Using $i^*$ for Transformational Creativity in Requirements Engineering

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Contents

1. Introduction
2. Related Work
3. Research Question
4. Study Design
5. Results
6. Conclusion & Future Work
What is creativity?

Creativity is defined as the ability to produce work which is both novel and appropriate.

Creativity is just connecting things. When you ask creative people how they did something, they feel a little guilty because they didn't really do it, they just saw something. It seemed obvious to them after a while.

— Steve Jobs

Creativity is intelligence having fun

- Albert Einstein
IMPORTANCE

Why do we need creativity in RE?

- Creativity will be the next economic activity replacing the current focus on information.
- With the increase in demand for sustainable, cost-effective software there is an increasing need for software engineers to develop products which are innovative and novel.

Steve Jobs was right when he declared the iPhone a revolutionary product. It redefined the smartphone category and put a powerful computer in the hands of more than a billion people around the world. – cnet.com
“Our job is to give the client, on time and on cost, not what he wants, but what he never dreamed he wanted; and when he gets it, he recognizes it as something he wanted all the time.”

– Sir Denys Lasdun (English architect)
TYPES OF CREATIVITY

Creativity

Based on novelty
- H-Creative
- S-Creative
- P-Creative

Based on search space
- Exploratory
- Combinational
- Transformational
Different ways to engineer creative requirements

- **Exploratory creativity**
  - Snowballing, Traditional brainstorming, Free association, Serial association

- **Combinational creativity**
  - Fixed and random stimuli, Selecting multiple random stimuli

- **Transformational creativity**
  - Assumption surfacing, Boundary relaxation
access control

students

passwords

intruders

password allocation process

fingerprint
RESEARCH OBJECTIVE

- What is the role of i* in transformationally creative RE?

DILBERT

I'LL NEED TO KNOW YOUR REQUIREMENTS BEFORE I START TO DESIGN THE SOFTWARE.

FIRST OF ALL, WHAT ARE YOU TRYING TO ACCOMPLISH?

I'M TRYING TO MAKE YOU DESIGN MY SOFTWARE.

I MEAN WHAT ARE YOU TRYING TO ACCOMPLISH WITH THE SOFTWARE?

I WON'T KNOW WHAT I CAN ACCOMPLISH UNTIL YOU TELL ME WHAT THE SOFTWARE CAN DO.

TRY TO GET THIS CONCEPT THROUGH YOUR THICK SKULL. THE SOFTWARE CAN DO WHATEVER I DESIGN IT TO DO!

CAN YOU DESIGN IT TO TELL YOU MY REQUIREMENTS?
RESEARCH QUESTIONS

- How do analysts perform transformational creativity in goal modeling?
- Which are the analysts’ common practices & struggles?
- Can we provide additional support to i* model to help in transformational creativity?
STUDY DESIGN

- Decide on a domain to be used and collect data
- Clean up data and present a table to the participants
- Manually go through the submissions and classify them into categories
- Judge whether the submissions are transformative or not
The following 13 references include 'Meeting Scheduler' in i* notations:

1. an RE'14 presentation, 2. an RE'12 paper, 3. an i*12 paper, 4. a VaMoS'07 paper, 5. a CASCON'06 paper,
6. a DEAS'05 paper, 7. another RE'12 paper, 8. an i*13 paper, 9. a technical report, 10. an ER'13 paper,
11. an RE'02 paper, 12. an ER'07 workshop paper, and 13. an RE'97 paper.
## Existing modeling constructs and their frequencies of occurrence.

<table>
<thead>
<tr>
<th>Actor</th>
<th>Goal</th>
<th>Softgoal</th>
<th>Task</th>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mtg. Initiator (7)</td>
<td>Mtg. Be Scheduled (14)</td>
<td>Low Effort (10)</td>
<td>Attend Mtg. (4)</td>
<td>Details (3)</td>
</tr>
<tr>
<td>Mtg. Scheduler (5)</td>
<td>Agreeable Mtg. Date (4)</td>
<td>Quick (4)</td>
<td>Organize Mtg. (3)</td>
<td>Proposed Date (2)</td>
</tr>
<tr>
<td>Mtg. Participant (5)</td>
<td>Solicit Response (4)</td>
<td>Accuracy of Constraints (4)</td>
<td>Determine Mtg. Date (3)</td>
<td>Agreement (2)</td>
</tr>
<tr>
<td>Important Participant (5)</td>
<td>Collect Timetables (4)</td>
<td>Collection Effort (3)</td>
<td>Participate in Mtg. (3)</td>
<td>Facilities Confirmed Room (1)</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

14
Only 30.2% of the constructs were transformationally creative.

 Majority of them were focused in the same domain of meeting scheduler.

 The submitted domains were classified into meeting prep/post work, remote participants, services and new domains.

 Distribution of “new” domains.

 - New Domains: 2, 12%
 - Meeting Prep/post Work: 7, 44%
 - Services: 4, 25%
 - Remote Participants: 3, 19%
- Majority of the constructs were exploratory.
- Exploratory creativity might be a precondition to explorative creativity.
- Softgoals are less likely to provoke transformational creativity.
- Tasks can be a starting point for transformational creativity.
i* models for online trading

Strategic rationale

Strategic dependency
ANALYSIS

Process to find a new domain which is transformationally creative.

1. Identify the bridging node.
2. Model new domain.
3. Refining transformative relationship.

Example: Location -> Safe Location -> Safety.

Meeting Feedback -> Product Feedback
CONCLUSIONS

- Exploratory creativity is a stepping stone for transformational creativity.
- Tasks serve as a common starting point for transformational creativity.
- Softgoals will likely generate domains which will be within the meetings scheduler domain.
- Important to identify a bridging node to identify a new domain.
FUTURE WORK

- Provide automated support using data analysis.
- Include diverse and heterogeneous participants in the study.
- Research ways in which domains and their interdependence could be visualized.
- Define measures and metrics to help guide the creative RE process.
Using $i^*$ for Transformational Creativity in RE

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