Assessing Process Models with Cognitive Psychology
[work in progress]

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Agenda

- Motivation / Problem Statement
- Proposed Approach
- Research Agenda
- Questions
What makes a process model understandable?

MOTIVATION /
PROBLEM STATEMENT
Current Situation

- Plethora of process modeling languages
  - BPMN
  - YAWL
  - DecSerFlow
  - EPC
  - ...
Which Language to Choose?

• Decision criteria
  o Expressiveness (cf. workflow patterns)
  o Standardization
  o Tool support
  o Personal experience
  o Understandability
But how to Capture Understandability?

• How can we measure understandability?
  o For a specific model
    – Questions about a process model
    – Average answering performance as surrogate
  o In general
    – Metrics (inspired from software engineering)
    – Possible to assess the understandability of a language?

• Basic assumption
  o Understandability as result of the interaction between process model and the human mind
However...

• How does the interplay between process model and human mind look like?
  o Influence of **model-specific** factors?
  o Influence of **language-specific** factors?
  o Influence of **personal** factors?
In the domain of business process modeling, it is not yet understood how the human mind handles process models. We need a closer look at this process of understanding to effectively assess model understandability.
A step towards insights into model understandability…

PROPOSED APPROACH: COGNITIVE PSYCHOLOGY
What is Cognitive Psychology?

• Definition
  
  „Cognitive psychology is a subdiscipline of psychology exploring internal mental processes. It is the study of how people perceive, remember, think, speak, and solve problems.”¹)

Why Cognitive Psychology

- Well-established field (since 1950s)
- Based on experimental results
  - Replication and validation!
- Appears to be a strong foundation for our purpose
- Of special interest: external representation
External Representation

• Abstract problem needs an external representation to be perceived
  o Real business process: abstract problem
  o Business process model: external representation

• Important: external representation is not just information, it can support/inhibit cognitive processes!
Example: Representation of a Business Process

Real-world business process

BPMN model

DecSerFlow model
Underlying Concepts

- But which representation is better?
- Central Concept: Working Memory
  - Required by all conscious mental activities
  - Mental effort: utilization of working memory
  - Severely limited: 7 +/- 2 information “slots“
  - Overflow: rapid performance decrease!
- Cognitive Load Theory (CLT)
- How do humans then deal with tasks that require more than ~7 slots?
How to Circumvent Limited Working Memory?

• Strategies for reducing mental effort
  o Chunking
  o Computational offloading
  o External Memory
Chunking in General

• Each „chunk“ information requires one slot
• Aggregate information to bigger chunks
• Example
  o 2) Remember sequence: USA ASIA
  o Ad 1): 7 chunks required
  o Ad 2): 2 chunks required
  o Same information stored!
  o But also: Training required
Chunking in Business Process Models

- How could chunking work for business process models?

![Diagram showing chunking in business process models]
Computational Offloading

- External representation allows information to be directly „read-off“

Do the lines cross?

\[ y = x + 2 \]
\[ y = -x + 4 \]
Computational Offloading in Process Models

• How could computational offloading work for business process models?
• Task: List all possible execution traces!
External Memory

- Transfer parts of the working memory to an external memory
  - Pencil and paper
- Example: solve \( x = -x + 2 \)
  - \( x = -x + 2 \)
  - \( 2x = 2 \)
  - \( x = 1 \)
- Intermedia steps do not need to be stored in working memory!
External Memory in Business Process Models

• How could external memory work for business process models?
• Mental simulation of processes: store state
Wrapping Up

• How to reduce mental effort?
  o Aggregate information (chunking)
  o Outsource computation (comp. offloading)
  o Outsource information (external memory)

• Each strategy depends on external representation and training!
What is the vision about?

RESEARCH AGENDA
Our Vision

• Concepts from cognitive psychology are applied to business process models
  o Which mental effort does a model/language impose?

• Scenarios
  o Assess understandability of a model
  o Guide model creation
  o Assess understandability of a language
  o Guide language creation
  o Computer support to improve understanding
The Long Road to Model Understandability

- Our roadmap
  - Initial focus: empirical research
    - Are the supposed effects indeed observable?
    - Strength of effects need to be investigated
  - Design science based on these building-blocks, empirical validation
    - Elaborate metrics that are based on findings to assess model understandability
    - Provide tool-support to improve understanding
Next Steps

• Currently: Impact of hierarchy on model understandability
  o Theoretical basis @ EESSMod 2011
  o Currently preparing setup for experiment
    – To be conducted: January 2012
Concepts revisited…

10,000 FEET VIEW
10,000 Feet View

Cognitive Psychology

apply to

Business Process Models

yields

BP-specific concepts of cognitive psychology

allow for

Applications

• Assess/Predict Understandability
• Improve Understandability
• Design Languages
Thank you for your attention!

TIME FOR QUESTIONS