Serious games - Usage in Civil Society: the Military, Health, Informal Vocational and Formal Education Settings

Stelios Xinogalos
Department of Applied Informatics, School of Information Sciences
University of Macedonia, Thessaloniki, Greece
stelios@uom.edu.gr

Outline

- Serious games definition and sectors of usage

- Military serious games

- Health serious games

- Informal vocational serious games

- (In)formal educational serious games

- Serious games implemented @ UOM

- Current research on Serious Games @ UOM

Serious games - origins

"Games may be played seriously or casually. We are concerned with serious games in the sense that these games have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement. This does not mean that serious games are not, or should not be, entertaining."

Abt, C. C. (1970). Serious Games. Viking Press.

Researcher who worked in an U.S. research laboratory during the cold war (Abt Associates, 2005). One of his goals was to use games for training and education.

Serious games - today

- **Game**: a physical or mental contest, played according to specific rules, with the goal of amusing or rewarding the participant.
- **Video Game**: a mental contest, *played with a computer* according to certain rules for amusement, recreation, or winning a stake.
- **Serious Game**: a mental contest, played with a computer in accordance with specific rules that *uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives*.

Zyda, M. (2005). "From visual simulation to virtual reality to games". *IEEE Computer*, 25-32.

Industry/sectors of serious games
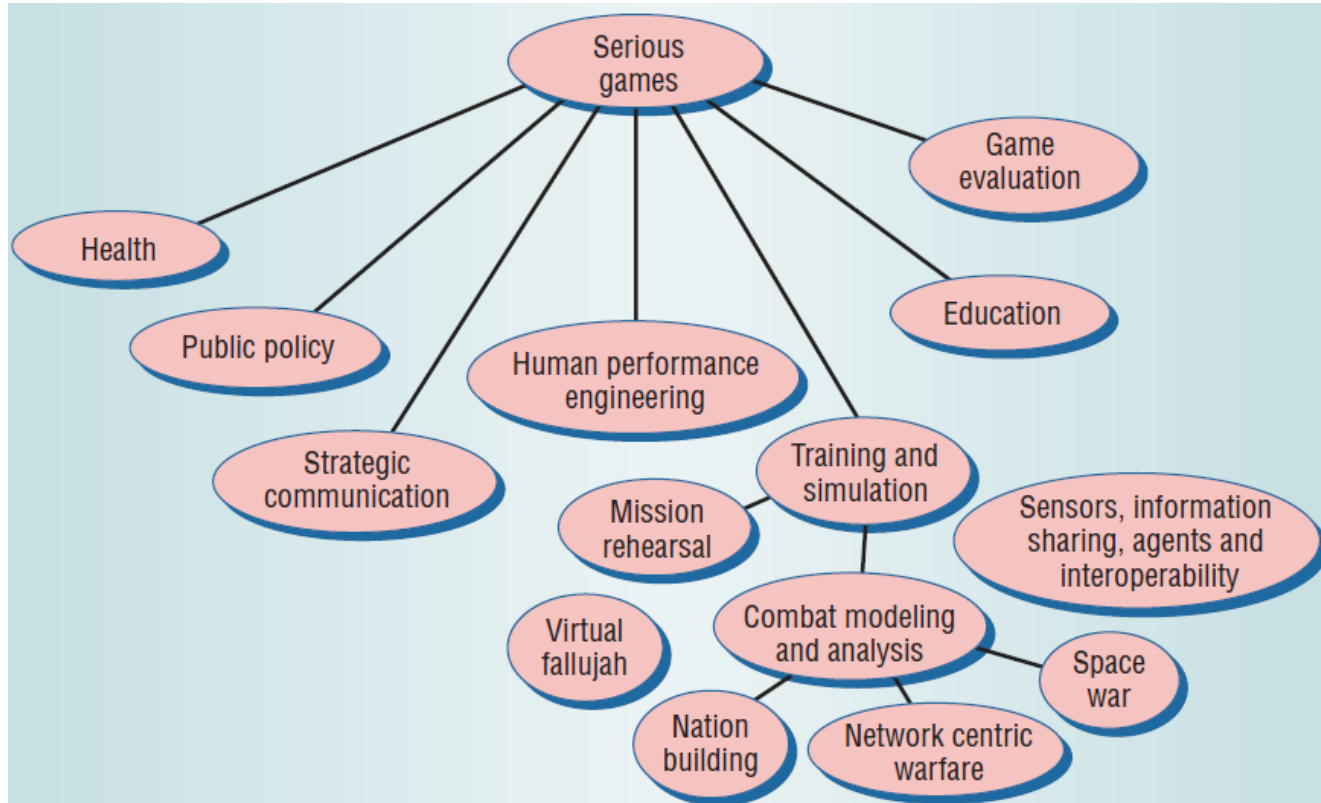
Zyda, M. (2005). "From visual simulation to virtual reality to games". *IEEE Computer*, 25-32.

Military serious games - origins

America's Army (recruiting tool & military training simulator):
http://www.americasarmy.com/

Figure 2. America's Army. The most widely used and successful serious game to date, this title initially served as a recruiting tool.

Figure 3. Training simulator. Despite the initial evaluator's skepticism, America's Army proved to be an effective military training simulator. Soldiers who played the rifle range segment of the game, for example, earned improved scores on the real-life rifle range.

Zyda, M. (2005)

Military serious games - origins

- **1999**: a failure to reach the Army recruiting goals results in the Congress's decision to increase the Army's recruiting funds.

- Colonel Casey Wardynski, an Army's Chief Economist and Professor at the United States Military Academy envisioned **"using computer game technology to provide the public a virtual Soldier experience that was engaging, informative and entertaining."**

- **2002**: America's Army is published by the US Army.

- **2008**: the U.S. Army creates a video game unit and invests $50 million for watching trends in the gaming industry and identifying technology that can be used to train soldiers.

"The Army takes this seriously,"
Statement by Lieutenant Colonel Gary Stephens (Product manager for air and ground tactical trainers at Project Executive Office) at the military newspaper *Stars & Stripes in 2008*.

Military serious games - usage

- Recruiting

- Training
  - Field Training
  - Cultural and Language Training

- Psychological support

- Building awareness

Military serious games - advantages

- they are cost-effective
- time and labor effort to set up training is minimized
- training is safe
- training can be applied in large scale
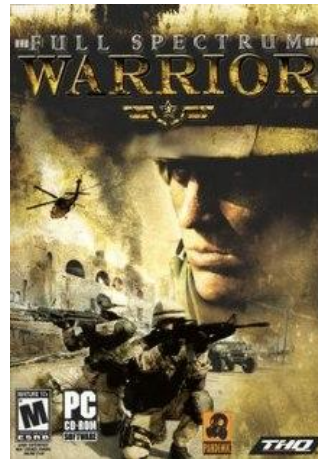- training can be repeated as many times as needed

Downside

Military games usually exclude the negative facets of the Army, such as collateral damage and harassment.

Such games might give a false impression of reality, so be critical!

Military serious games - examples

Recruiting & Field Training

Field training & Psychological Support

Full Spectrum Warrior has been used by psychologists to assist veterans from Iraq overcome the effects of post-traumatic stress disorder.

Cultural & Language Training
Practicing skills in conducting meetings and negotiations in a specific cultural context.


Sexual Harassment and Assault Prevention and Response (SHARP) is a game aiming at training commanders to tackle sexual assault and harassment in their units.

Military serious games - technology

- Military games are characterized by a **high level of fidelity with real world events**.

- Highly realistic character behaviors and environments require **high quality graphics** and **Artificial Intelligence**.

- They require **dynamic**, **immersive** training systems.

… usually a case of professionals.

Health serious games - usage
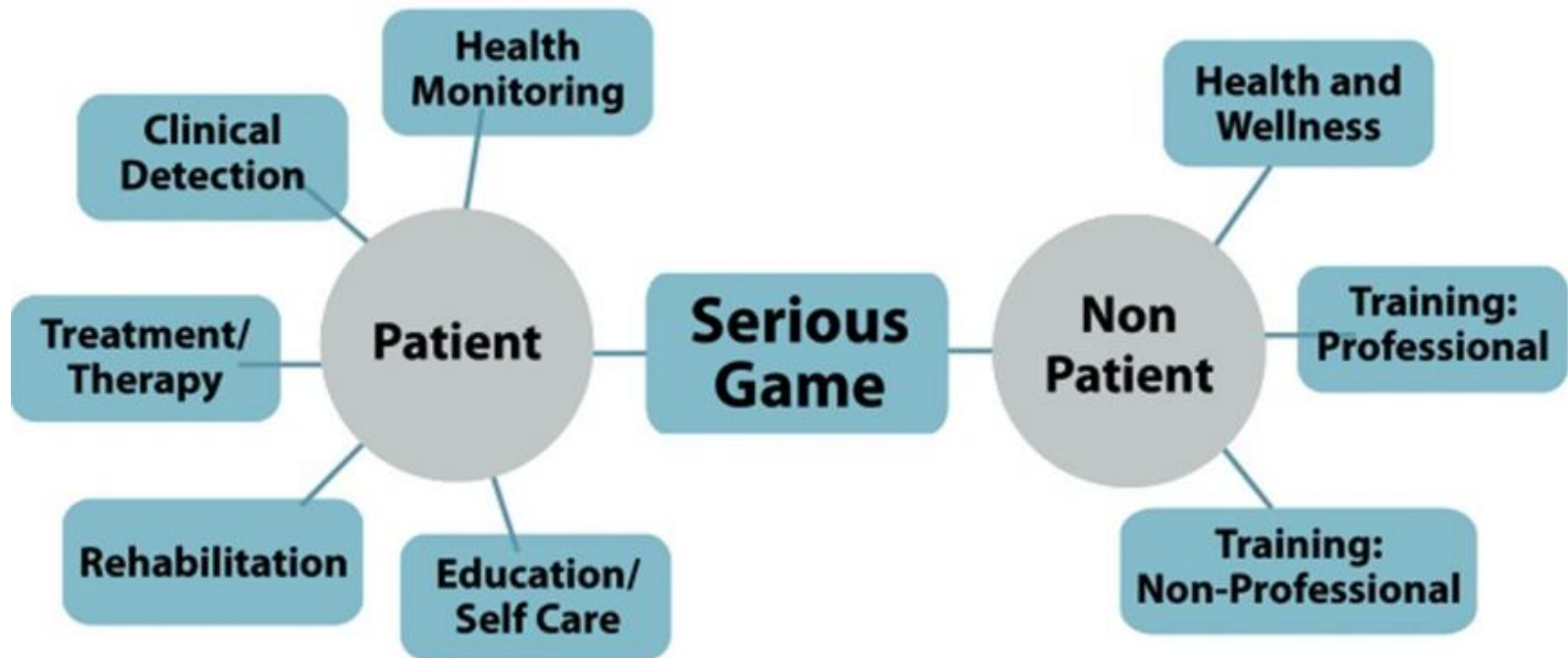
Wattanasoontorn, V., Boada, I., García, R., & Sbert, M. (2013). Serious games for health. *Entertainment Computing, 4*(4), 231-247.

Health serious games - usage

- **Serious games for rehabilitation**: the main aim of these games is to improve cognitive and motor skills of patients during the rehabilitation.

- **Serious games for health promotion and education**: depending on the target population, these games focus on aspects such as raising awareness, diet, exercise, hygiene and social abilities.

- **Serious games for educating and training healthcare professionals**: these games form training tools that provide a simulated environment.

- **Video games for distracting patients during painful medical procedures**: the immersive characteristic of video games and virtual reality have been shown to be effective in focusing a patient's attention away from the pain caused by their treatment.

Health serious games - usage

	Professionals Training	26	24.07%
	Health & Wellness	25	23.15%
	Non-Professionals Training	16	14.81%
	Rehabilitation	15	13.89%
	Treatment	13	12.04%
	Education	9	8.33%
	Detection	4	3.70%

Game Objective

	General Health	43	39.81%
	Stroke	5	4.63%
	Diabetes	5	4.63%
	Brain Health	5	4.63%
	Autism	4	3.70%
	Neuro Health	4	3.70%
	Obesity	3	2.78%
	Alzheimer	2	1.85%
	Cancer	2	1.85%

	Chronic Pain	2	1.85%
	Flu	2	1.85%
	Injuries	2	1.85%
	Knee Surgery	2	1.85%
	Parkinson	2	1.85%
	Quit Smoking	2	1.85%
	Upper-Limb Rehabilitation	2	1.85%
	Others	21	19.44%

Disease

Source: Wattanasoontorn et al. (2013)

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Health serious games - advantages

- **Realistic role-play** is time and labour intensive.

- Traditional teaching methods lack in **psychological fidelity** (*they do not mimic the responses that the real situation would cause*).

- Game technology-based tools are less expensive, take less time, and result in **less medical errors** when surgery is actually performed.

- Health simulations allow the player to **repeat till s/he reaches mastery** in a safe environment that would be too costly, dangerous or time consuming to do in real life.

Health serious games - advantages

- **Serious games for rehabilitation**: make the exercises easier and more fun compared with the traditional methods through using simulation and virtual reality (VR) environments.

- **Serious games for health promotion and education**: raise awareness on various health issues.

- **Serious games for educating and training healthcare professionals**: make training safe and cost-effective, they are repeatable and result in reducing medical errors and subsequent healthcare costs.

- **Video games for distracting patients during painful medical procedures**: are effective in focusing a patient's attention away from the pain caused by their treatment.

Norwegian Centre for **E-health Research**

https://ehealthresearch.no/files/documents/Faktaark/Fact-sheet-2016-11-Serious-Games-in-Healthcare.pdf

Health serious games - examples

Pulse!! is a serious game for learning complex medical practices technical knowledge, including diagnosis of illnesses, ER services and complex surgical procedures.

The **Computer Assisted Rehabilitation ENvironment** (**CAREN**) is a versatile, multi sensory system for clinical analysis, rehabilitation, evaluation and registration of the human balance system.
The use of virtual reality enables researchers to assess the subject's behavior and includes sensory inputs like visual, auditory, vestibular and tactile.

Health serious games - examples

HopeLab developed the third-person shooter game **Re-Mission** and **Re-Mission2** in order to support children that fight with cancer and encourage their treatment adherence.

The player fights against cancer with multiple weapons and powers based on real strategies like chemotherapy, antibiotics and body's natural defenses.

Kato et al. (2008) and Cole et al. (2012) studied the effects of the game and concluded that playing ReMission led to more consistent treatment adherence, faster rate of increase in cancer knowledge, and faster rate of increase in self-efficacy in young cancer patients.

Cole, S. W., Yoo, D. J., Knutson, B. (2012). Interactivity and Reward-Related Neural Activation during a Serious Videogame. PLoS ONE, 7(3), doi:10.1371/journal.pone.0033909.
Kato P. M., Cole S. W., Bradlyn A. S., Pollock B. H. (2008). A Video Game Improves Behavioral Outcomes in Adolescents and Young Adults With Cancer: A Randomized Trial. Pediatrics, 122(2), e305-e317. doi:10.1542/peds.2007-3134.

Health serious games - technology

- **Immersive technology** which provides perceptually-real environments.

- **Special equipment** such as holography, head-mounted displays (HMDs), haptic tactile equipment, virtual reality headsets, mobile devices and wearable sensors.

- **Augmented reality** that allows computer generated virtual imagery to exactly overlay physical objects in real time.

Platform

■	PC	76	70.37%
■	Console	12	11.11%
■	Handhield	12	11.11%
■	Multi	8	7.41%
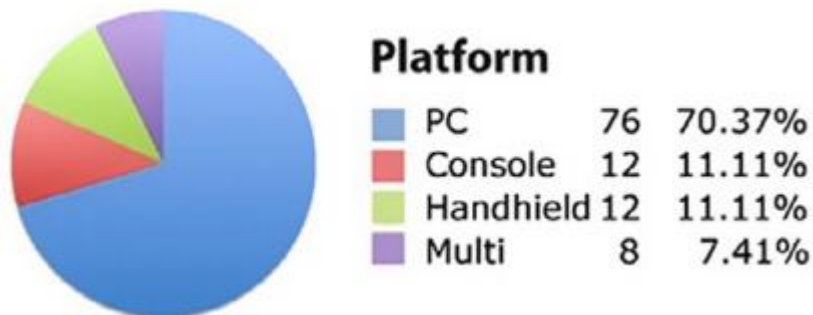
Source: Wattanasoontorn et al. (2013)

Health serious games - conferences

7th International Conference on Serious Games and Applications for Health, IEEE SeGAH 2019:

http://www.segah.org/2019/

8th Games for Health Conference 2018:

https://www.gamesforhealtheurope.org/

Informal Vocational serious games - usage

- SGs are used for acquiring vocational skills in a great variety of sectors, ranging from business and entrepreneurship to manual vocations (such as plumping, work safety).

- SGs are used for supporting players to develop both the functional skills related to particular vocations, and the "soft skills" which are required for young people to prosper in the world of work, such as problem-solving, communication, innovation and collaboration.

Informal Vocational serious games - advantages

- SGs can introduce players to various vocations in a non-threatening, risk-free and fun environment.

- A basic experience of "working" in a number of different fields can be gained.

- Players can practice and improve their skills again and again in an environment where making mistakes is not at all considered as a failure.

- Actually, within a game, mistakes are an intrinsic part of the mechanics and the player learns by trying various strategies either successful or not in his/her attempt to reach the final goal.

Informal Vocational serious games - examples

Students learn how to run a sports retail store based on retailing football club merchandise.
In the process they experience the start-up and management of a business, learning both from their mistakes and from their successes.
http://www.thesmallbusinessgame.co.nz/aboutTheGame.aspx

Serious game about safety on workplace - obstacles on the floor.
The player is a manager of small team of workers who's mission is to load the space ship.
http://vahur.net/busyworkers/game.html

Informal Vocational serious games - examples

siLang (Culturally Oriented Language Skill Development in line with Workplace Needs):

Windows, Mac & Android
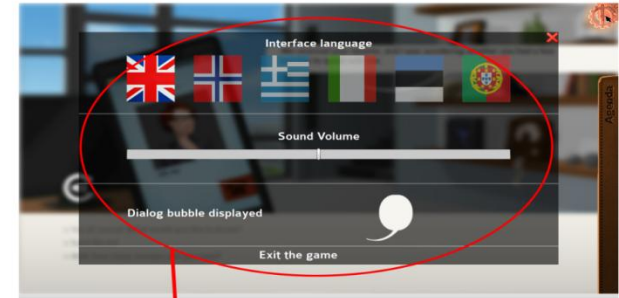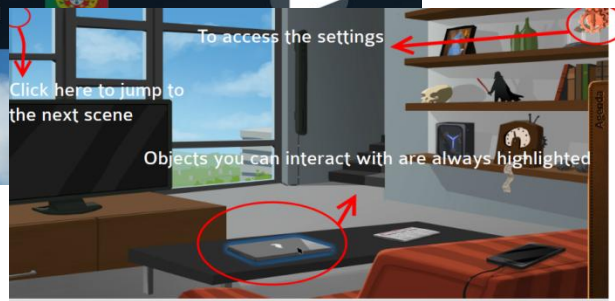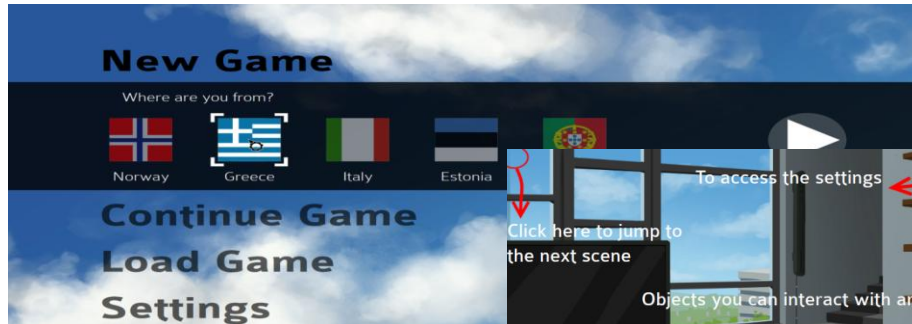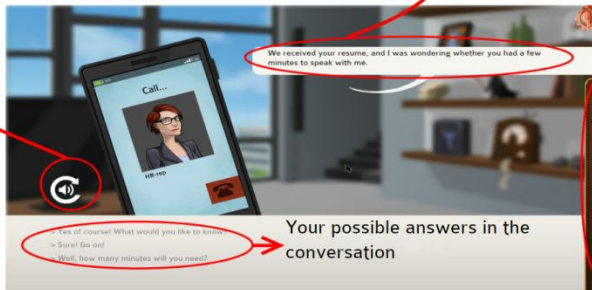
(In)formal Educational serious games - advantages

What happens when we bring games into the classroom?

* games create intrinsic motivation through fantasy, control, challenge, curiosity, and competition

* games in the classroom advance student's interest in developing new skills and participating in new roles that could be difficult to experience in the real world

* psychologists agree that play is a crucial method through which we test ideas, develop new skills, and participate in new social roles (Piaget 1962; Vygotsky 1978).

Ulicsak, M. (2010). *Games in education: serious games: A Futurelab literature review*. FutureLab.

(In)formal Educational serious games - challenges

What are the reasons for not bringing games into the classroom?

- Concerns about physical and cost barriers, having enough hardware, licenses and sufficient access.
- Lack of instructors' confidence in using the game, having the time to read the manual.
- It is not clear to the instructor how and at what degree the game relates to the curriculum goals.
- Limited support in assessing student's learning.
- Games are not effective for all students for learning specific fields.

Ulicsak, M. (2010). _Games in education: serious games: A Futurelab literature review_. FutureLab.

(In)formal Educational serious games - challenges

"…. bringing **a commercial-quality educational game into the classroom** may create as many motivational problems as it solves.

When I introduced **Civilization III** into curricula, I found that students were anything but immediately motivated. …

Although after-school students were less resistant and more motivated to learn the game, roughly **25% of students** in school situations **complained that the game was too hard**, complicated, and uninteresting, and they elected to withdraw from the gaming unit and participate in reading groups instead.

About another **25% of the students** (particularly academic underachievers) **loved playing the game**, thought it was a "perfect" way to learn history, and **considered the experience a highlight** of their school year.

… the game-based curriculum provided **opportunities for replaying history** and for considering hypothetical historical scenarios."

Squire, K. (2005). Changing the game: What happens when video games enter the classroom?. *Innovate: Journal of online education*, *1*(6).

Serious games implemented @ UOM

CMX (educational MMORPG for Computer Programming):

PhD Malliarakis Christos
Dept. of Applied Informatics

Malliarakis, C., Satratzemi, M., Xinogalos, S. (2017). CMX: The Effects of an Educational MMORPG on Learning and Teaching Computer Programming, *IEEE Transactions on Learning Technologies*, Vol. 10, Issue 2, 219-235, doi:10.1109/TLT.2016.2556666.

Incorporating Serious Games in the MSc in Applied Informatics @ UOM

Working on CMX gave motivation to propose a course on

"Serious Games Programming"

for the new curriculum of the Master in Applied Informatics in the academic year 2014-15.

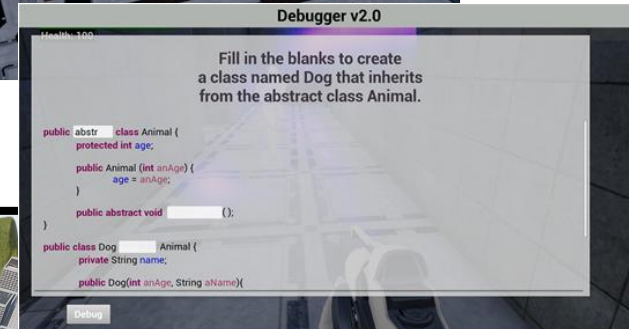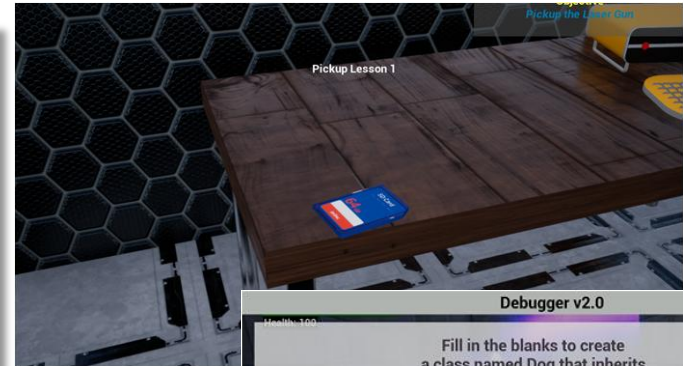This course has resulted in the implementation of several SGs in the context of BSc and MSc theses and PhD research…

Xinogalos, S. (2018). Programming Serious Games as a Master Cource: Feasible or not? *Simulation & Gaming*, Vol. 49, Issue 1, 8-26.

Serious games implemented @ UOM

Learning OOP in Java, Msc thesis, Tsiligoneas Vangelis, 2015
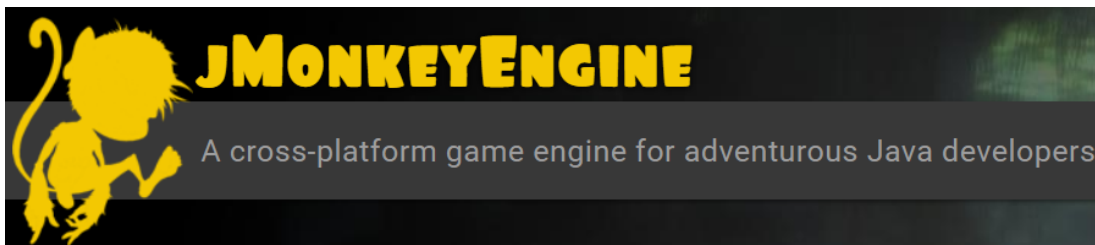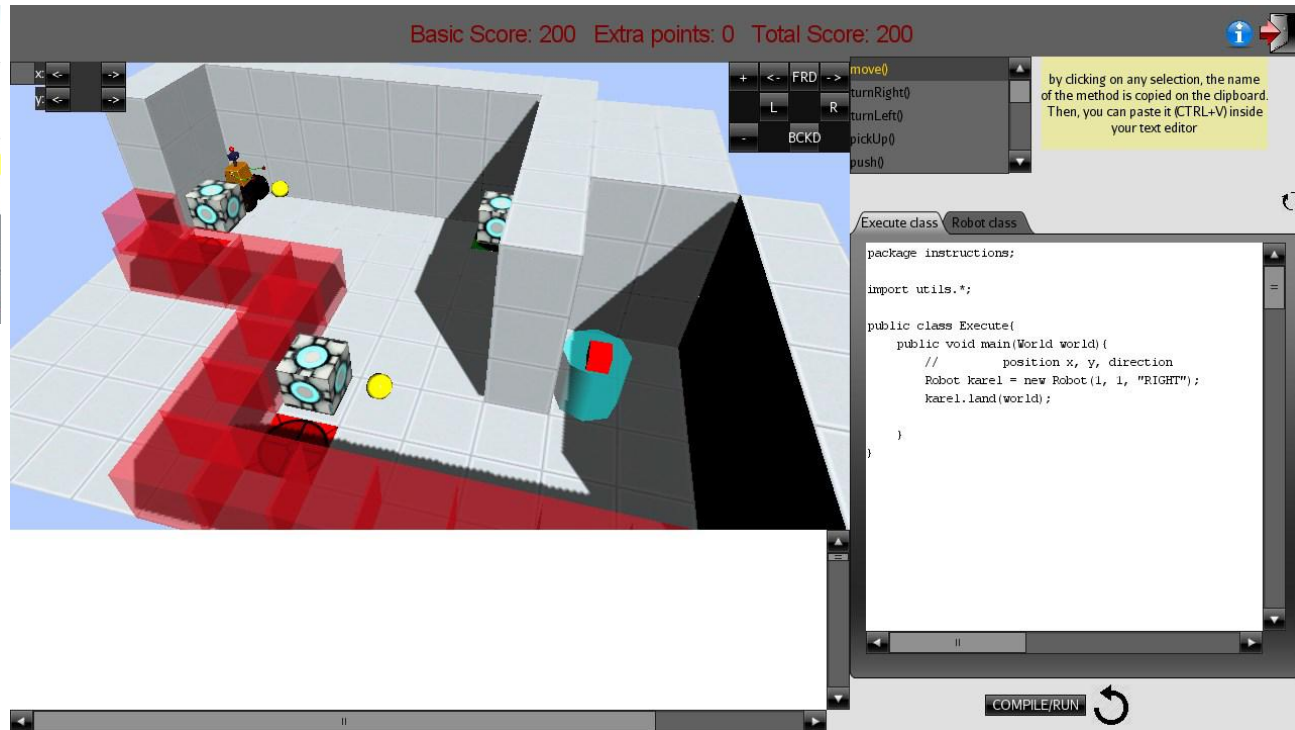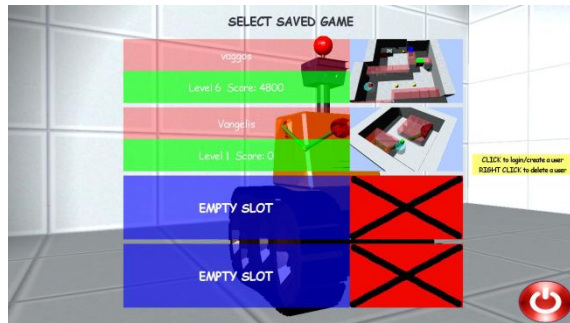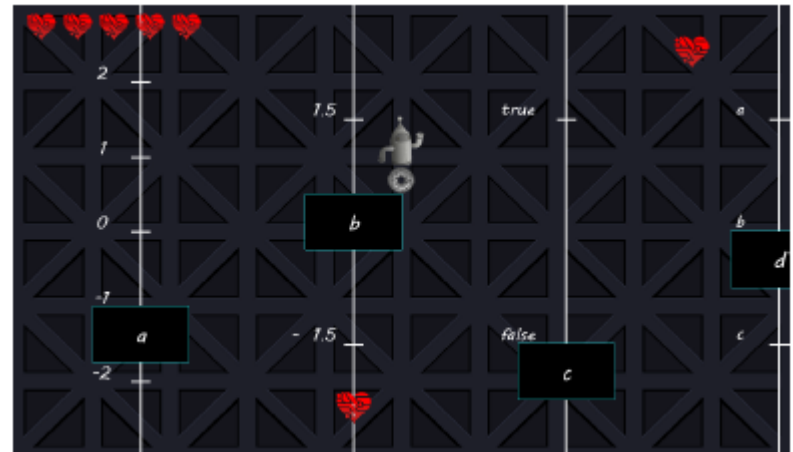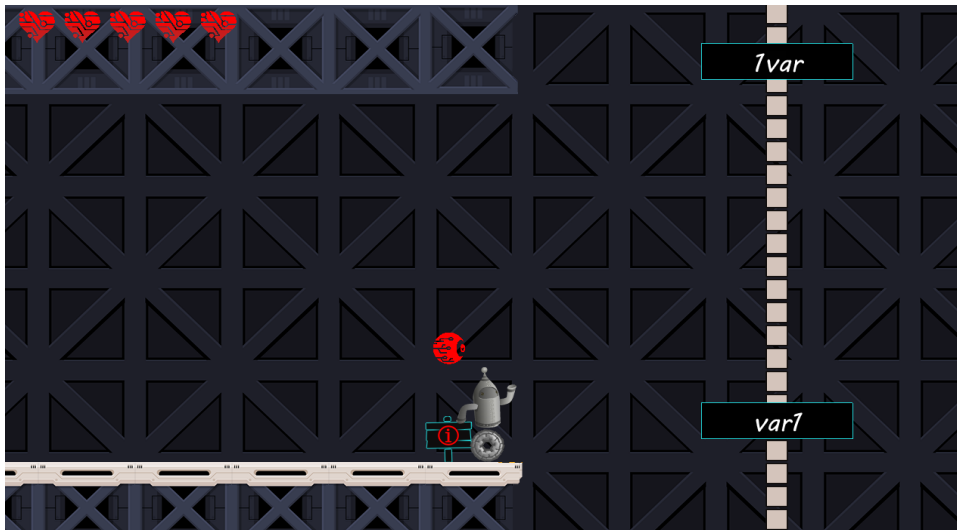
Serious games implemented @ UOM

Learning OOP concepts in Java, Bsc thesis, Michailidis G., 2017

Serious games implemented @ UOM

jAVANT-GARDE – cross platform game for learning programming concepts in Java, Galgouranas Stefanos, BSc thesis, 2018

Cross platform Java development framework

Galgouranas, S., & Xinogalos, S. (2018). jAVANT-GARDE: A Cross-Platform Serious Game for an Introduction to Programming with Java. *Simulation & Gaming*. DOI: 10.1177/1046878118789976.
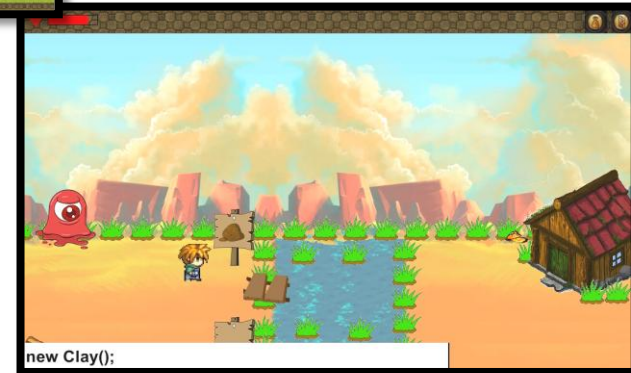
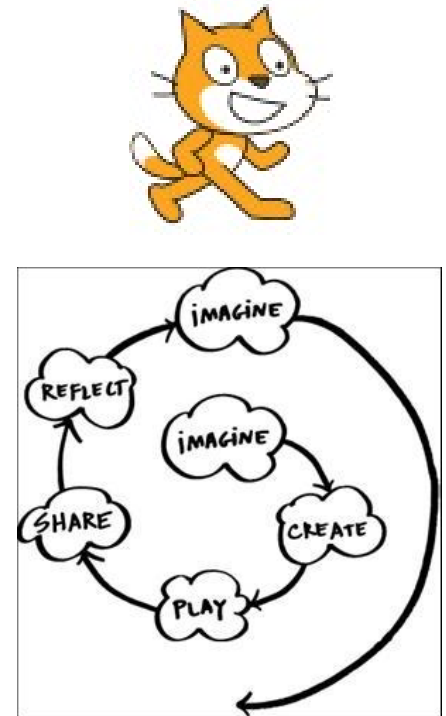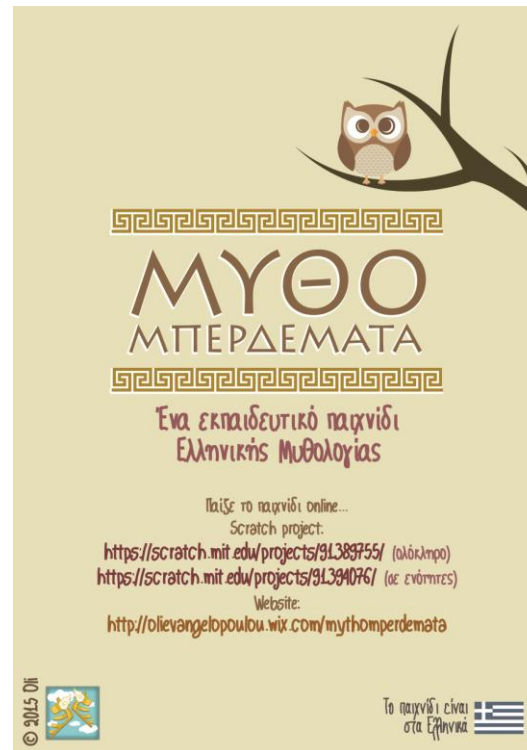https://sites.google.com/a/uom.edu.gr/stelios-xinogalos/serious-games/programming

Serious games implemented @ UOM

Game of Code: Lost in Javaland – cross platform for learning OOP concepts

Serious games implemented @ UOM

Evangelopoulou, O., & Xinogalos, S. (2018). MYTH TROUBLES: An Open-Source Educational Game in Scratch for Greek Mythology. *Simulation & Gaming,* Vol. 49, Issue 1, 71-91, DOI: 10.1177/1046878117748175.

https://scratch.mit.edu/projects/91389755/
Evangelopoulou Olymplia, MSc thesis, 2016 34

Serious games implemented @ UOM

CELLS of WAR – a serious game for familiarizing players with the Immune System

Konstantara Konstantina, MSc thesis, Master on Applied Informatics, 2018

Current research @ UOM

- Serious games for people with Intellectual Disabilities and Autism
  PhD candidate: Stavros Tsikinas

- Environments for designing and implementing Location-based Serious Games for Mobile Devices
  PhD candidate: Spyros Xanthopoulos

- Programming Environments and Games for teaching Computational Thinking (Programming) to young students
  PhD candidate: Andreas Giannakoulas

- Serious Games in Cultural Heritage
  PhD candidate: Tsita Christina, Supervisor: Maya Satratzemi

Educational Technology Research Group

EdTechRG|UoM

Software and Data Engineering Lab
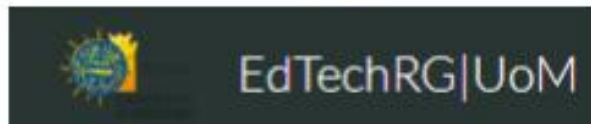
Εργαστήριο Τεχνολογίας Λογισμού & Δεδομένων
Software and Data Engineering Lab

Conclusions & practical experiences

Serious games do have an **impact on society**
    and research is required
        in order for them to have an even greater impact…

Conclusions &
practical experiences

What makes a serious game effective, especially if it is going to be used in the classroom?

- First of all, the game must be fun!
- The next big challenge is to incorporate the educational material and ensure that the game remains fun.
- In order for this to happen the game scenario and the learning activities must be in harmony.
- Actually, learning must be accomplished through playing and not just award the student with some playing because s/he has achieved a learning goal.
- The educational material and the activities must be in accordance with the intended course.
- The time needed to master the game and approach the educational goal should not forbid its usage in the class.

… and of course all these must be meet after the goal and the target group of the game are clearly defined!

Conclusions &
practical experiences

Is it possible for BSc/Msc students to design and implement a (serious) game?

The answer is yes, if they are willing to work hard
…and usually the idea of implementing a game gives them the necessary motivation to do so!

Important steps for students:
- Study carefully the field and deeply comprehend the material that the game intends to transfer.
- Use one of the established SGs Design Frameworks to guide the process of designing the game.
- Select the appropriate tool for implementing the game based on prior programming knowledge and/or willingness to learn something new.
- Use an established SGs Evaluation Framework to assess the acceptance/effectiveness of the game.

Thank you!