Annote: A Serious Game for Medical Students to Approach Lesion Skin Images of a Digital Library

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Gamification and Serious Gaming (1)

Gamification: application of game-design elements and principles in non-game contexts

• exploits game mechanics to improve skills and knowledge by enhancing engagement and excitement while performing a task that usually does not provides them

Gamification and Serious Gaming (2)

Serious Games: games designed not only for the pure entertainment

• focused on the <u>simulation</u> with pedagogical purpose, by exploiting fun and competition

• used in environments like: defense, education, scientific exploration, health care, emergency management, city politics, …
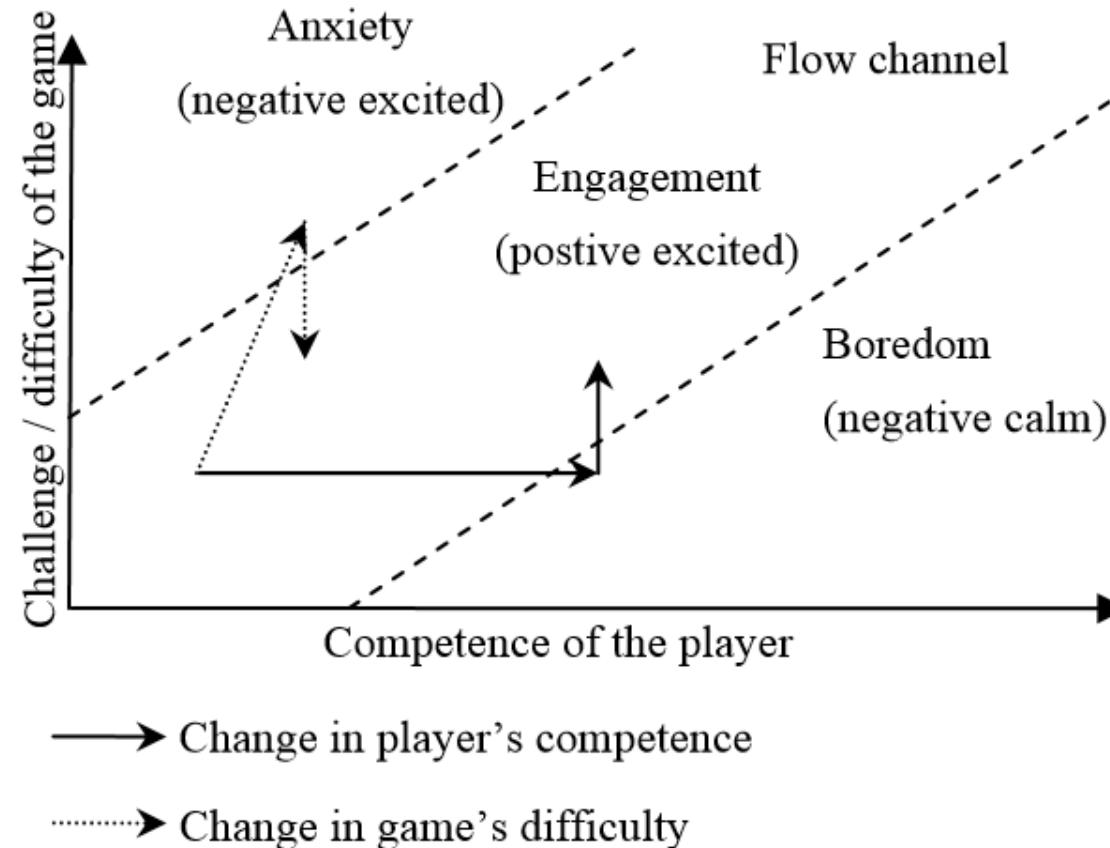
Flow Theory

Flow is a state with total involvement where skills fully meet the challenge

Csìkszentmihalyi

The Gamification Process (1)

Problem:

In medical field, the clinical image annotation (i.e. dermatology) is a time-consuming task made by experts:

- requires skills and specific knowledges
- medical students need to practice
- academics need to evaluate students
- clinical data have privacy and security protocols

<u>Usable and reliable Annotation Tools are not enough !!!</u>
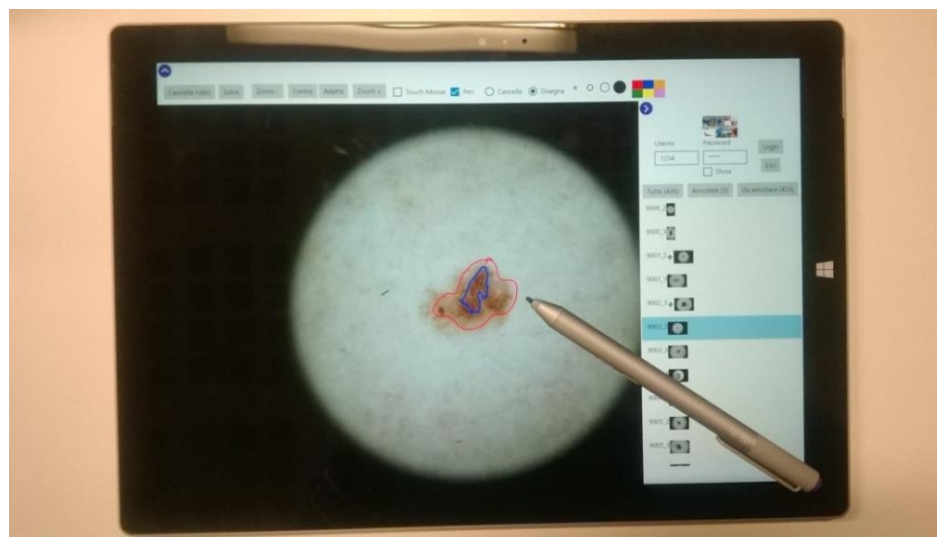
The Gamification Process (2)

A Serious Game can enhance training, evaluation, collaboration and communication

The Annotation Tool can be used to develop a Serious Game

Game Objects: act of 'draw strokes' and use of interactive tools

- **Repetitiveness** is a <u>learning element</u> that, differently from commercial videogames, reinforces behavior change and progression in performances

The Gamification Process (3)

The works of Hamari and Coltell presents guidelines and design concepts tested on empirical studies

• Score Points	• Challenge	• Story/Plot	• Rules
• Leaderboard	• Levels	• People	• Safety
• Achievements	• Progress	• Fantasy	• Interaction
• Rewards	• Goals	• Exploration	
Design/Content	**Design**	**Content**	**System**

Design and Content (1)

Main challenges offered by the game:

- **border challenge** (precision): player has to draw a lesion border annotation that imitates the 'official' one (ground-truth)

- **structures challenge** (recognition): player has to annotate groups of skin textures, clues and patterns (lines, circles, reticles,..)

- **time challenge** (pressure): player must annotate respecting a flowing timer

- **lesion classification** (quiz): player gives a diagnosis on the severity of a skin lesion from a displayed image annotation

Design and Content (2)

Difficulty modes given by:
- type and amount of images chosen for a game session
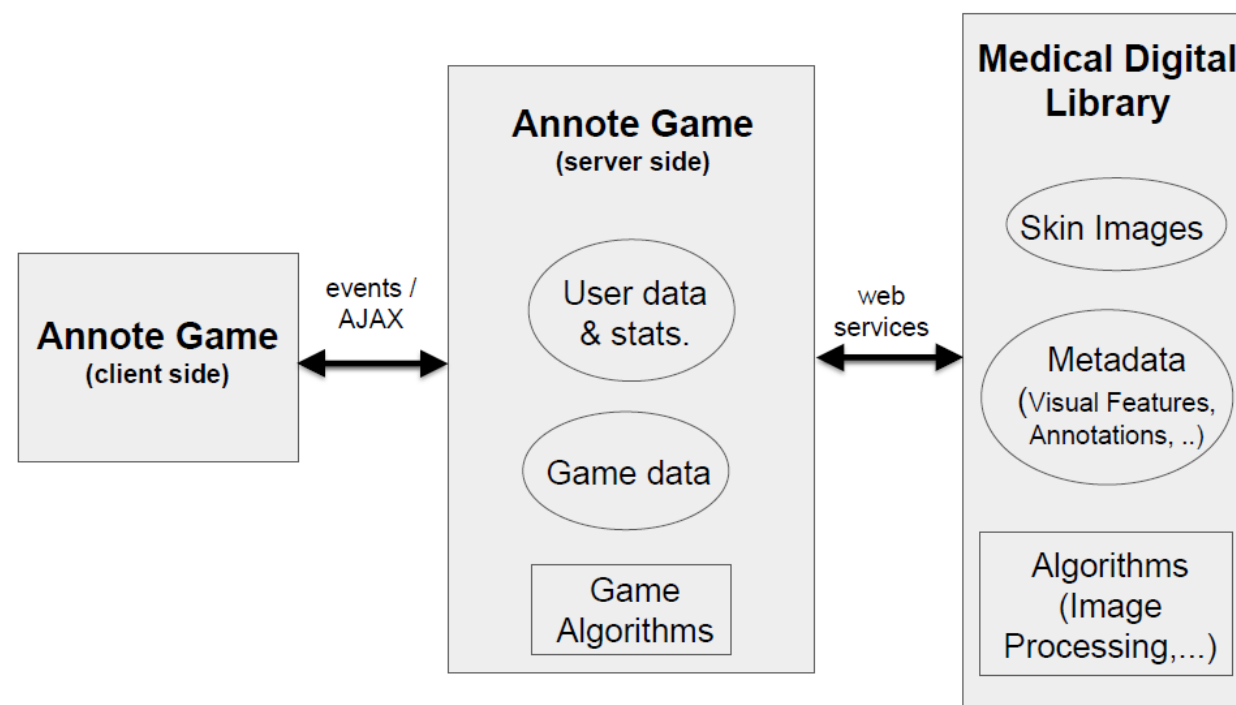- activation of aid/impediment game features

Modifiers and **Rewards:**
- **power-up / penalty**: grant or steal resources (time, points) or enable/disable features and tools performances

- **points** and **leaderboard**: centralized classification which emphasizes the desire to improve the gaming (and learning) performances

- **personal profile**: customizable, summarizes player informations

- **badges** and **achievements**: 'titles' depending from the gaming story (number of accomplished tasks, amount of gained points, …)

The System Architecture

Large part of the technology reuses the original annotation tool

- .NET Framework (ASP.NET with C#) for the server side
- XHTML with Javascript for the client side
- Dynamic events and messages exchange
- Web Services: allow communication between heterogeneous technologies

The Gaming Interface

Composed by 4 Sections:

1. **upper**: player profile

2. **middle**: interactive tools

3. **lower-left**: skin lesion image with strokes

4. **lower-righ**t: gaming data and messages

Future Work

- design and perform evaluation studies

- qualitative and quantitative data analysis

- comparison between 'standard' learning and the 'gamified' one

- usable editor for content customization

- sound and graphic effects

- cooperative and multiplayer modes

Thanks for the attention !!!