Tackling the Requirements

Jigsaw Puzzle

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Presentation outline

- Problem
- Background and motivation
- Proposal
- Evaluation
- Conclusion
- Future work
It needs to be red colour!

Be sure it is nothing but yellow!
How can we enable them (the stakeholders) to see the implications of the requirements in each other?

We can show them the SRS or the Use Cases... and try to convince them.

Yeah! But the best would be if they could see by themselves and together we could find a solution!
Problem

Present the requirements and conflicts in a way that fosters

- **co-responsibility & co-ownership**
  - the software system solution is not (only) a RE analyst problem

➢ Need – explicit representation
Background and motivation

- Good techniques to identify and handle
  - ambiguity (Berry et al)
  - inconsistency (e.g. NFRF, viewpoint-based, modelling languages)

- Not appropriate to communicate with stakeholders - heterogeneous background (non SE expert)

- Need new approach – separation of:
  - processing information about conflicts from
  - the issue of communication those conflicts
Background and motivation

- Gotel: use of (good) **visual metaphors** for RE
  - geometric metaphors (UML, i*)
    - need to be learned, not suited when there is no org.
  - other visual (City – Knight/Panas/Wettel, Landscape - Balzer)
    - used for artifacts already existing

- RE and **creativity**  - Robertson02, Maiden04,05,07
  - analogical reasoning techniques
    - analogies difficult to understand
Stakeholders work together with the req. eng. to create ideas for new systems.

- Need new visual metaphors
- Easy to understand visual analogies
- Analogies for artifacts that are being built
Proposal

- Two well understandable analogies
  - Jigsaw puzzle – we are building a system
  - [Boccuzzo07] – badly-shaped means badly-designed
- Metrics: well-shaped house (...) – well-designed class

Requirements Jigsaw Puzzle
Proposal

- Jigsaw puzzle piece represents a requirement
  - when the requirement text contains conflicts with other requirements
  - the respective puzzle pieces almost fit together but not perfectly

- It communicates explicitly that exists a problem!
Proposal - Crisis Management System SRS text

- **Availability**
  1. The **system** shall be in operation **24 hours a day, everyday, without break, throughout the year except for a maximum downtime of 2 hours every 30 days for maintenance.**
  2. The system shall **recover in a maximum of 30 seconds upon failure.**

- **Real-time**
  1. The **control centre** shall **receive and update** the following information on an on-going crisis **at intervals not exceeding 30 seconds:** resources deployed; civilian casualties...
  2. The delay in communication of information between control centre and rescue personnel as well as amongst rescue personnel shall not exceed **500 milliseconds.**
Proposal - Crisis Management System jigsaw puzzle

A. AVAILABILITY
1. IN OPERATION: 24 h/day, everyday, no break, except max. downtime for maintenance: 2 h each 30 d
2. MAX. RECOVER UPON FAILURE: 30 seconds
3. MAINTENANCE shall postpone or interrupt, if crisis imminent.

B. RELIABILITY
1. MAX. FAILURE RATE: 0.001%
2. MOBILE COMMUNICATION on every location, terrain, weather

D. REAL TIME
1. CONTROL CENTRE UPDATE INFORMATION max. interval: 30 seconds
2. COMMUNICATION with RESCUE PERSONNEL max. delay: 500 milliseconds
3. INFORMATION RETRIEVAL max. delay: 500 milliseconds

K. ACCURACY
1. MAP, TERRAIN, WEATHER DATA with accuracy: 99%
2. PROVIDE UP-TO-DATE INFO
3. RECORD RECEIVED DATA without modifications
4. COMMUNICATION with RESCUE RESOURCES max. deterioration factor: 0.0001 per 1000 kilometres
Proposal

1. Identify most problematic conflicts to make them visual explicit
2. Jigsaw puzzle metaphor in action improving co-responsability in a fun and serene environment
3. Conflicts in NFRs discussion
4. Effective depiction for NFRs and its conflicts: Jigsaw puzzle metaphor
Evaluation - hypotheses

- H1: Jigsaw puzzle game promotes a relaxed environment
- H2: Increased effectiveness in communication and handling of conflicts, when compared with text
- H3: Foster team work and communication improving co-authoring and co-responsibility
Evaluation - methodology

- Experiments emulating a meeting planned for 2hrs
  - Collaborated as group, offering comments
  - Handled the pieces, picking them up of the table and showing to others
  - Assembled the puzzle, trying different strategies
  - Discussed conflicts, searching for consensus
  - Handwrote a consensus list of conflicts and possible solutions
  - Found all the conflicts we were aware + some we had not thought a priori
  - Had fun!
Evaluation - analysis

- Users do prefer the jigsaw puzzle than textual presentation
- The detection of conflicts was almost always more efficient with the jigsaw puzzle presentation
- Users easily engaged in team work
  - co-responsibility and creative attitude
- Users would like to have a digital jigsaw puzzle
  - but some do not want to abandon the physical puzzle
**Evaluation - conclusions**

- Jigsaw puzzle metaphor and its work mode
  - promotes fun, relaxation, creativity
  - no need to introduce a game in the meeting
    - the tool in use is a game - jigsaw puzzle!
  - the participants scan for conflicts
    - increases stakeholders’ awareness that this is their problem too, and thus commitment
Evaluation - conclusions

- Jigsaw puzzle metaphor and its work mode
  - the participants use a common “document”
    - instead of each one its own (usual mode)
  - promotes team cooperation
- meetings perceived as fun
  - eases the recruitment of participants
Evaluation - threats to validity

- Clarify bias
  - Formatting of the text in the pieces
  - Investigators also acting as meeting facilitators
  - Reporting and analysing results

- Rich thick descriptions

- Report discrepant information

- Avoid familiarity and learning – different examples

- Tiredness effect – reverse the order of text/jigsaw

- Give ‘same’ information for text as for jigsaw puzzle
Conclusion

- Jigsaw puzzle metaphor
  - adequate relevant communication means to discuss requirements / conflicts - makes them explicit
    - Easily understandable language
    - Gaming nature of the language
- Crucial separation of processing information about conflict from communication of conflicts
Future work

- Develop realisation of the approach
  - integration of the tools to detect/rank conflicts
  - connection between conflict detection and communication mechanism
  - Jig3P: what text treatment? how lay down pieces?
  - integration with the remaining tasks of system development
Future work

- Jigsaw puzzle supported digitally
  - real-time intelligent interaction
    - add/update/remove requirements
  - collaborative functionalities: differentiate each participant’s contributions
  - digital recognition of work done in physical pieces
    - enable work with both physical and digital pieces
Thanks!

Do you have any questions?
Evaluation – design

- Unit of analysis – small group (3 to 5) participants
  - Experiment 1 – all requirement engineers
  - Experiment 2 – at least one RE expert, others engineers from computing and no computing
  - Experiment 3 – one RE expert, one engineer with no RE knowledge, and a manager

- Data collection techniques
  - Participant observation (audio and video record analysis)
    - Brainstorm and think aloud
  - Reports written by one element on behalf of the group
  - Questionnaires