On Requirements Visualization

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REV’07 - Monday 15th October, 2007 (India)
The Problem

• A meta-problem?
• Where is visualization used in RE?
• What for?
• Who for?
• With what results?

VISUALIZATION: “the act of forming a mental vision, image, or picture of (something not visible or present to the sight, or of an abstraction); to make visible to the mind or imagination.” [OED]
A Problem

- Do we SEE requirements?
- Can we render requirements visible?
- Can we gain some quick or new insight?
  - How do we know if our requirements are any good?
  - Are our requirements healthy? Credible?
- Visualizing the multi-dimensional nature of requirements:
  - Individual requirements
  - Sets of requirements
Can Visualization Help?

From page 157 of [1]:

Req #: 75
Req Type: 9 (functional requirement)
Event/Use Case #: 6
Description: The product shall issue an alert if a weather station fails to transmit readings.
Rationale: Failure to transmit readings might indicate that the weather station is faulty and needs maintenance, and that the data used to predict freezing roads may be compromised.
Source: Road Engineers
Fit Criterion: For each weather station, the product shall issue an alert when the number of readings per hour is not within the expected number of readings per hour.
Customer Satisfaction: 3
Customer Dissatisfaction: 5
Dependencies: None
Conflicts: None
Supporting Materials: Specification of Rosa Weather Station
History: Raised by GBS, 28 July 99

From page 159 of [1]:

Req #: 110
Req Type: 11 (non-functional requirement - usability)
Event/Use Case #: 6, 7, 8, 9, 10
Description: The product shall be easy for the road engineers to use.
Rationale: Failure to transmit readings might indicate that the weather station is faulty and needs maintenance, and that the data used to predict freezing roads may be compromised.
Source: Road Engineers
Fit Criterion: For each weather station, the product shall issue an alert when the number of readings per hour is not within the expected number of readings per hour.
Customer Satisfaction: 3
Customer Dissatisfaction: 5
Dependencies: None
Conflicts: None
Supporting Materials: Specification of Rosa Weather Station
History: Raised by GBS, 28 July 99

From website of [1]:

Req #: 74
Req Type: 9 (functional requirement)
Event/Use Case #: 7, 9
Description: The product shall record all the roads that have been treated.
Rationale: To be able to schedule untreated roads and highlight potential danger.
Source: Arnold Snow, Chief Engineer
Fit Criterion: For each weather station, the product shall issue an alert when the number of readings per hour is not within the expected number of readings per hour.
Customer Satisfaction: 3
Customer Dissatisfaction: 5
Dependencies: None
Conflicts: None
Supporting Materials: None
History: Created February 29, 2006

What’s Been Created?

• 3 ideas:
  – Individual requirement’s footprint
  – Snapshot of health (requirements set) focusing on possible concerns associated with a few important properties
  – Overall big picture (requirements set) focusing on stability / volatility
## Requirement’s Footprint

<table>
<thead>
<tr>
<th>#</th>
<th>attribute name</th>
<th>[type]</th>
<th>(content)</th>
<th>{symbol}</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>requirement no</td>
<td>[number]</td>
<td>(000)</td>
<td>{square}</td>
</tr>
<tr>
<td>2</td>
<td>requirement type</td>
<td>[number]</td>
<td>(00)</td>
<td>{square}</td>
</tr>
<tr>
<td>3</td>
<td>events/use cases list</td>
<td>[references]</td>
<td>(000)-(000)-(000)-...</td>
<td>{linked ovals}</td>
</tr>
<tr>
<td>4</td>
<td>description</td>
<td>[text]</td>
<td>(abc...)</td>
<td>{expanding circle}</td>
</tr>
<tr>
<td>5</td>
<td>rationale</td>
<td>[text]</td>
<td>(abc...)</td>
<td>{expanding circle}</td>
</tr>
<tr>
<td>6</td>
<td>originator</td>
<td>[reference or text]</td>
<td>(000)/(abc...)</td>
<td>{square}/{expanding circle}</td>
</tr>
<tr>
<td>7</td>
<td>fit criterion/tests</td>
<td>[text]</td>
<td>(abc...)</td>
<td>{expanding circle}</td>
</tr>
<tr>
<td>8</td>
<td>customer satisfaction</td>
<td>[range]</td>
<td>(1,2,3,4,5)</td>
<td>{upward vertical arrow}</td>
</tr>
<tr>
<td>9</td>
<td>customer dissatisfaction</td>
<td>[range]</td>
<td>(1,2,3,4,5)</td>
<td>{downward vertical arrow}</td>
</tr>
<tr>
<td>10</td>
<td>priority</td>
<td>[range]</td>
<td>(?)</td>
<td>{upward vertical arrow}</td>
</tr>
<tr>
<td>11</td>
<td>conflicts list</td>
<td>[references]</td>
<td>(000)-(000)-(000)-...</td>
<td>{linked squares}</td>
</tr>
<tr>
<td>12</td>
<td>supporting materials</td>
<td>[references]</td>
<td>(000)-(000)-(000)-...</td>
<td>{linked circles}</td>
</tr>
<tr>
<td>13</td>
<td>history</td>
<td>[text or list or references]</td>
<td>(abc...)/(000)-(000)-(000)-...</td>
<td>{expanding circle}/{linked circles}</td>
</tr>
</tbody>
</table>
Empty Requirement
Visual Mapping (i)

From page 159 of [1]:

**Req #:** 110  
**Req Type:** 11 (non-functional requirement - usability)  
**Event/Use Case #:** 6, 7, 8, 9, 10  
**Description:** The product shall be easy for the road engineers to use.  
**Rationale:** It should not be necessary for the engineers to attend training classes in order to be able to use the product.  
**Source:** Sonia Henning, Road Engineering Supervisor  
**Fit Criterion:** A road engineer shall be able to use the product to successfully carry out the cited use cases within 1 hour of first encountering the product.  
**Customer Satisfaction:** 3  
**Customer Dissatisfaction:** 5  
**Dependencies:** None  
**Conflicts:** None  
**Supporting Materials:**

|   | requirement no (110)  
|---|---------------------|---|--------------------------|---|-----------------------------|---|-----------------|---|----------------------------|
| 1 | requirement type (11)  
| 2 | events/use cases list (006)-(007)-(008)-(009)-(010)  
| 3 | description (11 words)  
| 4 | rationale (21 words)  
| 5 | source (5 words)  
| 6 | fit criterion/tests (26 words)  
| 7 | customer satisfaction (3)  
| 8 | customer dissatisfaction (5)  
| 9 | priority (? not given)  
| 10 | conflicts list (000)  
| 11 | supporting materials (void)  
| 12 | history (6 words)  

**History:** Raised by AG 25 Aug 99

Crude to automate; plan to make more of semantics

*NB 'Dependencies: None' does not fit shell*
Visual Mapping (ii)

1 requirement no (110)
2 requirement type (11)
3 events/use cases list (006)-(007)-(008)-(009)-(010)
4 description (11 words)
5 rationale (21 words)
6 source (5 words)
7 fit criterion/tests (26 words)
8 customer satisfaction (3)
9 customer dissatisfaction (5)
10 priority (? not given)
11 conflicts list (000)
12 supporting materials (void)
13 history (6 words)

NB 'Dependencies: None' does not fit shell
Resulting Visualization
From website of [1]:
Req #: 74
Req Type: 9 (functional requirement)
Event/Use Case #: 7, 9
Description: The product shall record all the roads that have been treated.
Rationale: To be able to schedule untreated roads and highlight potential danger.
Source: Arnold Snow, Chief Engineer
Fit Criterion: The recorded treated and untreated roads shall agree with the drivers’ road treatment logs.
Customer Satisfaction: 3
Customer Dissatisfaction: 5
Dependencies: None
Conflicts: None
Supporting Materials: None
History: Created February 29, 2006

Another Mapping

NB 'requirement no' changed to avoid conflict with another example
Resulting Visualization
How Does it Work?

- Lengthy rationale provided
- Attribute values missing
- If this is HUGE - there is going to be a lot of history to deal with
- Lengthy fit criteria
- Supports fewer use cases than #110
- Customer’s going to be peeved if this isn’t implemented
On Requirements Visualization

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Stakeholder groups

Stakeholders

Requirements

Event/use cases

www.systemsguild.com/GuildSite/Robs TEMPLATE.html

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## Requirements Health Check

<table>
<thead>
<tr>
<th>REQ</th>
<th>Value</th>
<th>Source</th>
<th>Rationale</th>
<th>Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td># 74</td>
<td><img src="emoji" alt="Sad" /></td>
<td><img src="emoji" alt="Happy" /></td>
<td><img src="emoji" alt="Happy" /></td>
<td><img src="emoji" alt="Happy" /></td>
</tr>
<tr>
<td># 75</td>
<td><img src="emoji" alt="Sad" /></td>
<td><img src="emoji" alt="Neutral" /></td>
<td><img src="emoji" alt="Happy" /></td>
<td><img src="emoji" alt="Happy" /></td>
</tr>
<tr>
<td># 110</td>
<td><img src="emoji" alt="Sad" /></td>
<td><img src="emoji" alt="Happy" /></td>
<td><img src="emoji" alt="Happy" /></td>
<td><img src="emoji" alt="Happy" /></td>
</tr>
</tbody>
</table>
Requirements Big Picture

Stakeholder groups

Stakeholders

Requirements

Events/use cases

#74

#75

#110
Validation, Critique, Next Steps?

• These are **visions** of visualization possibilities in RE … there is a lot to do!
• Currently: simple - can be automatically generated and support a small set of questions / tasks
• Future: a collection of visual renderings to support multiple tasks, more use of semantics, user consultation
WANTED!

VISUALIZATIONS FOR REQUIREMENTS ENGINEERING

YOUR VIZ HERE!!!

REWARD

FAME, GLORY & ALL THAT STUFF...

IN PROCEEDINGS OF THE 3RD INTERNATIONAL WORKSHOP ON REQUIREMENTS ENGINEERING VISUALIZATION, 2008?
Questions for You…

• Current visualizations in RE:
  – Create a list of what there is
  – What are they used for?
  – Who by?
  – Do they work?
  – Do you use them / like them?

• What questions / tasks do we struggle with in RE?

• Could visualization support some of these?