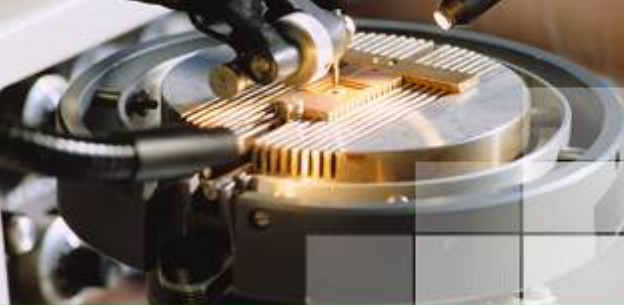




 POLITECNICO DI MILANO

Dipartimento di
Elettronica e Informazione

Affective Preference From Physiology in Videogames: a Lesson Learned from the TORCS Experiment

M. Garbarino, M. Matteucci, A. Bonarini
garbarino@elet.polimi.it

Dipartimento di Elettronica e Informazione, Politecnico di Milano
Artificial Intelligence and Robotics Lab

A lesson learned...

Introduction

Long Term Research Goal

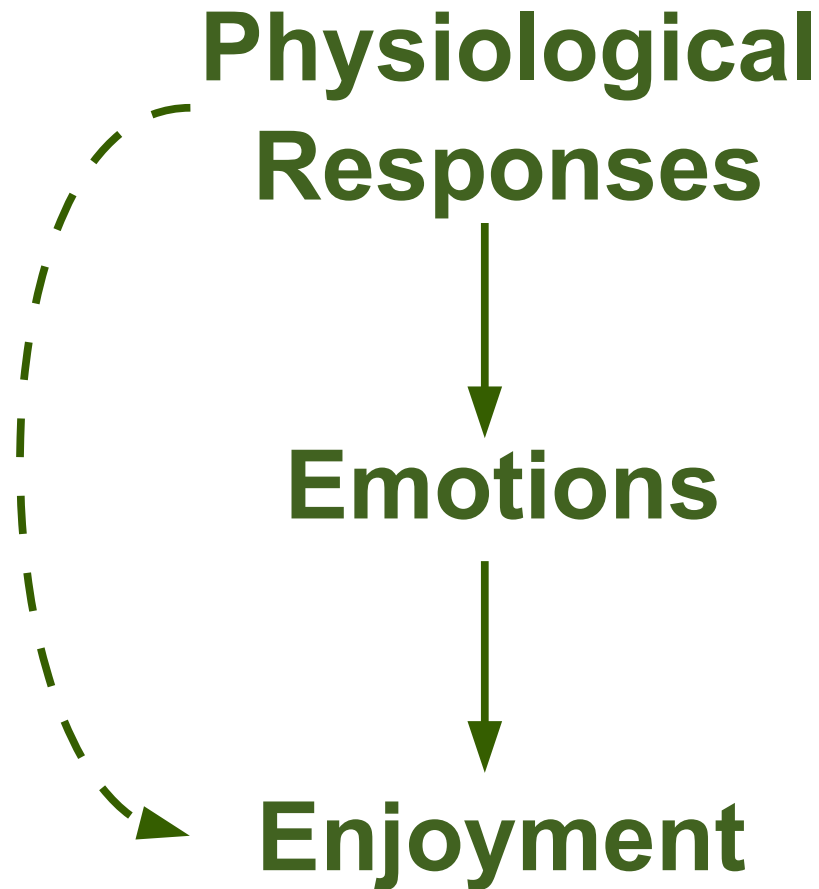
- Developing games that maximize the user enjoyment

What makes a video game enjoyable?

Can we measure user enjoyment?

Can physiology answer these questions?





The TORCS Experiment

Experimental Setup

TORCS (The Open Racing Car Simulator):

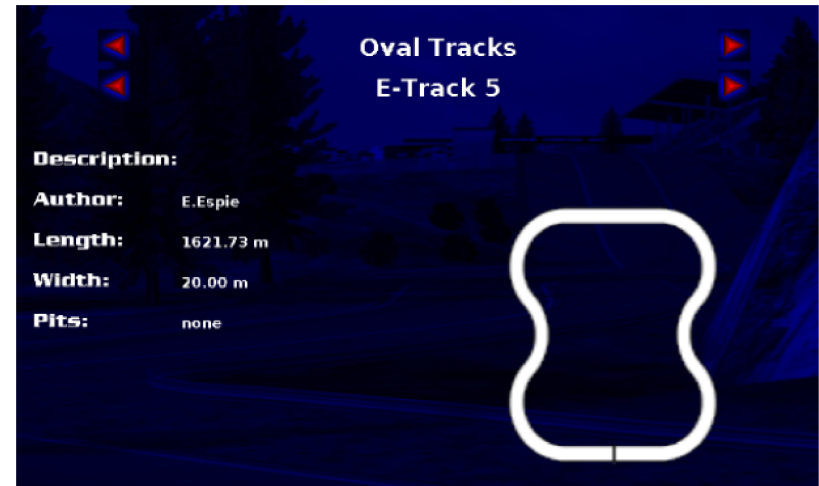
- Easy enough to have homogeneous game experience among users with different gaming background
- Emotionally different situations characterized by similar physical activity
- Custom logging and opponent AI (open source project)



Experimental Setup

The races

- 3 minutes races
- Easy oval track
- 1 vs 1
- 3 custom AI opponents:
 - L (Loser)
 - C (Challenging)
 - W (Winner)



Experimental Setup

Protocol (~30 minutes)

- General questionnaire on user experience in games **before the races**
- 7 races against one of 3 opponents tested with **different ordering** (W C L W L C W)
- 2 Alternative Forced Choice preference questionnaires **after each pair of races**
- No external interaction after setup phase

Experimental Setup

Physiological Acquired signals

- Blood Volume Pulse
- Galvanic Skin Response
- Electrocardiogram
- Respiration
- Temperature



In-game measurements

- Brake/acceleration
- Steering
- Speed/position on the track
- Position and distance from the opponent car

Camera recordings

- Frontal
- Environmental

Published Papers

Preference Learning

- **CIG2010**, Modelling enjoyment preference from physiological responses in a car racing game

Enjoyment Classification by Ranking Preferences

- **AFFINE2010**, Enjoyment Recognition From Physiological Data in a Car Racing Game

Generalization power of physiological features

- **ACII2011**, Generic Physiological Features as Predictors of Player Experience

Linear and non-linear methods comparison

- **Poster @ ACII2011**, Learning General Preference Models from Physiological Responses in Video Games: How Complex is it?

Relationship between stimuli, questionnaires and measurements

- **Poster@ACII2011**, The affective triad: stimuli, questionnaires and measurements

Published Papers

Published

- Different approaches: preference learning, classification
- Different methodology: linear, non-linear
- Cross analysis with a different dataset

Not published generic issues

- Participants
- Questionnaire
- Measurements

Participants

Participants - Recruiting

Recruiting: a common problem

- Hard to find a reasonable amount of volunteers



- 75 subjects is OK but...

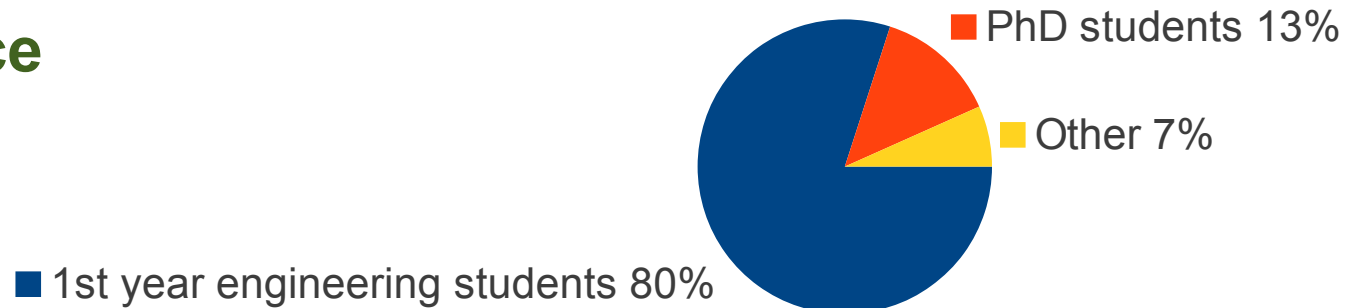
	year	#part.
Picard et al.	2001	1
Wagner et al.	2005	1
Yoo et al.	2005	6
Choi & Woo	2005	1
Healey & Picard	2005	9
Liu et al.	2006	14
Rani et al.	2006	15
Zhai & Barreto	2006	32
Jones & Troen	2007	13
Leon et al.	2007	8
Liu et al.	2008	6
Katsis et al.	2008	10
Yannakakis & Hallam	2008	72
Kim & André	2008	3
Chanel et al.	2009	13

van den Broek et. al. 2009

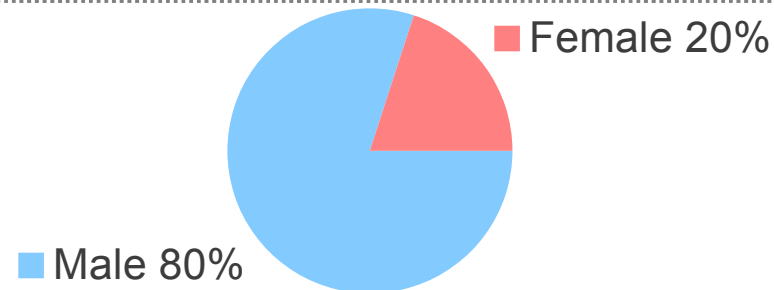
Participants – Sample Population

... the population sample is biased!

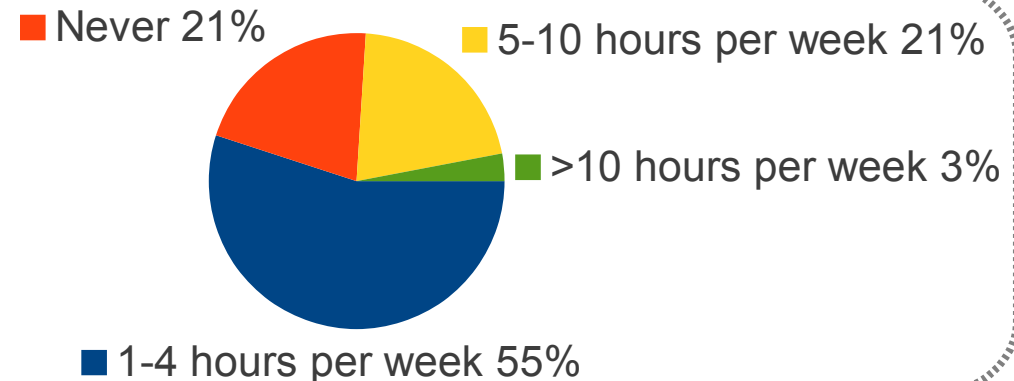
Source



Sex



Hours of Play

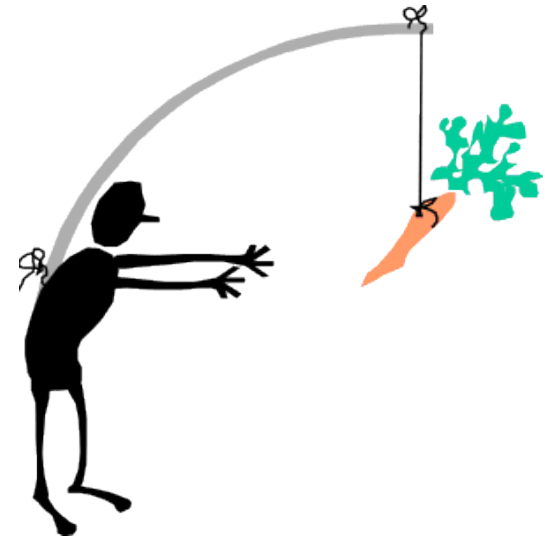


Participants - Motivation

Good motivation is fundamental!

Competing for a prize

- Keeps motivation high
- The genuine concept of enjoyment was distorted
- The *preference* is not related to “fun” but rather to “winning”

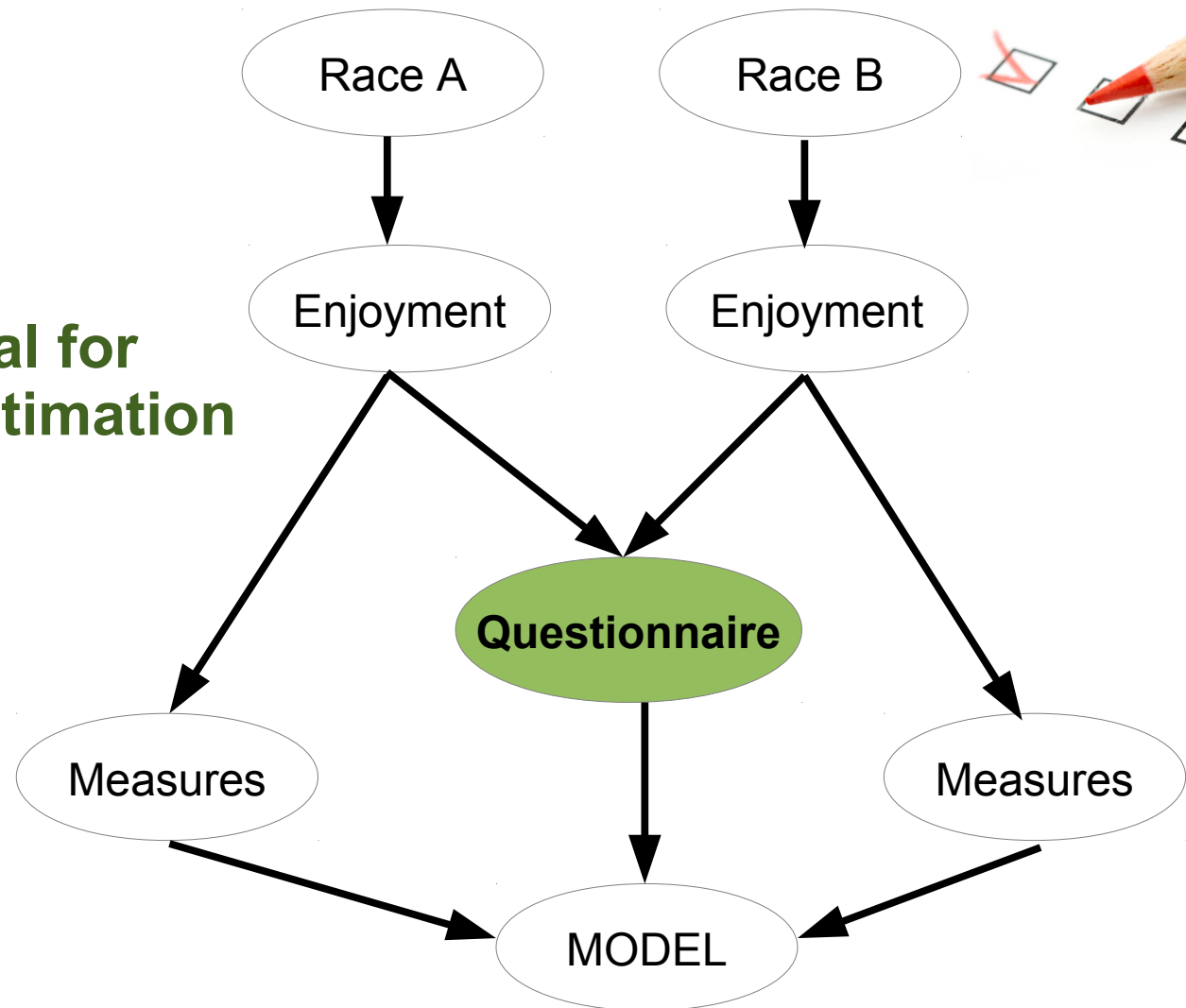


Questionnaire

Questionnaire: Preference

17

**Fundamental for
model estimation**



Questionnaire: 2AFC

Two Alternative Forced Choice

- Between pair of races
- “Which race did you like most?”
 1. The last race
 2. The previous race



Pros

- Normalizes the personal conception of enjoyment
- Allows the comparison between subjects

Cons

- Noisy answers when the player is not sure
- Strength of the preference is unknown

Questionnaire: 4AFC

Four Alternative Forced Choice

- “Which race did you like most?”
 1. The last race
 2. The previous race
 - 3. I liked them both**
 - 4. I did not like them both**



Pros

- Ignore uncertain preferences → better model estimation

Questionnaire: Additional Question

Ask the player the reason of the choice

- “What did you enjoy most/least during the last game?”
- Helps in clusterizing players
 - Inexperienced (preference evolves with learning)
 - Experienced (preference related to the performance)

Main drawback

- The flow is interrupted
- Is OK with independent pairs of games



Measurements

Measurements

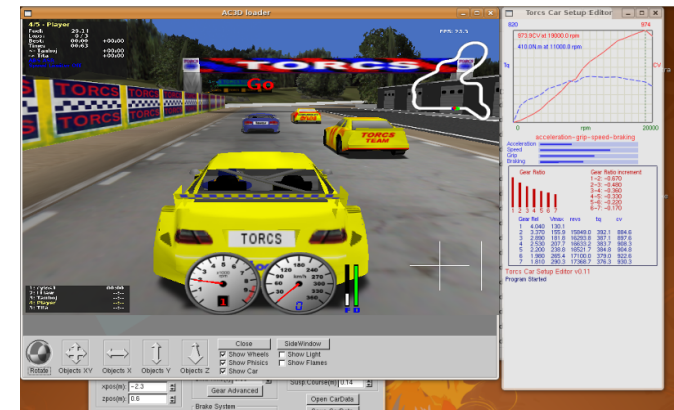
Is physiology the right way to go?

- High intra-subject variability
- Law of initial values
- Habituation
- Invasive sensors (for now...)



Can in-game measurements do better?

- Fun is not always related to the performance
- No additional hardware required
- Transparent to the players



Measurements

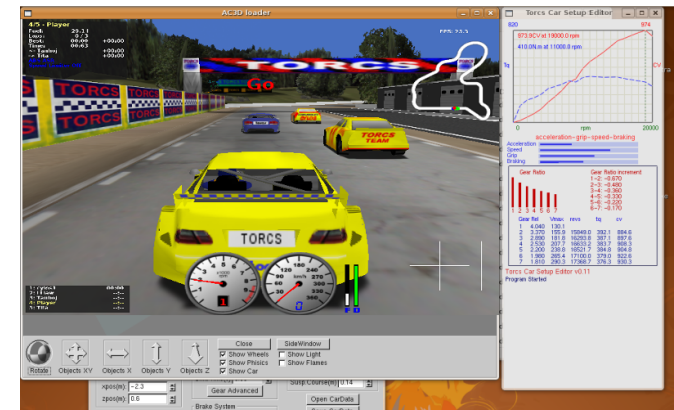
We tried both physiology & in-game metrics

- Same methodology
- Same experiment
- Combined analysis

And the winner was...

- In-game measurement 80% CCR
- Physiology 74% CCR

But, wait a second!
Are we measuring the task?



Measurements

Task typology (a priori hypothesis)

- 2 **boring** races: **L**osing and **W**inning opponent
- 1 **challenging** race: **C**hallenging opponent

Number of overtakes

- 100% CCR in task prediction
- 80% CCR in enjoyment prediction

80% of the players preferred the challenging race



Given the task, we can predict users' preference at 80%

In Conclusion

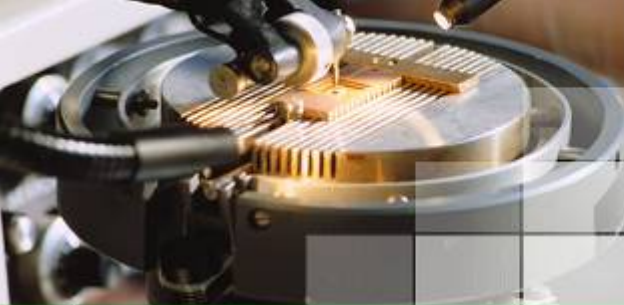
How far are we from a videogame that successfully exploits the affective feedback?

Which is the right methodology to follow?

Are physiological measurements and generic complex model the right way to go?

Any Answers?

Thank you for your time



 POLITECNICO DI MILANO

Dipartimento di
Elettronica e Informazione

Affective Preference From Physiology in Videogames: a Lesson Learned from the TORCS Experiment

M. Garbarino, M. Matteucci, A. Bonarini
garbarino@elet.polimi.it

Dipartimento di Elettronica e Informazione, Politecnico di Milano
Artificial Intelligence and Robotics Lab