



www.imagelab.ing.unimore.it



UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

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

Fabrizio Balducci

University of Modena and Reggio Emilia



UNIMORE

UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

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 simulation with pedagogical purpose, by exploiting fun and competition
- used in environments like: defense, education, scientific exploration, health care, emergency management, city politics, ...

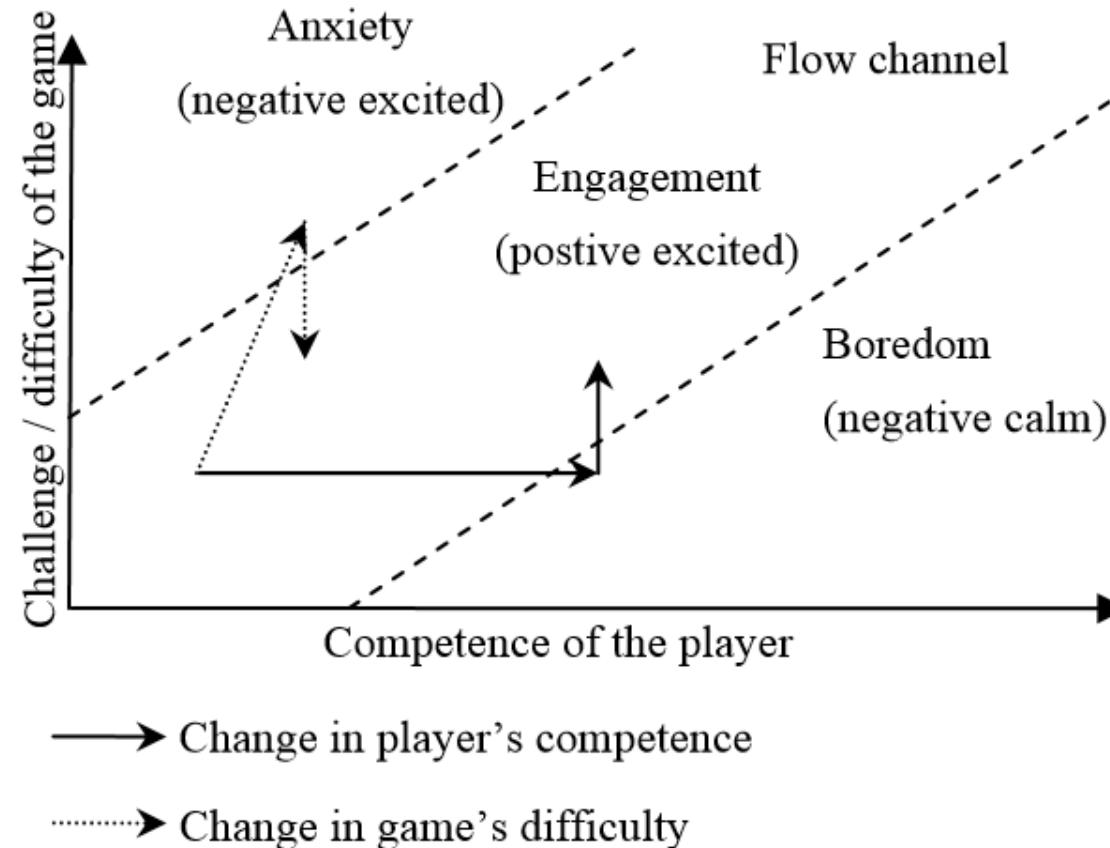
Flow Theory



UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

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

Csikszentmihalyi



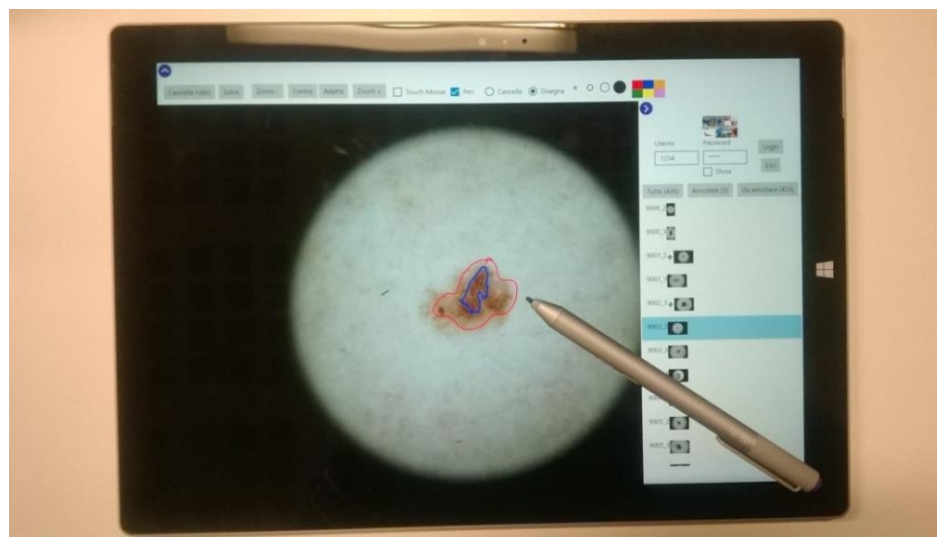
The Gamification Process (1)

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

Usable and reliable Annotation
Tools are not enough !!!



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 learning element 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
- Leaderboard
- Achievements
- Rewards

Design/Content

- Challenge
- Levels
- Progress
- Goals

Design

- Story/Plot
- People
- Fantasy
- Exploration

Content

- Rules
- Safety
- Interaction

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

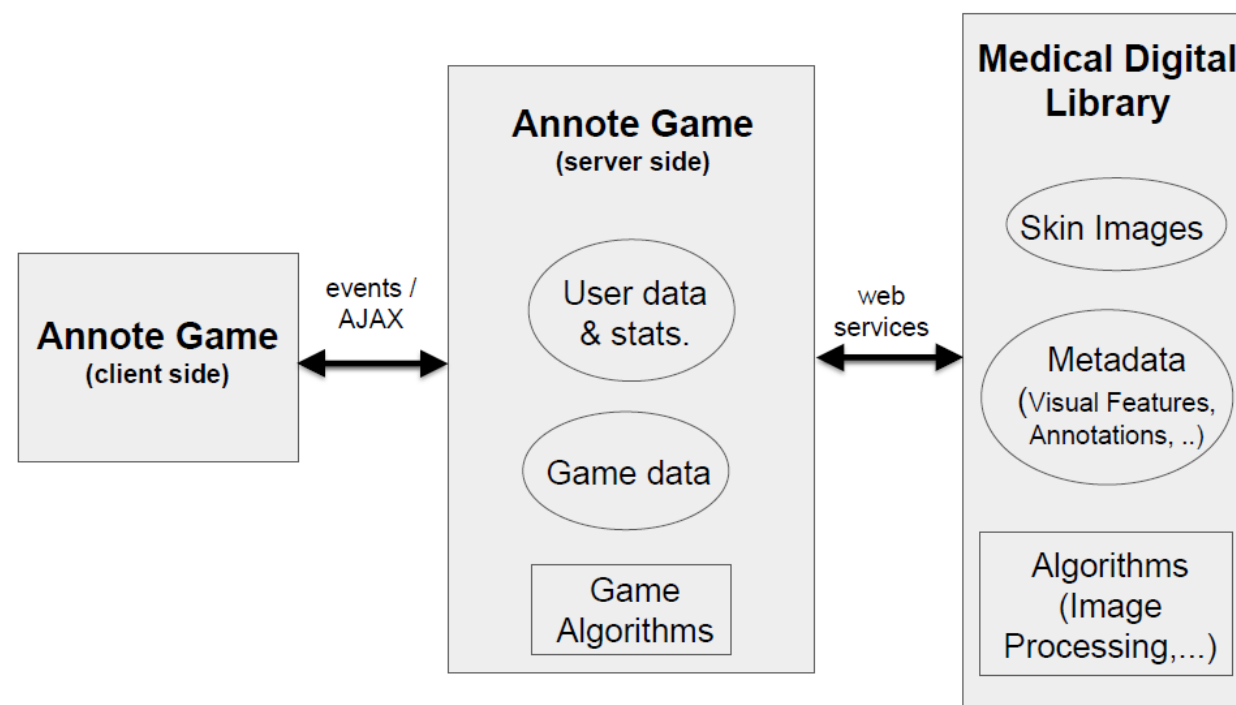
Modifiers and Rewards:

- **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



The screenshot shows a web browser window with the URL `imagelab.ing.unimore.it/annotateProject`. The interface is divided into several sections:

- Player Profile (Upper):** A small avatar of a character and a list of stats: Player: Azba94, Points: 3982, Badge: Captain.
- Interactive Tools (Middle):** A toolbar with buttons for 'Clear all', 'Zoom -', 'Center', 'Adapt', 'Zoom +', 'Erase', and 'Draw'. The 'Draw' tool is selected, and a color palette is visible.
- Task Information (Lower-Right):** A box containing task details: Task #126apn, Reward: 12 points, Notes: none. Below this is a message box with the text '-Power up: zoom functions enabled !'.
- Task Instructions (Lower-Right):** A text box stating: 'Given the first part of annotation (green stroke), complete the annotation of the skin lesion (blue stroke) in 00.45 seconds.'
- Remaining Time (Lower-Right):** A timer showing 'Remaining time: 00.21'.
- Image (Lower-Left):** A large image of a skin lesion with a green stroke outlining a portion of it and a blue stroke outlining the rest of the lesion.
- Control Buttons (Bottom):** Three buttons labeled 'Submit', 'Reload', and 'New task'.

Composed by 4 Sections:

1. **upper:** player profile
2. **middle:** interactive tools
3. **lower-left:** skin lesion image with strokes
4. **lower-right:** 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



UNIMORE

UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

Thanks for the attention !!!