Measuring players' experience of games and real-time simulations

Lennart Nacke
BTH Game and Media Arts Laboratory
Sweden
About me

• Engineering Degree in Computational Visualistics

• Blekinge Institute of Technology
  – Department of Interaction and System Design
  – PhD Candidate in Digital Game Development

• EU FUGA (“Fun of Gaming”) project

• Game design research

• Player experience consulting
Why serious games?

- Emotional disposition influences learning
- Common misunderstanding: serious games ≠ games that are fun
- Fun fosters learning
- Serious games must be fun
Outline

• Gameplay and fun

• Gameplay experience metrics

• FUGA research results
GAMEPLAY AND FUN
Gameplay

• Emerges between player and game

• Challenges
  – Nontrivial player tasks
  – Sense of achievement

• Player Actions
  – Specified by game rules
  – To accomplish game goals
Fun

- Enjoyment
- Positive valence
- Psychological concepts
  - Flow
  - Immersion
  - Engagement
  - Presence
The Flow Model

The two-dimensional four-channel model of flow based on Csikszentmihalyi (1975) and Ellis et al. (1994)
GAMEPLAY EXPERIENCE METRICS
Example Metrics

• Psychophysiological
  – Valence (EMG)
  – Arousal (GSR)
  – Cognition (EEG)

• Visual Attention (Eye Tracking)

• Questionnaires
  – Subjective Experiences
  – Psychological dispositions
Facial Muscles

Corrugator supercili (negative valence), Orbicularis oculi and zygomaticus major (positive valence) are the facial muscles under investigation in physiological emotion research (in addition to galvanic skin response).
Psychophysiological Game Experiments Setup

The figure shows the EEG cap worn, while facial EMG (i.e. electromyography) electrodes are being attached with adhesive tape.
Experiment Session

Full setup during gameplay experiments.
Gaze Hotspots

This figure shows areas of highest visual interest on the game menu screen.
FUGA RESEARCH RESULTS
Experimental Setup

• Gameplay modulations
  – Boredom
  – Immersion
  – Flow

• Different game design principles under observation

• Hypothesis:
  “We can validate game design principles with gameplay experience metrics”
Subjective Results (GEQ)

Mean GEQ components scores for each level

- Boredom Level
- Immersion Level
- Flow Level
Subjective Results (Spatial Presence)

MEC Spatial Presence Questionnaire Means

- Spatial Presence Self-Location
  - Boredom Level: 2.07
  - Immersion Level: 2.6
  - Flow Level: 2.68

- Spatial Presence Possible Actions
  - Boredom Level: 2.57
  - Immersion Level: 3.3
  - Flow Level: 2.62
Objective results: Valence responses

Facial EMG response cumulative means for each level

- Flow Level
- Immersion Level
- Boredom Level

EMG ZM (µV)
EMG CS (µV)
EMG OO (µV)
Objective results: Arousal responses

Galvanic Skin Response Cumulative Means for each level

- Flow Level
- Immersion Level
- Boredom Level

GSR (log[µS])
Gameplay experience results*

- Game design affects
  - Positive valence and arousal

- EMG (ZM and OO) and GSR activity are related to flow (as subjectively indicated by GEQ)

- Accumulative measurements were used

Where do we go from here?

- Physiological input
  - Brain games
  - Emo games

- Serious games that are fun

- Fun from designing exciting and meaningful interactions
References

- http://gamescience.bth.se/research/publications/
- http://project.hkkk.fi/fuga/
Contact Details

Lennart Nacke

Blekinge Institute of Technology
Department of Interaction and System Design
Game and Media Arts Laboratory
Karlshamn, Sweden

Lennart.Nacke@bth.se

http://gamesscience.bth.se
http://www.acagamic.com