

Introducing the "Serious Games Mechanics": A theoretical framework to analyse relationships between "game" and "pedagogical aspects" of Serious Games

Citation for published version (APA):

Suttie, N., Lim, T., Louchart, S., Macvean, A., Westera, W., Brown, D., & Djaouti, D. (2012). Introducing the "Serious Games Mechanics": A theoretical framework to analyse relationships between "game" and "pedagogical aspects" of Serious Games. In A. De Gloria, & S. de Freitas (Eds.), *Procedia Computer Science* (2012 ed., Vol. 15, pp. 314-315). Elsevier. <https://doi.org/10.1016/j.procs.2012.10.091>

DOI:

[10.1016/j.procs.2012.10.091](https://doi.org/10.1016/j.procs.2012.10.091)

Document status and date:

Published: 19/12/2012

Document Version:

Peer reviewed version

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

<https://www.ou.nl/taverne-agreement>

Take down policy

If you believe that this document breaches copyright please contact us at:

pure-support@ou.nl

providing details and we will investigate your claim.

Downloaded from <https://research.ou.nl/> on date: 19 Jan. 2022

Open Universiteit
www.ou.nl



Virtual Worlds for Serious Applications (VS-GAMES'12)

In Pursuit of a 'Serious Games Mechanics'

A Theoretical Framework to Analyse Relationships Between 'Game' and 'Pedagogical Aspects' of Serious Games

Neil Suttie^a, Sandy Louchart^{a*}, Theodore Lim^a, Andrew Macvean^a, Wim Westera^b,
Damien Djaouti^c, Damian Brown^d

^aHeriot-Watt University, Edinburgh EH14 4AS, Scotland, UK

^bCELSTEC-Centre for Learning Sciences and Technologies, Open University of the Netherlands, Edinburgh EH14 4AS, Netherlands

^cInstitut de Recherche en Informatique de Toulouse, Université Paul Sabatier, 118 Route de Narbonne, F-31062 TOULOUSE CEDEX 9, France

^dSerious Games Interactive, Ravnsborggade 2-4, 2nd floor, 2200 Copenhagen N, Denmark

Abstract

Essential for the development of effective Serious Games is the careful balance of education and play. It is necessary to develop a clear understanding of game mechanics (i.e. the tools of game-play) and how these relate to relevant educational strategies. In this paper, we raise conceptual questions regarding the nature of Serious Games and the relationship between game mechanics, pedagogy and the conceptual level at which they connect. In developing theoretical framework linking game mechanics and learning, we aim to ease the work of the Serious Game designers attempting to produce both fun and pedagogically effective Serious Games.

© 2012 The Authors. Published by Elsevier B.V. Selection and/or peer-review under responsibility of the scientific programme committee of VS-Games 2012

Keywords: Serious Games, Game Mechanics, pedagogy, design framework, mapping

1. Introduction

Serious Games (SGs) can be defined as “games that do not have entertainment, enjoyment or fun as their primary purpose” [1]. SGs have been employed to address issues in a variety of fields including Healthcare, defense, Communication and education. However, the relationship between pedagogy and Game Mechanics (GM) remains unclear and it is difficult to identify the exact mechanisms linking pedagogy and SGs.

* Corresponding Sandy Louchart. Tel.: +44 0 131 451 3424; fax: +44 0 131 451 3327.
E-mail address: S.Louchart@hw.ac.uk.

2. Towards A Framework

From a game perspective, certain game aspects can provide indications as to where pedagogical constructs might be represented within SGs. Researchers in digital gaming have thus far commonly focused on genres, design patterns [2] and GMs [3]. While none of the methods discussed above provide a perfect fit for SGS, we observe that the user-centric description of GMs represents an attractive alternative to the game-centric representation of design patterns. We propose the Serious Game Mechanic (SGM) as a construct that defines the relationship between a learning mechanism and a set of GMs through which it is concretely realised. In examining what defines a SGM, apart from standard GMs and design patterns, we move towards a unified language for understanding and replicating pedagogically effective SGS.

GAME MECHANICS	THINKING SKILLS	LEARNING MECHANICS	LOTS to HOTS
<ul style="list-style-type: none"> ○ Design/Editing ○ Infinite Game play ○ Ownership ○ Protégé Effect ○ Status ○ Strategy/Planning ○ Tiles/Grids 	CREATING	<ul style="list-style-type: none"> ○ Accountability ○ Ownership ○ Planning ○ Responsibility 	
<ul style="list-style-type: none"> ○ Action Points ○ Assessment ○ Collaboration ○ Communal Discovery ○ Resource Management ○ Game Turns ○ Pareto Optimal ○ Rewards/Penalties ○ Urgent Optimism 	EVALUATING	<ul style="list-style-type: none"> ○ Assessment ○ Collaboration ○ Hypothesis ○ Incentive ○ Motivation ○ Reflect/Discuss 	
<ul style="list-style-type: none"> ○ Feedback ○ Meta-game ○ Realism 	ANALYSING	<ul style="list-style-type: none"> ○ Analyse ○ Experimentation ○ Feedback ○ Identify ○ Observation ○ Shadowing 	
<ul style="list-style-type: none"> ○ Capture/Elimination ○ Competition ○ Cooperation ○ Movement ○ Progression ○ Selecting/Collecting ○ Simulate/Response ○ Time Pressure 	APPLYING	<ul style="list-style-type: none"> ○ Action/Task ○ Competition ○ Cooperation ○ Demonstration ○ Imitation ○ Simulation 	
<ul style="list-style-type: none"> ○ Appointment ○ Cascading Information ○ Questions And Answers ○ Role-play ○ Tutorial 	UNDERSTANDING	<ul style="list-style-type: none"> ○ Objectify ○ Participation ○ Question And Answers ○ Tutorial 	
<ul style="list-style-type: none"> ○ Cut scenes/Story ○ Tokens ○ Virality ○ Behavioural Momentum ○ Pavlovian Interactions ○ Goods/Information 	RETENTION	<ul style="list-style-type: none"> ○ Discover ○ Explore ○ Generalisation ○ Guidance ○ Instruction ○ Repetition 	

Fig. 1. Game Mechanics Learning Mechanics Framework

3. Conclusions

From a pedagogical perspective it is difficult to dissociate GMs from educational components at the implementation level, and a SG forms an entity for which its function is to educate and entertain through a single compelling experience. If, as we suggest, pedagogical constructs are represented at a higher-level of abstraction than SGMs, crossovers between game and learning strategies should be identifiable. Therefore, we propose that through dissecting a wide range of successful SGs and examining their individual learning and play components through the theoretical framework proposed (See Fig 1), we can identify the SGMs that have proven successful and advance towards a practical conceptual design tool for effectively implementing educational mechanisms for future SGs.

Acknowledgements

This project is partially funded by the GALA project(www.galano.eu) under the European Community Seventh Framework Programme (FP7/2007 2013), Grant Agreement nr. 258169.

References

- [1] Michael, D., Chen, S. Serious Games: Games That Educate, Train, and Inform. Course Technology PTR, 2006.
- [2] Björk, S., Holopainen, J. (2004). Patterns in Game Design. Charles River Media.
- [3] Sicart, M. 2008. Defining Game Mechanics. The International Journal of Computer Games Research. Volume 8, Issue 2.