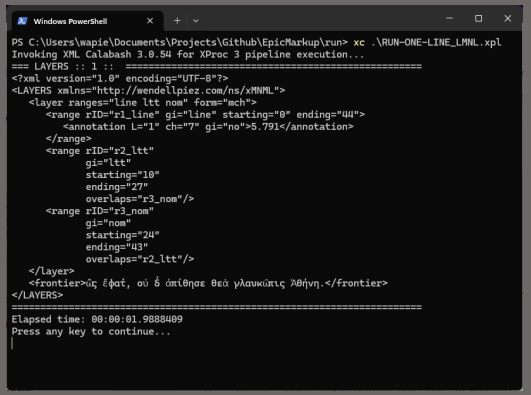
Or generated from (XML or other) source

```
[line [no}5.791{]}ὡς ἔφατ', [ltt}οὐ δ' ἀπίθησε [nom}θεὰ{ltt] γλαυκῶπις Ἀθήνη{nom].{line]
```

xMNML - a **tagged text (sequence) model**



LAYERS - a **range model**



XML results

... one (any) hierarchy at a time

```
<line no="5.791">ὡς ἔφατ', οὐ δ' ἀπίθησε <nom>θεὰ γλαυκῶπις Ἀθήνη</nom>.</line>
```

```
<line no="5.791">ὡς ἔφατ', <ltt>οὐ δ' ἀπίθησε θεὰ</ltt> γλαυκῶπις Ἀθήνη.</line>
```

```
<line no="5.791">ὡς ἔφατ', <ltt>οὐ δ' ἀπίθησε <nom>θεὰ</nom></ltt><nom> γλαυκῶπις Ἀθήνη</nom>.</line>
```

```
<line no="5.791">ὡς ἔφατ', <ltt_s/>οὐ δ' ἀπίθησε <nom>θεὰ<ltt_e/> γλαυκῶπις Ἀθήνη</nom>.</line>
```

Same example, up closer

xMNML model

XML elements for start, end, empty tags

Presents a “tagging control surface”

Properties of ranges are calculated

Text is segmented and linked

```
PS C:\Users\wapie\Documents\Projects\Github\EpicMarkup\run> xc .\RUN-ONE-LINE_LMNL.xpl
Invoking XML Calabash 3.0.54 for XProc 3 pipeline execution...
=== xMNML :: 1 ::  ================================================
<?xml version="1.0" encoding="UTF-8"?>
<LMNL xmlns="http://wendellpiez.com/ns/xMNML">
   <start gi="line" rID="r1_line" L="1" ch="1" off="0" ext="44">
      <annotation L="1" ch="7" gi="no">5.791</annotation>
   </start>
   <text cf="r1_line" off="0" ext="10">ὡς ἔφατ, </text>
   <start gi="ltt" rID="r2_ltt" L="1" ch="29" off="10" ext="17"/>
   <text cf="r1_line r2_ltt" off="10" ext="14">οὐ δ ἀπίθησε </text>
   <start gi="nom" rID="r3_nom" L="1" ch="48" off="24" ext="19"/>
   <text cf="r1_line r2_ltt r3_nom" off="24" ext="3">θεὰ</text>
   <end gi="ltt" rID="r2_ltt" L="1" ch="56" off="27" ext="17"/>
   <text cf="r1_line r3_nom" off="27" ext="16"> γλαυκῶπις Ἀθήνη</text>
   <end gi="nom" rID="r3_nom" L="1" ch="77" off="43" ext="19"/>
   <text cf="r1_line" off="43" ext="1">.</text>
   <end gi="line" rID="r1_line" L="1" ch="83" off="44" ext="44"/>
</LMNL>
================================================================
Elapsed time: 00:00:01.9967690
Press any key to continue...
```

```
[line [no}5.791{]}ὡς ἔφατ', [ltt}οὐ δ' ἀπίθησε [nom}θεὰ{ltt] γλαυκῶπις Ἀθήνη{nom].{line]
```

```
<line no="5.791">ὡς ἔφατ', οὐ δ' ἀπίθησε <nom>θεὰ γλαυκῶπις Ἀθήνη</nom>.</line>
<line no="5.791">ὡς ἔφατ', <ltt>οὐ δ' ἀπίθησε θεὰ</ltt> γλαυκῶπις Ἀθήνη.</line>
<line no="5.791">ὡς ἔφατ', <ltt>οὐ δ' ἀπίθησε <nom>θεὰ</nom></ltt><nom> γλαυκῶπις Ἀθήνη</nom>.</line>
<line no="5.791">ὡς ἔφατ', <ltt_s/>οὐ δ' ἀπίθησε <nom>θεὰ<ltt_e/> γλαυκῶπις Ἀθήνη</nom>.</line>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<LAYERS xmlns="http://wendellpiez.com/ns/xMNML">
   <layer ranges="line ltt nom" form="mch">
      <range rID="r1_line" gi="line" starting="0" ending="44">
         <annotation L="1" ch="7" gi="no">5.791</annotation>
      </range>
      <range rID="r2_ltt"
             gi="ltt"
             starting="10"
             ending="27"
             overlaps="r3_nom"/>
      <range rID="r3_nom"
             gi="nom"
             starting="24"
             ending="43"
             overlaps="r2_ltt"/>
   </layer>
   <frontier>ὡς ἔφατ, οὐ δ ἀπίθησε θεὰ γλαυκῶπις Ἀθήνη.</frontier>
</LAYERS>
================================================================
Elapsed time: 00:00:01.9888409
```

LAYERS model

Ranges, with annotations*

A control surface for the control surface

No tags, just text plus ranges (in layers)

* This example shows three ranges, one with an annotation

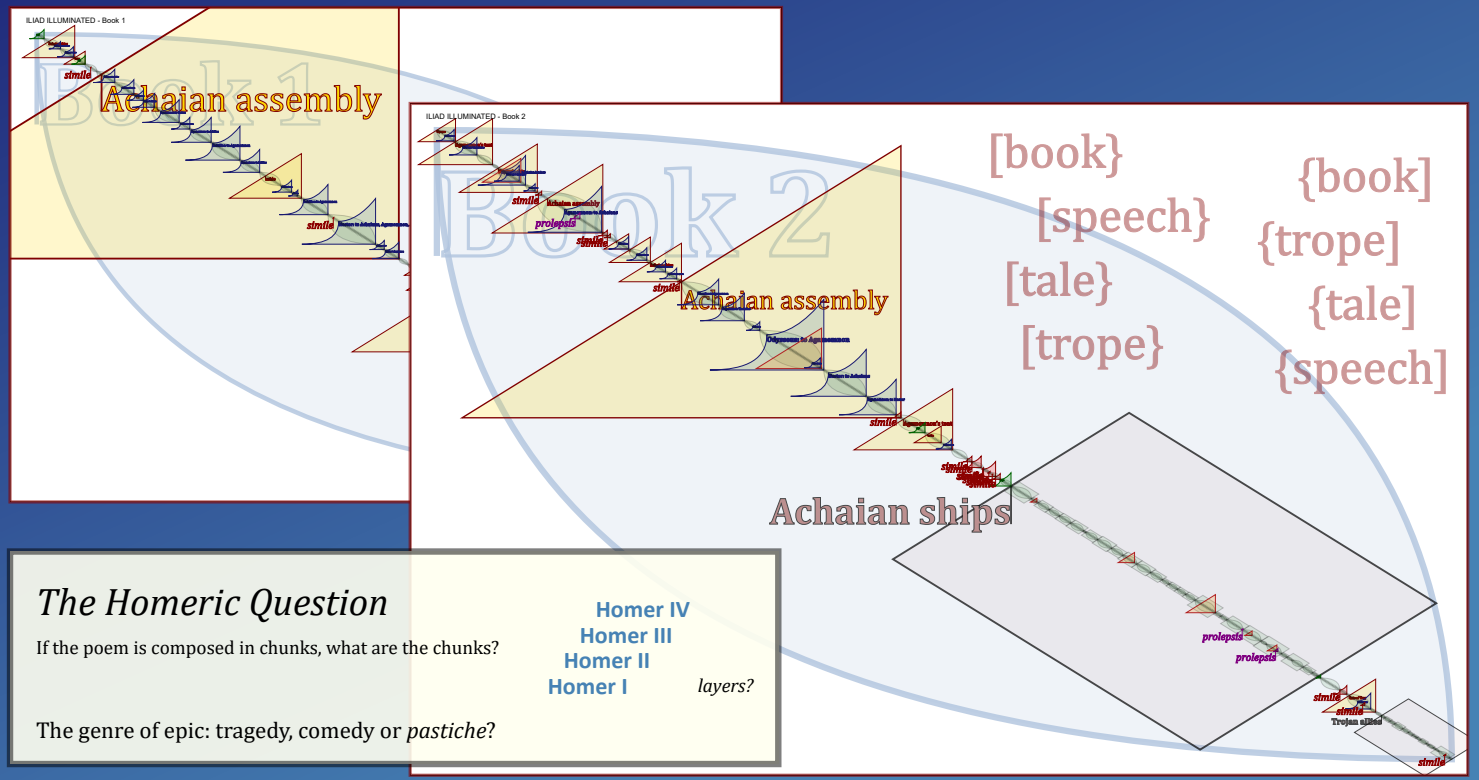
Epic Findings

The fractal structure of Homer's *Iliad*

Units of measure

morpheme, word (ονομα), line (στιχος), phalanx (φαλαγξ: ~10 lines), stratos (στρατος: ~100 lines), rhapsody (ραψωδια ~1000 lines)

Form and formula (*all the way down*) — WAVE or KYMA (κυμα) pattern



The Homeric Question

If the poem is composed in chunks, what are the chunks?

Homer IV
Homer III
Homer II
Homer I *layers?*

The genre of epic: tragedy, comedy or *pastiche*?

Range maps depict the extent of ranges of text within the poem.

See all range maps so far at `https://github.com/wendellpiez/EpicMarkup/tree/main/data/Iliad/rangemaps`

Project goals and progress

`https://github.com/wendellpiez/EpicMarkup`

`https://github.com/wendellpiez/Laminator`

Free to inspect, assess, acquire, apply, adapt

Technical topics

Markup, tags, hierarchies and schemas
Whitespace (always)
Tag (re)writing vs/and transformation
Why XProc is nice for this

Parallel initiatives (by the developer)

Using public domain data from PerseusDL and Homer Multitext Project

Homer helper site (Scriptorium Method):
`https://raventracks.org/`

Lightweight *Iliad* Assisted Reader: **Iliad Elucidated**
`https://raventracks.org/#elucidated_iliad`



LMNL, MNML, Laminator

LMNL markup is now easy to make

From XML or from scratch

More data, more examples?

Applications: narrative and genre studies, textual criticism and others

Work in progress: **Iliad Illuminated**

LMNL encoded source data

Dynamic web page display

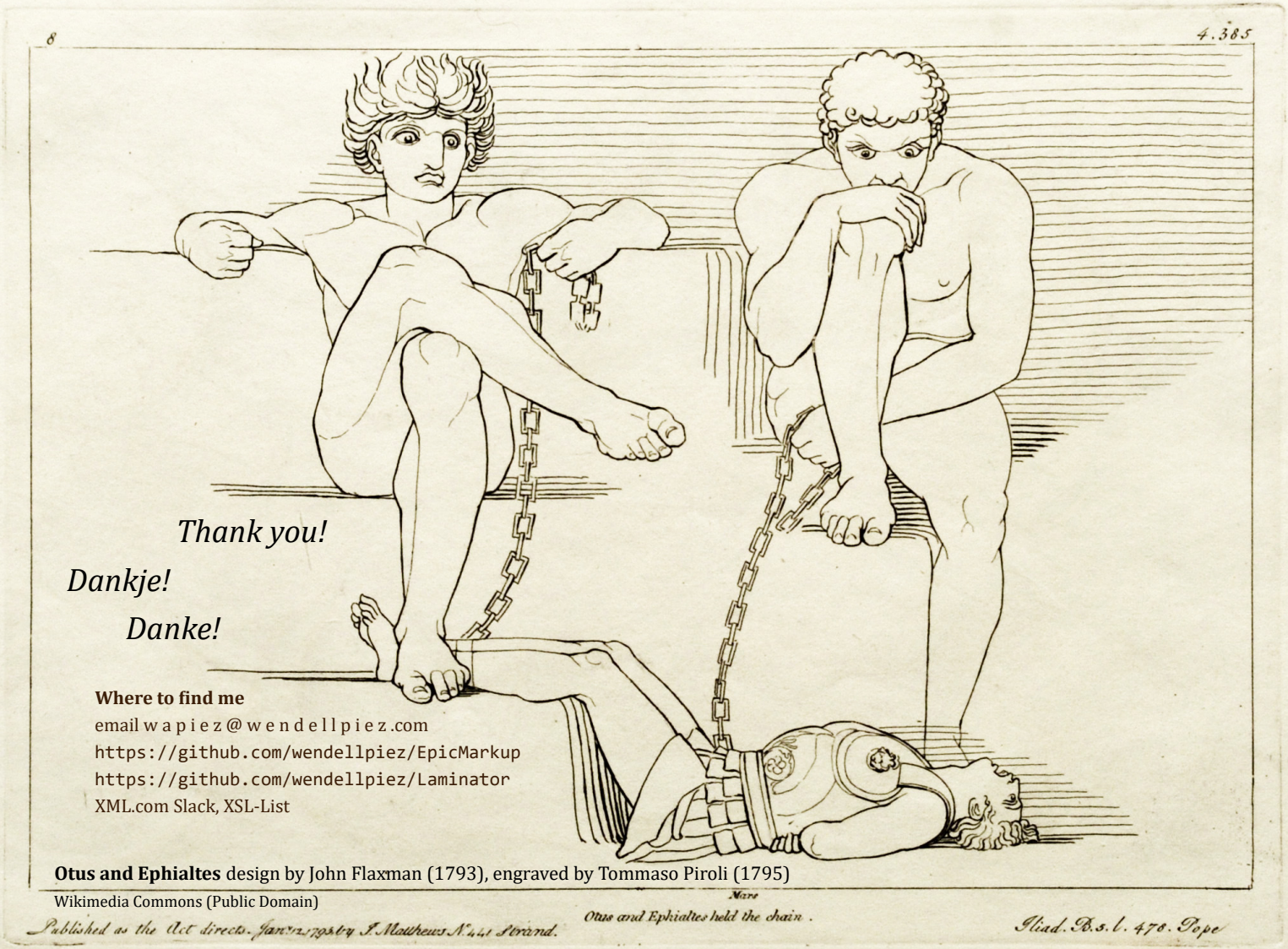
Showing scenes, speeches, similes and more

TODO: Formal specifications for MNML LMNL as implemented

TODO: Laminator documentation and testing

TODO: Other implementations - maybe XPath 4.0 (record object type), SaxonJS, Typescript, Python?

TODO: LMNL Annotations; Hyperdocument model; DTS 1.0 API ...?



Thank you!

Dankje!

Danke!

Where to find me

email w a p i e z @ w e n d e l l p i e z .com

`https://github.com/wendellpiez/EpicMarkup`

`https://github.com/wendellpiez/Laminator`

XML.com Slack, XSL-List

Otus and Ephialtes design by John Flaxman (1793), engraved by Tommaso Piroli (1795)

Wikimedia Commons (Public Domain)