# Evaluating wiki-enhanced ontology authoring

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joint work with:
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# Ontology modeling

- Crafting domain ontologies often requires the collaborative effort of a team of actors

- To favor the design of quality ontologies, collaboration should be supported in an articulated way:

  - between actors having different roles and skills: domain experts (DE), knowledge engineers (KE)

  - to facilitate communication, discussion, decision making, etc.

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# Wiki features for collaborative modeling

- **Wiki-based systems** have been applied for the **editing of structured content**, including ontologies (e.g. SMW, OntoWiki, MoKi)

- Typical wikis features exploitable to support collaboration in ontology modeling:

  - easy customization of the UI, according to the skills and role of the team members

  - collaborative editing functionalities: e.g., discussion, notification, watchlist, history and revision...

# Customization of the UI: multi-mode access

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# Customization of the UI: multi-mode access

A **mountain** is a large landform that stretches above the surrounding land in a limited area usually in the form of a peak. A mountain is generally steeper than a **hill**   [....]

**All**

unstructured

# Customization of the UI: multi-mode access

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**All**

unstructured

### Axioms

| | | |
|---|---|---|
| Mountain | \cisa Landform | Remove |
| Mountain | \cisa \forall HasLocation.(GeographicalPlace) | Remove |
| Mountain | \cisa  \not Hill \cand  \not Plain | Remove |

Add another axiom

fully-structured    **KEs**

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# MoKi
## the Modelling WiKi ---

# Customization of the UI: multi-mode access

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**Axioms**

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| Mountain | \cisa  \not Hill \cand  \not Plain |

Add another axiom

**is a**

Every Mountain is a  Landform    Remove

Add another isa axiom

**Properties**

| **Subject** | | **Object** | |
|---|---|---|---|
| Mountain | HasLocation | GeographicalPlace | Remove |

Add another property

**Verbalized**
- Every Mountain is something that is not a Hill and that is not a Plain.

fully-structured    **KEs**

lightly-structured    **DEs**

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# Collaborative editing functionalities

**Discussion**

# Collaborative editing functionalities

page | discussion | + | history | delete | move | protect | watch | refresh | notify

## Talk:Locus of control

Esistono sottotipi? -- KE 14:56, 6 December 2011 (CET)          [new][edit][reply]

Esistono dei sottotipi di locus of control? In caso contrario si potrebbe considerare come un individuo.

Re: Esistono sottotipi? -- DE2 15:27, 6 December 2011 (CET)          [new][edit][reply]

ok individuo

## Discussion

[Mark this page as patrolled]

## My watchlist

(for DE1)
View relevant changes | View and edit watchlist | Edit ra

## Watchlist

Watchlist options

32 pages on your watchlist, not counting talk pages.

● E-mail notification is enabled.

Show last 1 | 2 | 6 | 12 hours 1 | 3 | 7 days all
Hide minor edits | Hide bots | Hide anonymous users | Hide logged-in users | Hide my edits

Namespace:  all          ↕    ☐ Invert selection   Go

### 6 December 2011

● (diff) (hist) . . Motivazione; 16:22 . . (+384) . . DE2 (Talk | contribs)
● (diff) (hist) . . Metacognizione; 16:20 . . **(+600)** . . DE2 (Talk | contribs)
● (diff) (hist) . . Empowerment; 16:11 . . (+83) . . DE1 (Talk | contribs)
● (diff) (hist) . . Autostima; 16:10 . . (+111) . . DE1 (Talk | contribs)
● (diff) (hist) . . Locus of control; 16:04 . . **(+622)** . . KE (Talk | contribs)
● (diff) (hist) . . Motivazione intrinseca; 16:02 . . (0) . . DE1 (Talk | contribs)
● (Deletion log); 16:02 . . KE (Talk | contribs) deleted "Locus of control" (*Author request: content was: 'luogo metaforico all'interno die quale si*

# Collaborative editing functionalities

### Discussion

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### History & Revision

## Revision history of "Motivazione intrinseca"

View logs for this page

― Browse history ―

From year (and earlier):  [        ]  From m

(Latest | Earliest) View (newer 500) (older 500) (20 | 50 | 100 | 250 | 500)

Diff selection: mark the radio boxes of the revisions to compare and hit enter or the button at the bottom.
Legend: **(cur)** = difference with current revision, **(prev)** = difference with preceding revision, **m** = minor edit.

   [ Compare selected revisions ]

○ (cur) (prev)  ⦿  16:02, 6 December 2011  DE1 (Talk | contribs)  (810 bytes) (undo)
○ (cur) (prev)  ⦿  15:06, 6 December 2011  KE (Talk | contribs)  (810 bytes) (undo)
○ (cur) (prev)  ○  15:06, 6 December 2011  KE (Talk | contribs)  **m** (798 bytes)  (moved *Intrinseca* to *Motivazione intrinseca*) (u
○ (cur) (prev)  ○  14:41, 6 December 2011  DE1 (Talk | contribs)  (798 bytes) (undo)
○ (cur) (prev)  ○  14:33, 6 December 2011  DE2 (Talk | contribs)  (654 bytes) (undo)
○ (cur) (prev)  ○  14:32, 6 December 2011  DE1 (Talk | contribs)  (60 bytes)  (Created page with '{{Domain model categorizatio

# Collaborative editing functionalities

**Discussion**

**Notification**

**Watchlist**

**History & Revision**

# Our contribution

- An empirical evaluation of the effectiveness of wikis collaborative features for ontology modeling:

(i)  making DEs more active in the authoring of ontologies

(ii) supporting the collaboration during modeling

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# Experimental Study
## Research Questions

- **RQ1**: Do the wiki-enhanced collaborative authoring features improve the involvement (and productivity) of DEs in editing activities?

- **RQ2**: Do the wiki-enhanced collaborative authoring features reduce the effort required to team members to interact?

- **RQ3**: Do the users perceive the support provided by the wiki-enhanced collaborative authoring features as effective?

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# Experimental Study
## Setting

- 4 teams were asked to independently design domain ontologies with and without wiki collaborative features

- Two versions of MoKi were used:
  - MoKi
  - (NC)MoKi: MoKi with all the collaborative features <u>disabled</u>

➡ Rationale: focus on the specific aspects we were interested to evaluate, avoiding the influence of additional factors

- Users were allowed to interact through MoKi/(NC)MoKi, emails, chat

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# Experimental Study
## Subjects, Design, and Material

- Each team was composed of two DEs and one KE:

  - DEs: pedagogists and psychologists employed in a publishing house (Edizioni Erickson) specialized in educational books

  - KEs: experts in knowledge engineering working at FBK

- Two domains:

  - cognitive abilities: attention and concentration (AC)

  - motivational and emotional aspects of learning process (ME)

- Each team worked with each version of MoKi, in two different labs (L1, L2) of 2 hours each

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# Experimental Study
## Subjects, Design, and Material

- **Balanced** Experiment Design:

|  | L1 (morning session) | | L2 (afternoon session) | |
|---|---|---|---|---|
|  | **(NC)MoKi** | **MoKi** | **(NC)MoKi** | **MoKi** |
| TeamA | AC | | | ME |
| TeamB | | AC | ME | |
| TeamC | ME | | | AC |
| TeamD | | ME | AC | |

- Material / Training:
  - DEs were provided with a document on the domain to be formalized
  - Tutorial and hands-on sessions with both MoKi and (NC)MoKi

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# Experimental Study
## Research Question I

- <u>Investigated Factor</u>: involvement (and productivity) of DEs

- <u>Variables</u>:
  - number of edited axioms
  - number of editing operations

- <u>Results</u>:

| Variable | | Mean | | p-value* |
|---|---|---|---|---|
| | | (NC)MoKi | MoKi | |
| DEs | axioms | 3.11 | **4.43** | 0.03 |
| | operations | 21.63 | **29.13** | 0.038 |
| KEs | axioms | 2.36 | **1.32** | 0.025 |
| | operations | 31 | **11.75** | 0.049 |

*computed according to the paired Wilcoxon statistical test

- <u>Conclusions</u>: wiki-enhanced collaborative features increase the involvement of DEs in authoring the ontology

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# Experimental Study
## Research Question II

- <u>Investigated Factor</u>: effort to interact

- <u>Variable</u>:

  - number of characters in communications

- <u>Results</u>:

| | | Mean | | p-value* |
|---|---|---|---|---|
| | Variable | (NC)MoKi | MoKi | |
| DEs & KEs | #characters | 3919.25 | **3319.92** | 0.046 |

*computed according to the paired Wilcoxon statistical test

- <u>Conclusions</u>: wiki-enhanced collaborative features reduce the effort required by team members to interact (and hence collaborate)

# Experimental Study
## Research Question III

- <u>Investigated Factor</u>: perceived effectiveness for collaboration aspects

- <u>Variables</u>:
  - users' subjective perception on overall effectiveness, overall ease of use, effectiveness for specific collaboration aspects [rating wrt a 0..4 likert scale]

- <u>Results</u>:

| | Investigated Factor | | Neg | Pos | Median | p-value* |
|---|---|---|---|---|---|---|
| DEs & KEs | overall effectiveness | | 0 | 8 | 3 | 0.0047 |
| | ease of use | | 0 | 12 | 2.56 | 0.0005 |
| | effectiveness for specific collaboration aspects | awareness | 0 | 10 | 3 | 0.0016 |
| | | communication | 1 | 8 | 3 | 0,0196 |
| | | coordination | 1 | 5 | 2 | 0.1025 |
| | | decision making | 0 | 9 | 3 | 0.0027 |
| | | team building | 3 | 6 | 2.5 | 0.3173 |

*computed according to the Chi-squared test

- <u>Conclusions</u>: users perceive the support provided by wiki-enhanced collaborative features as effective

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# Conclusions & On-going Work

- We performed a rigorous empirical evaluation of the effectiveness of wiki features to support collaborative ontology authoring

- Wiki-enhanced collaborative features favor:
  - the active involvement of DEs in the ontology authoring process
  - the interaction of modelers with other team members

- Non wiki-based modeling tools could also benefit from the introduction of wiki-enhanced collaborative features

- Further on-going investigations on the impact of wiki-enhanced features on
  - the collaborative modeling process, and
  - on the ontology entity life-cycle
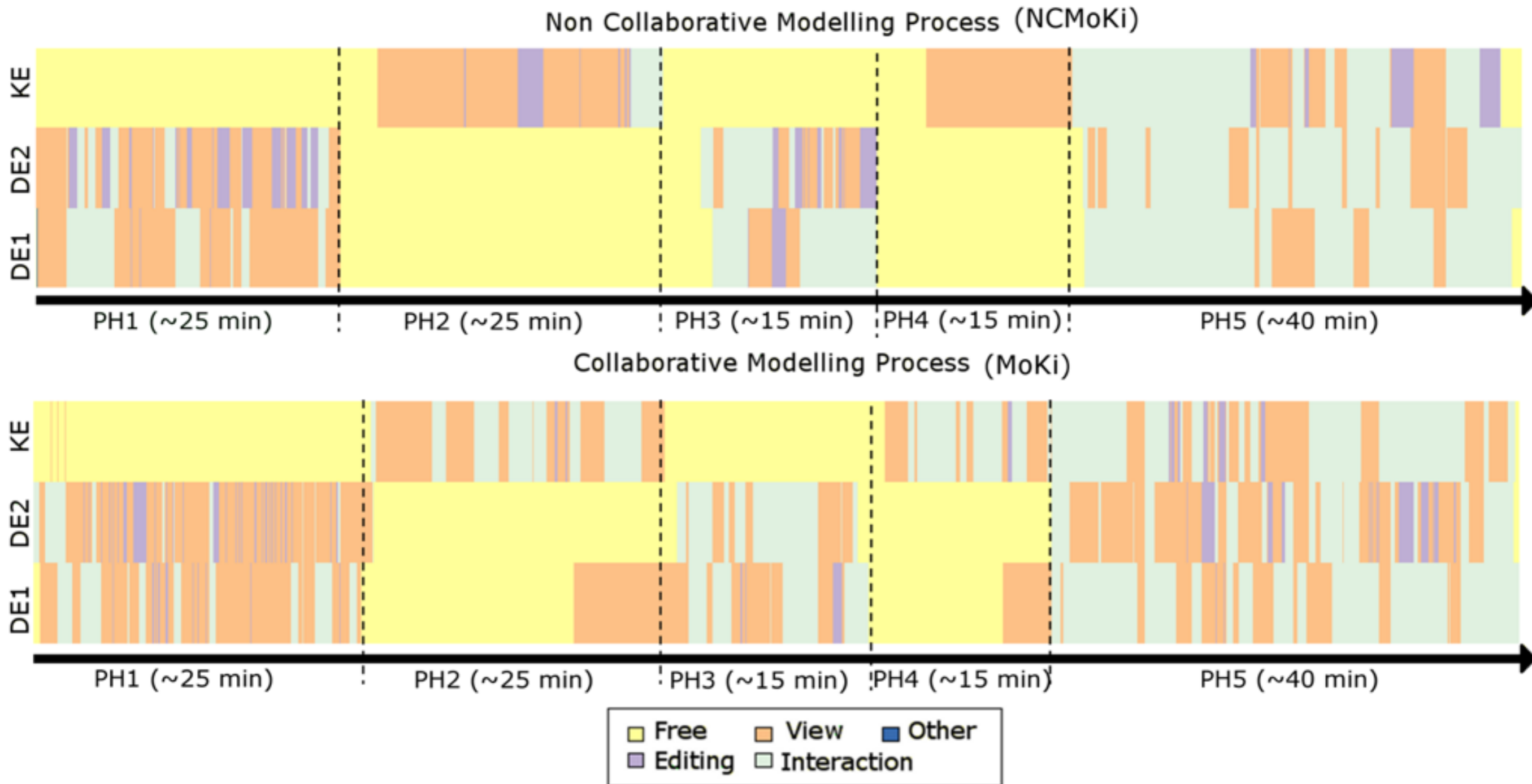
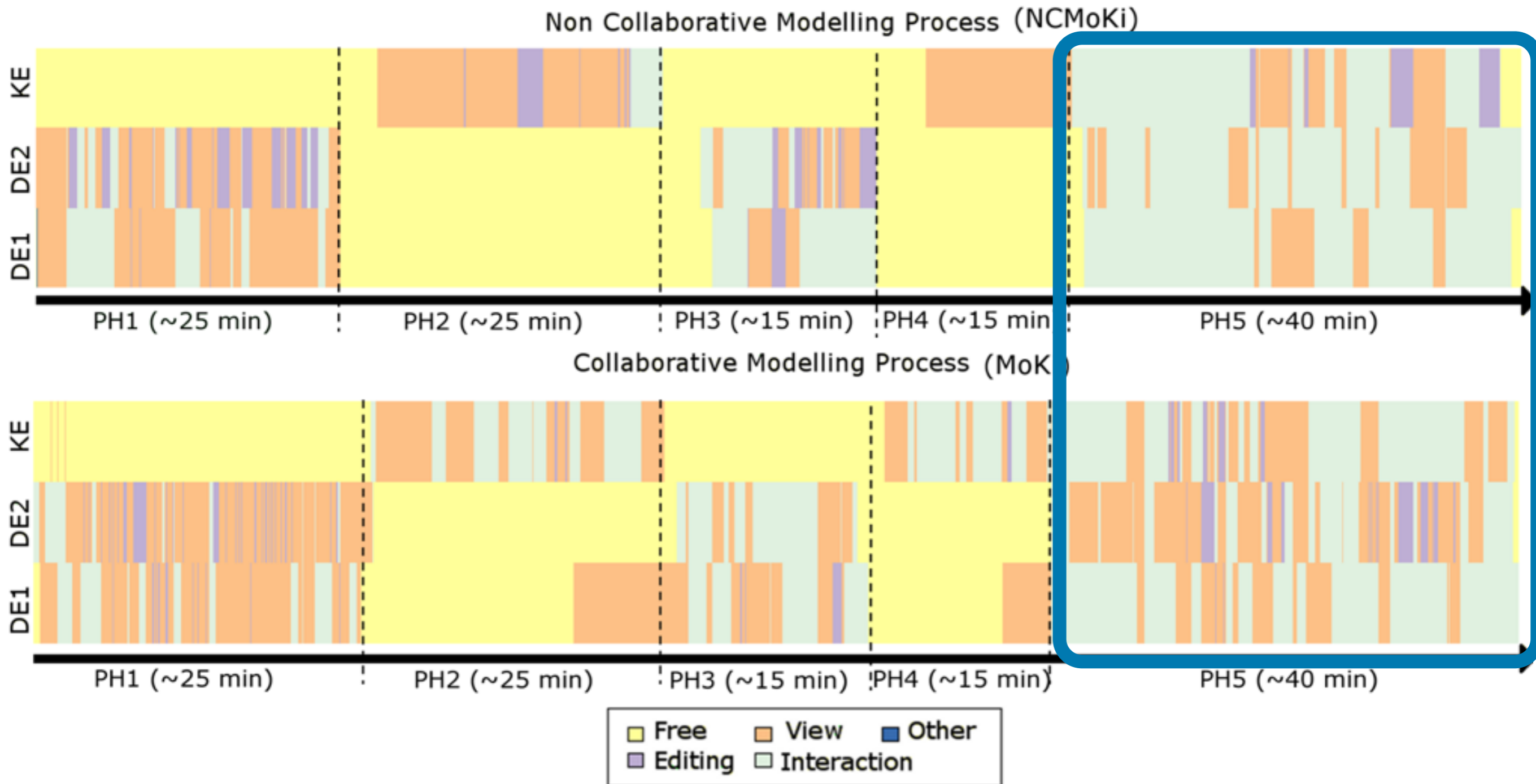# Experimental Study

## Further Aspects...: Impact on modeling process

# Experimental Study

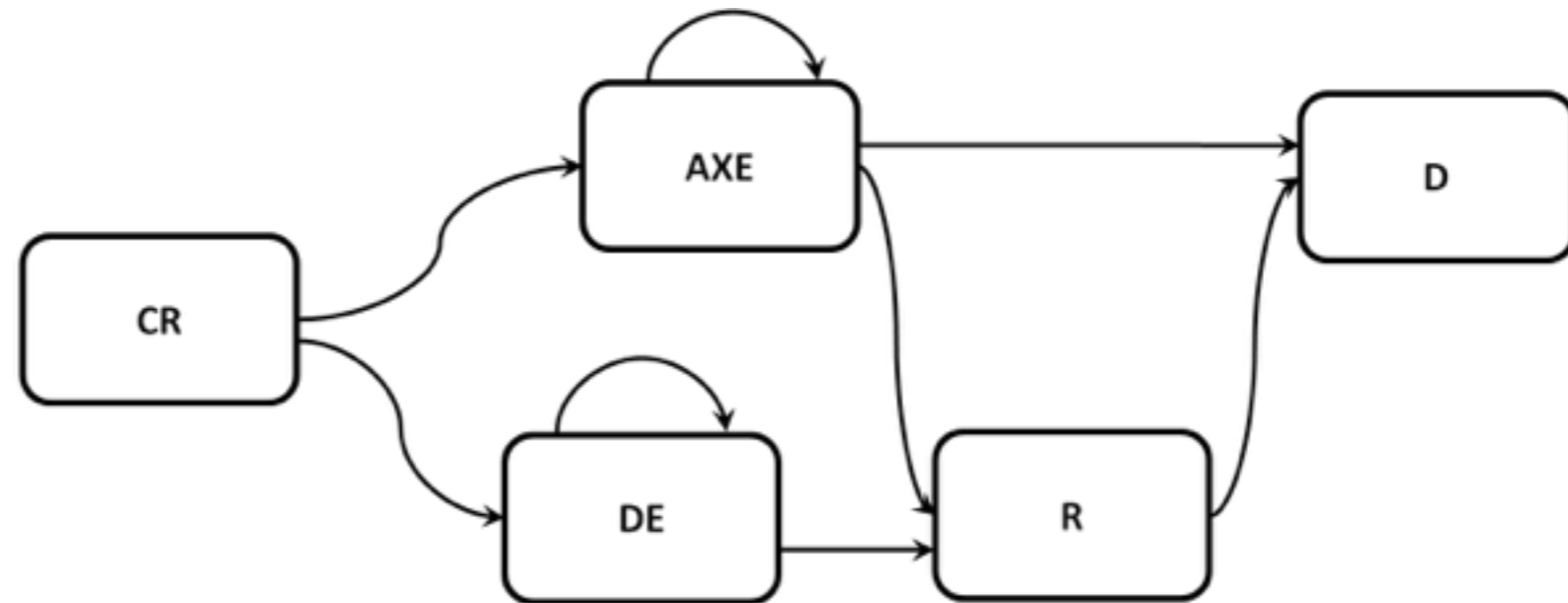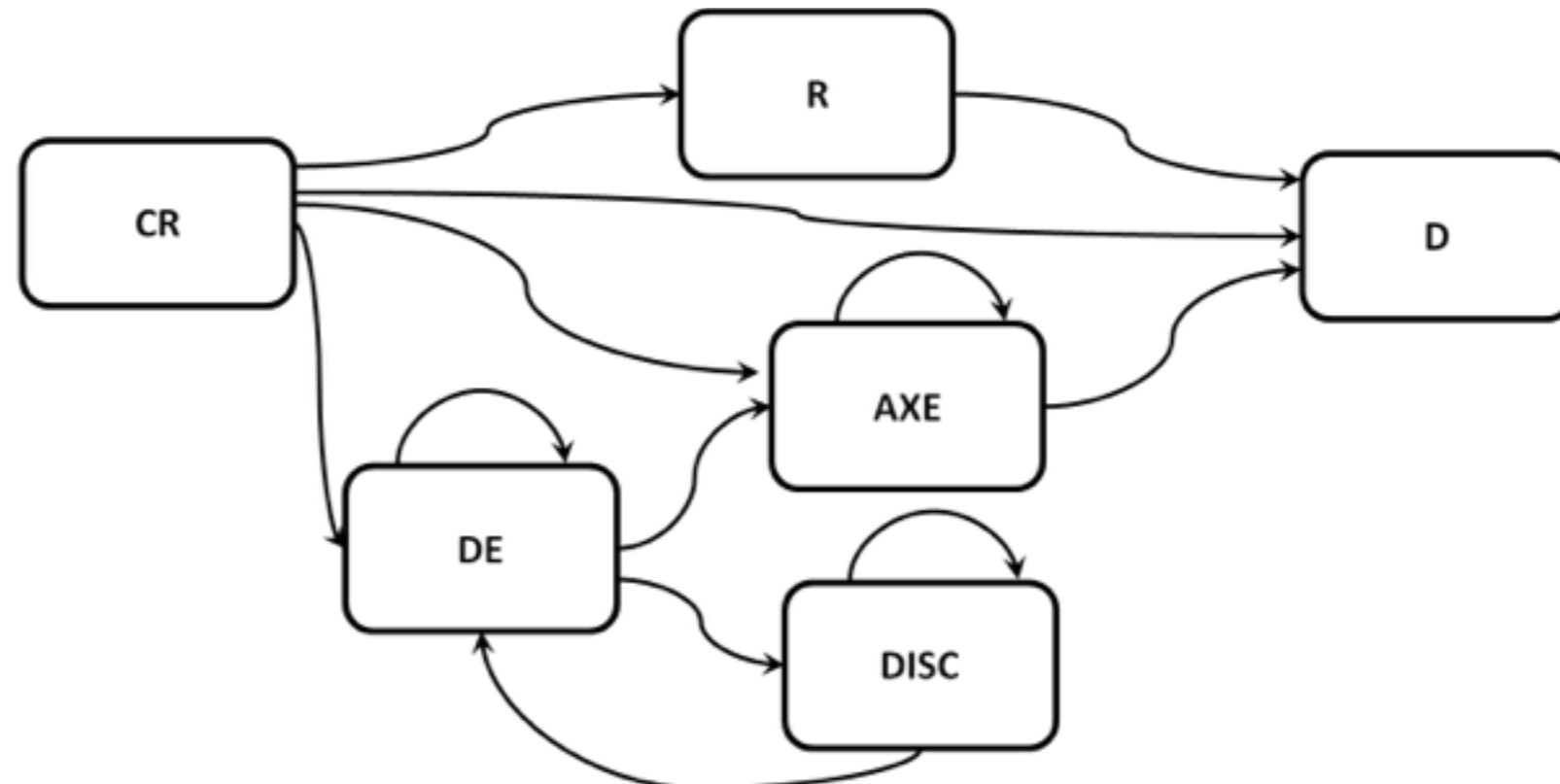## Further Aspects...: Impact on modeling process



Non Collaborative Modelling Process (NCMoKi)

PH1 (~25 min)  PH2 (~25 min)  PH3 (~15 min)  PH4 (~15 min)  PH5 (~40 min)

Collaborative Modelling Process (MoK)

PH1 (~25 min)  PH2 (~25 min)  PH3 (~15 min)  PH4 (~15 min)  PH5 (~40 min)

Free  View  Other
Editing  Interaction

# Experimental Study

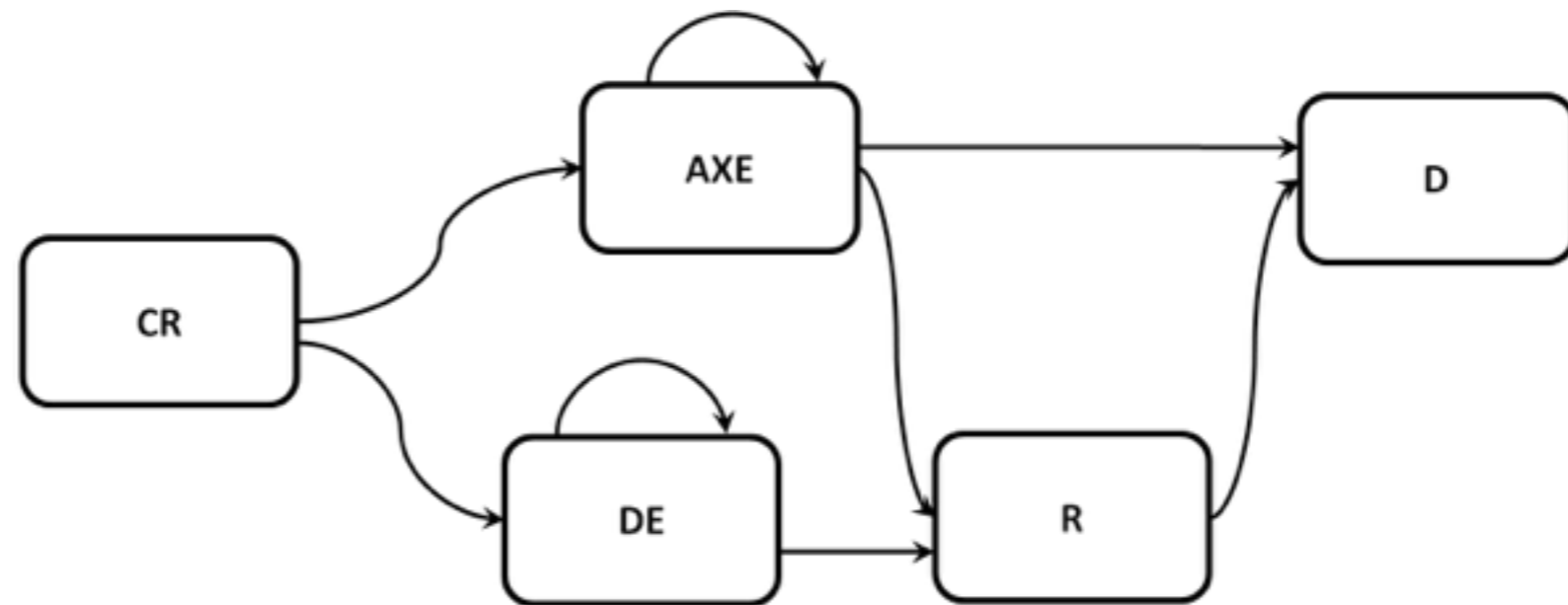Further Aspects...: Impact on ontology entity life-cycle

# Experimental Study

Further Aspects...: Impact on ontology entity life-cycle



AXE — Axiom Editing
CR — Creation
D — Deletion
DE — Description Editing
R — Renaming

(NC)MoKi

AXE — Axiom Editing
CR — Creation
D — Deletion
DE — Description Editing
DISC — Discussion
R — Renaming

MoKi

# Experimental Study
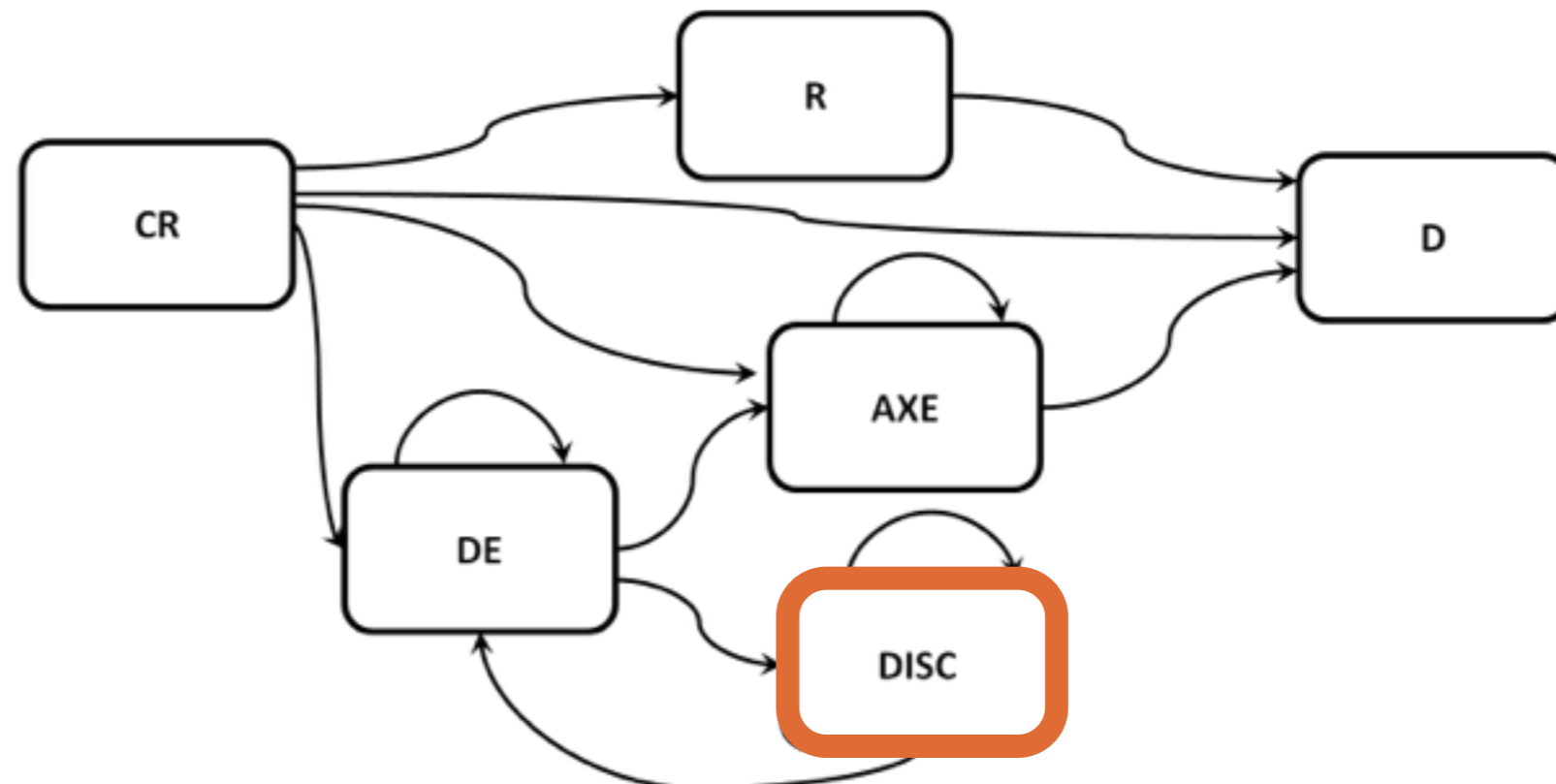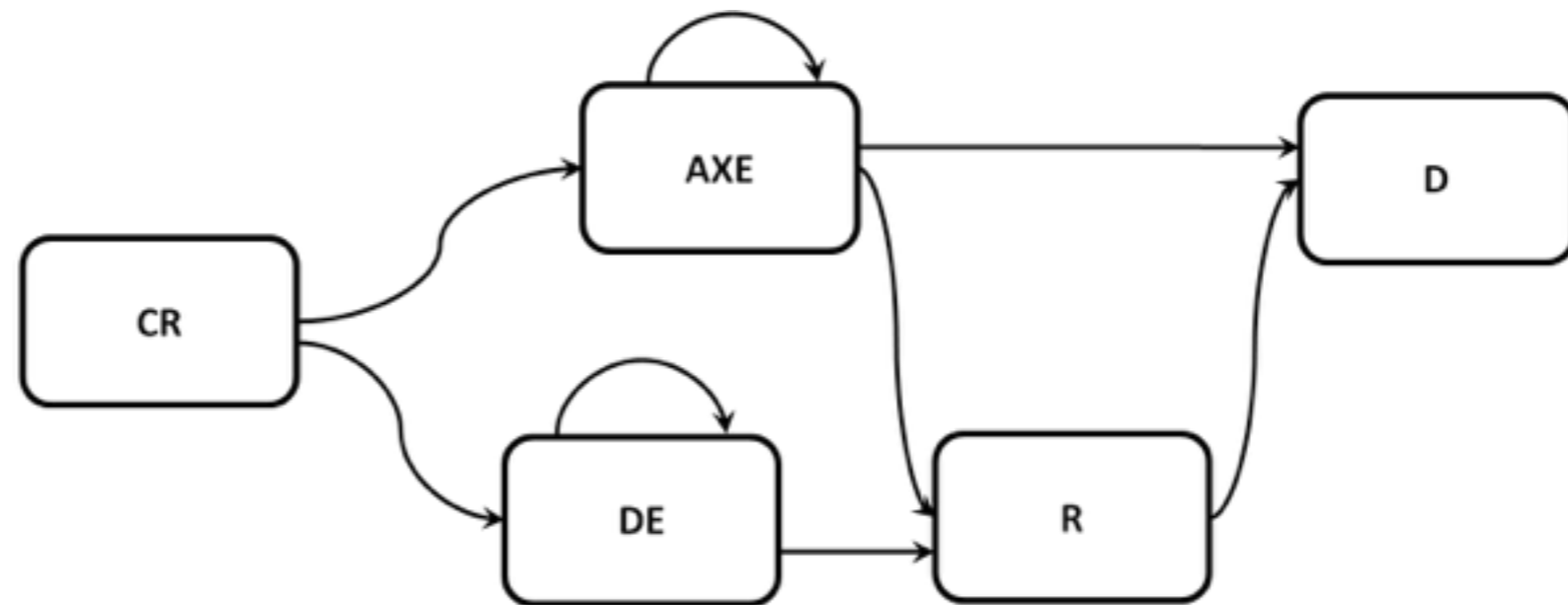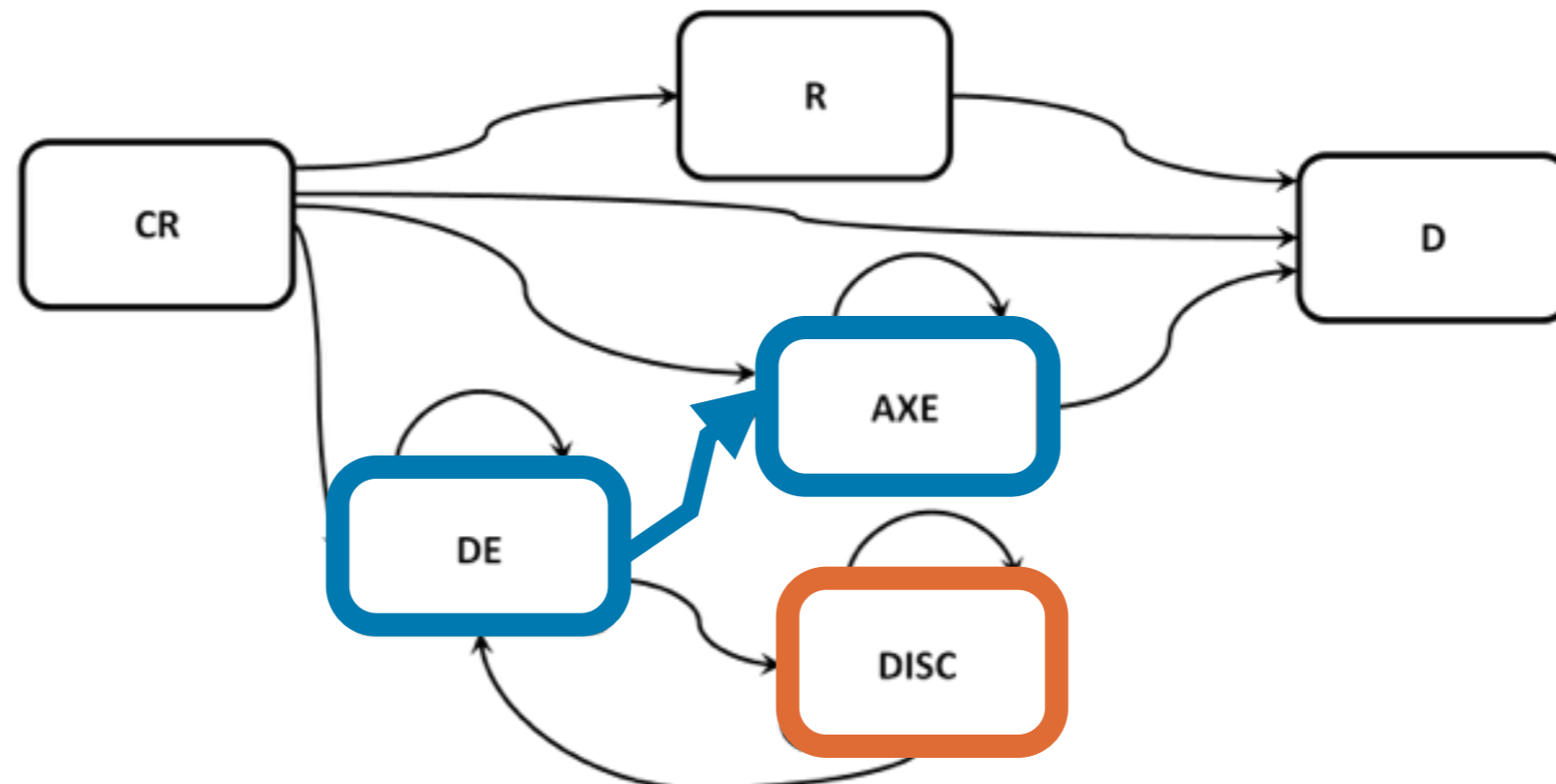
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| | |
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**(NC)MoKi**

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**MoKi**

# Thank you! Questions?

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