Use of Games in Software Engineering Courses

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Motivation

- Advisor for Toni Bakarčić's master thesis "*Use of Agile Methodologies in Software Engineering Education*" finished in June 2019
  - Seminar (exploration of techniques and tools)
  - Project (agile coach and scrum master)
- During the seminar presentation, *Ball Point Game* was played
  - pass as many balls as possible through every team member in the given timeframe (e.g. 2 minutes) following certain rules
  - repeat the game several times estimating how many balls would be passed in the forthcoming iteration
- This has raised interest and questions (and skepticism)

Importance of games and simulations

- game ≠ simulation but it is often interchanged
- Enables students to learn from/by failure and in a shorter time period
  - von Wangenheim, C.G., Shull, F, *To game or not to game?* IEEE Software 26 (2), 2009
- Not a novel thing, or exclusive to agile
  - E.g. A simulator to help Ford's new product development teams
    - "rearchitect it's core business process"
    - "*With a simulated world, it's OK to try and more is sometimes learned by screwing up than by doing well*"
      - from Ellis Booker: "Have You Driven a Simulated Ford Lately?" (Computerworld, Vol. 28. No 27, p. 76, 1994)
- What can be learned from those games and at which level?

Ball Point Game

- By Boris Gloger in 2008

  https://app.box.com/s/mg9kq3d17e

  – More detailed description:

    - http://dpwhelan.com/blog/uncategorized/learning-scrum-through-the-ball-point-game/
    - http://www.plays-in-business.com/ball-point-game-introducing-agile-by-the-fun-way/

- Purpose of the game is to introduce agile thinking to new teams

  – Trust, Self-organization, Inspecting and Adapting, Agile Ceremonies…

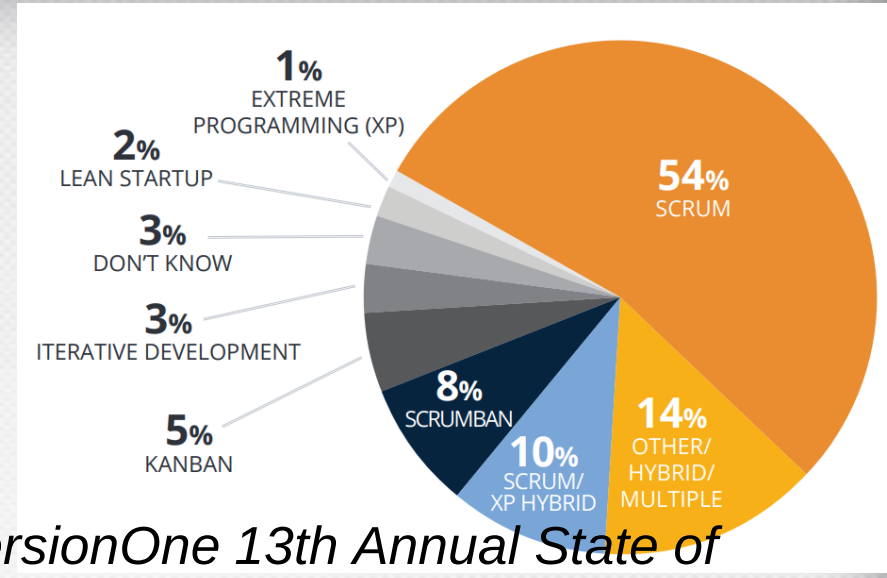
- Can these claims be proved or it is just team building?

Notable SCRUM games

- Lego4Scrum by Alexey Krivitsky (2009)
  - version 3.0 from 2017 https://www.lego4scrum.com
  - Iteratively build a city from Lego Bricks (2-3 hours of play)
  - Game objectives
    - user story mapping, estimates, backlog refinement, scrum meetings, continuous integration and deployment
- SCRUMIA
  - 60 min pen and pencil game with 3 sprints
  - building paper boats, planes, hats…
  - C.G. von Wangenheim et al. *SCRUMIA—An educational game for teaching SCRUM in computing courses,* The Journal of Systems and Software 86 (2013) 2675– 2687

… and many others

Why are there so many Scrum games?



- Agile is a trend and Scrum is the most dominant
  - Source and figure: *CollabNet VersionOne 13th Annual State of Agile Report*. (2019). https://www.stateofagile.com/#ufh-i-521251909-13th-annual-state-of-agile-report/473508
- Most adopted techniques in project management area
  - Daily standup (86%), Sprint/Iteration planning (80%), Retrospectives (80%), Sprint/Iteration Review (80%)
  - Only 2 engineering practices in top 10 adopted techniques
    - Unit testing (69% adoption rate), Coding standards (58%)
- Goose that lays golden eggs
  - Many seminars with games, and (not so cheap) game sets

Small digression

- Opinions about agile methodologies varies…
  - Ivar Jacobson: "*Today agile software development is more craft than engineering. It is based on practices formulated as rules of thumb instead of practices standing on a scientific foundation*."
    - https://www.ivarjacobson.com/industrial-scale-agile
  - Alistair Cockburn on August 19, 2019
    - https://heartofagile.com/agile-is-not-dead-quite-the-opposite/
  - Some more interested non-scientific articles
    - https://philippe.bourgau.net/why-agile-transformations-usually-dont-work-part-1-the-situation/
    - https://www.forbes.com/sites/cognitiveworld/2019/08/23/the-end-of-agile/

Key conclusions from several systematic reviews (1)

Caulfield et al. : *Systematic Survey of Games Used for Software Engineering Education,* Mod. Appl. Sci. 5(6), 28-43, 2011

- Learning objectives related only to knowledge (1st level of Bloom's taxonomy)
- Most studies (16/26) were not experimental (no random assignments and/or control groups)

de Smale S. et. al. *The Effect of Simulations and Games on Learning Objectives in Tertiary Education: A Systematic Review*. LNCS 9599, pp. 506–516, 2016.

- 29/64 studies explicitly studied the effects of gaming
  - 26 positive + 3 neutral
  - publication bias?
- Unambiguous framework needed to evaluate the effects

Key conclusions from several systematic reviews (2)

Battistella, P., Wangenheim, C. G.: *Games for Teaching Computing in Higher Education – A Systematic Review.* IEEE Technology and Engineering Education (ITEE) Journal, 9(1), 8-30, 2016.

Petri, G., Gresse von Wangenheim, C.: How games for computing education are evaluated? A systematic literature review. Computers & Education, 107, 68-90, 2017.

Petri at. al. *Effectiveness of Games in Software Project Management Education: An Experimental Study,* Journal of Universal Computer Science, vol. 25, no. 7 (2019), 840-864

- 117 studies evaluated (53 in SE + 23 regarding software development fundamentals)

- Most games aim at lower cognitive levels and have lack of
  - systematic development and incorporation into the learning context
  - scientific rigor (only small part was experimental)
    - evaluations performed in an ad-hoc manner, using a simple research method typically with questionnaires

Questions that arise (1)

- Is the “agile thinking/way” so complicated that games are needed to clarify the theory, or games are created because it is simple?
- Does anyone know any RUP or waterfall game?
- Why a generic game would be better compared to a real or simulated model?

Questions that arise (2)

- What are we learning?
  - Quote from University of Technology Sydney Software Engineering video https://www.youtube.com/watch?v=Wy5F1XyNt74 about Lego Scrum Game (2017)

"*The subject focuses on the processes of software development, not the programming*"

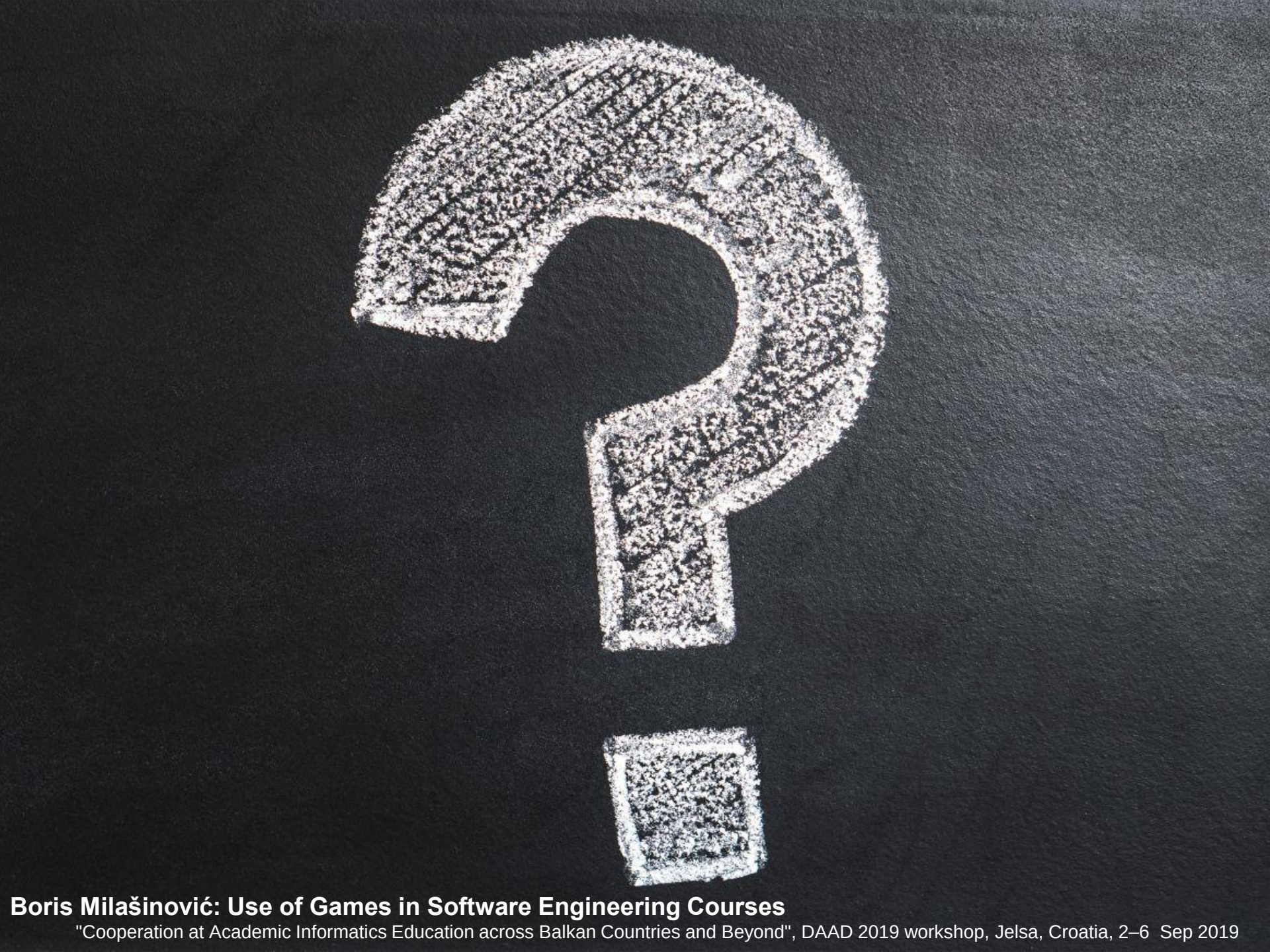
  - But where is "software" in building bricks?
  - This implies that the development process is generic

Questions that arise (3)

- Are project planning and management generic disciplines and are they the same for every discipline?
  - Can you experience software project planning by planning a budget for e.g. doughnut store, bakery or car factory?
  - Does playing *Civilization* or *Panzer General* improve planning?
- Would you manage to copy (achieve) the results by coping the practices?
  - Are project estimations wrong due to lack of generic planning techniques (i.e. planning poker) or due to lack of expertise (estimation by function points or analogy, …)
- In which course to use gaming and would it be beneficial?
  - Would gaming lower or raise classroom attendance? It could be "expensive" to test

Conclusions

- Games sometimes resemble food supplements or placebo
  - Generic games could have positive effects, but it is hard to prove
  - Conclusions should be drawn from tests not from questionnaires or anecdotally
- Simulators rarely used
  - probably harder to develop and not so entertaining
- However, games could be useful as they can detect problems concerning human factors
  - By Krivitsky certain behaviors from games could be projections of working habits especially behavior under stress and communication styles (“managers”, “dictators”, “loud voices”)
    - Related to teamwork in general, not just to SE



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