



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 weather station is faulty and needs me used to predict freezing roads may be Source: Road Engineers
Fit Criterion: For each weather station communicate to the user when the reading per hour is not within the man the expected number of readings per hour
Customer Satisfaction: 3
Customer Dissatisfaction: 5
Dependencies: None
Conflicts: None
Supporting Materials: Specification 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: use.
Rationale: Failure to transmit reading weather station is faulty and needs me used to predict freezing roads may be Source: Road Engineers
Fit Criterion: For each weather station communicate to the user when the reading per hour is not within the man the expected number of readings per hour
Customer Satisfaction: 3
Customer Dissatisfaction: 5
Dependencies: None
Conflicts: None
Supporting Materials: Specification 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: 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

[1] Robertson, S. AND Roberson, J. Mastering the Requirements Process. ACM Press, 1999 (www.systemsguild.com/GuidSite/RobTemplate.html)

For me!

WANTED!
VISUALIZATIONS FOR REQUIREMENTS ENGINEERING

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Event/Use Case #: 6
Description: The product shall issue weather station is faulty and needs me used to predict freezing roads may be Source: Road Engineers
Fit Criterion: For each weather station communicate to the user when the reading per hour is not within the man the expected number of readings per hour
Customer Satisfaction: 3
Customer Dissatisfaction: 5
Dependencies: None
Conflicts: None
Supporting Materials: Specification 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: use.
Rationale: Failure to transmit reading weather station is faulty and needs me used to predict freezing roads may be Source: Road Engineers
Fit Criterion: For each weather station communicate to the user when the reading per hour is not within the man the expected number of readings per hour
Customer Satisfaction: 3
Customer Dissatisfaction: 5
Dependencies: None
Conflicts: None
Supporting Materials: Specification 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: 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

REWARD
FAME, GLORY & ALL THAT STUFF...

FROM "ON REQUIREMENTS VISUALIZATION" BY ORLENA G. GOTEL, FRANCIS J. MARCHESE AND STEPHEN J. MORRIS, IN PROCEEDINGS OF THE 2ND INTERNATIONAL WORKSHOP ON REQUIREMENTS ENGINEERING VISUALIZATION, 2007.

For you!

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

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

□□○●○○○●↑↑↑□○○

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:
History: Raised by AG 25 Aug 99

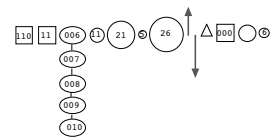
- 1 requirement no (110)
- 2 requirement type (11)
- 3 events/use cases list (006)-(007)-(008)-(009)-(010)
- 4 description (11 words)
- 5 rationale (21 words)
- 6 source (5 words)
- 7 fit criterion/tests (26 words)
- 8 customer satisfaction (3)
- 9 customer dissatisfaction (5)
- 10 priority (? not given)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

NB 'Dependencies: None' does not fit shell

Crude to automate; plan to make more of semantics

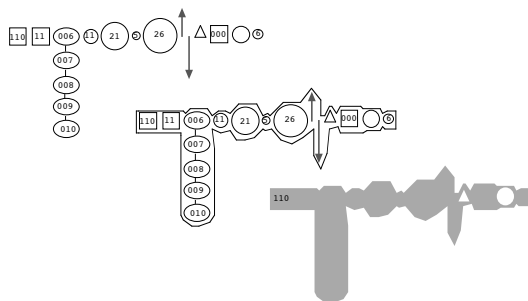
Visual Mapping (ii)

- 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)



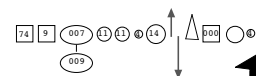
NB 'Dependencies: None' does not fit shell

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

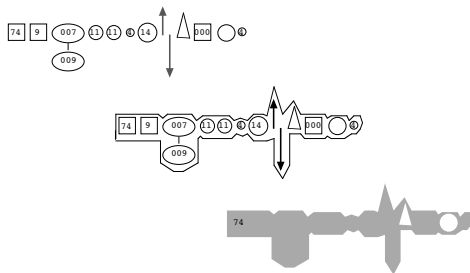
Another Mapping



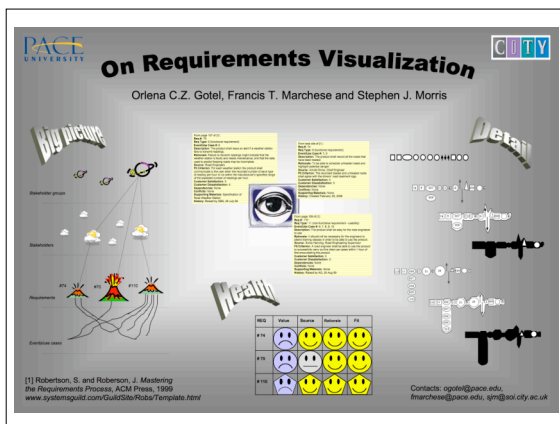
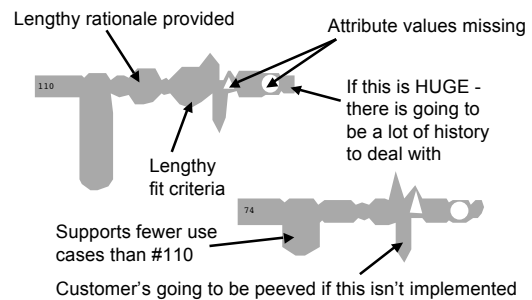
- 1 requirement no (74)
- 2 requirement type (9)
- 3 events/use cases list (007)-(008)-(009)
- 4 description (11 words)
- 5 rationale (11 words)
- 6 source (4 words)
- 7 fit criterion/tests (14 words)
- 8 customer satisfaction (3)
- 9 customer dissatisfaction (5)
- 10 priority (void)
- 11 conflicts list (000)
- 12 supporting materials (void)
- 13 history (4 words)

NB 'requirement no' changed to avoid conflict with another example

Resulting Visualization



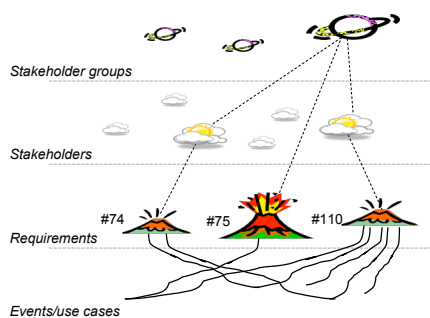
How Does it Work?



Requirements Health Check

REQ	Value	Source	Rationale	Fit
# 74				
# 75				
# 110				

Requirements Big Picture



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





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?

