An Empirical Investigation of Scenarios Gained and Lost in Architecture Evaluation Meetings

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Motivation & Background

- Software architecture is a success-critical issue in software projects.
- Defects and Changes can have a major impact on quality of delivered system, project duration, and cost.
- Issues related to Quality Attributes and Non-Functional Requirements (such as modifiability, performance, and maintainability) should be addressed early.

Basic Idea:

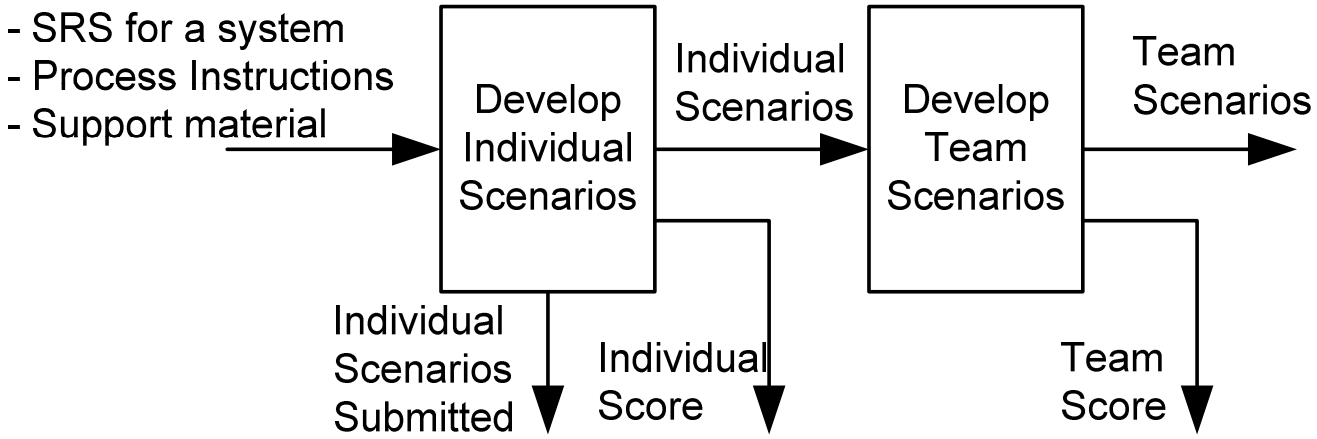
- Using benefits of Software Inspection Processes to identify Scenarios for Architecture Evaluation.
  - Scenarios can be used to address these Non-Functional Requirements.
  - Architecture evaluation supports project managers to consider quality sensitive scenarios in early software architecture decisions based on architecture evaluation processes like ATAM.
  - Process from Software Inspection: (a) Individual Scenario Brainstorming and (b) Team Meeting.

Research Questions & Study Process

- Empirical study (controlled experiment) on a scenario elicitation workshop with focus on team meeting effectiveness.

- Key research questions:
  - How do guidance with change categories influence scenario brainstorming supported by these categories (top-down)?
  - What is the effect of scenario brainstorming performance of real and nominal teams regarding scenario gain and lost.

- Study Process:



Experiment Description

Study Material:

- Requirements Specification for a Web-Based Distributed Collaboration tool.
- Quality Attribute: Modifiability (over three years).
- 6 Software Change Categories provided to the treatment group (e.g., UI changes, communication tool changes, etc).

Variables:

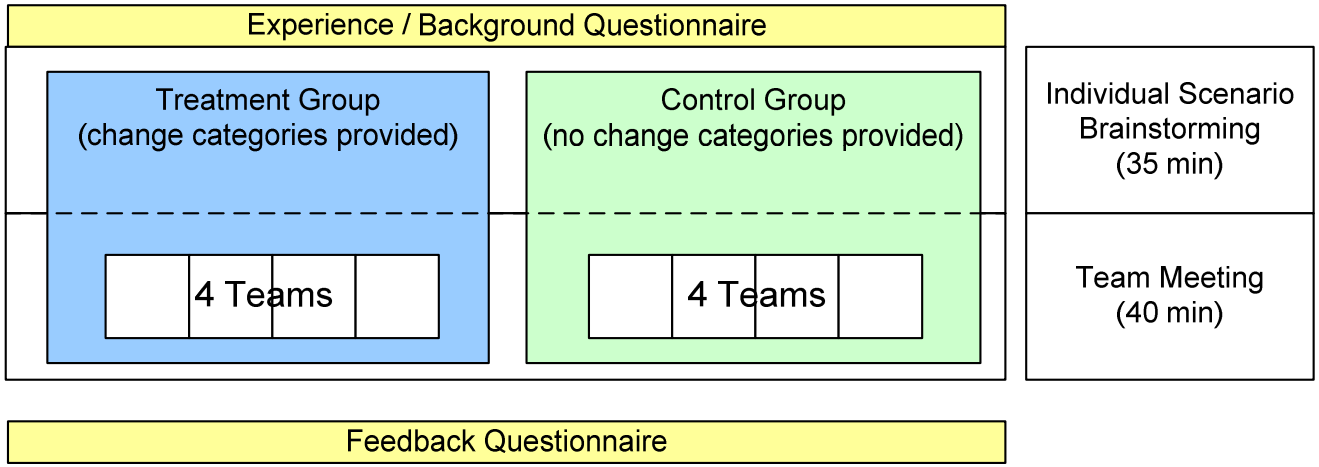
- Independent Variables: Domain specific change categories of software changes.
- Dependent Variables: Frequency of scenarios: (a) individual, (b) real 3-person teams, (c) nominal (non-communicating) 3-person teams.

- **Randomized balanced design / Randomized group assignment.**
- Treatment group: change categories provided (12 participants), 4 teams.
- Control group: change categories not provided (12 participants), 4 teams.

Execution & Threats to Validity

Experiment Execution:

- Selection of participants, group assignment (treatment and control group) and (real) team composition.
- Briefing session (30 min).
- Experiment Execution
  - individual
  - team.
- Frequency-Based Scenario Classification.

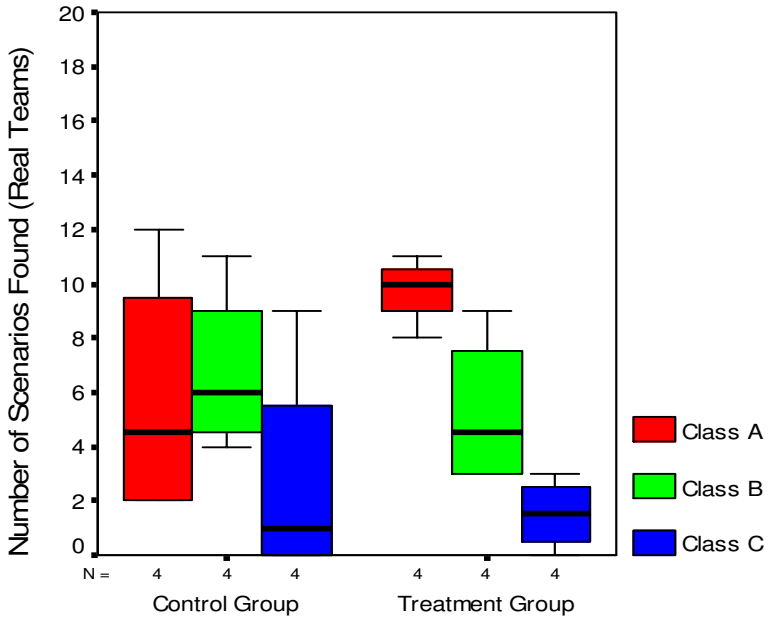


Validity Considerations:

- Internal validity: randomized subject assignment, Scoring schemes (frequency-based), Subject experience (students).
- External validity: classroom setting, similar background of participants, possible limited experience on the domain, short software requirements specification might not be typical in industry setting.

Scenario Reports by Real Teams

- Real 3- Person Teams
  (collaborative team meeting).
- Up to 90% more scenarios compared to individuals.
- Notable differences for all scenario classes of control and treatment group members:
  - More critical scenarios (class A)
  - Less class B and C scenarios
- But no significant differences.
- Top down scenario method (change categories provided) might provide a better guidance for critical scenarios.



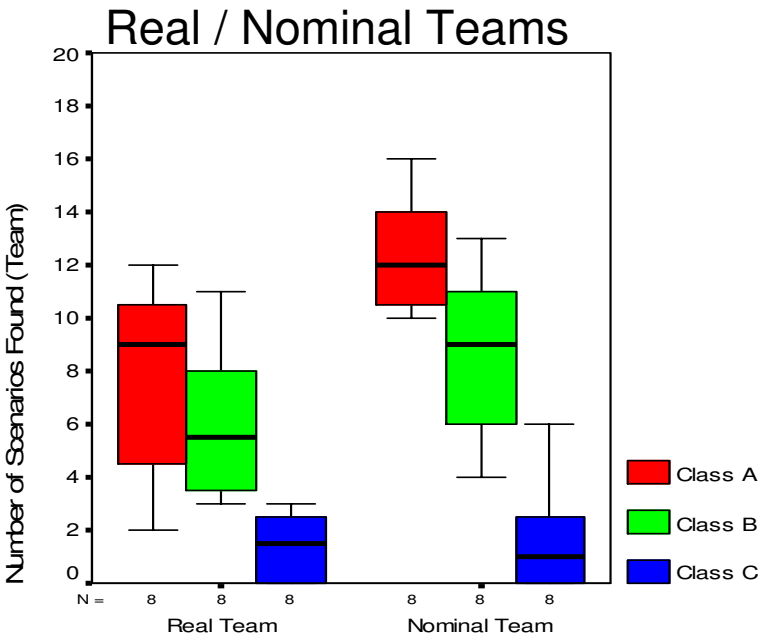
Real Teams

Real Teams

Scenario Category	Control Group		Treatment Group	
	Mean	Std.Dev.	Mean	Std.Dev.
Class A	5.8	4.79	9.8	1.26
Class B	6.8	3.10	5.3	2.87
Class C	2.8	4.27	1.5	1.29

Gain / Loss of Scenarios

- Comparison of 3 person teams (similar team members): real vs. nominal teams
- Average total number of scenarios found:
  - Real Teams 15 scenarios.
  - Nominal Teams: 22 scenarios.
- Scenario gained / lost in team meetings:
  - Class A/B: more lost than gained.
  - Class C: similar number of gained/lost scenarios.
- Nominal teams
  - are more effective.
  - require less effort (no team meeting)
  - These results indicate that real team meetings hinder scenario elicitation.



Gain / Lost Scenarios

Scenario Category	Gain		Loss	
	Mean	Std.Dev.	Mean	Std.Dev.
Class A	3.0	2.14	7.0	2.73
Class B	4.4	2.51	7.0	2.73
Class C	2.1	3.00	1.6	2.20

Conclusions and Future Work

- Impact of Change Categories
  - Change categories are used to guide reviewers in the scenario brainstorming process (top-down approach).
  - Results show a significant improvement of identified critical (class A) scenarios.

- Scenario Gain / Loss in Team Meetings.
  - Less effort because there is no real team meeting.
  - Results show a higher number of scenario losses in a real team meeting for critical and important scenarios and a comparable number of gains/losses for less important scenarios.
  - Real team meetings seems to be questionable regarding the team meeting conducted in this study.

→ Future work is an ongoing analysis of impact factors on team meetings.

→ Replication of the study to achieve a deeper insight in team meeting processes.