



On Requirements Visualization

Orlena Gotel, Pace University, New York

Francis Marchese, Pace University, New York

Stephen Morris, City University, London

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 a warning if the weather station fails to transmit readings.

Rationale: Failure to transmit reading from a weather station is faulty and needs maintenance. A weather station used to predict freezing roads may be faulty.

Source: Road Engineers

Fit Criterion: For each weather station, the product shall communicate to the user when the recorded reading per hour is not within the manufacturer's expected number of readings per hour.

Customer Satisfaction: 3

Customer Dissatisfaction: 5

Dependencies: None

Conflicts: None

Supporting Materials: Specification of 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 use.

Rationale: The product shall use training data.

Source: S

Fit Criterion: The product shall be successful in encountering

Customer Satisfaction: 3

Customer Dissatisfaction: 5

Dependencies: None

Conflicts: None

Supporting Materials: None

History: Raised by AG 29 Aug 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/GuildSite/Robs/Template.html)

For me!

WANTED!

VISUALIZATIONS FOR REQUIREMENTS ENGINEERING

From page 157 of [1] :

Req #: 75

Req Type: 9 (functional requirement)

Event/Use Case #: 6

Description: The product shall issue fails to transmit readings.

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

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:

training cla

Source: S

Fit Criterion:

successful

encounteri

Customer

Customer

Dependen

Conflicts:

Supportin

History: R

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/GUILDSITE/ROBS/TEMPLATE.HTML).

REWARD

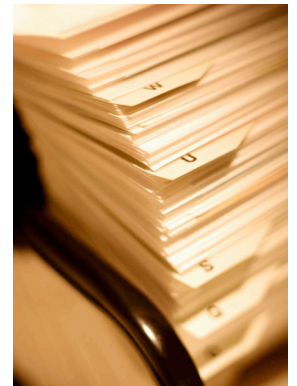
FAME, GLORY & ALL THAT STUFF...

FROM: "ON REQUIREMENTS VISUALIZATION" BY ORLENA C.Z. GOTEL, FRANCIS T. 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

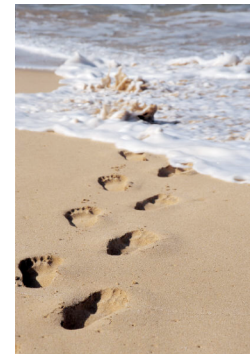
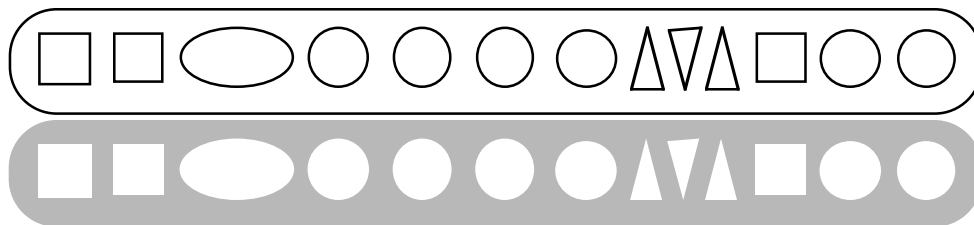
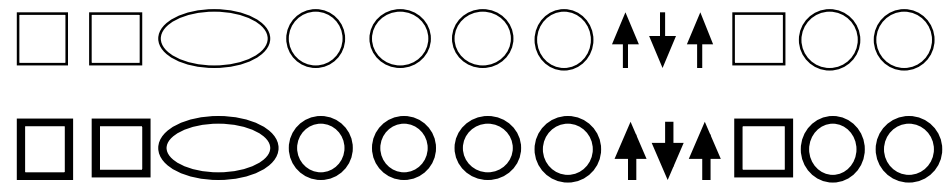


Requirement's Footprint

#	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

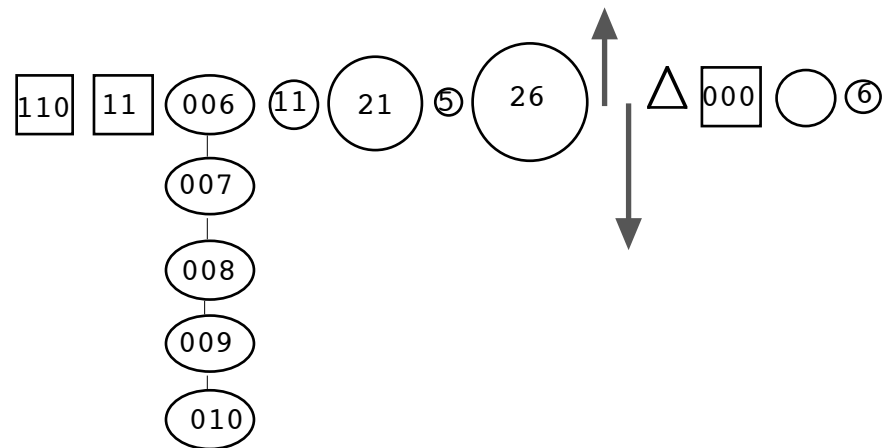
- 1 requirement no (110)
- 2 requirement type (11)
- 3 events/use cases list (006)-(007)-(008)-(009)-(010)
- 4 description (11 words)
- 5 rationale (21 words)
- 6 source (5 words)
- 7 fit criterion/tests (26 words)
- 8 customer satisfaction (3)
- 9 customer dissatisfaction (5)
- 10 priority (? not given)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

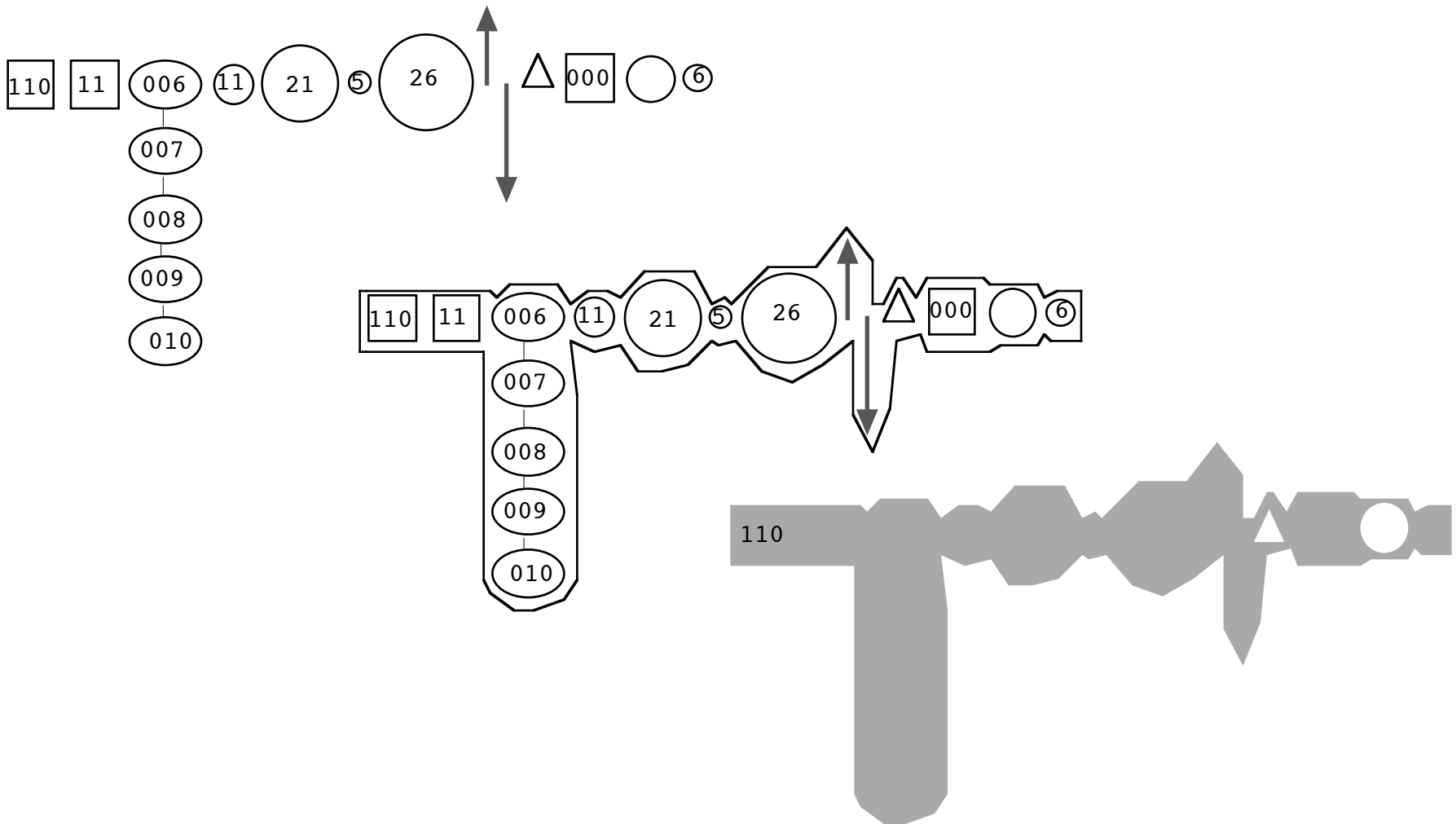
Visual Mapping (ii)

- 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

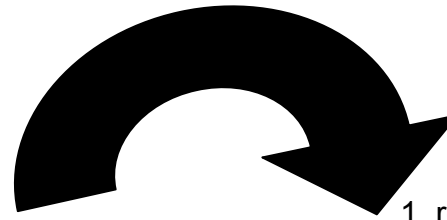
Customer Dissatisfaction: 5

Dependencies: None

Conflicts: None

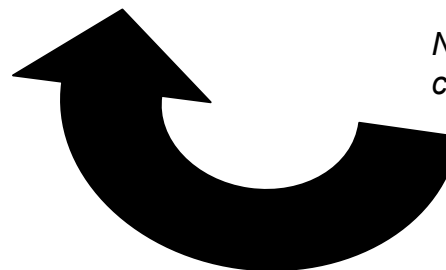
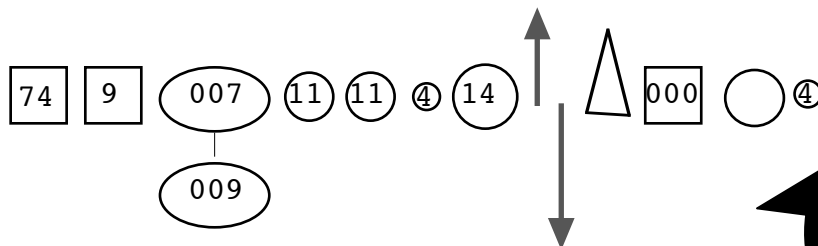
Supporting Materials: None

History: Created February 29, 2006



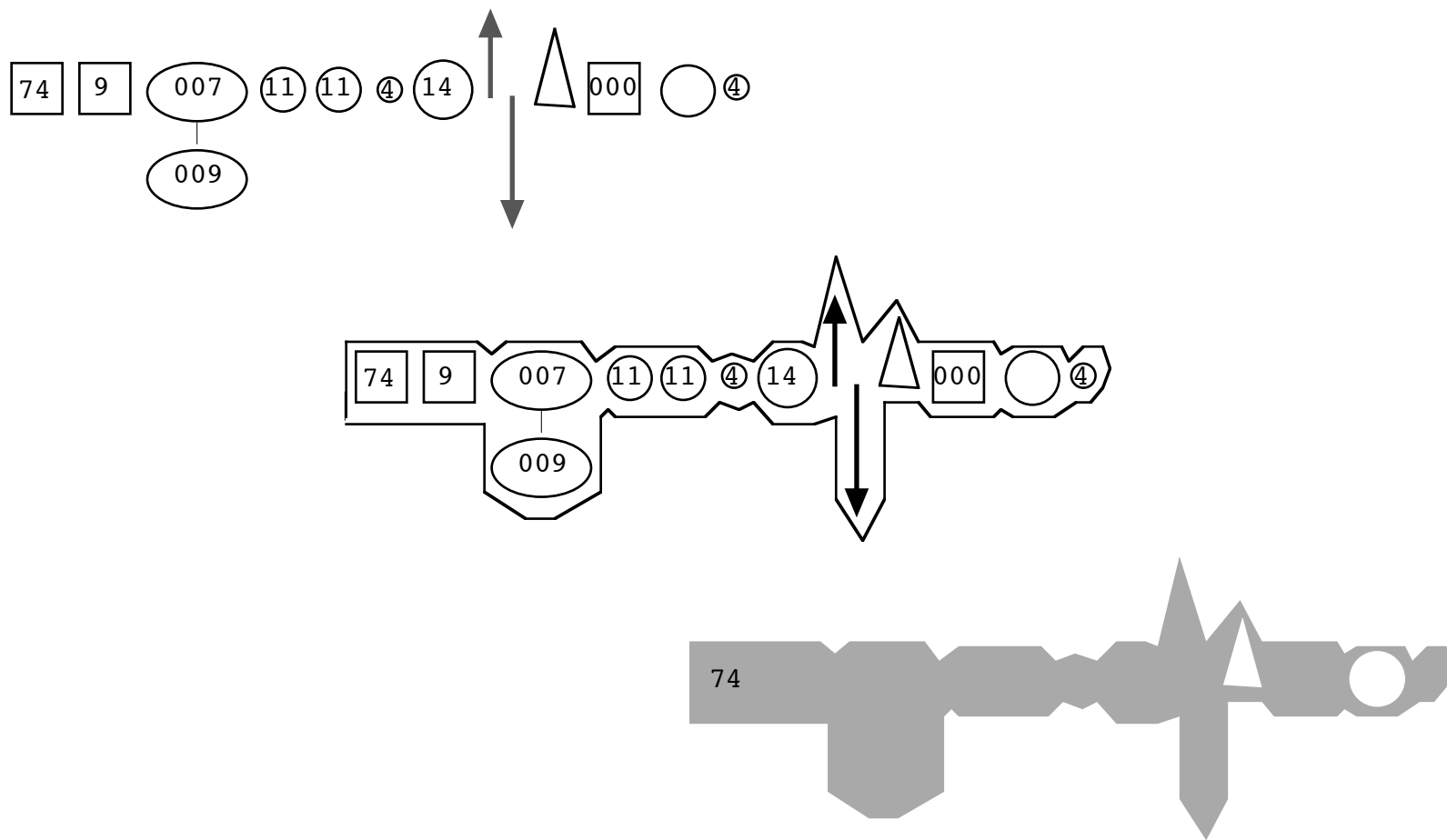
- 1 requirement no (74)
- 2 requirement type (9)
- 3 events/use cases list (007)-(009)
- 4 description (11 words)
- 5 rationale (11 words)
- 6 source (4 words)
- 7 fit criterion/tests (14 words)
- 8 customer satisfaction (3)
- 9 customer dissatisfaction (5)
- 10 priority (void)
- 11 conflicts list (000)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

Another Mapping

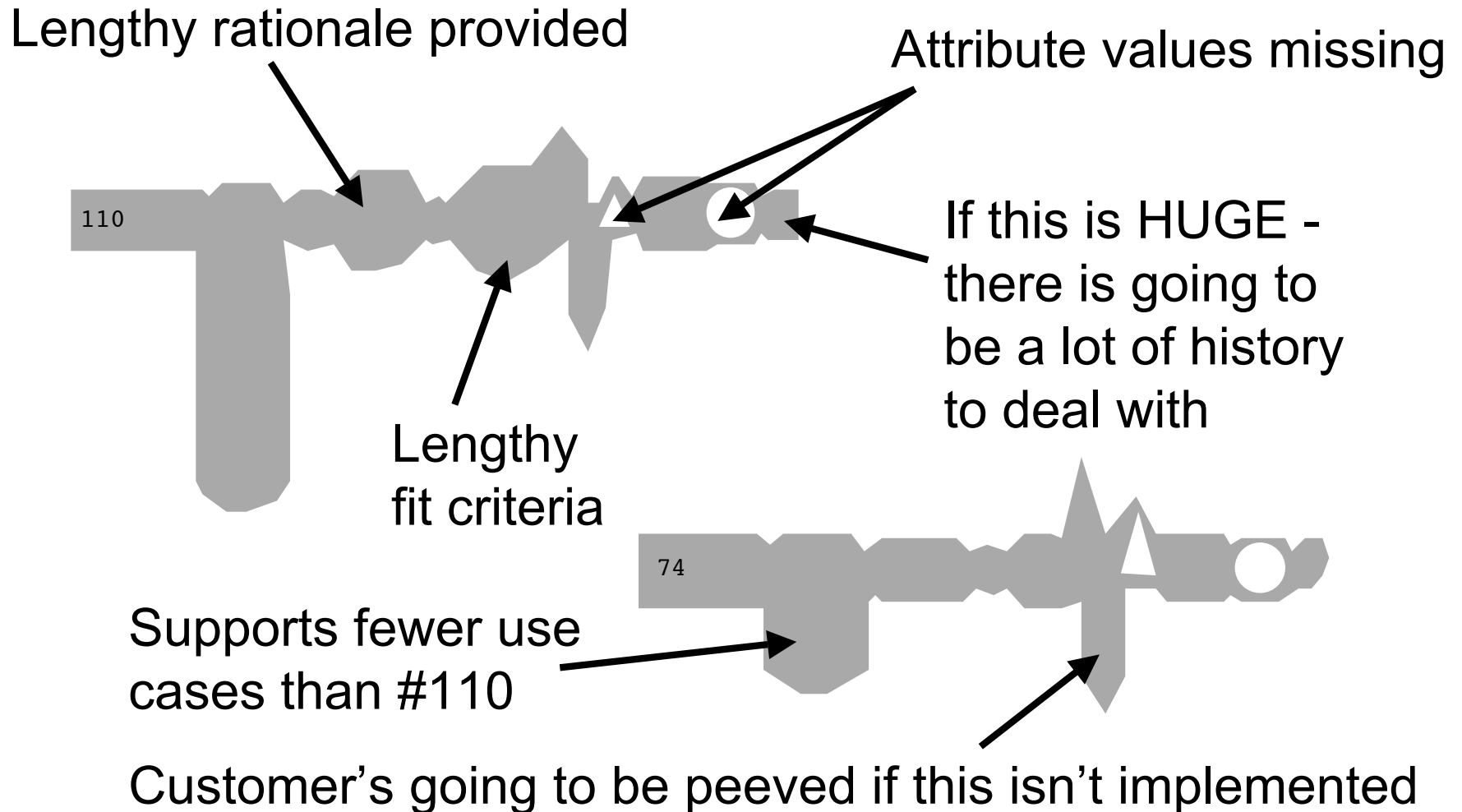


NB 'requirement no' changed to avoid conflict with another example

Resulting Visualization



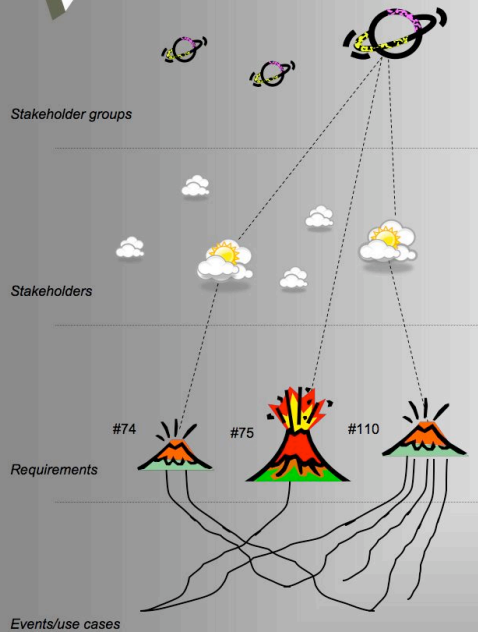
How Does it Work?



On Requirements Visualization

Orlena C.Z. Gotel, Francis T. Marchese and Stephen J. Morris

Big picture



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 incomplete.
Source: Road Engineers
Fit Criterion: For each weather station the product shall communicate to the user when the recorded number of each type of reading per hour is not within the manufacturer's specified range of 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, 26 July 99



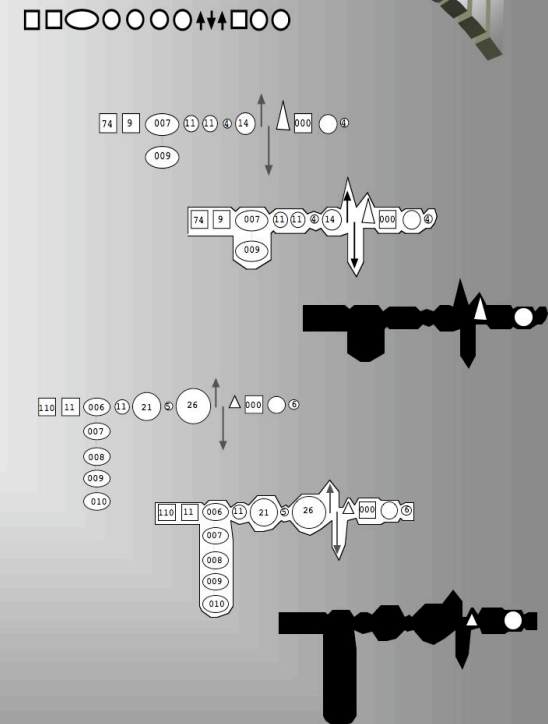
From web site of [1]:
Req #: 74
Req Type: 9 (functional requirement)
Event/Use Case #: 7, 9
Description: The product shall record all the roads that have been treated.
Rationale: To be able to schedule untreated roads and highlight potential danger.
Source: Arnold Snow, Chief Engineer
Fit Criterion: 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

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: None
History: Raised by AG, 25 Aug 99

Health

REQ	Value	Source	Rationale	Fit
# 74				
# 75				
# 110				






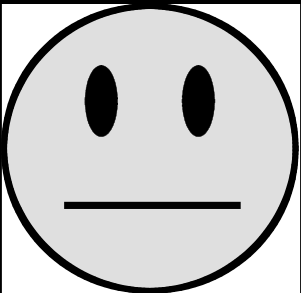


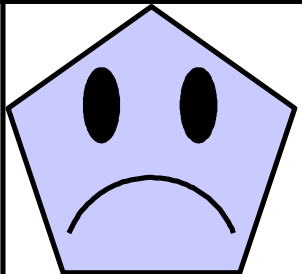
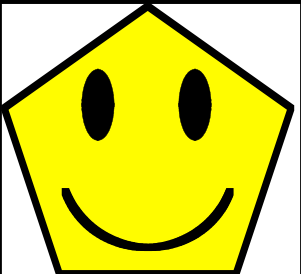
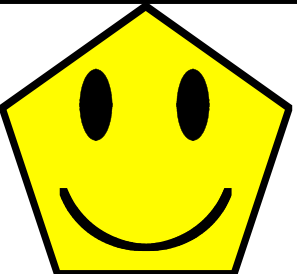
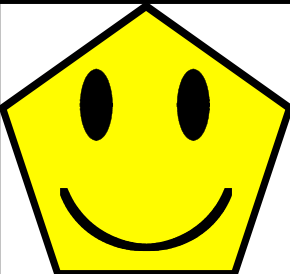
Detail



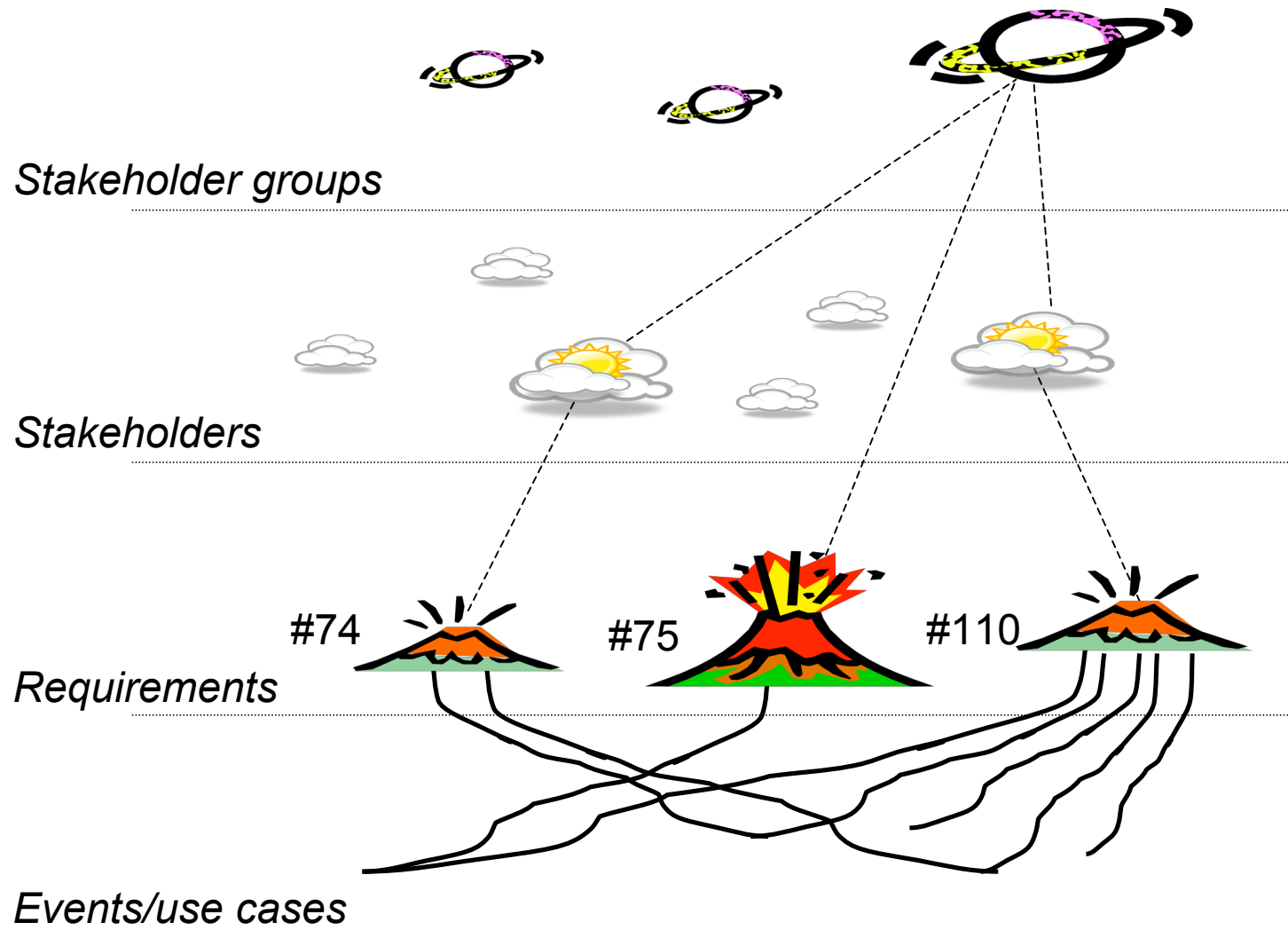
[1] Robertson, S. and Roberson, J. *Mastering the Requirements Process*, ACM Press, 1999
www.systemsguild.com/GuildSite/Robs/Template.html

Contacts: ogotel@pace.edu,
fmarchese@pace.edu, sjm@soi.city.ac.uk

Requirements Health Check

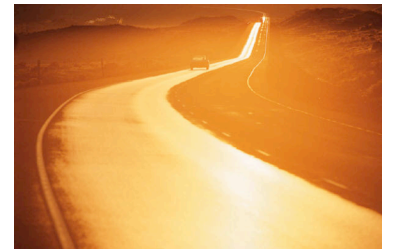
REQ	Value	Source	Rationale	Fit
# 74				
# 75				
# 110				

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



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?

