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Natural Language Processing with Process Models

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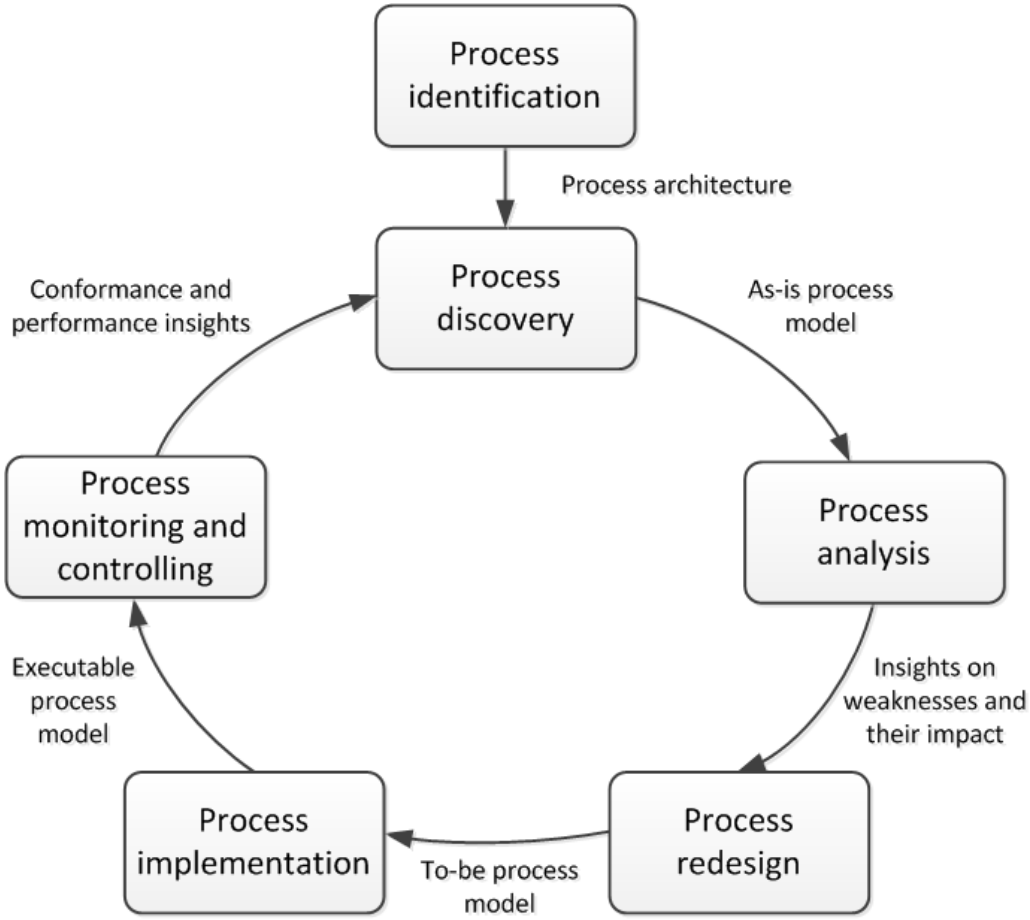
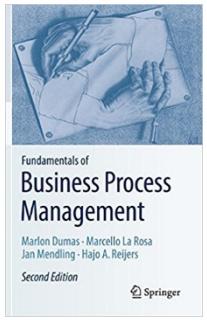
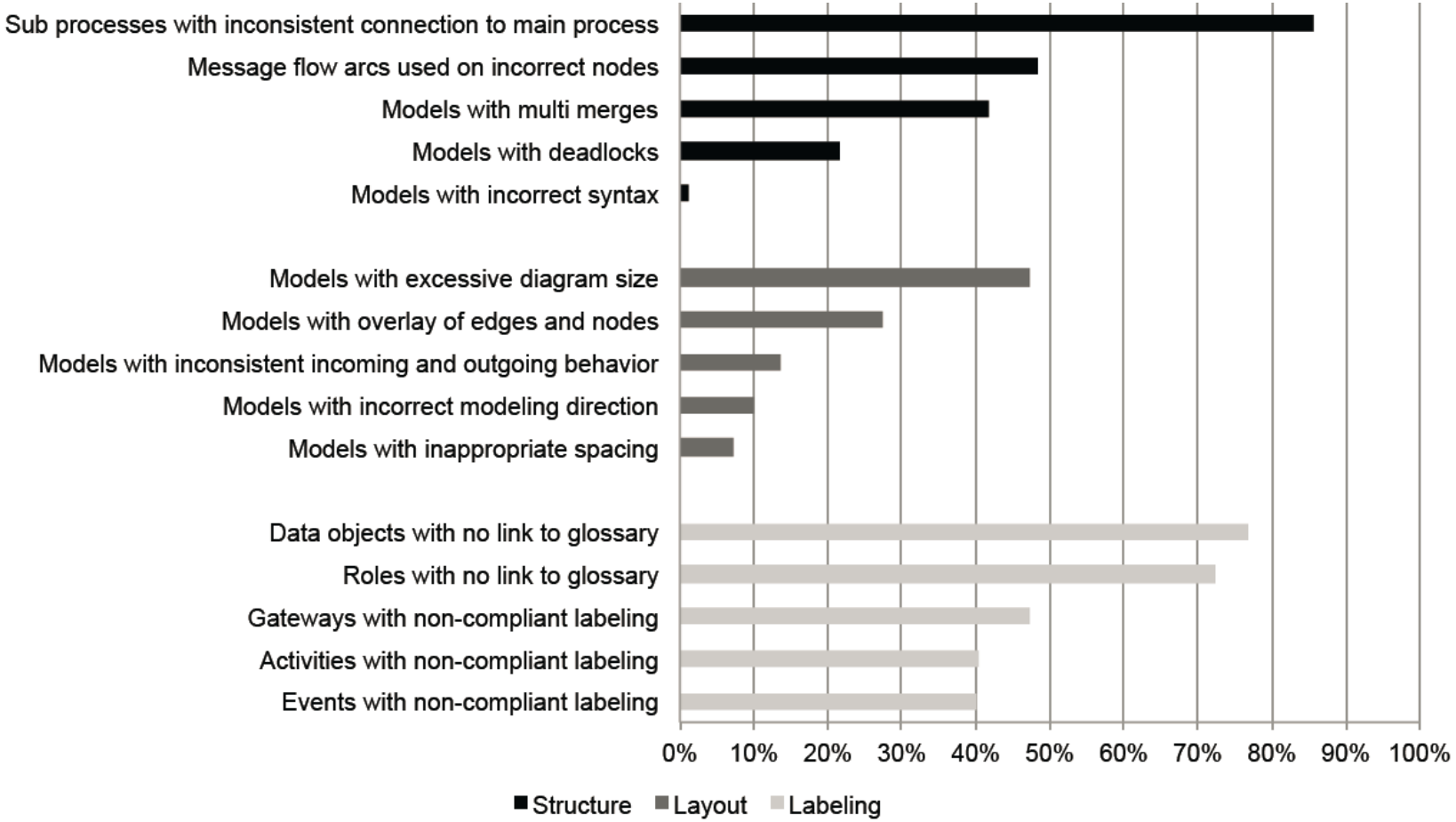
BPM Lifecycle





Dumas 2018

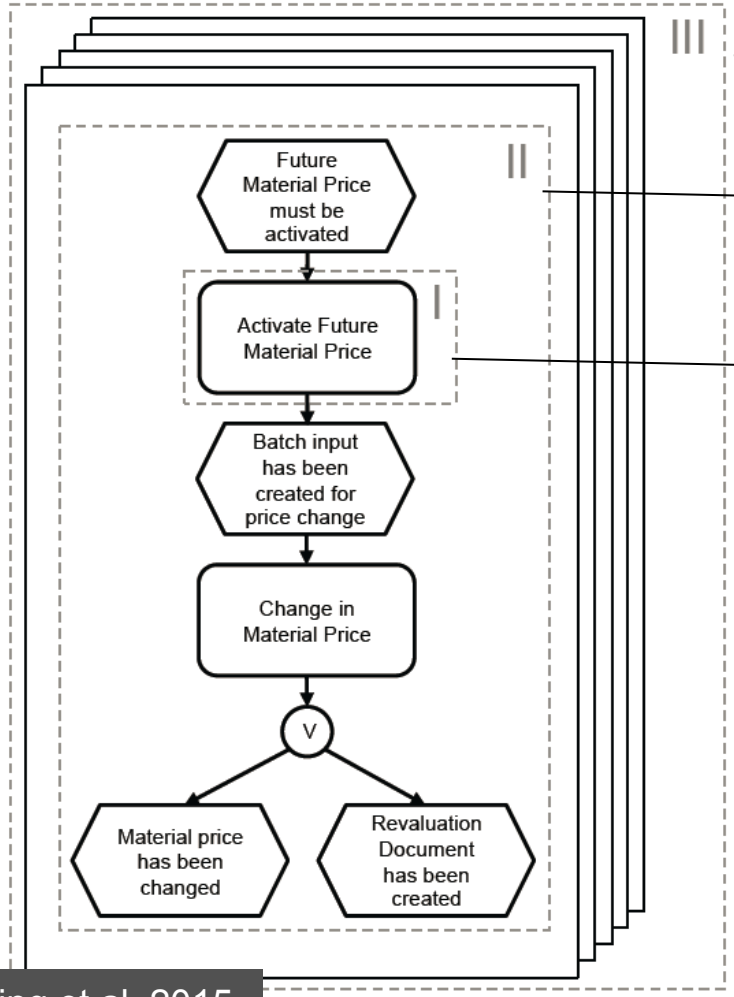
Current versus desirable quality



585 BPMN 2.0 process model from six companies

Leopold et al. 2015

25 Challenges of Semantic Process Modeling



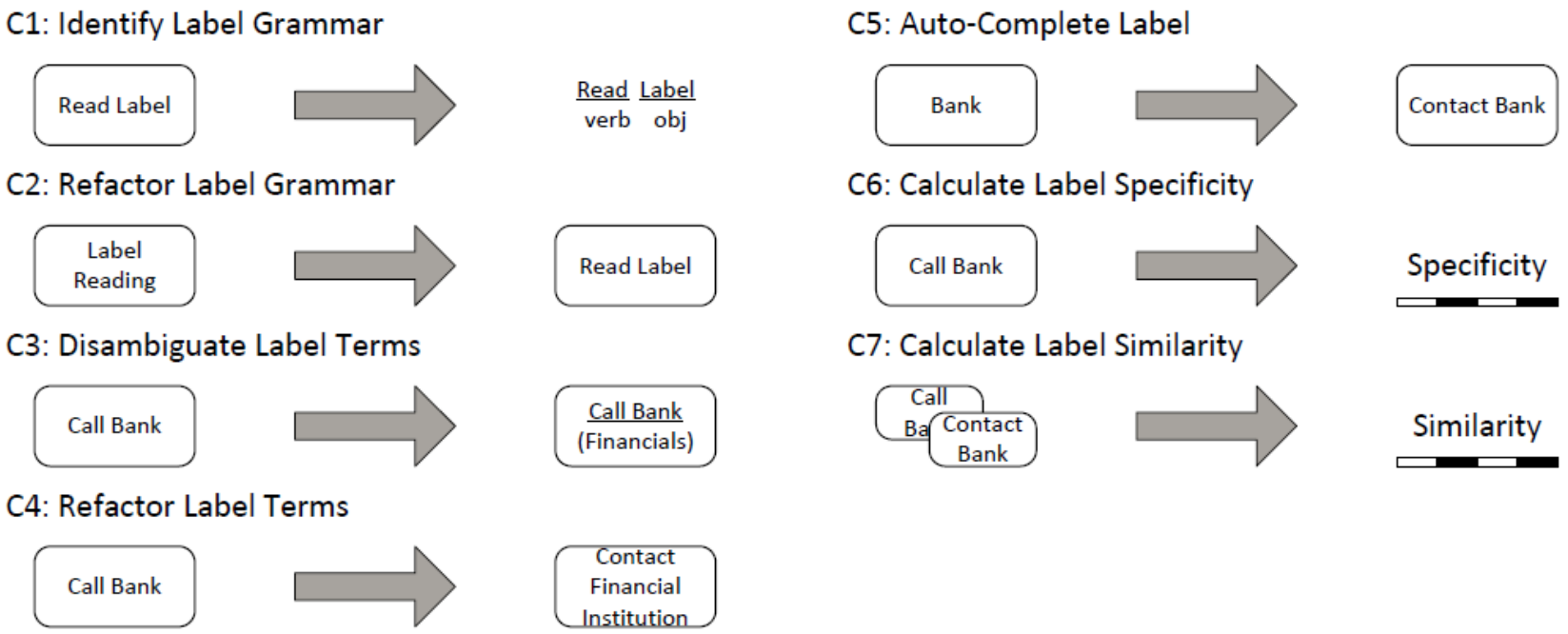
Collections

Models

Labels

Mendling et al. 2015

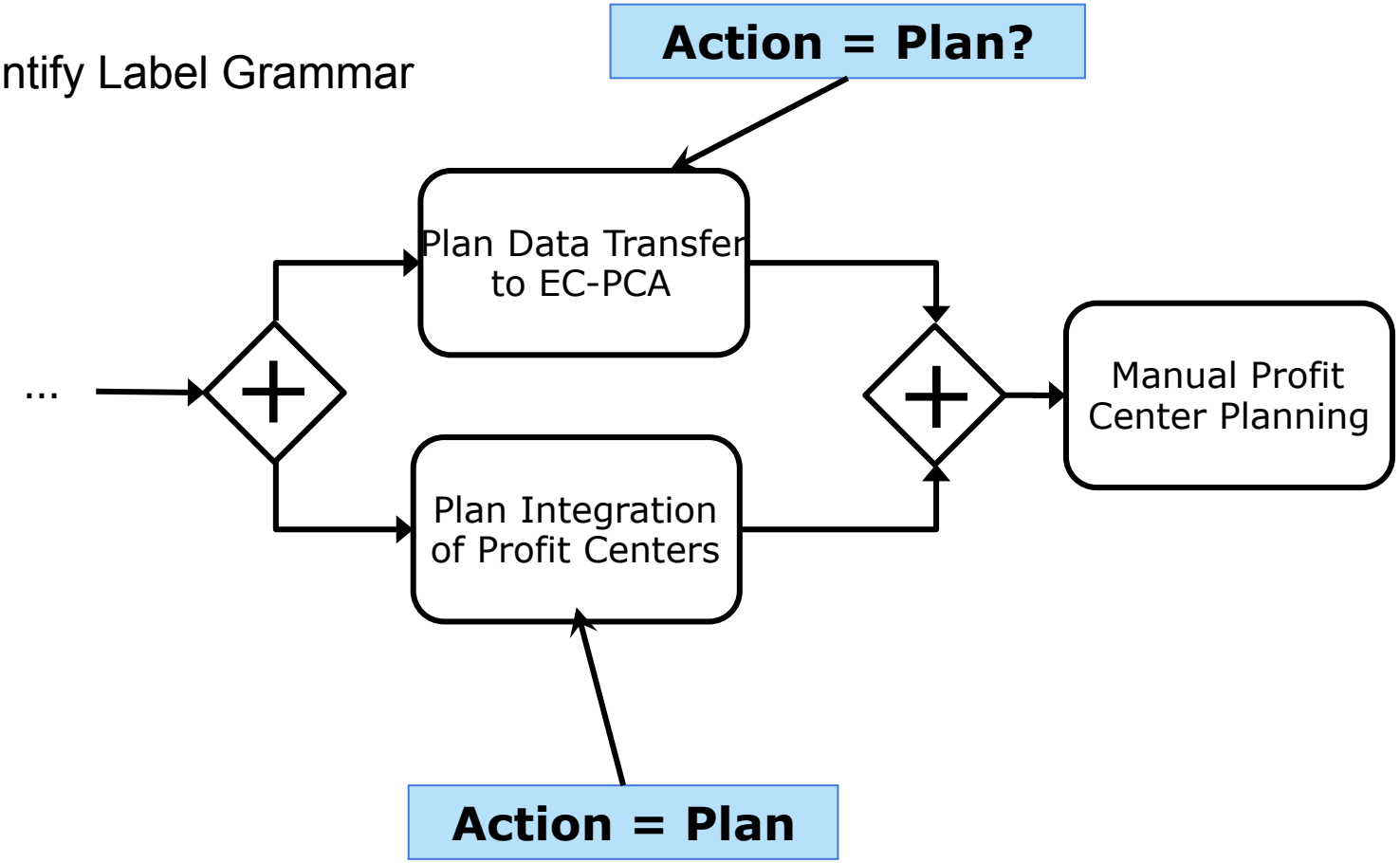
Challenges related to labels



Mendling et al. 2015

Label Ambiguity

C1: Identify Label Grammar



Challenges related to models

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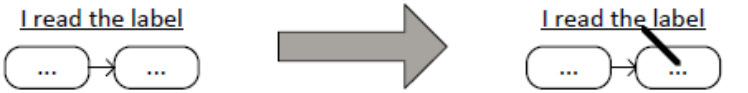
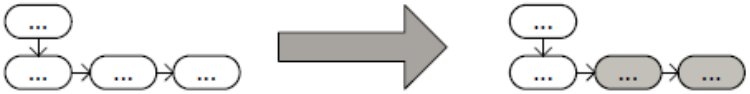
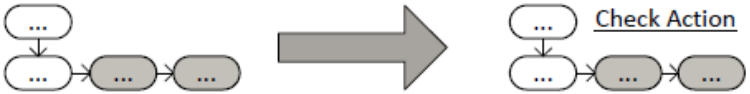
C8: Discover Label Mapping



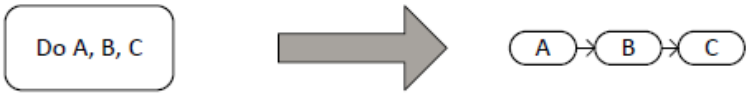
C9: Identify Semantic Fragment



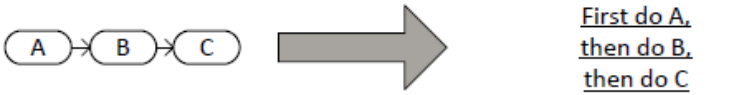
C10: Identify Fragment Name



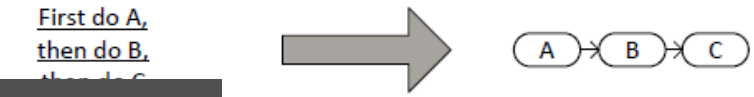
C11: Unfold Label to Structure



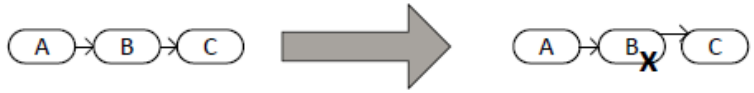
C12: Transform Model to Text



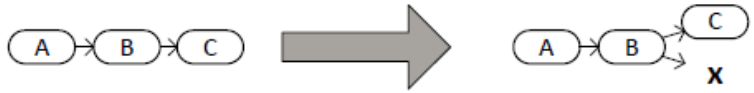
C13: Transform Text to Model



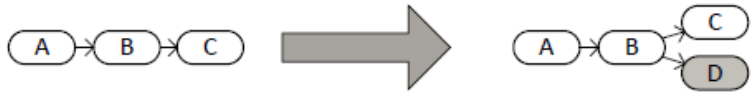
C14: Verify Model Correctness



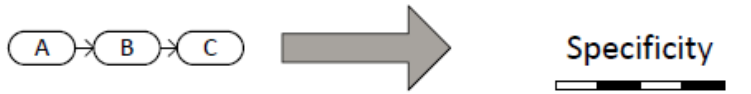
C15: Validate Model Completeness



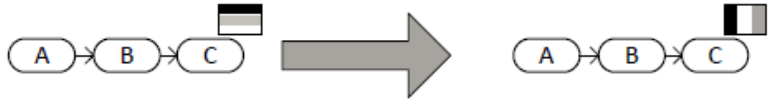
C16: Auto-Complete Model



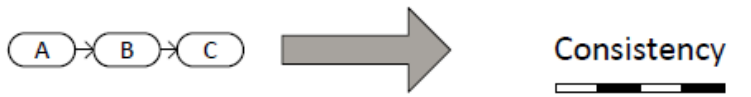
C17: Calculate Model Specificity



C18: Translate Model



C19: Calculate Model-Text Consistency



Mendling et al. 2015

FMD JIS

Translation from Text to Process Models

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- Main challenges
  - Syntactic Leeway
    - Changing active and passive voice of input text
  - Atomicity
    - activities can be split across sentences
  - Relevance
    - relative clauses, example sentences or meta-statements should not be translated to model elements
  - Referencing
    - anaphora, textual links
- Evaluation
  - Test set of 47 text-model pairs
  - Average translation accuracy is of 77%

Friedrich et al. 2011

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Translation from Process Model to Text

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- Main Challenges
  - Text Planning
    - text structuring
  - Sentence Planning
    - lexicalization and message refinement
  - Surface Realization
    - interfacing with established realizers
  - Flexibility
    - addresses variations of input data and adaptation of output

Leopold, 2015

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Conformance Checking between Process Models and Text

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- Main challenge
  - Check the conformance of process models and text
  - Align text labels of process models
- Achievements
  - Recorded process executions is compared with natural language specifications of processes
  - Ambiguity detected with probabilistic conformance checking

Aa, 2018;

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Process –Oriented Text Generation from Natural Language Text

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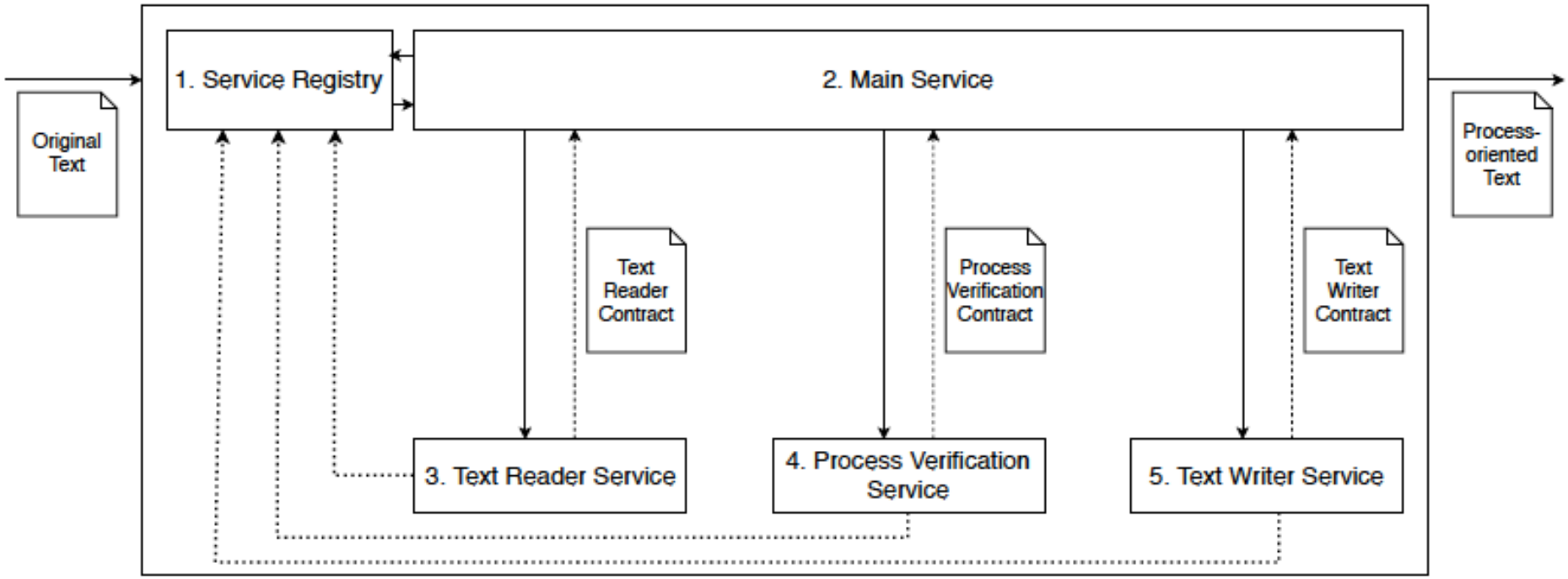
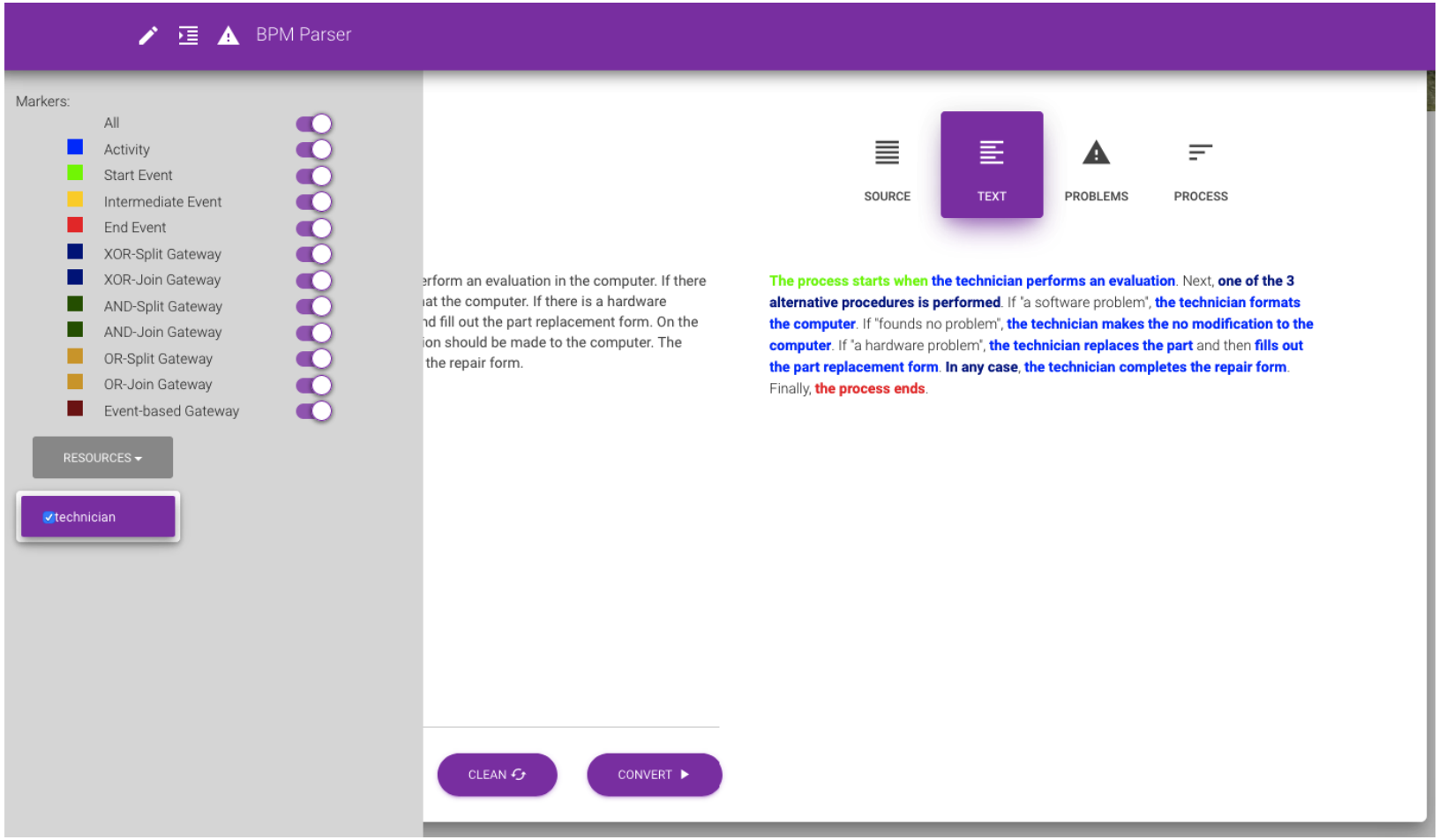
- Process –oriented text
  - Structured
  - Capable of maintaining the maximum information related to the business process
  - Is in conformance with BPMN 2.0

Process –Oriented Text Generation from Natural Language Text



Silva, 2018

Tool Overview



Silva, 2018

How a Process –Oriented Text must be Structured

- Describe the text as a sequence of facts
- Use no more than 5 sentences
- Use passive voice
- Make explicit in the text splits and joins
- Describe all the paths from the beginning of the process until a gateway. After, describe the next paths

Silva, 2018 based on Dumas, 2013

Process –Oriented Text Generation from Natural Language Text

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- Main characteristics of the approach
  - Can help in the BPM education
  - Can help business analysts to better understand the process models they should design

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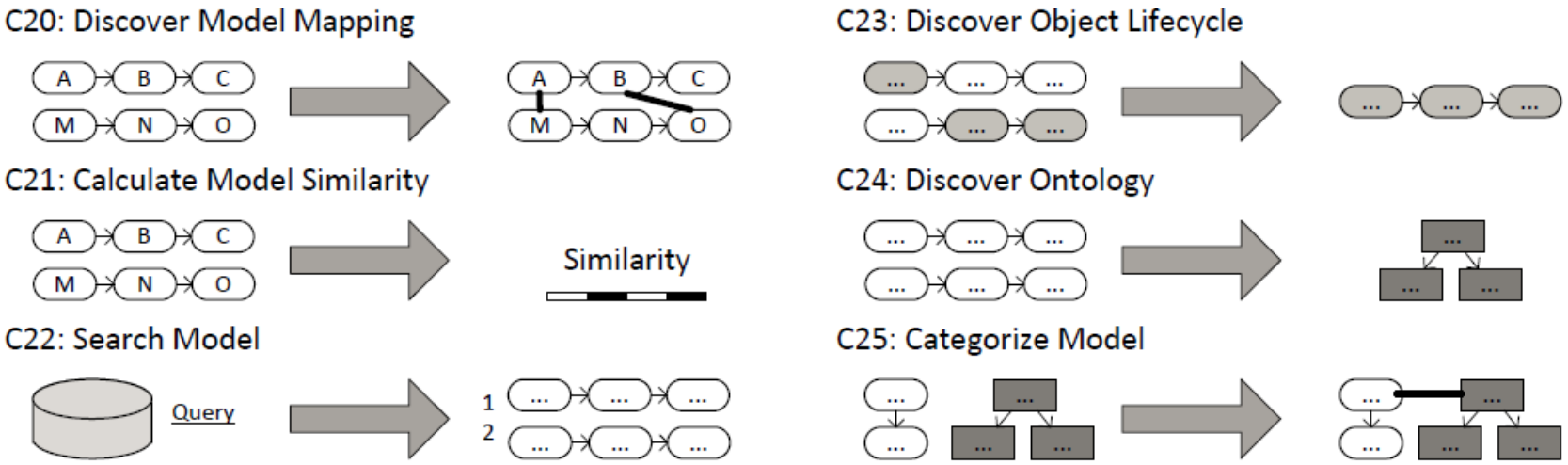
Challenges related to collections



Mendling et al. 2015

Research Plan on NLP for Requirements Engineering

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- Extend our approach to support a larger number of BPMN elements
- Filter natural language perspectives such as data and events
- Improve the quality of process descriptions
- Improve research on the extraction of declarative constrains from natural language

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References

- Dumas, La Rosa, Mendling, Reijers: Fundamentals of Business Process Management. Springer 2013
- Mendling, Leopold, Pittke: 25 Challenges of Semantic Process Modeling. International Journal of Information Systems and Software Engineering for Big Companies 1(1): 78-94, 2015.
- Friedrich, Mendling, Puhlmann. Process model generation from natural language text. In CAISE, Vol 6741, Springer, 2011: 482-496.
- Leopold, Mendling, Polyvyanyy. Supporting process model validation through natural language generation. IEEE Trans. Software Eng. , 40(8):818{840, 2014.
- Aa, Leopold, Reijers. Checking process compliance against natural language specications using behavioral spaces. Inf. Syst. , 78:83{95, 2018.
- Silva, Thom, Weber, Oliveira, Fantinato: Empirical Analysis of Sentence Templates and Ambiguity Issues for Business Process Descriptions. OTM Conference (1) 2018: 279-297.
- Leopold, Pittke, Mendling: Automatic Service Derivation from Business Process Model Repositories via Semantic Technology. Journal of Systems and Software. Accepted for publication.
- Leopold, Mendling, Günther: What we can learn from Quality Issues of BPMN Models from Industry. IEEE Software. Accepted for publication.
- Pittke, Leopold, Mendling: Automatic Detection and Resolution of Lexical Ambiguity in Process Models. IEEE Transactions on Software Engineering 41(6): 526-544, 2015.

References

- Van der Aa, Leopold, Reijers: Detecting Inconsistencies between Process Models and Textual Descriptions. In: 13th International Conference on Business Process Management (BPM 2015), Austria.
- Leopold: Natural Language in Business Process Models: Theoretical Foundations, Techniques, and Applications. LNBIP Vol. 168, Springer, 2013.