Gameplay to Introduce and Reinforce Requirements Engineering Good Practices

Renel Smith and Orlena Gotel
Pace University, New York

RE’08 - Thursday 11th September, 2008 (Barcelona)
Problem

- Learning about RE practices can be boring / costly:
  - Too much textually dense material
  - Have to grab attention quickly (within 1-2 hours)
- Many RE practices rely on participation with others and discursive activities
- Practices make better sense if contextualized
- Practices are not retained if not used
Objectives / Method

- Focus on awareness of key practices, their value, role of negotiation / decision making
- Review RE good practices and identify a lightweight set to help small novice organizations in requirements efforts
- Develop a simple game to teach RE good practices to novice requirements engineers by reinforcing a small set of lessons based upon the above
Research Questions

1. Which RE practices are well-suited for a academic and same setting (i.e., a lightweight set of RE practices)?

2. Assuming that it is possible to develop easy-to-adopt RE good practices that suit the needs of academia and small organizations, what are the desirable characteristics of a method to introduce them?

3. Following from the agile community, can a game be an effective method of introducing these lightweight RE practices in academia and small organizations?

4. What are the benefits to be derived from an interactive game built around RE good practices?
Challenges and Good Practices

1. Incomplete or ambiguous requirements
2. Insufficient rigor
3. Inadequate for development
4. Overemphasis on functional requirements
5. Problem not recognized
6. Current practices lag best practices
7. Lack of maturity and guidance
8. Perceived impracticability
9. Lack of awareness
10. Admitting mistakes
11. Selling idea to management
12. Increased short-term cost
13. Self-interest

Sommerville and Sawyer: RE Good Practice Guide (REGPG)

Ian Alexander: “10 Small Steps To Better Requirements”

Ralph Young: “Ten Effective Requirements Practices”

Karl Wiegers: “10 Requirements Traps to Avoid”
Gameplay Prerequisites

- Players new(ish) to RE
- Players from same domain
- Played in conjunction with RE training
- Facilitated
- Contextualized:
  - One to two hours introduction
  - Organization-specific projects
- Fast play / time-boxing
RE-O-Poly Game Concepts

- Based on Monopoly
- Money -> Stakeholder Satisfaction Points
- Board
- Chance -> Scenarios
- Community Chest -> Tasks
- Properties -> Projects
- Wild Cards
- Board circuits -> Iterations
- Decks to keep
RE-O-POLY: A GAME TO INTRODUCE LIGHTWEIGHT
REQUIREMENTS ENGINEERING GOOD PRACTICES

Renel Smith and Orelana Gotel
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This work reviews the many good RE practices described in the literature and identifies a lightweight set that will help small novice organizations in their requirements development efforts. It proposes a game-based approach to do this. RE-O-Poly is based on the popular game Monopoly and is intended to teach RE good practices to novice requirements engineers by reinforcing lessons previously learned.

Good Practices that Target RE Challenges

<table>
<thead>
<tr>
<th>Good Practices</th>
<th>Description</th>
<th>Benefits</th>
<th>Challenges Addressed (See Paper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
<td>An integral that a stakeholder has for a development project.</td>
<td>Translates into one or more business goals.</td>
<td>1,2,3,4,11</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Anyone who gives or uses something as a result of that project.</td>
<td>Ensures relevant requirements are those stakeholder priorities.</td>
<td>1,3,4,11,12</td>
</tr>
<tr>
<td>Structure</td>
<td>Use a standard structure in requirements documents.</td>
<td>Provides higher quality and lowers cost of requirements documents.</td>
<td>1,3,4</td>
</tr>
<tr>
<td>Verifying</td>
<td>Make the document easy to change.</td>
<td>Reduces costs of changing requirements.</td>
<td>2</td>
</tr>
<tr>
<td>Identifiers</td>
<td>Uniquely identify each requirement.</td>
<td>Provides unambiguous reference to specific requirements.</td>
<td>2</td>
</tr>
<tr>
<td>Policy</td>
<td>Use policies for requirements management and conflict resolution.</td>
<td>Provides guidance for all involved in requirements management and conflict resolution.</td>
<td>All</td>
</tr>
<tr>
<td>Templates</td>
<td>Use standard templates for representing individual requirements.</td>
<td>Presents requirements in a consistent way so they are more understandable.</td>
<td>1,3</td>
</tr>
<tr>
<td>Language</td>
<td>Use language precisely, consistently and concisely.</td>
<td>Presents requirements that are easier to read and understand.</td>
<td>1,7</td>
</tr>
<tr>
<td>Inspections</td>
<td>Organize formal requirements inspections and acceptance tests.</td>
<td>Ensures high percentage of requirements are collected.</td>
<td>1,2,3,5</td>
</tr>
<tr>
<td>Checklists</td>
<td>Use checklists for validation and analysis.</td>
<td>Helps to focus the validation process.</td>
<td>2,3,5</td>
</tr>
</tbody>
</table>

RE-O-Poly is designed for players new to RE. It is meant to be used in conjunction with RE training and to have a facilitator. Key game concepts include:
- Stakeholder Satisfaction Points (SSPs), which players earn or forfeit as the game progresses.
- Projects for the player to own, run and buy resources for, using SSPs and undertaking tasks.
- Scenario Cards, which show what happens when good RE practices are implemented or not, such as the use of requirements templates and traceability matrices.
- Task Cards, which provide an opportunity to earn (or lose) SSPs by answering RE questions, such as re-wording a problematic requirement.
- Iterations, one time round the board equates to one iteration of requirements activities.

References

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<tbody>
<tr>
<td>Goals</td>
<td>An idiom that a stakeholder uses for a development project</td>
<td>Translates into one or more actions</td>
<td>1,2,3,4,11</td>
</tr>
<tr>
<td>Scope Creations</td>
<td>Anyone who glosses over something as a result of a project</td>
<td>Ensures written requirements are what the stakeholders want</td>
<td>1,3,4,11,12</td>
</tr>
<tr>
<td>Structure</td>
<td>Use a standard structure in requirements documents</td>
<td>Provides high quality and lowers cost of requirements documents</td>
<td>1,3,4</td>
</tr>
<tr>
<td>Versioning</td>
<td>Make the document easy to change</td>
<td>Reduces costs of changing requirements</td>
<td>2</td>
</tr>
<tr>
<td>Verifications</td>
<td>Verify each requirement</td>
<td>Provides unambiguous reference to specific requirements</td>
<td>2</td>
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<tr>
<td>Policy</td>
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<td>Checklists</td>
<td>Use checklists for validation and analysis</td>
<td>Helps to focus the validation process faster, more complete analysis of requirements</td>
<td>2,3,5</td>
</tr>
</tbody>
</table>

Develop the game concept by:
- creating more concrete projects, scenarios and tasks;
- expanding the study to a control environment;
- understanding the impact of the game on participants;
- designing post game-play assessment instruments.

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Good Practices that Target RE Challenges

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<tr>
<td>Goals</td>
<td>An artifact that stakeholders can review and sign, indicating agreement. Ensures that the requirements are clear and unambiguous.</td>
<td>1, 2, 3, 4, 11</td>
<td></td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Anyone who gains or loses something as a result of the project. Ensures that the requirements are clear and understood by all stakeholders.</td>
<td>1, 3, 4, 10, 12</td>
<td></td>
</tr>
<tr>
<td>Structure</td>
<td>Use a standard structure in requirements documents. Provides higher quality and lowers cost of requirements documents.</td>
<td>1, 3, 4</td>
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**Defining Goal**

**Description**
Defining the intentions that stakeholders have for a project.

**Benefit**
Ensures requirements are what the stakeholders want and mitigates missing requirements.

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- **Stakeholder Satisfaction Points (SSPs)**, which players earn or forfeit as the game progresses.
- **Projects for the player to own, run and buy resources for**, using SSPs and undertaking tasks.
- **Scenario Cards**, which show what happens when good RE practices are implemented or not, such as the use of requirements templates and traceability matrices.
- **Task Cards**, which provide an opportunity to earn (or lose) SSPs by answering RE questions, such as re- wording a problematic requirement.
- **Iterations**, one turn round the board equates to one iteration of requirements activities.

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<td>An illustration that stakeholders use for a shared agenda.</td>
<td>Translates into one or more stakeholders.</td>
<td>1, 2, 3, 4, 11</td>
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<td>Stakeholders</td>
<td>Anyone who gains or loses something as a result of the project.</td>
<td>Ensures written agreements among stakeholders.</td>
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<td>1,2,3,4,11</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Anyone who gains or loses something as a result of that project.</td>
<td>Enumerate all requirements relating to stakeholders.</td>
<td>1,2,3,4,11,12</td>
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<td>Use the document to convey the intent of the project.</td>
<td>Reduces time of requiring document.</td>
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<td>1,7</td>
</tr>
<tr>
<td>Specifications</td>
<td>Use a standard for requirements specifications.</td>
<td>Tends to be high percentage of requirements understood.</td>
<td>1,2,3,5</td>
</tr>
<tr>
<td>Analysis</td>
<td>Use checklists to validate requirements.</td>
<td>Helps to focus the validation process.</td>
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Identify 2 key stakeholders for this project (20 SSP)

What technique(s) would you use to elicit requirements from the key stakeholders (25 SSP)

What non-functional requirements are going to be critical to explore for this project and why? (30 SSP)
Stakeholder Satisfaction Points

- Players earn or forfeit SSPs as game progresses
- How do you compete?
- How do you win?
Wild Cards

Requirements are ambiguous -- miss a turn to rewrite them

Requirements are completed early -- go to next iteration

Requirements scope creeps -- return to start of this iteration

Get out of RE training FREE

Go directly to RE training

Unique IDs helped track a change -- roll again

You buy a tool thinking it will solve problems -- pay 50 SSP

Tool used with no process in place -- pay 100 SSP

Tool used with process in place -- receive 100 SSP
Other Concepts

- Iterations - one time round the board equates to one iteration of RE activities
- Decks - players get to keep a copy of the scenario cards as learning material
- Resources - SSPs can be used to buy books, templates and tools for project activities
- Quality - it is in everyone’s hands
## Overview of Studies

<table>
<thead>
<tr>
<th></th>
<th>Study 1: Graduates</th>
<th>Study 2: US Undergrads</th>
<th>Study 3: Cambodian Undergrads</th>
<th>Study 4: ABC Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group Size</strong></td>
<td>12</td>
<td>7</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td><strong>Prior Exposure to RE</strong></td>
<td>CS775 (5) None (7)</td>
<td>None</td>
<td>None</td>
<td>CS775 (15) None (5)</td>
</tr>
<tr>
<td><strong>SE Experience (Industry)</strong></td>
<td>Limited</td>
<td>None</td>
<td>None</td>
<td>Medium-High</td>
</tr>
<tr>
<td><strong>SE Experience (Academic)</strong></td>
<td>Medium</td>
<td>Limited</td>
<td>Limited</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Game Length</strong></td>
<td>60 mins</td>
<td>35 min</td>
<td>30 mins</td>
<td>50 mins</td>
</tr>
<tr>
<td><strong>Play Groups</strong></td>
<td>4 and 5</td>
<td>5</td>
<td>5</td>
<td>7 and 7</td>
</tr>
<tr>
<td><strong>Control Groups</strong></td>
<td>3</td>
<td>2</td>
<td>4, 4, 4</td>
<td>6</td>
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<tr>
<td><strong>Debrief</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Observation</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Questionnaires</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Pre and Post-Game Testing</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Facilitator</strong></td>
<td>Author</td>
<td>Author</td>
<td>Pace Professor</td>
<td>Author and Pace Professor</td>
</tr>
</tbody>
</table>
### Results from Post Gameplay Questionnaires

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree (%)</th>
<th>Agree (%)</th>
<th>Neither (%)</th>
<th>Disagree (%)</th>
<th>Strongly Disagree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-World Relevance</td>
<td>32</td>
<td>57</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fun Factor</td>
<td>67</td>
<td>26</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Kept Me Interested</td>
<td>50</td>
<td>46</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Participant Involvement</td>
<td>58</td>
<td>34</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Intellectual Stimulation</td>
<td>38</td>
<td>54</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Knowledge, Not Chance</td>
<td>15</td>
<td>69</td>
<td>12</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Would Play Again</td>
<td>31</td>
<td>58</td>
<td>12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Alternative to Classroom</td>
<td>44</td>
<td>44</td>
<td>8</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>
## Summarized Testing Results

<table>
<thead>
<tr>
<th></th>
<th>Study 1: US Grad Students (2 sessions)</th>
<th>Study 2: US Undergrads</th>
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</thead>
<tbody>
<tr>
<td><strong>Control Group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre Test</td>
<td>n/a</td>
<td>n/a</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Post Test</td>
<td>n/a</td>
<td>n/a</td>
<td>28</td>
<td>42</td>
</tr>
<tr>
<td>Improvement</td>
<td>n/a</td>
<td>n/a</td>
<td>25</td>
<td>29</td>
</tr>
<tr>
<td><strong>Play Group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre Test</td>
<td>31</td>
<td>11</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>Post Test</td>
<td>57</td>
<td>28</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td>Improvement</td>
<td>26</td>
<td>17</td>
<td>32</td>
<td>23</td>
</tr>
</tbody>
</table>
Findings (1 of 2)

Which RE practices are well suited for a novice setting (i.e., a lightweight set of RE practices)?

- RE is rich with numerous good practices,
- Novice users could benefit from introduction of an essential core set of good practices,
- We distilled a set of ten good practices.

Assuming that it is possible to develop easy-to-adopt RE good practices, how can those practices be introduced and reinforced in novice organizations in order to build RE competence?

- Games are intrinsically motivating
- A relatively painless way to teach and reinforce knowledge.
- A game can provide a sandbox for learning RE good practices.
Findings (2 of 2)

Following from the agile community, can a game be an effective method of introducing lightweight RE practices into novice organizations?

1. Gameplay is an effective way to increase a player’s knowledge of RE good practices.
2. RE-O-Poly can be a useful pedagogical tool for helping organizations impart knowledge and institute RE good practices in a:
   - fast,
   - painless,
   - relatively transparent
   - and cost-effective manner.

What are the benefits to be derived from an interactive game built around RE good practices?

1. RE Novices benefited from the highly discursive activity of an RE game such as RE-O-Poly.
2. The game promoted face-to-face communication, especially in the form of negotiation among a set of players.
Limitations

- Participant’s ability to apply the RE knowledge learned from the game in daily practice.
- Long-term Knowledge retention.
- Game’s effectiveness compared to other traditional methods of introducing RE good practices.
Ongoing Work

- Fine tuning gameplay
- Continue to play and measure results
- Tailor to a different audience
- Understanding impact of the game:
  - Improve pre and post game-play educational assessment instruments
  - Comparing to other forms of RE education and training
- Exploring other gaming genres
RE-O-POLY: A GAME TO INTRODUCE LIGHTWEIGHT REQUIREMENTS ENGINEERING GOOD PRACTICES

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This work reviews the many good RE practices described in the literature and identifies a lightweight set that will help small novice organizations in their requirements development efforts. It proposes a game-based approach to do this. RE-O-Poly is based on the popular game Monopoly and is intended to teach RE good practices to novice requirements engineers by reinforcing lessons previously learned.

RE-O-Poly is designed for players new to RE. It is meant to be used in conjunction with RE training and to have a facilitator. Key game concepts include:

- Stakeholder Satisfaction Points (SSPs), which players earn or forfeit as the game progresses.
- Projects for the player to own, run and buy resources for, using SSPs and undertaking tasks.
- Scenario Cards, which show what happens when good RE practices are implemented or not, such as the use of requirements templates and traceability matrices.
- Task Cards, which provide an opportunity to earn (or lose) SSPs by answering RE questions, such as re-wording a problematic requirement.
- Iterations, one time round the board equates to one iteration of requirements activities.

Develop the game concept by:
- creating more concrete projects, scenarios and tasks;
- expanding the study to a control environment;
- understanding the impact of the game on participants;
- designing post game-play assessment instruments.

References