

MiMi in the Psalms (and beyond)

Expanding the Exegetical Toolbox with an Algorithm for
Participant Analysis

Outline

1. The Research Problem

Research question, problem, my approach, coreference resolution as method

2. Coreference Resolution - *MiMi*

Definitions, Psalm 21:8–10, algorithm implementation

3. Results

performance for: mention detection, coreference resolution

1.1 Research Question

What are the implications of a linguistic, computational analysis to help identify and analyse reference data in the Psalms corpus for the literary analysis?

1.2 Research Problem

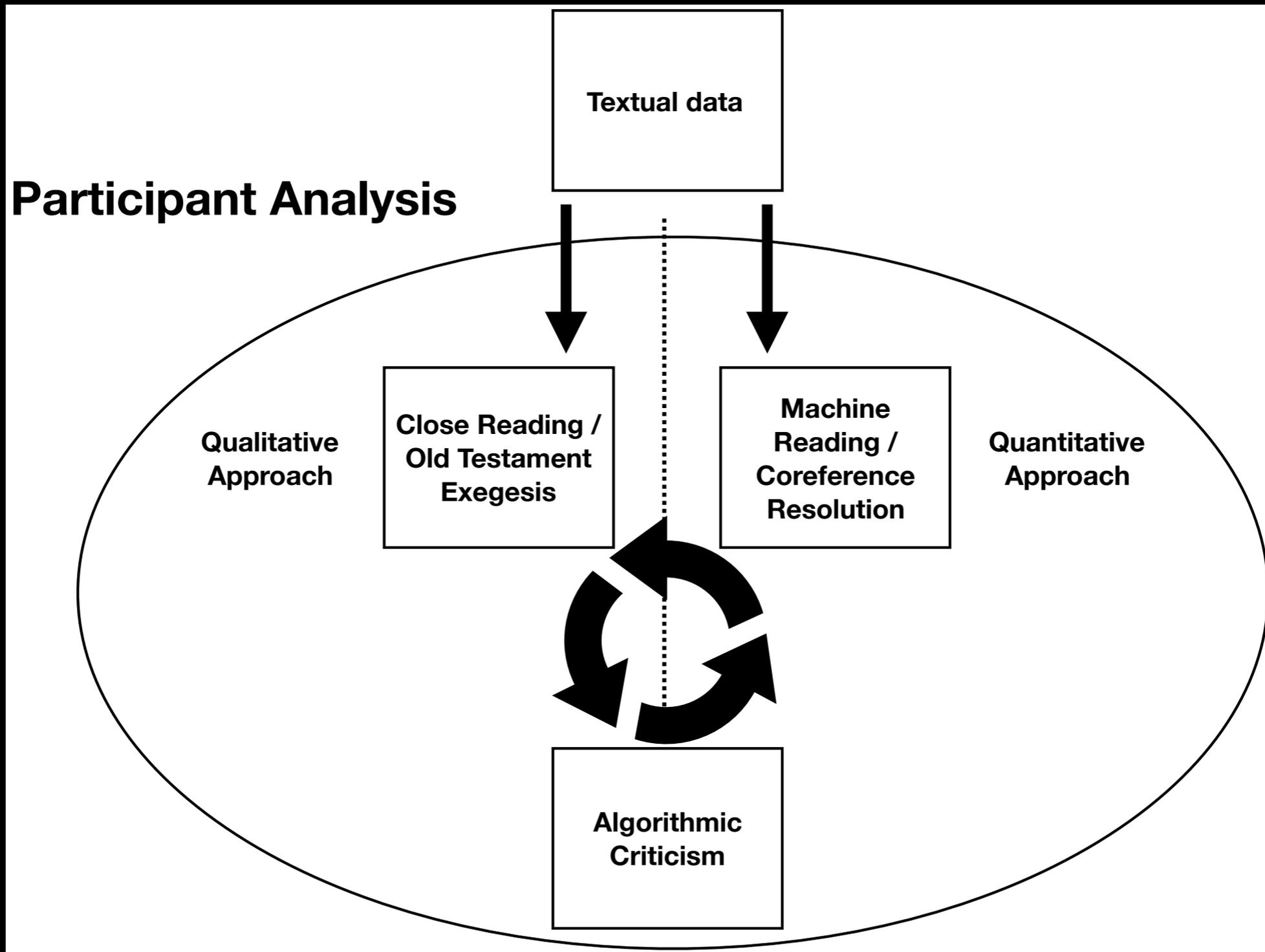
1. Problem of identification of participants:

- Noun Phrases: NP
- Pronouns: IPP, SPP, DP
- Verbs: events
- Named Entities (NE): person, languages, locations, cardinals, time etc.

2. Biblical Hebrew grammars and OT commentaries

3. Lots of data - no systematic method

1.3 My Approach



2. Coreference Resolution

A mention, i.e. a piece of reference information:

NP, SPP, IPP, DP, Verb, NE

Coreference resolution is understood as the (automatic) identification of references to entities in a document as 'mentions', and clusters them into equivalence classes.

A document is one Psalm, one chapter in the HB

Participant analysis is the critical evaluation of multiple coreference resolution operations.

2.1 Psalm 21: 8-10

8. For the king trusts in YHWH,

through the loyalty of the Most High he does not totter.

9. Let your hand find all your enemies,

your right hand should find your haters.

10. You should make them as a furnace of fire in time of your appearance,

YHWH in his wrath should swallow them

and let fire eat them.

2.1 Ps 21 - Mention Detection

8. For [the king]₁ [trusts]₂ in [YHWH]₃,

through the [loyalty of the Most High]₄ not [he does totter].

9. Let [hand [your]] [find] [all enemies] your],

[right hand [your]] should [find] [haters [your]].

10. [You should make [them]₁₆]₁₇ as a [furnace of fire] in [time of appearance [your]],

[YHWH] in [wrath [his]] should [swallow [them]]

and let [fire] [eat [them]].

2.1 Ps 21 - Mention Detection

[the king]₁

[trusts]₂

[YHWH]₃

[loyalty of the Most High]₄

[You should make [them]₁₆]₁₇

[You should make]₁₆

[them]₁₇

2.2 Ps 22 - Resolve Coreference

8. [the king] [trusts] [YHWH][loyalty of the Most High][he does totter].

9. [hand [your]] [find] [all enemies] [your]] [right hand [your]] [find] [haters [your]].

10. [You make [them]] [furnace of fire] [time of appearance [your]], [YHWH] in [wrath [his]] [swallow [them]] [fire] [eat [them]].

Class 1: {the king, trusts}

Class 2: {loyalty of the Most High, totter}

Class 3: {YHWH, you make, your, YHWH, his, swallow}

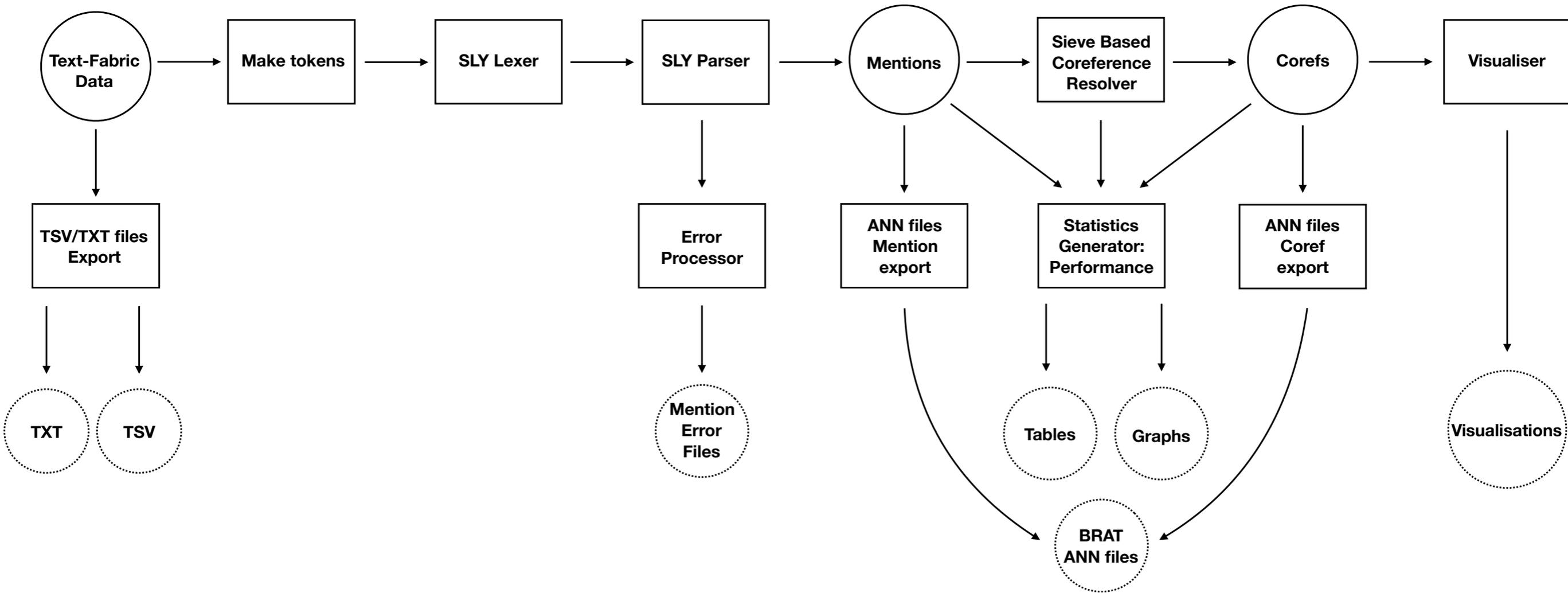
Class 4: {your, your, your}

Class 5: {them, them, them}

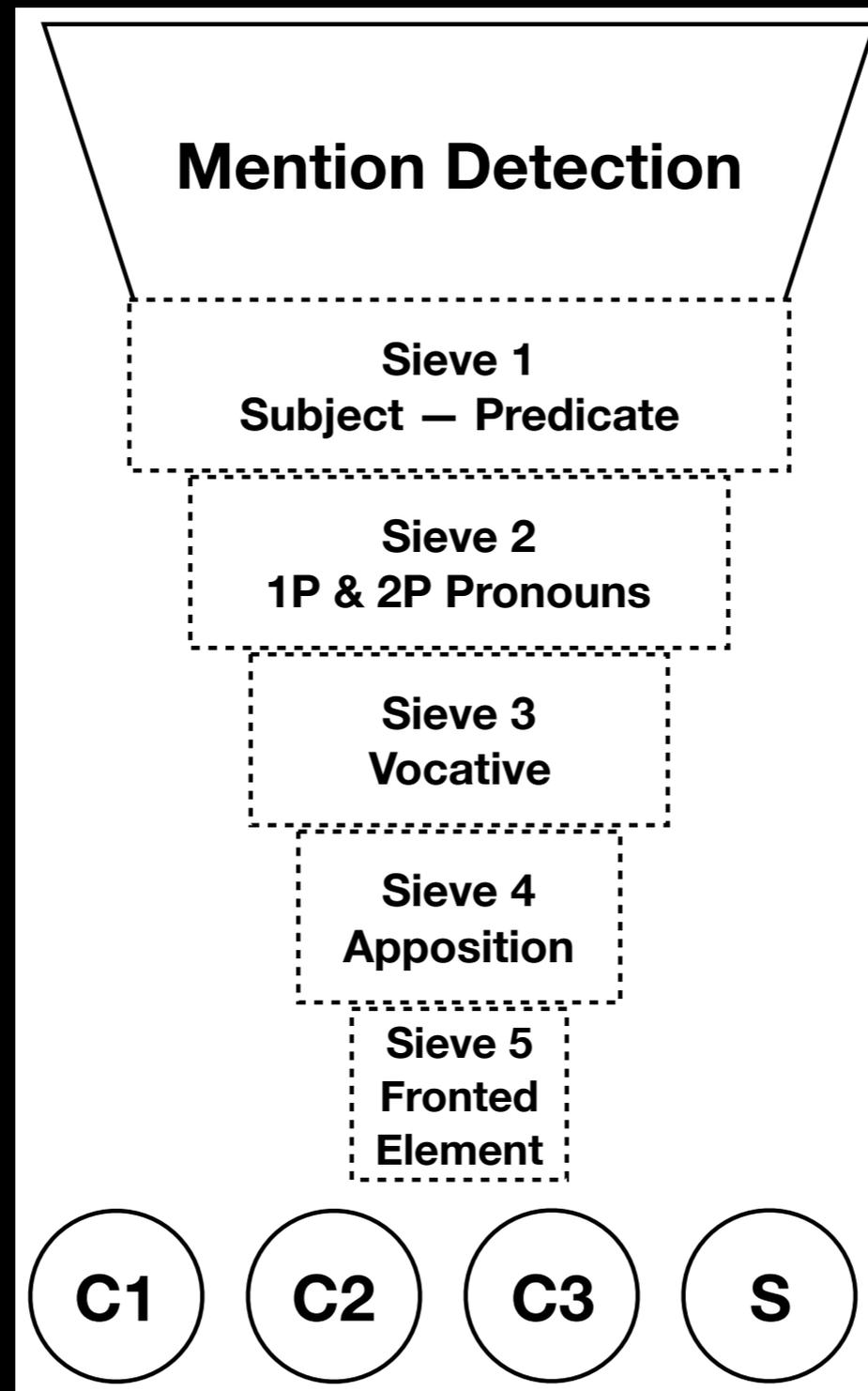
Singletons: {enemies} {haters}
{wrath}

2.2 MiMi - Architecture

Phrase Atoms - Words - Features



2.2 MiMi - Implementation



2.3 MiMi - Mention Detection

SLY: lex/yacc parser implementation for Python

Context Free Grammar for BHSA phrase atoms:

Rule 8 `phrase_atom` \rightarrow `verbal_phrase`

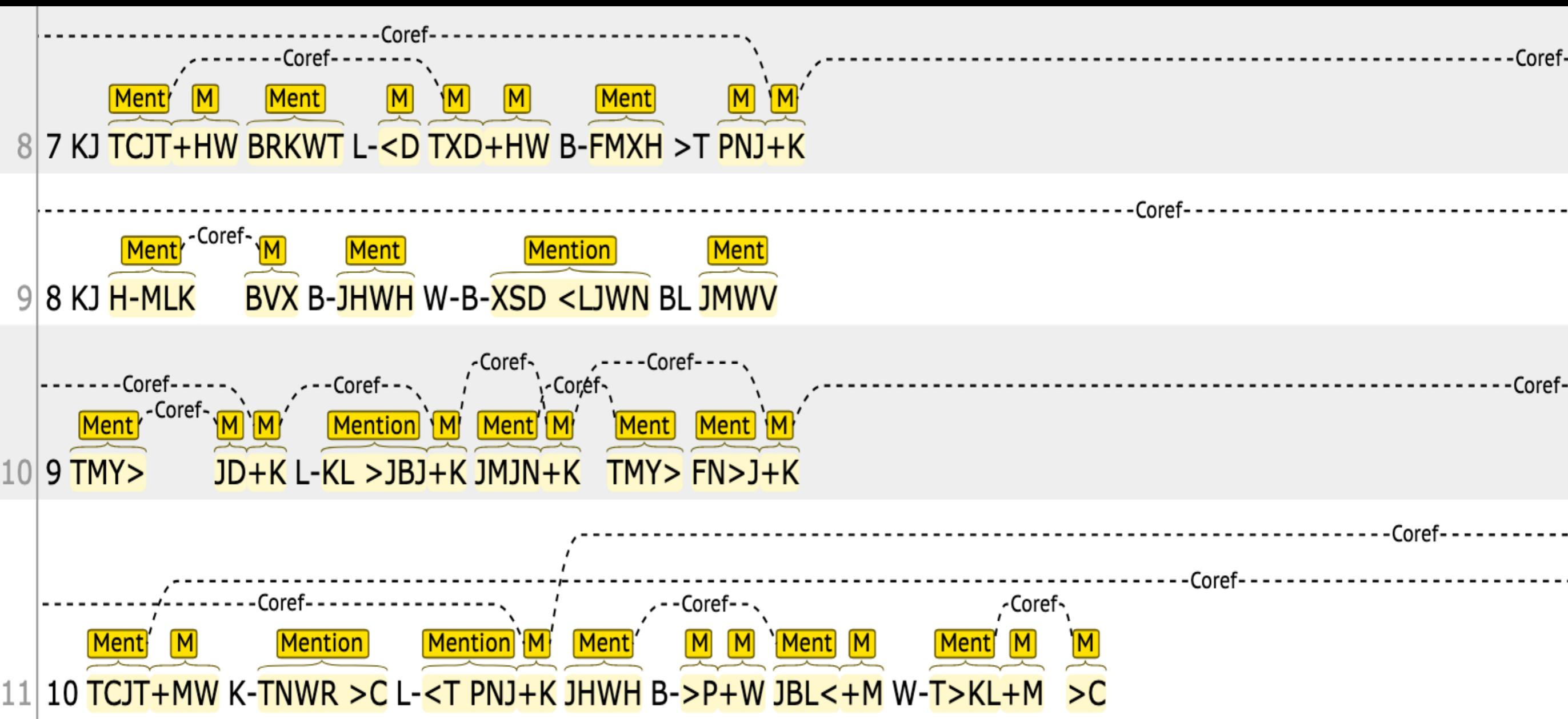
Rule 13 `verbal_phrase` \rightarrow `normal_vp`

Rule 16 `normal_vp` \rightarrow `VERB`

2.4 Data - .ann

```
Psalms_021.ann
T92      Mention 561 564 CKM
T93      Mention 567 572 MJTRJ
T94      Mention 572 574 +K
T95      Mention 575 580 TKWNN
T96      Mention 584 587 PNJ
T97      Mention 587 590 +HM
T98      Mention 595 599 RWMH|
T99      Mention 600 604 JHWH
T100     Mention 607 609 <Z
T101     Mention 609 611 +K
T102     Mention 612 617 NCJRH
T103     Mention 620 625 NZMRH
T104     Mention 626 631 GBWRT
T105     Mention 631 633 +K
*        Coreference T7 T8
*        Coreference T14 T18 T19 T22
*        Coreference T40 T44
*        Coreference T49 T50
*        Coreference T54 T55
*        Coreference T59 T61
*        Coreference T69 T72
*        Coreference T74 T76
*        Coreference T84 T87 T89
*        Coreference T64 T80 T90 T95
*        Coreference T4 T6 T10 T28 T36 T48 T56 T58 T60 T63 T68 T85 T94 T99 T101 T105
*        Coreference T102 T103
```

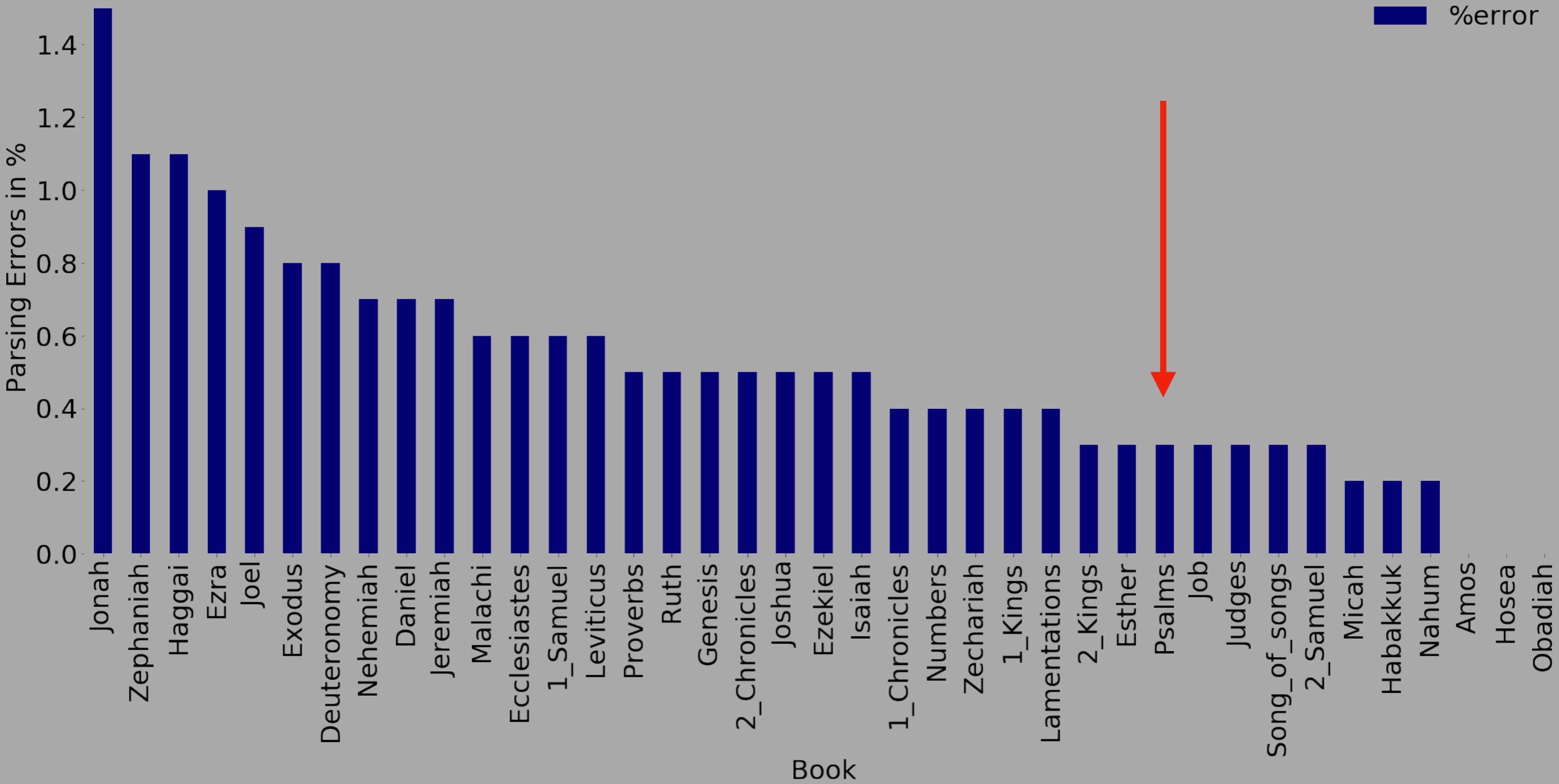
2.4 Data - *brat*



3. Results

1. Mention detection
2. Coreference resolution
3. [Inter-annotator agreement analysis]
4. [Qualitative analysis]

MiMi Mention Detection Parsing Errors in %



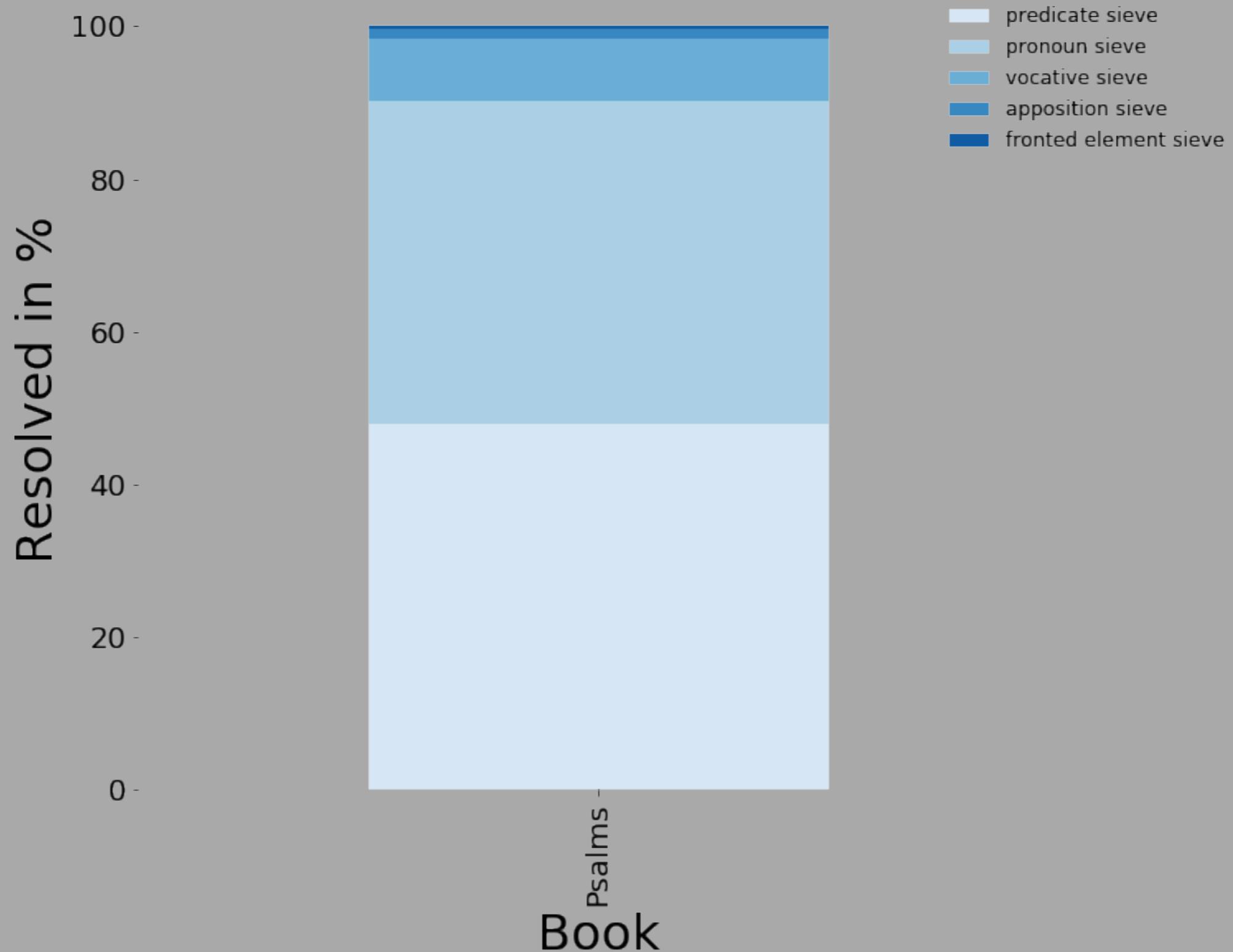
3.1 Results - Psalms

Input corefs	Resolved	Singletons ann	Unresolved	%Resolved	%Singletons ann	%Unresolved
18484	6539	4788	11945 7157	35.4 47.7	25.9	64.6 26.4

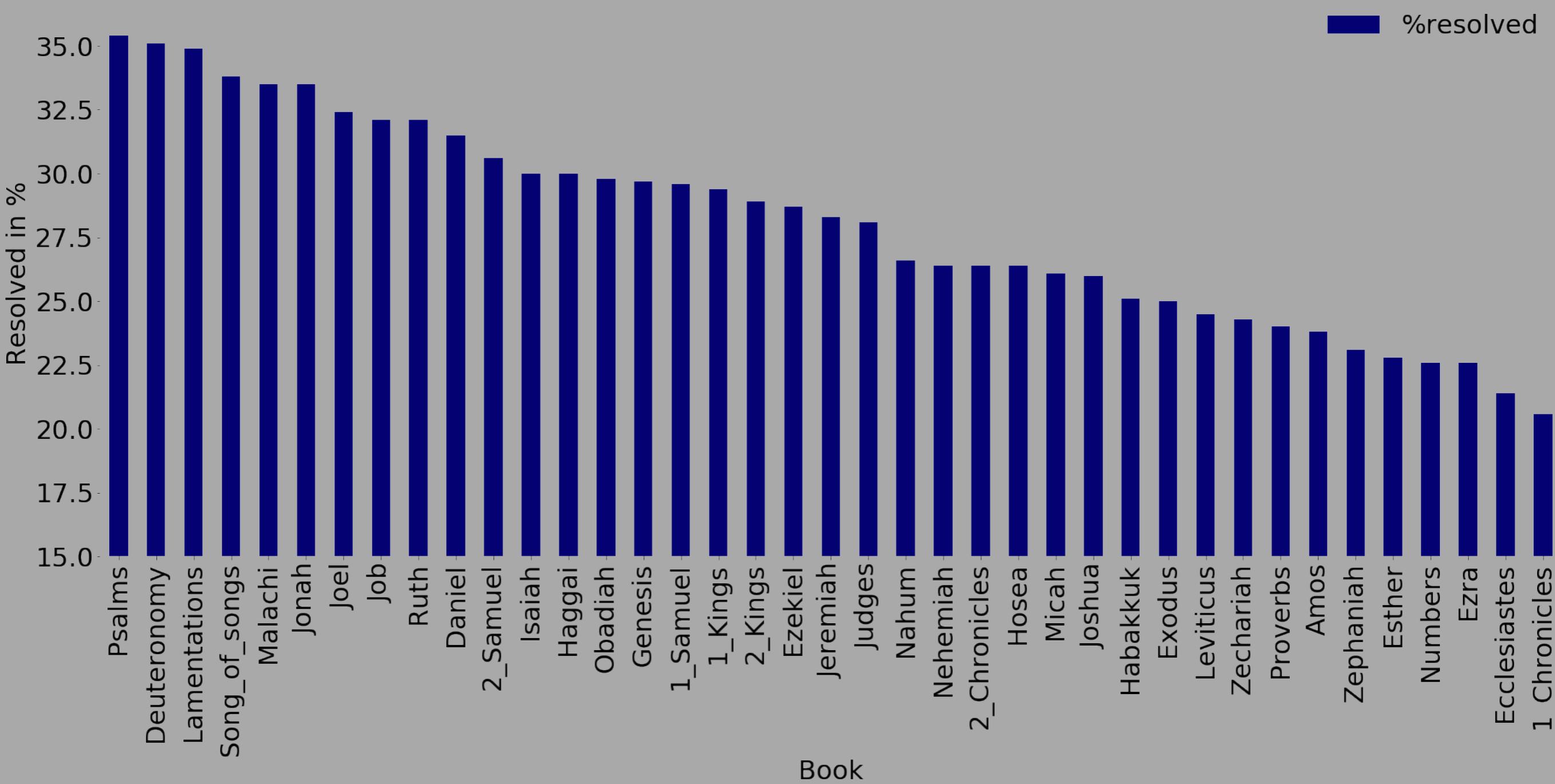
3.1 Results - Psalms

Predicate	1P / 2P Pronouns	Vocative	Apposition	Fronted Element	Total
3138	2756	535	90	20	6539
50%	42.1%	8.2%	1.4%	0.3%	100

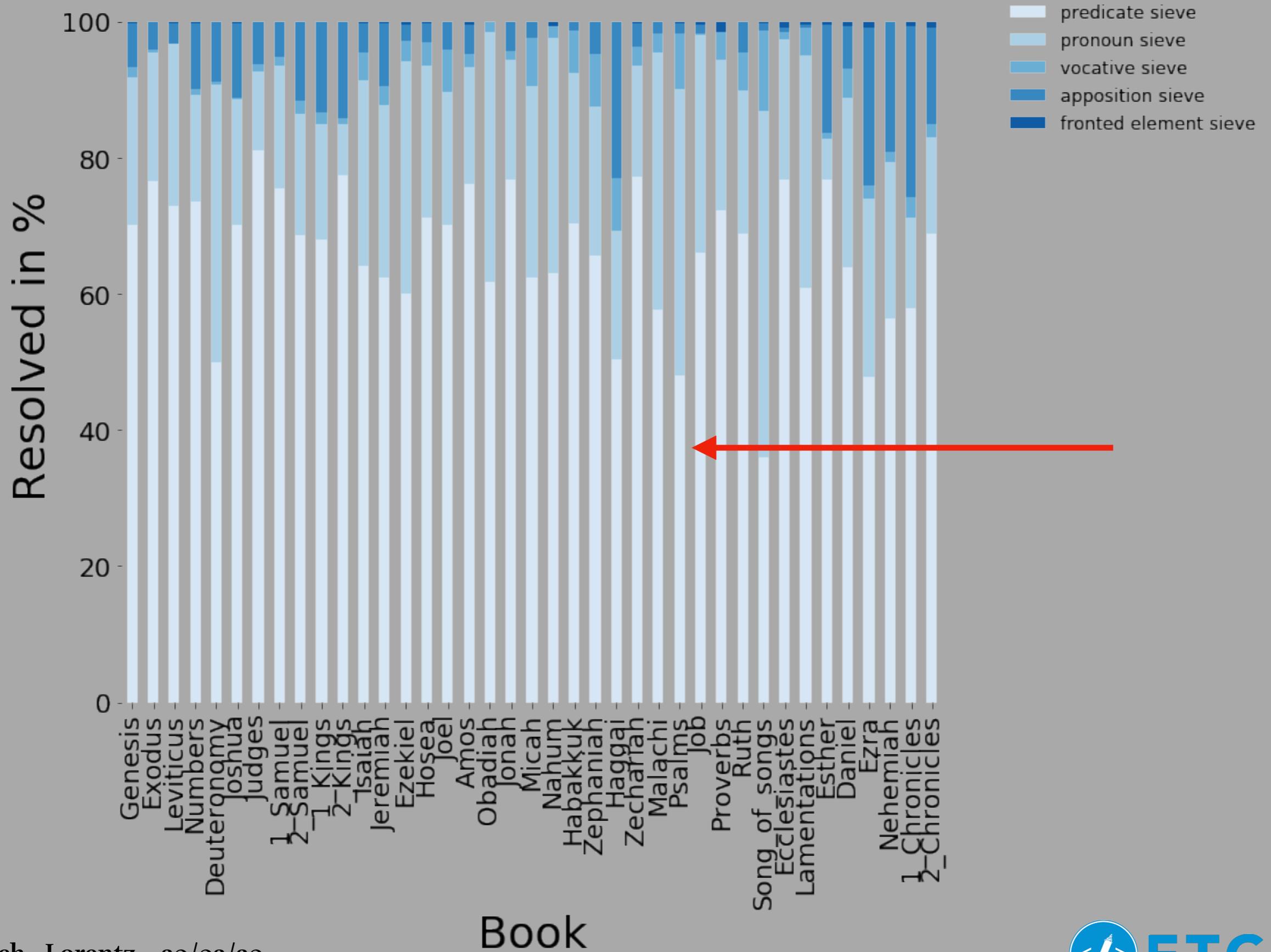
Coreference Sieves



MiMi Coreference Resolution Success in %



Coreference Sieves



Questions

<https://github.com/cmerwich/participant-analysis/>