DH2025
ACCESSIBILITY
& CITIZENSHIP

Ὅσοι ἄνθρωποι, τοσαῦται γνῶμαι
Harmonizing Guidelines for Handwritten Text Recognition of Ancient Greek
DH2025, Lisbon, July 14-18th, 2025

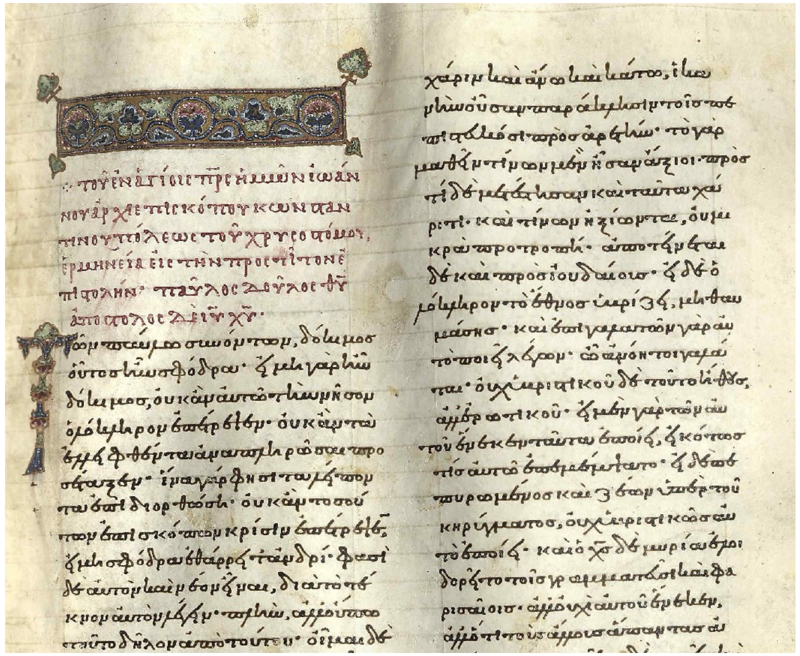
HTR for Byzantine manuscripts

Recognising Ioannes Chrysostomus, Maximus Planudes, and Cyril of Alexandria

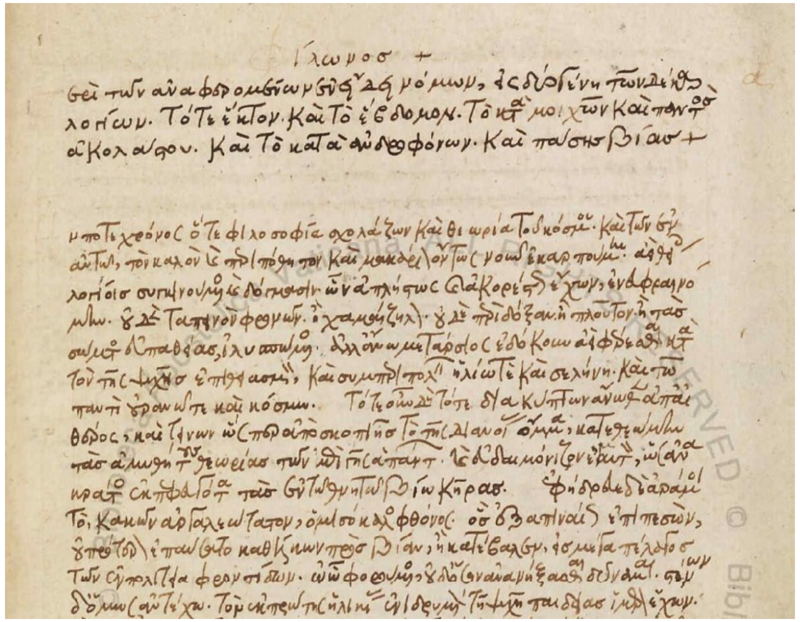
Elpida Perdiki
Democritus University of Thrace

This project is carried out within the framework of the National Recovery and Resilience Plan Greece *2.0,* funded by the European Union – NextGenerationEU *(Implementation body: HFRI).*
Duration: 01/01/2024 – 31/12/2025

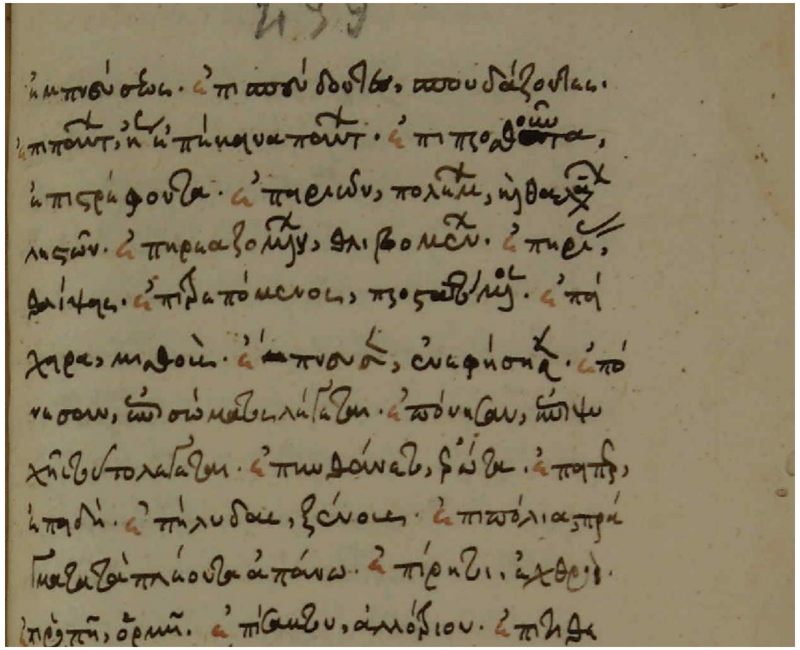
What went wrong (and right)



John Chrysostom



Maximus Planudes



Cyril of Alexandria (?)

One method, three case studies

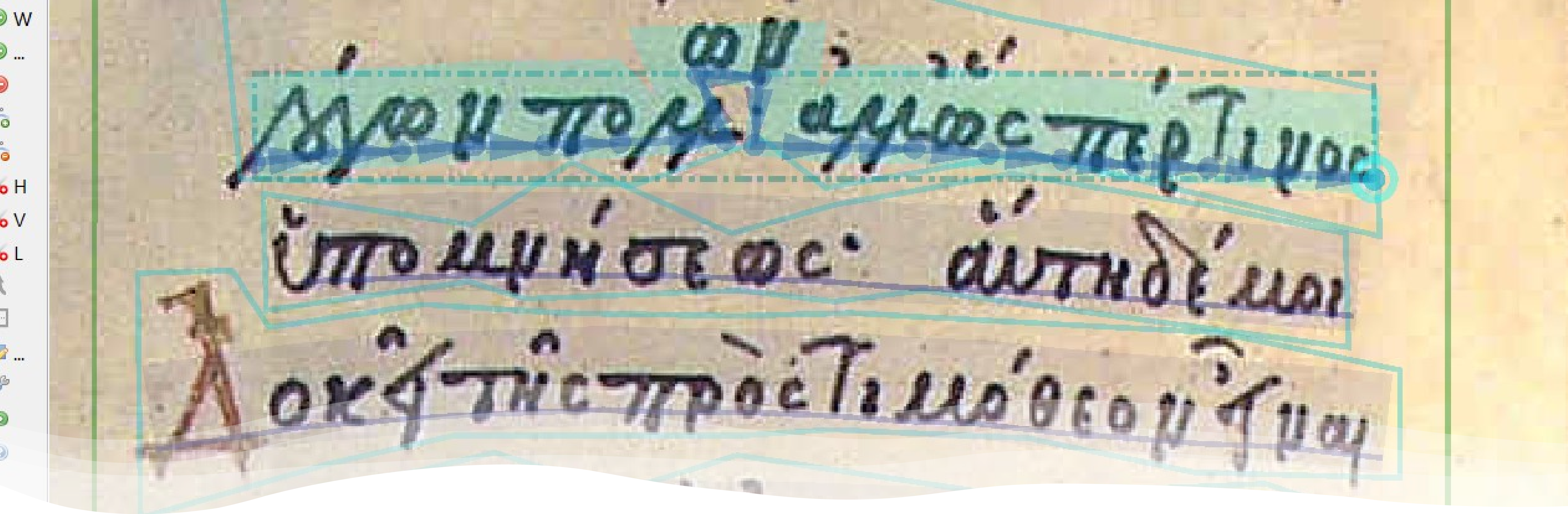
Same system configurations for all models

Quality over quantity

No overlap between training & validation data

General Workflow

- Digitised Images
- Diplomatic Transcription
- Model Training (Transkribus)
- CER Evaluation
- Fine-tuning

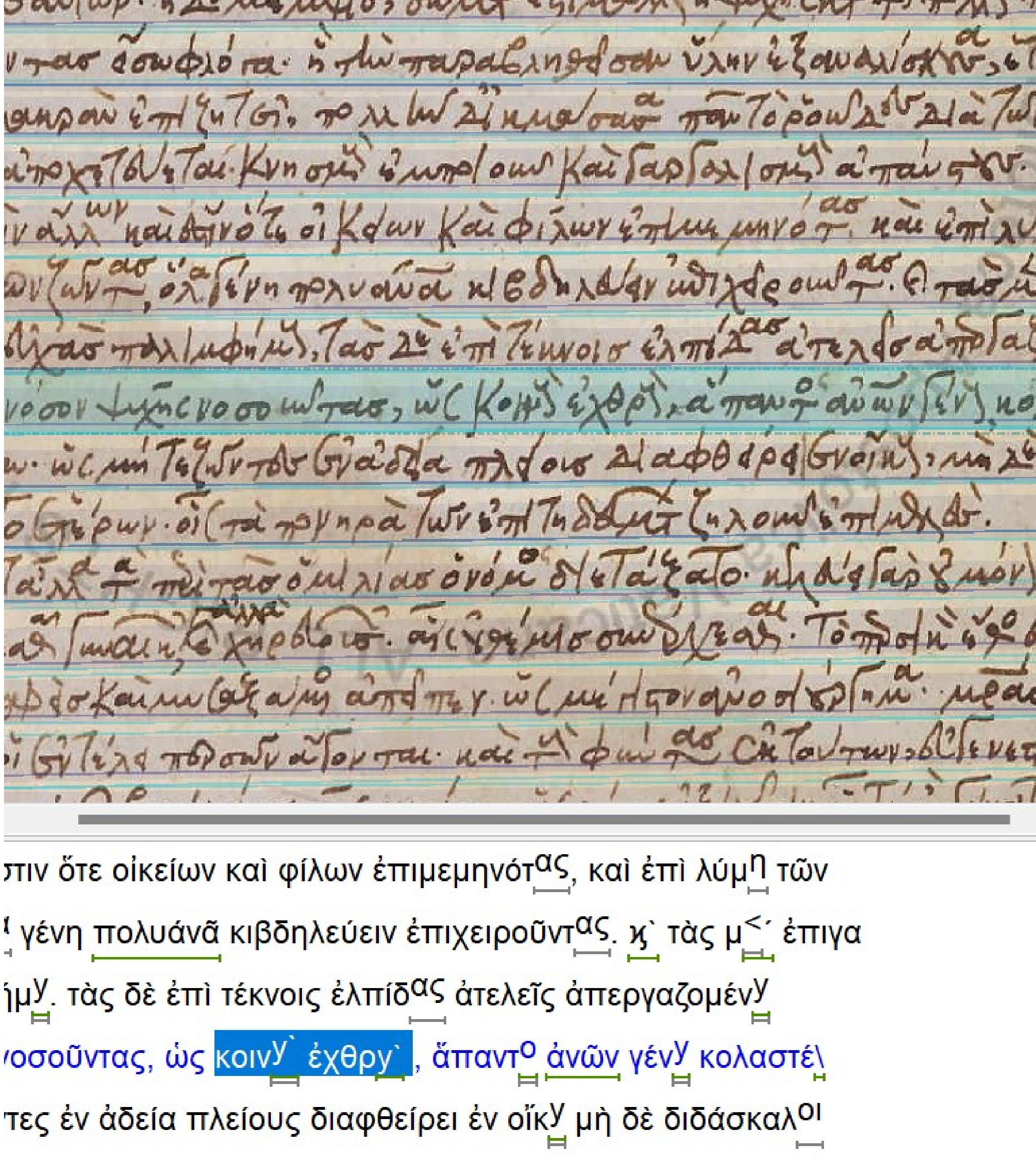


Case Study I: Ioannes Chrysostomus – The Great Success

- 11 manuscripts (10th–14th c.), mixed image quality
- Total training input: **29,228 words**
- Diplomatic, consistent transcription (2 annotators)
- Layout fine-tuned (superscripts, hanging lines)
- Final model (*Chrysostomicus I*): **3.9% CER**

Maximus Planudes – The hidden potential of correcting your errors

- 2 autograph manuscripts, 13th century
- 4 transcribers, 8,000 words, diplomatic transcription
- Initial model (one manuscript): 16% CER
- After corrections: 8.5% CER
- Combined model (both manuscripts): 8.9% CER (transfer learning)
- Main takeaway: transcription consistency > system tweaks



στιν ὅτε οἰκείων καὶ φίλων ἐπιμεμηνότ^{ας}, καὶ ἐπὶ λύμ^{η} τῶν

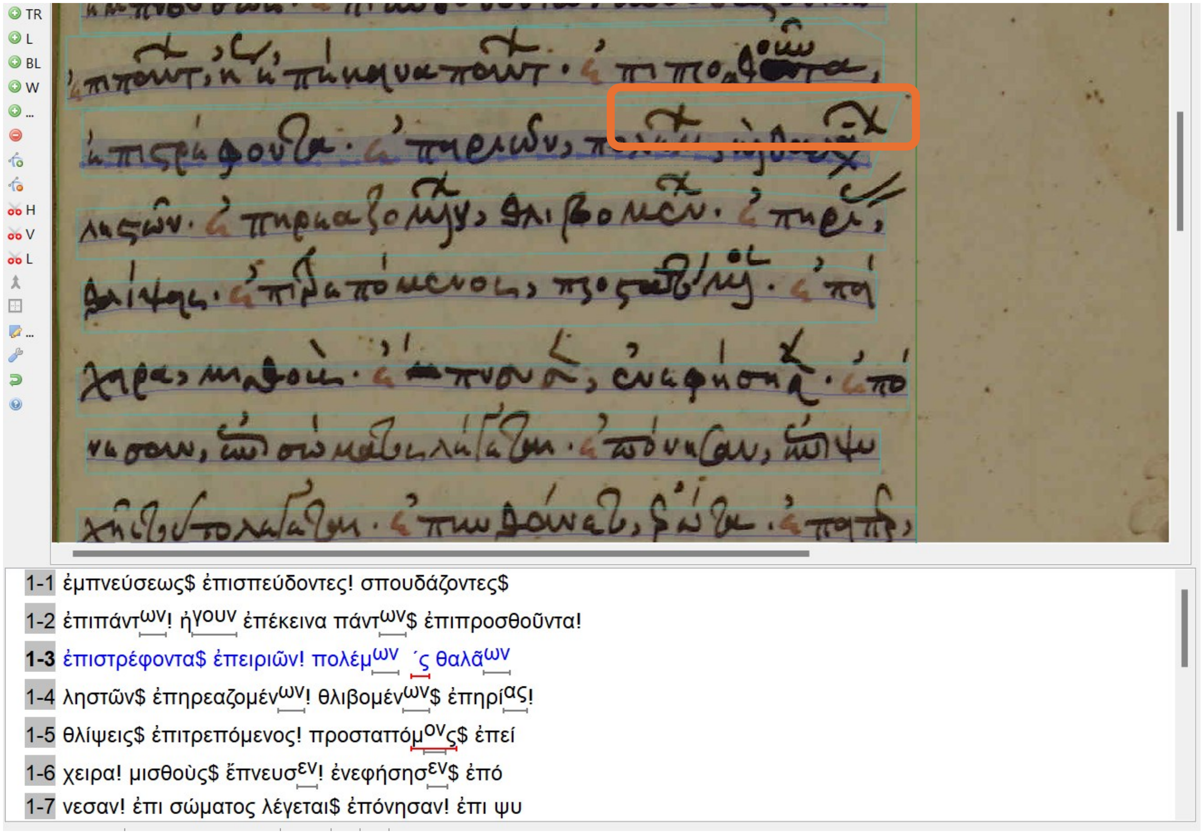
γένη πολυάνᾶ κιβδηλεύειν ἐπιχειροῦντ^{ας}. ϗ` τὰς μ$^{<´}$ ἐπιγα

ἡμ^{υ}. τὰς δὲ ἐπὶ τέκνοις ἐλπίδ^{ας} ἀτελεῖς ἀπεργαζομέν^{υ}

οσοῦντας, ὡς κοιν^{υ}` ἐχθρυ`, ἅπαντ^{ο} ἀνῶν γέν^{υ} κολαστέ\

τες ἐν ἀδεία πλείους διαφθείρει ἐν οἴκ^{υ} μὴ δὲ διδάσκαλ^{οι}

Cyril of Alexandria – The almost disaster



1-1 ἐμπνεύσεως$ ἐπισπεύδοντες! σπουδάζοντες$

1-2 ἐπιπάντ^{ων}! ἠ^{γουν} ἐπέκεινα πάντ^{ων}$ ἐπιπροσθοῦντα!

1-3 ἐπιστρέφοντα$ ἐπειριῶν! πολέμ^{ων} ΄ς θαλᾶ^{ων}

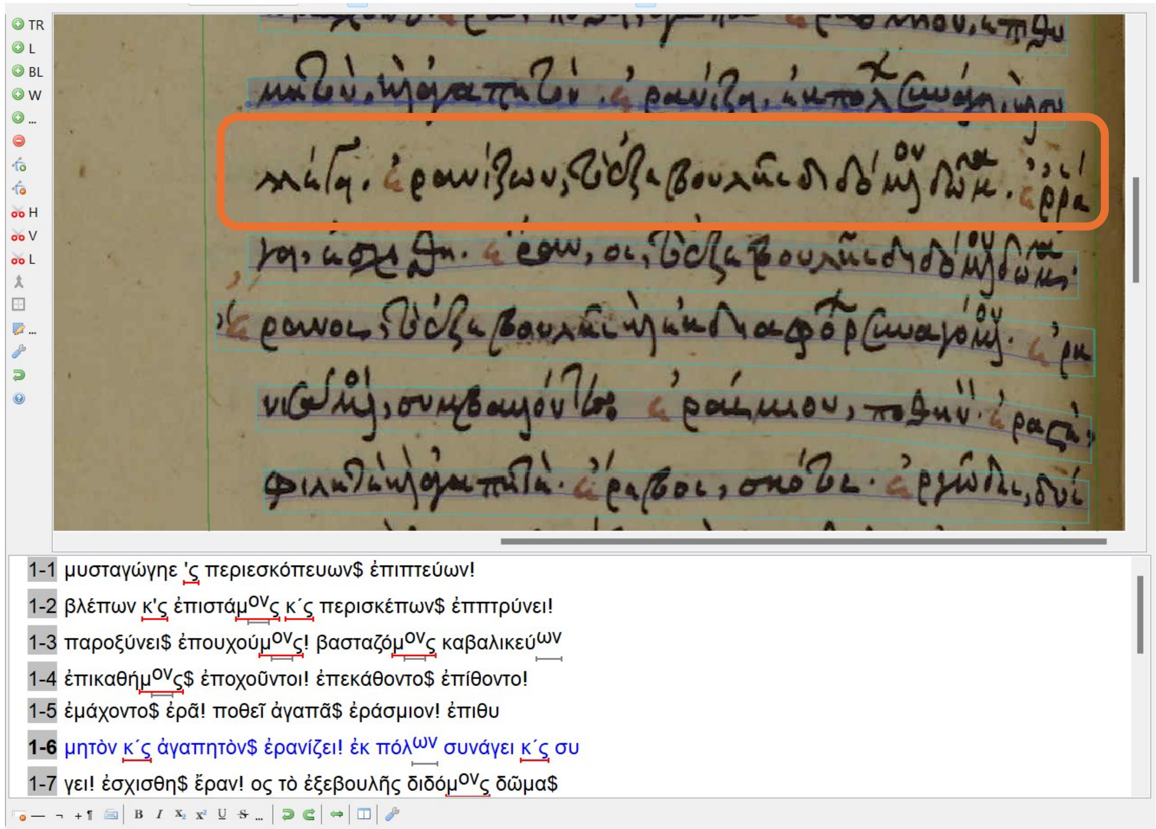
1-4 ληστῶν$ ἐπηρεαζομέν^{ων}! θλιβομέν^{ων}$ ἐπηρί^{ας}!

1-5 θλίψεις$ ἐπιτρεπόμενος! προσταπόμ^{ον}ς$ ἐπεί

1-6 χειρα! μισθοὺς$ ἔπνευσ^{εν}! ἐνεφήσησ^{εν}$ ἐπό

1-7 νεσαν! ἐπι σώματος λέγεται$ ἐπόνησαν! ἐπι ψυ

Superscripted abbreviations out of basline



1-1 μυσταγώγηε 'ς περιεσκόπευων$ ἐπιπτεύων!

1-2 βλέπων κ'ς ἐπιστάμ^{ον}ς κ΄ς περισκέπων$ ἐπππρύνει!

1-3 παροξύνει$ ἐπουχούμ^{ον}ς! βασταζόμ^{ον}ς καβαλικεύ^{ων}

1-4 ἐπικαθήμ^{ον}ς$ ἐποχοῦντοι! ἐπεκάθοντο$ ἐπίθοντο!

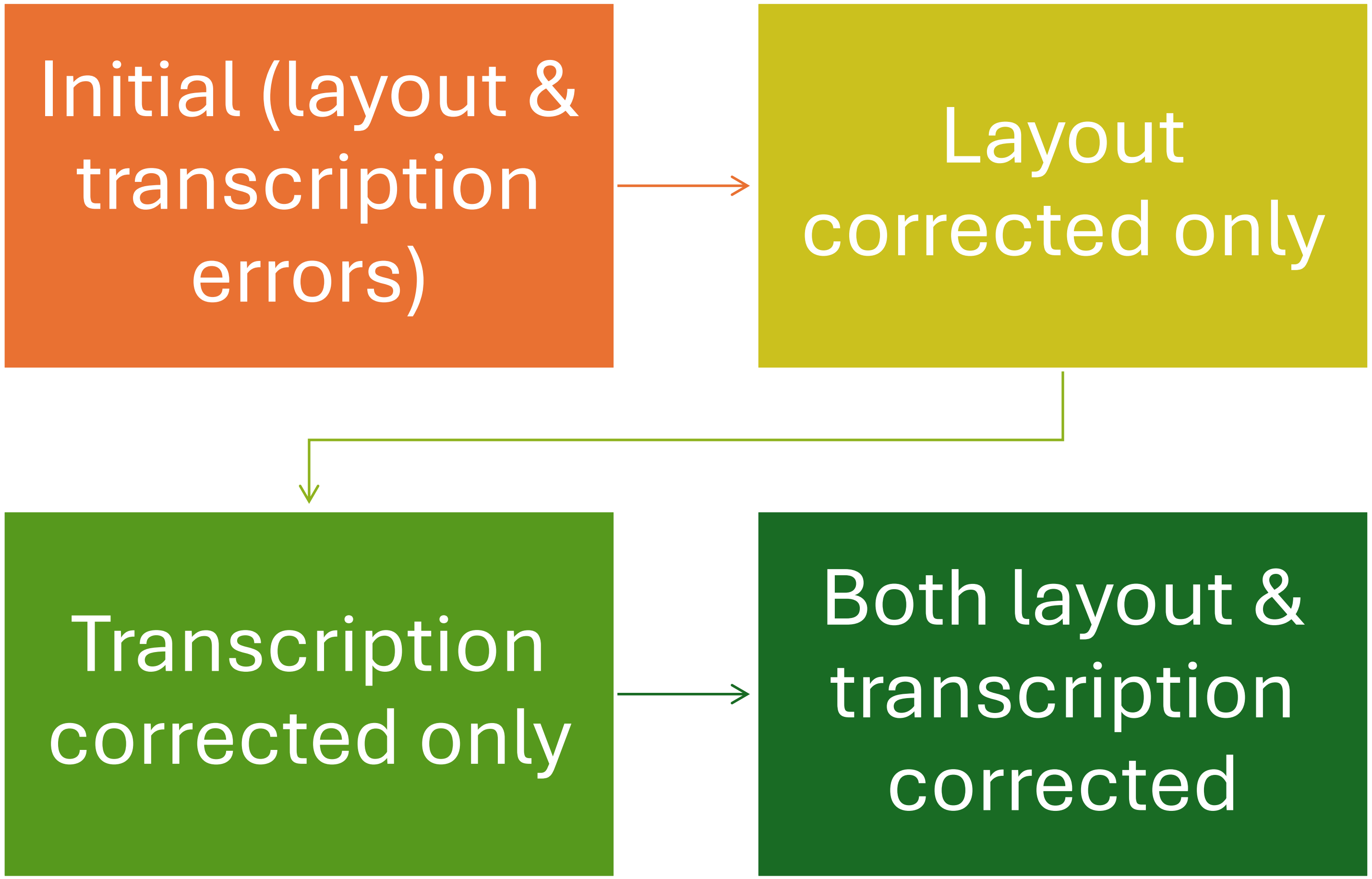
1-5 ἐμάχοντο$ ἐρᾶ! ποθεῖ ἀγαπᾶ$ ἐράσμιον! ἐπιθυ

1-6 μητὸν κ΄ς ἀγαπητὸν$ ἐρανίζει! ἐκ πόλ^{ων} συνάγει κ΄ς συ

1-7 γει! ἐσχισθη$ ἔραν! ος τὸ ἐξεβουλῆς διδόμ^{ον}ς δῶμα$

Missing line from layout recognition

Targeting HTR errors: 4 different models



Initial (layout & transcription errors)

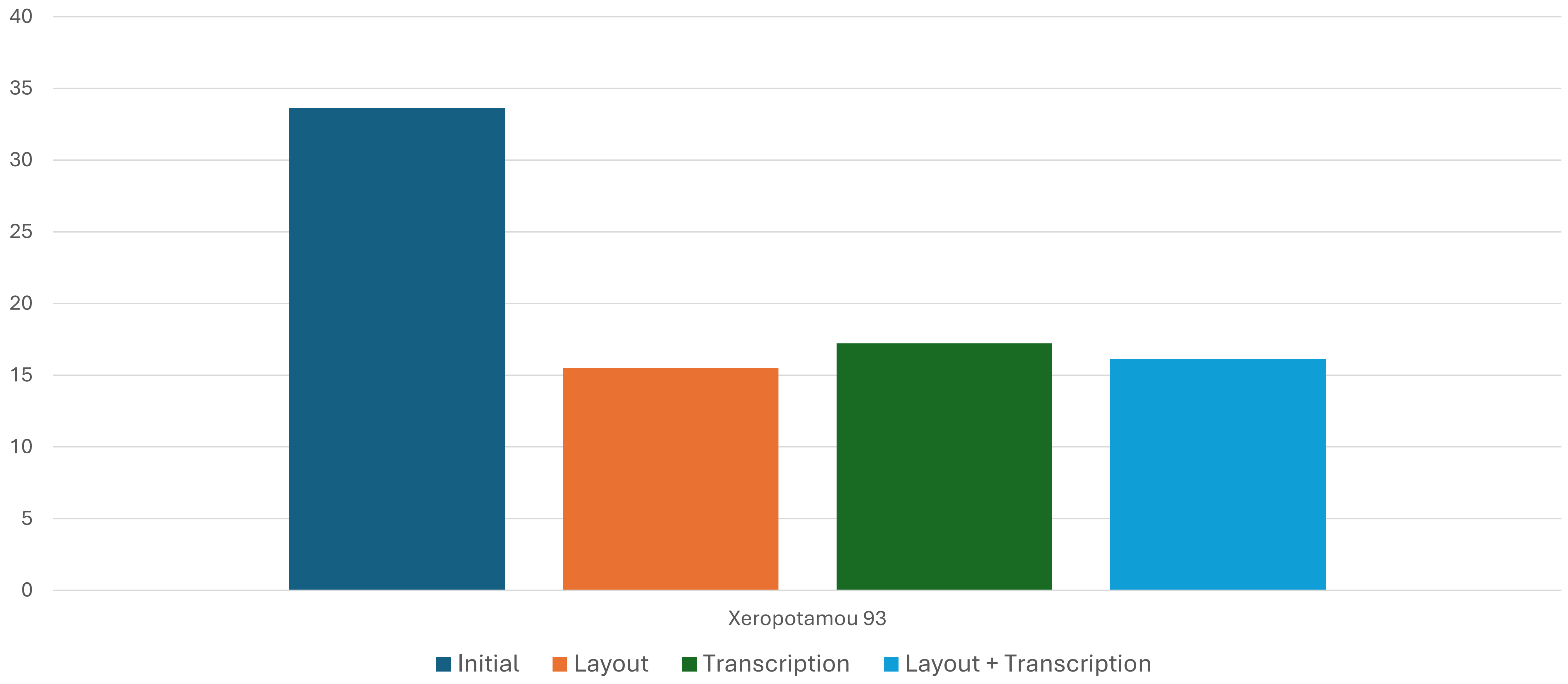
Layout corrected only

Transcription corrected only

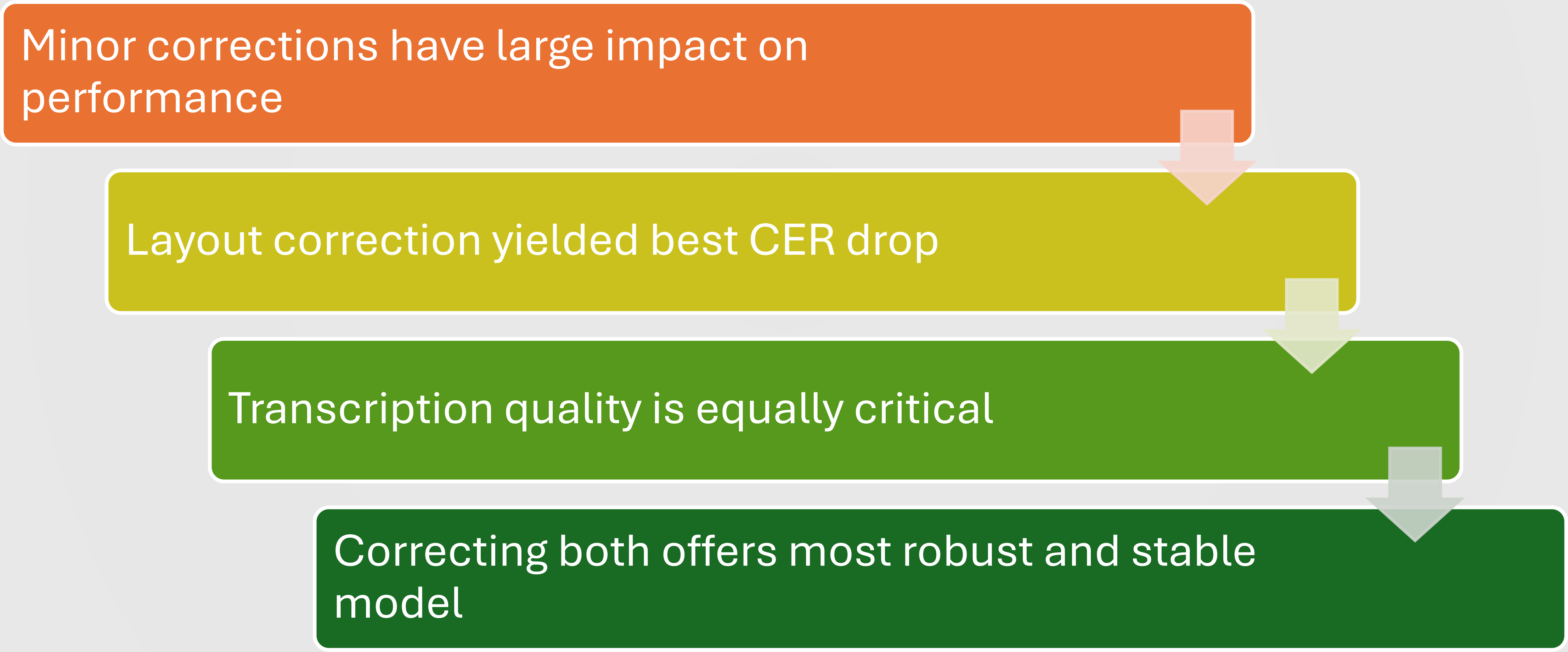
Both layout & transcription corrected

Corrections applied only to: Xeropotamou 093
Training set: 8,000 words (10% validation)
System settings fixed: max epochs=250, learning rate=0.0003, early stopping=20

CER after corrections



What it means



Minor corrections have large impact on performance

Layout correction yielded best CER drop

Transcription quality is equally critical

Correcting both offers most robust and stable model

What we get from all of these

- HTR systems **depend heavily** on quality training data.
- Even clean digitisation **fails** if layout or transcription are inconsistent.
- **Quality & consistency** in annotation > quantity of data.
- Clear guidelines + supervision = **better performance**.
- The human factor is **as crucial** as technology.

What needs to be done

Systematic layout spot-checks before training

Peer-reviewed transcription tests & agreed conventions

Consistent abbreviation expansion (preferably in metadata)

Annotator training on guidelines & rationale

Ongoing communication & supervision

All we have to decide is what to do with the time that is given us.

J.R.R. Tolkien, *The Fellowship of the Ring*