Improving Requirements Engineering by Artefact Orientation

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Requirements Engineering Process Improvement

**Context**

- Software Process Improvement (SPI)
- Requirements Engineering (RE)
  - Highly volatile discipline (project-specific variations, dependency to application domains, ...)
  - Low degree of standardisation possible

**How to conduct**

Requirements Engineering Process Improvement?

„Define and outline requirements“
Requirements Engineering Process Improvement
Principles and Paradigms (simplified)

**Improvement Principles**

1. Solution-driven
   - Assessment against external norm / benchmark against pre-defined criteria
   - **Other terms:** deductive, prescriptive, normative

2. Problem-driven
   - Analysis of company-specific problems and goal-driven improvement design (criteria for improvement elicited)
   - **Other terms:** inductive, goal-driven

**SW Process Paradigms (simplified)**

A. Activity-based
   - Focus on activities, methods, practices
   - **Other terms:**

B. Artefact-based
   - Focus on artefacts, dependencies, roles
   - **Other terms:**
Improving RE by Artefact orientation

Why Artefact Orientation: Experiences from Research Projects
- Application: Advantages w.r.t. certain criteria including flexibility in RE process and improvement of artefacts' syntactic quality*
- Design: Eases RE analysis and (process) design **

Why Problem Orientation: Survey on RE
- Reluctance against benchmark-driven, normative REPI approaches***

Qualitative analyses: 80%
Metrics: 40%

No solution-driven RE improvement
"I am not convinced of the benefits of external standards."

* Mendez et al. A Meta Model for Artefact Orientation: Fundamentals and Lessons Learnt in Requirements Engineering (MoDELS’10)
** Mendez et al. A Case Study on the Application of an Artefact-based Requirements Engineering Approach (EASE’11)
*** Mendez et al. Pattern-based Guideline to Empirically Analyse Software Development Processes (EASE’12)
**** Mendez et al. Naming the Pain in Requirements Engineering (TR’13, EASE’13)
Improving RE by Artefact orientation

How?

Starting point: Empirical design science principles

- Knowledge/Technology transfer
- Problem and goal orientation

- **Design specific-purpose treatment to individual problem!**
- **Design treatment in an artefact-oriented manner!**

* R. Wieringa. Technical Action Research as a Validation Method in Information Systems Design Science (DESRIST 2012)
## Improving RE by Artefact orientation

**Approach resulting from Research Projects**

### RE Improvement Problem Investigation

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| Investigation of RE Artefacts           |
| Kick-Off                                |
| Art.-based RE Analysis                  |
| Reporting & Decision                    |
| Analysis Report                         |

### Treatment Design & Design Validation

| Artefact-based RE Improvement Design and Validation |
| Conceptualisation art.-based RE |
| Validation |
| Construction art.-based RE |
| Release Planning |

| Design and Validation of Improvement Transfer |
| Design of Process Integration |
| Evaluation in Pilot |
| Training Design |
| Release |

### Inference of least common denominators

### Application of empirical design science principles

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- **Treatment Implementation**
- **Engineering cycle**
- **Implementation Evaluation / Problem Investigation**
- **Design Validation**
- **Treatment Design**
Improving RE by Artefact orientation
A brief Overview
Improving RE by Artefact orientation

**Investigation of Stakeholders & Goals**

**Goals**

1. Understand context
2. Elicit background
3. Define goals and measurement of (improvement) success

**Results**

1. Stakeholders, goals (and criteria)
2. Company background and RE definition
3. REPI plan

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Investigation of RE Artefacts

Goals
1. Analyse current state
2. Trigger self-reflection

Results
1. "As-Is" artefact model

* Mendez et al. Field Study on Requirements Engineering: Investigation of Artefacts, Project Parameters, and Execution Strategies (IST 2012)
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Investigation of RE Artefacts

Goals
1. Analyse current state
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Results
1. "As-Is" artefact model
2. Gap analysis (w.r.t. reference model and goals)
Improving RE by Artefact orientation
Investigation of RE Artefacts

Goals
1. Analyse current state
2. Trigger self-reflection

Results
1. „As-Is“ artefact model
2. Gap analysis (w.r.t. reference model and goals)
3. Expert opinion:
   - “Why is it as it is?”
   - “What could and should be changed?”

* Mendez et al. Field Study on Requirements Engineering: Investigation of Artefacts, Project Parameters, and Execution Strategies (IST 2012)
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Artefact-based RE Improvement Design and Validation

Goals
1. Re-design “as-is” model
   (let the participants do it!)
2. Knowledge transfer

Results
1. Sketch of „to-be“ artefact model - (canonical) action research
   - Artefacts and dependencies
   - Roles and responsibilities
   - Variations (for Tailoring)
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Artefact-based RE Improvement Design and Validation

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2. Conceptualisation
3. Implementation
Improving RE by Artefact orientation
Design and Validation of Improvement Transfer

Goals
1. Evaluate results in projects (against goals)
2. Prepare and support dissemination

Results
1. Process integration

Improving RE by Artefact orientation

Design and Validation of Improvement Transfer

Goals

1. Evaluate results in projects (against goals)
2. Prepare and support dissemination

Results

1. Process integration
2. Evaluation (action research)

Improving RE by Artefact orientation

Design and Validation of Improvement Transfer

**Goals**

1. Evaluate results in projects (against goals)
2. Prepare and support dissemination

**Results**

1. Process integration
2. Evaluation (action research)
3. Training material (boring part...)

Preliminary Results from Empirical Evaluation

Context

- Wacker Chemie AG
- 5 process engineers
- 3 pilot projects
- Improvement goal: Traceability and integration of RE with QA

Research questions

1. How well are process engineers supported in their RE improvement task?
2. How well are project participants supported by the new RE reference model?

Evaluation

REPI endeavour

Preliminary rating

Final rating after completion of pilot projects
Preliminary Results from Empirical Evaluation

**Process Engineering View**
1. Support of knowledge transfer
2. Support of goal orientation
3. Confirmed experience orientation

**Project View**
1. Increased syntactic quality (condensed)
2. Increased traceability (project goal)
Preliminary Results from Empirical Evaluation

Validity: Only preliminary results

→ We need extension and further evaluations!
Conclusion

- So far, we seem to have avoided the pitfalls of current solution-driven REPI approaches
  - Focus on artefacts eases structuredness & supports quality in RE artefacts
  - Support of knowledge transfer and problem-driven improvement
- “Not invented here”-syndrom tackled by action research
  - Early involvement of stakeholders
  - Problem-driven analysis, design (and evaluations)
- Also:
  - Higher effort!
  - Does not replace solution-driven approaches!

We are still learning...

- Rated as hard to be applied by others
  - REPI is also about social skills!
- REPI is part of a holistic change process

Future Work

- Support partner in change process (& learn from it!)
- Finalise evaluation and report full results
A final note about the reviewers:
“Thank you for some very good suggestions!”

Thank you!