Elicitation Awareness in Conceptual Modeling: The Role of Transparency

i*’15

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Support from
Main Goal

Bring elicitation to the front
Main Premise

Elicitation is taken for granted
Facts

- **Bias towards Modeling**
  - “However, in our educational system it is institutionalized that students get a ‘perfect’ problem description and don’t have to align with anyone in order to solve the problem (other than the odd question of clarification to the instructor).” (Sikkel, Klaas and Daneva, Maya (2011) *Getting the client into the loop in information systems modelling courses*. In: REET 2011)

- **Elicitation through Modeling**
  - "In requirements acquisition a preliminary model for the specification of the entire composite system is elaborated and expressed in a “rich” language. This language needs a variety of built-in concepts to structure requirements about the composite system in terms of the kind of abstractions usually found in requirements documents, such as objectives and constraints to be met by the composite system, entities, relationships, events, and actions taking place in it, agents controlling the actions, responsibilities assigned, possible scenarios of system behavior, and so forth." (Dardenne, van Lamsweerde, Fickas, *Goal-directed requirements acquisition*, In Science of Computer Programming 20 (1993) 3-50 Elsevier (2063 citations)
The role of Transparency

“Transparency is an interesting quality because it makes it necessary to attach requirements models to software”

John Mylopoulos
**The role of Elicitation**

“There's no sense in being precise when you don't even know what you're talking about.”

John von Neumann
The RE Formula
Jackson View

specified machine behaviour is about these shared phenomena only

requirements are typically about these private phenomena

environment properties relate all of these shared and private phenomena, and so relate the requirements to the machine behaviour

figure 1.

M. Jackson, The meaning of requirements
Reinterpretation of Jackson View

Universe of Discourse

The Machine

The Environment

R

S

K

K

Time
The Elicitation Task

*Elicit K and R in order to write S*
Well ... Problems...

- The complexity of the Requirements Problem (Finding a “suitable” $S$ given $R$ and $K$)
- Qualitative versus Quantitative
- “The Problem is not at the Interface”
- The mappings of NAT and REQ ($R$ and $K$)
Problems ... Ubiquity

Ubiquitous Software Systems

- Main Ubiquitous Software Systems characteristics:

  Functional Characteristics
  Sensible, invisible, sometimes tolerant, heterogeneous, decentralized and interoperable...

  Restrictive Characteristics

  and we still need to assure their quality...

G. Travassos’s keynote at SBQS 2015, Manaus
Problems ... An instance of Ubiquity

Mapping quality requirements for pervasive mobile games
Luis Valente • Bruno Feijó • Julio Cesar Sampaio do Prado Leite
Problems ... The Interface Problem

DFD

(the "problem" at the interface) M.I.

(the "problem" is not at the interface) M.I.
Opposite Poles

Independent Elicitation

Model Driven Elicitation
Independent Elicitation

- Use of several MTT to gather information about the Universe of Discourse. Examples: Interviews, Questionnaires, Document Reading, Observation, Ethnography, Reverse Engineering, Reuse,..

- Universe of Discourse has different information sources, ranging from humans to devices.

- Repository for K and R: making the distinction.

- The Completeness Fallacy
Repository for Independent Elicitation

Elicitar  Elicit

F.Is  Information Sources

Universo de Informações  Universe of Discourse

Throw facts  Tira Fatos

Rastro  Trace

BAÚ DE FATOS  Fact repository

Modelar  Modelo

Linguagem

Repository for Independent Elicitation
Elicitation Tricks
Model Driven Elicitation

- Use of MTT to fill in the model
- The model operators and operands / nodes and edges are the “things” to elicit.
- K and R are implicit, since S is the target
- Depends on the richness of the model: MER, Use Case Diagram, KAOS, .... Each has a different set of operands and operators / nodes and edges.
- Usually there is more than one model (language) per S.
ER Diagram

https://en.wikipedia.org/wiki/Entity%E2%80%93relationship_model
DFD Diagram

Dardenne, van Lamsweerde, Fickas, *Goal-directed requirements acquisition*,
Opposite Poles

- No one is best
- Pros and Cons
  - Time
  - Previous Knowledge Available
  - Another team’s task
  - Coverage
  - Multiple languages for S
- Possible compromise policies
  - Evolution driven
  - Concurrent Engineering
  - Learning Organization
However ...

How to maintain the focus on the triplet K, S, R?
That is: If S is seen as the primary “object” how to avoid loosing contact with both K and R?
Is this just a traceability issue?

We need more.
How to be aware of K and R in S?
Definitions

- "Awareness is the ability to perceive, to feel, or to be conscious of events, objects, thoughts, emotions, or sensory patterns." (merriam-webster)

- Awareness is a fundamental requirement for software that needs to adapt itself to some degree.
  - Self-adapting provides to software the ability to deal with changes in the environment in which the software is inserted.

- The requirement of awareness, in its turn, provides the software the abilities to perceive what is happening in the environment, and "understand" how the environment changes, and how changes in the environment affect its proper functioning.

- Actors playing the role of a modeler needs to be aware about elicitation.
SIG for Awareness

Elicitation Awareness

- Elicitation Awareness by the modeler
- Elicitation Awareness by the model
- Question: how to bring this awareness to the process as well as to the models?
How Transparency may be of Help?

- Quality related to information access
- To be aware: there is a need to be informed
- Transparency improves efficacy of communication, thus helping sensing by humans and tagging the models
- Processes need to be more transparent as to improve human / agent awareness about elicitation
- S needs to be more transparent as to improve its awareness towards K, and R.
Transparency Network
Citizens

Focus on Citizens

Focus on Consumers (2)

Focus on Stakeholders (1)

Stakeholders: shareholders, customers, employees, suppliers.
• Consumers who use goods or service targeted by transparency policies.
Transparency Ladder
## Transparency Maturity Model

<table>
<thead>
<tr>
<th>Transparency SIG</th>
<th>Maturity Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level 2</td>
</tr>
<tr>
<td>Accessibility</td>
<td></td>
</tr>
<tr>
<td>公licity</td>
<td>CW</td>
</tr>
<tr>
<td>可得性</td>
<td>CW</td>
</tr>
<tr>
<td>可携性</td>
<td>CW</td>
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<tr>
<td>Usability</td>
<td></td>
</tr>
<tr>
<td>Operability</td>
<td>CW</td>
</tr>
<tr>
<td>可用性</td>
<td>CW</td>
</tr>
<tr>
<td>可持性</td>
<td>CW</td>
</tr>
<tr>
<td>Uniformity</td>
<td></td>
</tr>
<tr>
<td>可操作性</td>
<td>AM</td>
</tr>
<tr>
<td>可操作性</td>
<td>AM</td>
</tr>
<tr>
<td>Simplicity</td>
<td></td>
</tr>
<tr>
<td>可组合性</td>
<td>AM</td>
</tr>
<tr>
<td>可组合性</td>
<td>AM</td>
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<tr>
<td>Intuitiveness</td>
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<tr>
<td>可理解性</td>
<td>AM</td>
</tr>
<tr>
<td>可理解性</td>
<td>AM</td>
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<tr>
<td>Adaptability</td>
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<tr>
<td>可扩展性</td>
<td>AM</td>
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<tr>
<td>可扩展性</td>
<td>AM</td>
</tr>
<tr>
<td>Perforability</td>
<td></td>
</tr>
<tr>
<td>可适用性</td>
<td>AM</td>
</tr>
<tr>
<td>可适用性</td>
<td>AM</td>
</tr>
<tr>
<td>User-friendliness</td>
<td></td>
</tr>
<tr>
<td>易用性</td>
<td>AM</td>
</tr>
<tr>
<td>易用性</td>
<td>AM</td>
</tr>
<tr>
<td>Usability</td>
<td></td>
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<tr>
<td>Operability</td>
<td>CW</td>
</tr>
<tr>
<td>可用性</td>
<td>CW</td>
</tr>
<tr>
<td>可操作性</td>
<td>CW</td>
</tr>
</tbody>
</table>

### Legend:
- Weakly Comply (WC)
- Partially Comply (PC)
- Averagely Comply (AC)
- Comply (C)

Transparency Network
So What?

- “Software Engineering is Big Science” V. Basili
- Several of you here have been working in ways to promote more elicitation awareness.
- More is needed, both on the modeling side as well as on the process side.
- I will go over some ideas we have been working.
Software Oriented
Actor Oriented
The Strategic Actor Model

SA Model

∀ agent occupies position X → agent plays role covered by position X.
Out-of-Bounds Feedback
Information Source Diagram
Intentionality Panel

Antonio de Padua Albuquerque Oliveira: Engenharia Intencional: Um Método de Elicitação, Modelagem e Análise de Requisitos
An Example of Process

Diagram:

1. A - Build Lexicon
2. A - Prepare IP Diagrams
3. A - Identify Requirements
4. B - Extract Goals
5. B - Distinguish SDsituations
6. B - Write Requirements

Sources of Information

LEL
Goals and Softgoals
Goals List
IP Diagrams
SDsituations
Requirements
Requirements List
Requirements from Goals

Antonio de Padua Albuquerque Oliveira: Engenharia Intencional: Um Método de Elicitação, Modelagem e Análise de Requisitos
Another Process

EXTENDING i* WITH AWARENESS MODELING CONSTRUCTS

• Our proposal is to add, to i* models, abstractions that help software to perceive the environment with its inherent changes and to relate these new abstractions to other elements in the models that determine the software behavior:

**Situation** - is “the state of the real world at a certain moment or during an interval in time at a certain location”[12].

**Context** - is “a mechanism to describe situations by their defining features and group them into one unit” or in other words: “a context is a description of the current situation on an abstract level that can be matched against previously specified situations”[12].

  • A description can be constituted by “a number of conditions that can be evaluated to true or false, possibly with an assigned certainty”


Reusing non-functional patterns in i* modeling; H Cunha, JC Sampaio do Prado Leite Requirements Patterns (RePa), 2014 IEEE 4th International Workshop on, 25-32
Example of a Question Pattern for Context-Awareness

Initial

Context-awareness

- Help
- Help
- Help
- Computing environment
- Location
- Physical environment

Result

Context-awareness

- Help
- Help
- Physical environment
- Computing environment
- Location

Refinement Rules

R1 - Question Identification (physical environment): {"What data should be sensed and measured?", "What kind of sensors or instruments should be used?", "How can the information provided by sensors or instruments used be accessed?"}

R2 - Question Identification (computing environment): {"A middleware is used?", "What resources are available?", "How can the resources be accessed?", "How information is modeled?", "How information is stored?", "How information is retrieved?", "How information is exchanged among different actors?"}

R3 - Question Identification (location): {"Where is the user/device/software?", "Which coverage is necessary, local or global?", "Will the software operate in an indoor environment or in an open place?"}

Reusing non-functional patterns in i* modeling; H Cunha, JC Sampaio do Prado Leite
Requirements Patterns (RePa), 2014 IEEE 4th International Workshop on, 25-32

27/08/2015
EXTENDING i* WITH AWARENESS MODELING CONSTRUCTS

SRConstruct for the Awareness Requirement
# The Pattern Language

<table>
<thead>
<tr>
<th>Awareness requirement name</th>
<th>&lt;The name should follow the rule: Awareness [Topic] &gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Topic description:</strong></td>
<td>&lt;Brief description of the topic (problem domain) related to the awareness requirement&gt;</td>
</tr>
<tr>
<td><strong>Goal:</strong></td>
<td>&lt;The goal impacted by the context&gt;</td>
</tr>
<tr>
<td><strong>Awareness subtype:</strong></td>
<td>&lt;The awareness subtype (from awareness catalog) which is related to this requirement&gt;</td>
</tr>
<tr>
<td><strong>Suggested operationalization</strong></td>
<td>&lt;Suggested operationalization to this requirement. Some of them can be found in awareness catalog &gt;</td>
</tr>
<tr>
<td><strong>Alternative actions:</strong></td>
<td>&lt;The alternative means to achieve the goal impacted by the context&gt;</td>
</tr>
<tr>
<td><strong>Entity:</strong></td>
<td>&lt;The entity in which the context awareness element is anchored (what the context is about)&gt;</td>
</tr>
<tr>
<td><strong>Source of entity data:</strong></td>
<td>&lt;The source from where the entity data will be acquired&gt;</td>
</tr>
<tr>
<td><strong>Context description</strong></td>
<td>&lt;List of variables that enables the situations identification&gt;</td>
</tr>
</tbody>
</table>

## Domains of variable

<domain definition section for variables in context description>

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Domain</th>
</tr>
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<tbody>
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</table>

## Context situations specification

<specification section for the context situations>

<table>
<thead>
<tr>
<th>Situation name</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

## Alternative action choice

<specification of relations among situations and alternative actions>

<table>
<thead>
<tr>
<th>Situation</th>
<th>Alternative action</th>
<th>Impact</th>
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<tbody>
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Thanks

- This is a team work
- Several present and past collaborators
- Special thanks to the i* community
- [www.inf.puc-rio.br/~julio](http://www.inf.puc-rio.br/~julio)