COLLABORATIVE GAMIFICATION DESIGN FOR SCIENTIFIC SOFTWARE

Position Paper

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SOFTWARE SUSTAINABILITY
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- Extensibility
- Interoperability
- Maintainability
- Portability
- Reusability
- Scalability
- Usability

SOFTWARE SUSTAINABILITY

• USABILITY

SOFTWARE SUSTAINABILITY

• USABILITY

GAMIFICATION

SOFTWARE SUSTAINABILITY

• USABILITY

GAMIFICATION DESIGN

(AWARE OF)

EXTENSIBILITY  REUSABILITY
INTEROPERABILITY  SCALABILITY
MAINTAINABILITY  USABILITY
PORTABILITY
GAMIFICATION
• “The use of game design elements in non-game contexts” [3]
  - Deterding et al.

• Gameful design: designing an activity as a game. (often involves goals, points, etc.)

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- Gameful design: designing an activity as a game. (often involves goals, points, etc.)

- “Gamification should be composed of cross media references from games to other products” [4]
  - Popa

- Transposition of game-like aesthetics and interactivity to other media


• Community building and exchange of knowledge.
• Use of gameplay, game aesthetics and/or technology by engineering software.
• Gamification of citizen science and science education.
GAMIFICATION | SCIENTIFIC SOFTWARE 
(and correlated areas)

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OUR PREVIOUS EFFORTS

• Action research: Gamified functionalities for a simulation software (oil and gas industry).
• Literature review: Scientific software development, use, user interfaces, and gamification.
Action Research

- Research, adaptation and prototyping of design elements.

Lessons Learned include:
- Criteria for researching games
- Scientific software needs
- Difficulties in gameful design
- Perils of hi-fidelity prototyping
- Impediments to implementation

New control scheme for 4D navigation (better insight)

Wiimote-compatible positioning tool (adapted for precision)

THE LENS OF THE LAB

Scientific software should **augment insight, productivity, and knowledge**. It should facilitate and integrate supported stages of scientific work (modeling, simulation and result analysis, and generate output for publication, sharing, or further research.

When designing for scientific software, consider the questions:

- How can the interface **represent the scientific matter**, reinforce the way it works and support the theory behind it? How can it **present and explore complex data** at high levels of precision? How can it prevent and fix errors?

- Is the user interface intuitive, consistent and uncluttered? Is it flexible enough to allow for **incremental expansion and customization**? Is it adequate to the platforms it was designed for, and to other software it should be integrated to?

- **How do scientists work?** How is the work environment, culture, ethics, conventions, current practices and best practices? What do users need and expect? How can design embrace different levels of scientific specialization, computer literacy, and programming skills? How can it **promote and attract collaboration** or community building?

- **How can games inform and inspire** the software aesthetics and interactivity? Which game design elements could provide structure, goals, feedback, guidance, progression, flow, fun and experimentation? Would competition and point-based systems motivate or demotivate?

- **Is implementation feasible** regarding scope, planning, timescale, technologies, human resources, and software lifecycle?
How to establish good communication, during design stages, between all stakeholders?

- Understand needs
- Gather requirements
- Discuss possibilities
COLLABORATIVE AND OPEN DESIGN

• Can address typical challenges from scientific software
• Employed in many successful development cases
• Compatible with scientific software development culture
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- **Understanding** specialized users and their work. 14, 15, 16
- **Empowering** and responding to *actual* user-base.17
- **Integrating** disciplines18, visions19, schedules 20, 21 and authorship.22

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14 C. M. Pancake, “Improving the Usability of Numerical Software through User-Centered Design”
15 R. R. Springmeyer, “Applying observations of work activity in designing prototype data analysis tools”
17 D. De Roure and C. Goble, “Software design for empowering scientists”
18 C. Chen, J. Zhang, and M. S. Vogeley, “Reflections on the Interdisciplinary Collaborative Design of Mapping the Universe”
19 M. Spencer, “Brittleness and Bureaucracy: Software as a Material for Science”
20 D. Kelly and S. Smith, “3rd CASCON Workshop on Software Engineering for Science”
22 M. Turk, “Fostering Collaborative Computational Science”
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- Project Community / OMERO software
- European Middleware Initiative: Community-based discussion tools
- STAR software iterative design process
- University of Illinois’ hackathon for taxonomy software interface
- biok: programmable software co-designed and co-developed with users

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27 C. Letondal and W. E. Mackay, “Participatory programming and the scope of mutual responsibility: balancing scientific, design and software commitment”
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- “Do-it-yourself” mentality, amateurism, shared knowledge.\(^{28}\)
- Computational science communities pioneered ‘Open’ movement.\(^{29}\)
- “Professional End User Developer”.\(^{30}\)

\(^{28}\) P. Atkinson, “Orchestral manoeuvres in design”
\(^{30}\) J. Segal, “Some Problems of Professional End User Developers”
OPEN GAMIFICATION DESIGN

Open access to the conceptualization and planning of gamified functionalities in a collaborative manner, in order to make the design phase as informed as possible.

*Ideally supported by a designer
THE DESIGN BOARD

Conversational media used as a tool for collaborative design.

*Ideally used in conjunction with the Lens of the Lab
Blogs, Forums, CMSs, Trello, GitHub... any platform that allows participants to:

- Initiate and join **discussions**.
- Publish and access **supportive material** (e.g., text documents, images).
- **Search** and/or browse past discussions.
- Access appropriate design **guidelines** (i.e., the Lens of the Lab)
ILLUSTRATIVE SCENARIO
I am having problems categorizing geometry: Having to keep the CTRL key down all the time feels tiring. When I accidently release the key, it makes me unselect everything. Also, dragging names between hierarchical tree views often causes me to unselect everything.
The Lens of the Lab

[...]
- How can games inform and inspire the software’s aesthetics and interactivity?

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The Lens of the Lab

[...]  
- Which game design elements could provide feedback and progression?  
[...]  
- Is implementation feasible?
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Given our UI development framework, we cannot highlight a layer on the hierarchy tree, but we could display an on-screen message such as “100 objects have been added to Category A layer”. Also, we could add an object counter beside that layer’s name in the tree view.
Step 1: Activate picking tool by clicking on the appropriate button

Step 2: Select Category layer from the tree view

Step 3: Pick objects by clicking on them

Step 4: Add objects to selected layer by pressing the space bar key

3 objects have been added to layer Category A.
OK, let's add it to the backlog.
POTENTIAL GAINS

- Better usability
- Better compliance /user acceptance
- Less time between design and implementation
NEXT STEPS

• Find opportunities for testing the design board and the Lens of the Lab.
• Further research on scientific software gamification
Thank you!

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