“What I did on my Holidays”

…including how not to write an informative talk title…

… and give lots of negative results.

By William Uther

Outline

- Where was I?
- What on earth was I doing **there**?
  - What should a computer want from a game?
  - Psychopysiological feedback and you
- What did I actually **do**?
  - Tetris, HyperMask, Measuring minds
- How to get maximum impact for your research dollar

Sony Computer Science Labs

- I was working with Dr. Kim Binsted
  - Wrote the first computer punning riddle generator
- Located in Tokyo
- A wholly owned subsidiary of Sony
- ‘Public’ labs
  - These people publish research papers
  - I didn’t get to see any cool pre-release products

What should a computer want from a game?

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  - Reinforce the computer player when they win
- To get **rich**!
  - Reinforce the computer player when Joe Sucker puts another quarter in the slot
    - Tell the computer the time so it can make the game harder when the arcade is usually full
    - Enter players initials when the game starts so it can make it harder for the good players right from the start

What should a computer want from a game?

- To Win
  - Reinforce the computer player when they win
- To get **rich**!
  - Reinforce the computer player when Joe Sucker puts another quarter in the slot
- To help the human have fun
  - Try to read the human's level of enjoyment and use that as a reinforcement function for the computer player

Using psychophysiological feedback

- Measure the user as they perform some activities with varying ‘fun’ levels
  - Find (learn?) a mapping from physical sensors to ‘fun’
- Measure the user during a game
  - Measurements part of state
  - Measurements translated through learnt ‘fun’ model and fed in as a reinforcement signal

Prior work with psychophysiological signals

- Prof. Rosalind Picard, MIT
  - 70% accuracy distinguishing 5 emotions
- Nintendo BioTetris.
  - Made by Seta for the Nintendo 64
  - Measures user heart rate
  - Adjusts game play to fix heart rate at set point
    - High rate = exciting
    - Slow rate = relaxing
  - Very simplistic model

What makes a game fun?

- Traditional games
  - Difficulty increases with level
  - For a given level difficulty is fixed
  - E.g. Tetris
    - Level controls speed at which blocks drop
    - More play time leads to higher levels
    - Game design attempts to match user adaptation with level difficulty increase

What makes a game fun?

- "Push the player till they're almost dead then let them win."
  - Quote from Dr. Ian Davis (Activision)
  - Allows user to feel they overcome overwhelming odds
  - Used in many different genres
  - Leads to standard 'level' structure of games

What makes anything fun?

- Traditional western plot structure has a ‘story arc’:
  - Hero starts off in a ‘mundane’ existence
  - Gets in conflict
  - Almost fails
  - Overcomes odds to win
- Story arc suggests ‘fun’ is related to change in ‘tension’
  - NOT fixed tension level

Wild and wooly

- Maximise game satisfaction through a short ‘post-game’ period
  - May help overcome game addiction without sacrificing enjoyment
  - Allows timed games to be ended without frustration

Signal detection

- Using an industry standard D-A converter
- Measuring multiple signals
  - Heart rate
  - Chest expansion
  - Jaw muscle tension
  - ‘Smile’ muscle tension
  - Galvanic skin response

What I actually DID

- Tetris
- HyperMask
- Psychphysiological measurement

Tetris

- There have been a number of papers published about this
- Use features
  - Current block
  - Current block location
  - Description of top row
  - Height of top row
  - Number of gaps below top row
- ~~Linear function approximator~~

Tetris

- I tried plugging in Leemon's WebSim
  - Q-Learning
  - Neural Net approximator
- It didn't work
- Talked to Geoff Gordon recently
  - Use row and rotation as actions
  - Use Value Iteration

Psychopysiological Measurements

- The MIT research used pre-segmented data from a single person projecting a sequence of discrete emotions
- We were trying to map continuous data to a, very noisy, continuous signal over a long time period
  - Didn’t manage to learn much at all
  - Eyeballing the data didn’t show any obvious trends either

Organisation of Sony CSL

- About 40 researchers
- Quite a few AI researchers, but also networking, theory. . .
- Want to keep budget below 0.1% of Sony's revenue
- Want to be able to sell it as "look at all the research area's we're covering with your money"
  - Spread out the reseachers over the research areas

HyperMask

- Nothing to do with anything I've talked about, but cool
- Build a mask with embedded IR LEDs
- Use a video camera to track it in 3D space
- Use a video projector to project a 'face' onto the mask

HyperMask

- Use a face model to
  - Allow expression to be set
  - Lip sync actor's speech in real time
- Was presented at SIGGRAPH this year

Other Screw-ups

- Bio-amplifiers arrived late and without power supplies
  - Ever tried to build your own power supply in a country where you don't speak the local language
- Bio-Sensors can be very flaky
  - Blood Volume sensor
- Be careful about extrapolating from research papers!! #@$%*