Serious Games & Gamification

Introduction – Best Practice Examples – Critical Reflection

„Der Mensch ist nur da ganz Mensch, wo er spielt.“

Schiller (1759 – 1805)

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Intro – Stefan Göbel

Person
- 42 years, married, 1 child (6)
- Digital Immigrant

CV
- Computer Science + Economy, Pedagogic
- Fraunhofer Institute for Computer Graphics, ZGDV, TU Darmstadt
- (Geo-)Graphic Information Systems, Digital Storytelling, Serious Games

Games
- C64, Boulder Dash, Winter Games
- Game Research, Development
- Casual Gamer
Intro – Game Culture & Economy

Who is Playing?
- 24 Mio. Gamers Online/Apps
- Gender: ~50/50
- Age: Mid 30

„We do not stop playing because we grow old, we grow old because we stop playing.“
George Bernard Shaw (1856 – 1950)

Commerce
- Games and Entertainment Market
  752 MEUR Q1/Q2 2013 in Germany (> Cinema)
  - Console, PC, Mobile .. Hardware, Software
  - Serious Games as prospering ‘Niche Market’

Science & Technology
- Game Technology as Driver in ICT
- Game Engines & Middleware

Cry Engine, Crytek, 2011
Xbox One, 2013
Intro – Game-based Approaches

Society & Application Domains

- Lack of Education (PISA), Lack of Movement (WHO 2010, Eurobarometer 2010)
- Demographic Trends (Ambient Assisted Living, vacant STEM job market)

Games as a Tool and Motivator and Facilitator

- Game Characteristics: Fun, Curiosity, Challenge..

Gamification

- "the use of game design elements in non-game context"
- "making non-game products [...] more enjoyable, motivating, and/or engaging to use"

(Deterding, Khaled, Nacke and Dixon, 2011)

Serious Games

- "A serious game is a game designed for a primary purpose other than pure entertainment.
- The "serious" .. refer to products used by industries like defense, education, healthcare.. politics"

(EN.WIKIPEDIA.ORG)
Intro – Game-based Approaches

Which is the most relevant game in the game history?

Alexei Pachitnow: Tetris, 1984

Is it a Serious Game or Gamification?
**Gamification – Approach**

**Use game elements in non-game contexts**
- Rules
- Goals, rewards → Badges
- Tracking, feedback → Points
- Competition → Leaderboards

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https://foursquare.com

http://de.slideshare.net/dings/meaningful-play-getting-gamification-right?from_search=3
Gamification – Examples, Daily Life

Use game elements in daily life activities
- Define a goal / sub-ordinate targets
- Set rules and challenge

Non-digital Examples
- Shorten the time of a walk by avoiding to step on cracks
- Moving the backyard in an unnecessary challenging way

Incentives and Rewards for ???

http://www.flickr.com/photos/seandreilinger/3342015670/sizes/o/in/photostream/
http://www.flickr.com/photos/trancemist/4128705938/sizes/l/in/photostream/

http://www.flickr.com/photos/mzn37/4001914227/sizes/o/in/photostream/
http://www.flickr.com/photos/pigpogm/4956017815/sizes/l/in/photostream/
Gamification – Examples, Leisure & Work

Health, Nike+
- Running, Basketball, Kinect Training, Daily Activities
- Nike+ SportWatch, Running App, SportBand, iPod nano
- Record activities, set (and improve) personal goals, share success, invite for common activity
- NikeFuel – ‘currency’ for movement

Software Engineering, Stackoverflow
- Open forum für software developers/programmers
- Points for ‘first best’ answer to a problem
- Investing time for self-satisfaction and reputation

Industry
- IDS Scheer Consulting & Crytek (→ SAP HANA)
- Daimler GreenSight City & Zone 2 Connect
- Experience Network & Uni Potsdam

http://nikeplus.nike.com/plus/
Gamification – Study by Thom et al. 2012 (I)

Research question:
- “How does the removal of gamification features affect user activity [...]?”

![Gamification interface showing status and activity comparison]

<table>
<thead>
<tr>
<th>rank</th>
<th>bee</th>
<th>status</th>
<th>total points</th>
<th>photo count</th>
<th>hive5 count</th>
<th>event count</th>
<th>buzz count</th>
<th>about you</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>employee A</td>
<td>busy bee</td>
<td>690</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>35</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>employee B</td>
<td>worker bee</td>
<td>250</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>8</td>
<td>✓</td>
</tr>
</tbody>
</table>
Gamification – Study by Thom et al. 2012 (II)

Evaluation Study, Set-Up
- Large IT enterprise, ~400,000 employees, globally distributed, headquarter in US
- Using an enterprise social network service
  - Points-based incentive system for adding lists, photos and comments
  - Leveling system in dependency of achieved points

Method & Results
- Gamification elements (points, badges, leaderboards…) were removed
- Log-Data two weeks before and two weeks after removal were analysed

<table>
<thead>
<tr>
<th></th>
<th>before removal</th>
<th>after removal</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photos</td>
<td>4502</td>
<td>2926</td>
<td>38.24</td>
<td>0.001</td>
</tr>
<tr>
<td>Lists</td>
<td>1277</td>
<td>780</td>
<td>39.07</td>
<td>0.001</td>
</tr>
<tr>
<td>Profile comments</td>
<td>8983</td>
<td>4056</td>
<td>49.5</td>
<td>0.001</td>
</tr>
<tr>
<td>Photo comments</td>
<td>2598</td>
<td>1348</td>
<td>308.78</td>
<td>0.001</td>
</tr>
<tr>
<td>List comments</td>
<td>1770</td>
<td>873</td>
<td>603.95</td>
<td>0.001</td>
</tr>
</tbody>
</table>
Gamification – Potential and Risks

intelligentgamification

- „Motivation und Engagement – Der Unterschied zwischen dummer und intelligenter Gamification“
- Extrinsic rewards vs. intrinsic motivation
    - (flow experience in leisure & at work)
    - Extrinsic motivation not promising resp. counter-productive (long-term)
    - → gamification elements like points or badges need to improve intrinsic goals
- Participation can provoke unsolicited contributions
    - → quality control/assurance necessary
- Autonomy, mastery, purpose are fundamental
    - → changing behaviors, developing skills, enabling innovation

Gartner says ‘by 2014, 80 percent of current gamified applications will fail to meet business objectives primarily due to poor design.’

Serious Games – *Games more than fun*

**Approach**
- Game technology & concepts + further research & technology
  → Application Domains

**Characteristics**
- Complex & Challenging
- Interdisciplinary, applied
- Authoring, control (adaptation & personalization) and evaluation

**Application Domains**
- Education, Training & Sim.
- Sports & Health, Exergames
- Politics, Participation, Planning

Göbel, SGC 2010
Serious Games – Application Domains

- Training & Simulation
- Education
- Educational Games
- Sports
- Health
- Serious Games
- Multimedia
- Social Media
- Sensor Technology
- Single-Player
- Learning Design
- Persuasive
- Service Provider
- Culture & Tourism
- Telecommunication
- Advertisement

Culture & Tourism
EnerCities

Health

Serious Games

Multimedia

Roxy

KOM – Multimedia Communications Lab
Serious Games – Grand Challenges

Complexity
- Characteristics of a Game (Design..) & „more“ (serious part)
- Interdisciplinary Approaches are necessary

Creation, SG development
- Authoring process and authoring environments

Adaptation & Personalization
- Singleplayer, Multiplayer

Evaluation
- Effects (learning effect, vital parameters, marketing effect)
- Affects (usability, user experience, fun, enjoyment)

Other, non-RTD issues
- Economic: cost/benefit ratio, business models
- Legal, ethical issues, privacy

Quality does have its price!
Serious Games for e-Participation
ISPRAT 2012-2013, TUD/httc, Stadt Darmstadt

Target User Group
- Digital Natives
- Generation Facebook

Approach
- Creativity, Web 2.0
- Identity, Community
- Communication (more than 'I like it')

Quality of User Generated Content?
Serious Games for Education, STEM (dt. MINT)
TechForce, AG Gesamtmetall

Career choice metal and electrical industry
- Insight (daily) activities, duties, functions
- Apply (complex) technology

(Game) Goal
- Build a glider
- Win a race
- Online highscore

Minigames for job preparation
- Generell skills (analytic thinking..)
- Technical understanding

Award
- Dt. Computerspielpreis 2009 (Serious Game)
Serious Games for Education, STEM (dt. MINT)
ExperiMINTe, AG Gesamtmetall

**Addition to (class) learning**
- Mechanics, electricity/electronics, technology
- (mathematics, computer science)
- Enabling instructors/teachers to create exercises
- → extensible repository

**Minigames**
- Interactive Simulations
- Practical Exercises

**Award**
- Dt. Computerspielpreis 2010 (Serious Game)
Serious Games for Technology-Enh. Learning
80Days (EU, FP7, STREP, TEL, 2008-2010)

Geo Learning Game „Save the Earth!“

- Curriculum → Micro Missions
- Story, Game & Learning Situations
- Personalization & Adaptation
- Game-based Assessment
- Cost-efficient Authoring/Production
- Target Audience: Kids ~12 years, m/f
  Authors: Teacher, Game Designer
Control – Personalization & Adaptation

Motivation
- Flexible, intelligent environments
- Individual learning, gaming and story paths

Challenges
- Diversity of users and contexts
- Strategies for control

Anxiety, Boredom and Flow (Csikszentmihalyi, 1990)
Control – Personalization & Adaptation
Narrative Game-based Learning Objects

Authoring
- Annotation of Situation → metadata
- Narrative, Gaming and Learning Context

Run-Time
- Basis for decision *How does a Story Continue?*

Story Model

\[
\begin{align*}
\langle SM_{HJ1}, 0.1 \rangle, \\
\langle SM_{HJ4}, 0.2 \rangle, \\
\langle SM_{HJ8}, 0.1 \rangle
\end{align*}
\]

Player Model

\[
\begin{align*}
\langle PM_{BAK}, 0.2 \rangle, \\
\langle PM_{BAS}, 0.4 \rangle, \\
\langle PM_{BAE}, 0.9 \rangle
\end{align*}
\]

Learning Context

\[
\begin{align*}
\langle A101, A102 \rangle, \\
\langle P210, P217 \rangle
\end{align*}
\]

\[\text{[GdCMS09, GWRS10]}\]
Control – Personalization & Adaptation
NGLOB, Gaming Context

Player Model [Bartle96]
- Killer
- Achiever
- Socializer
- Explorer

Diversity of Users

Unfolding Process of DEG
Appropriateness Factors of Situations for Player Types
Control – Personalization & Adaptation
Narrative Framing vs. Interactivity

R. Pilcher, ZDF Mediathek
Control – Personalization & Adaptation
Narrative Framing vs. Interactivity (80Days)

Hero’s Journey – Linear and Free Transitions

Interactive Storytelling & "Narrative Paradox"

[Campbell72, Vogler92, DCA07, GdCMS09]
Authoring – *StoryTec* authoring framework

**Authoring Tool**
- Support f. Non-Programmers
- Interaction Templates
  - Mini-Games
- Story Templates
  - My Favourite Places

**Player**
- Cross-Platform Publishing
  - PC/Mac, Web and Mobile
- Context Info, Analysis
- Make your own Story

[www.storytec.de](http://www.storytec.de)
Authoring – *StoryTec* authoring tool

**Story Editor**
- Story Structure
- Management

**Stage Editor**
- „Stage“
- Level Editor
- Templates

**Object Browser**
- Content
- Object Groups

**Property Editor**
- Attributes & Annotations
Authoring – *StoryTec* scientific player

**Left Part**
-‘Easy Player’
-Walk-Through
-Testing
  -Interaction
  -Gameplay

**Right Part**
-‘Scientific Tool’
-Rapid Prototyping
-Logging
-Analysis
  -Paths
  -Context Info
-Configuration

**Configuration (slider):**
Game vs. Learning (vs. Story)

Learning vs Playing: Weighting Context (NGLOB) for Personalization/Adaptation
Authoring – Technology Transfer
StoryTec for Tourism, Darmstadt Marketing (2011)

Motivation

- Information & Advertisement → Tourism
- Use Story & Game Metaphers

Contribution

- Story-driven Online Game about Darmstadt
- Mini Games: Puzzle, Quiz, Memory, ..
- RTD & StoryTec Tool (httc), Story & Design (S. Radke), Game Development (R. Konrad)

Benefit, Results

- http://www.darmstadt-marketing.de
- Low Budget: Expectations vs Production Costs
- ’Informative, interesting .. Extensions?’
Control in Multiplayer Serious Games
Woodment & Escape from Wilson Island (KOM)

Motivation

- Multiplayer Online Games for Collaborative Learning@School – for Teacher & Pupils

RTD Contribution

- Woodment, Support for Teacher & Learner:
  - Integration/Configuration of Content
  - Competition and Cooperation (Teamwork)
- Escape from Wilson Island, Game Mastering
  - Logging, Camera Modi, Split Screen
  - Control (Triggering Events..) at Runtime
- Communication
  - Direct via Chat vs. Indirect via NPC’s
- On-Going: Evaluation, Group Adaptation, Game Mastering

Collaborative Learning with Peer Education
PEDALE (TUD FIF, Math, CS, Psych, 2011-2012)

Motivation
- Exchange of Math Task Solutions
- Peer Tutoring (Knowledge Transfer) & Peer Assessment (Feedback, Reflection)
- Use of open-format Questions (later)

RTD Questions
- Does Peer Tutoring Improve Learning Results?
- Is it Motivating?
- Correlation among Skill Levels and Content Usability?
- .. covered by an Interdisciplinary Team

[Image of a computer screen with a graph showing distance over time, and a question in German]

KOM – Multimedia Communications Lab
29
Communication in Collaborative Learning Env. 
GENIUS (LOEWE ModellProjekt, 2011-2012)

Game + Social Media & Social Networks
- User-generated Content for Peer Tutoring
- Game Influence of/by Non-Players
- Viral Marketing Effects for Serious Game Distribution

Partners
- DECK13 Interactive
- KTX Software

RTD Questions
- Does Peer Tutoring Improve Learning Results?
- Is it Motivating?
- Correlation among Skill Levels and Content Usability?

Image sources: DECK13 Interactive GmbH, facebook.com, google.com, studivz.de and innovationsfoerderung-hessen.de
Evaluation – Measuring Effects

Hard and soft factors
Effects & Affects ?
User/Game Experience ?
Sustainability ?
Metrics ?

Subjective vs. Objective Measurement

EPOC, Emotiv

Flow, Mihály Csíkszentmihályi
Evaluation – Methodologies
Evaluation – Classic, empirical
Questionnaire for User Experience

Fragebogen zu „User Experience“

Antworten Sie bitte auf einer Skala von 1 – 10
(mit 1 = gar nicht und 10 = sehr)

1. Das Spiel hat Langeweile vermieden
2. Das Spiel hat Frustration vermieden
3. Ich habe mich nur selten über das Spiel geärgert
4. Das Spiel hat mich angenehm gefordert
5. Die Geschichte hat meine Fantasie angeregt
6. Ich konnte den Aufgaben, Eindrücken, Informationen und Möglichkeiten im Spiel gut folgen und war nicht überfordert oder überlastet
7. Das Spiel hat Spaß gemacht
8. Das Spiel gab mir das Gefühl eigenbestimmt und kompetent zu sein
9. Ich fand das Spiel ästhetisch/ ansprechend gestaltet
10. Das Spiel war mitunter so einnehmend, dass ich unbedingt wissen wollte, wie es weiter geht
11. Einen Entwicklungsprozess festzustellen motivierte mich stark weiter zu machen
12. Teilweise spielte ich nur noch um des Spieles willen
13. Teilweise fühlte ich mich wie ein Teil der Spielwelt
14. Ich hatte während des Spiels das Gefühl die Spiel Figur zu sein
15. Das Spiel bot die Möglichkeit ein eigenständiges Selbstkonzept zu entwickeln, dem es Spaß machte zu folgen
16. Das Spiel war so spannend, dass es meine ganze Aufmerksamkeit beim Spielen auf sich zog
17. Das Spiel war so interessant, dass ich gar nicht merkte, wie schnell die Zeit vergeht
18. An machen Stellen war das Spiel so fesselnd, dass ich vollkommen vom Spiel eingenommen wurde
19. Manchmal war ich im Nachhinein sehr erleichtert, da ich ein Scheitern befürchtete
20. Ich merkte, dass ich teilweise stark emotional beteiligt war (Spannung, Trauer, Erleichterung, Freude, Wut)
Evaluation – Online
Product Advertisement, cooperation TuneUp

Motivation
- Increase Orders/CVR
- Use Game Elements

Contribution
- Discount (Ad)Game
- Game with 9 Levels
- Evaluation Study via A/B/C Analysis: Game Only (A), Both (B), Discount Only (C)
  - 4 Weeks (July) online http://tryit.tuneup.de: 4493 visitors A, 4773 B, 4819 C

Benefit, Results
- Consistency in CVR (no CVR Uplift)
  - -1,92% A, -0,21% B, 0% C
- User Engagement Uplift ~220%

<table>
<thead>
<tr>
<th>test case</th>
<th>direct sales</th>
<th>cookie sales</th>
<th>user engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (game only)</td>
<td>114</td>
<td>191</td>
<td>67,5%</td>
</tr>
<tr>
<td>B (game)</td>
<td>49</td>
<td>83</td>
<td>69,4%</td>
</tr>
<tr>
<td>B (sum)</td>
<td>168</td>
<td>203</td>
<td>20,8%</td>
</tr>
<tr>
<td>C (discount only)</td>
<td>168</td>
<td>205</td>
<td>22,0%</td>
</tr>
</tbody>
</table>
Evaluation – Games for Health, Cardio Training
ErgoActive (Strategic Research SG@KOM 2009+)

Motivation, Contribution & Results

- Adopt Personalized Learning Technologies to Personalized Exergames
- Authoring Tool (Sport Scientists/Doctors) & Configuration (Therapists)
- Vital Parameters considered via Sensor Technology (Heart Rate, Speed, Power)
- Cooperation: Wiemeyer, Gutjahr
- Evaluation (n=48, age 14-64)
Evaluation – Games for Health, Cardio Training
ErgoActive (Strategic Research SG@KOM 2009+)

Effects (vital data) & Affects (fun, enjoyment)

Privacy, ethical issues?
Conclusion – Gamification vs. Serious Games

Gamification

▪ "The application of gaming metaphors in non game contexts to influence behavior, improve motivation and enhance engagement."
▪ Points, badges, etc.
▪ .. but no gameplay

Serious Games

▪ Game with a purpose (beyond pure entertainment)
▪ Simulation games as a sub-genre
▪ Real game, with gameplay

Games

▪ Game 'just' for entertainment
Conclusion – Gamification & Serious Games

Game-based approaches
- Game elements and concepts
- Tool for motivation..
- .. to underline a (non-game) goal

Potential and Risks
- Extrinsic and intrinsic motivation
- Personalization and Adaptation, Control
- Communication and Competition
- Privacy, ethical issues

Need
- Studies – Proof of Concepts: Effects & Affects, Benefit
- Guidelines, Quality Labels, Standards(?)
Conclusion – Serious Games @ TU Darmstadt

Interdisciplinary Research
- Key research area „Serious Games“ since 2011
- Ca. 15 research groups involved
- [www.serious-games.tu-darmstadt.de](http://www.serious-games.tu-darmstadt.de)
- serious-games@fif.tu-darmstadt.de

FIF Projects
- Serious Human Rescue Game, PEDALE/Maths, Learning
- SG4Health, Multiple Sequence Alignment

Other Activities
- Ringvorlesung (lecture) Serious Games
- Preparation of graduate school Serious Games Technologies
Contact

Serious Games @ KOM, TU Darmstadt
- www.kom.tu-darmstadt.de/serious-games
- Dr. Stefan Göbel
- Stefan.Goebel@kom.tu-darmstadt.de
- Tel.: 06151/16-6149

Autorenumgebung StoryTec u. Demos
- http://www.storytec.de

GameDays Event
- http://www.gamedays2014.de
- Int’l Conference, Workshops, Rallye
- April 1-5, TU Darmstadt
References gamification

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http://de.slideshare.net/dings/meaningful-play-getting-gamification-right?from_search=3

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Removing Gamification from an Enterprise SNS. ACM CSCW, 2012.

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Job & Karriere, COMPUTERWOCHE 37/13