BROADENING CS EDUCATION AND OUTREACH:
A INFORMATICS DEPARTMENT PERSPECTIVE

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Universidade Nova de Lisboa

NOVALINCS
LABORATORY FOR COMPUTER SCIENCE AND INFORMATICS

ECSS 2017 Lisbon

The Department

- Pioneer in Informatics education and research in Portugal
  - Integrated Master in CS and Informatics (180 in/y)
  - PhD Program in CS (80 students in pipeline)
  - “Introduction to Informatics” to 10 Eng Programs (800 in/y)
  - NOVA Laboratory for Computer Science and Informatics
    - World class research + problem driven innovation

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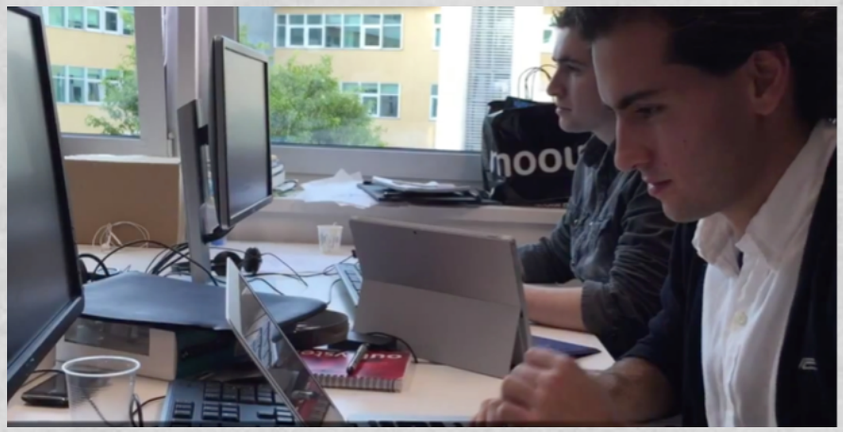
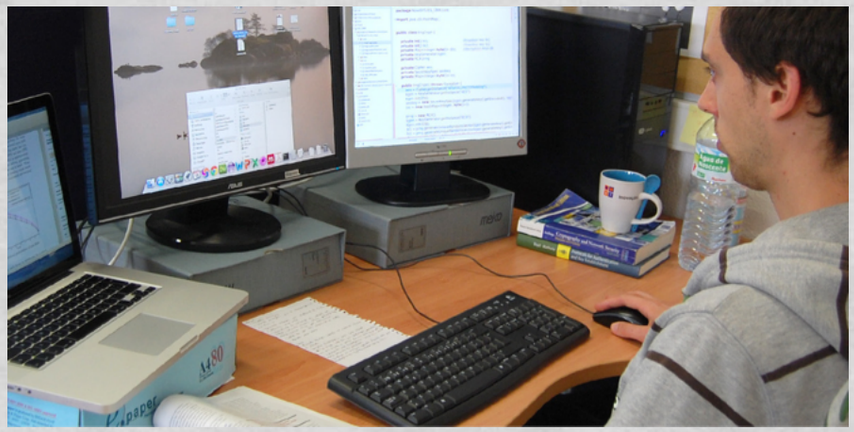
- We look for collaborative research with partner companies and outreach intensively to promote education and research
- We strive to integrate teaching, research and outreach
- Major goal: recruit stronger candidates, increase diversity, create deeper interest in computer science and informatics

APDC course (mid program)
practical activity for curricular development

- 18 ECTS 3rd year course (unique at national level)
- 20 Weeks hands-on activity outside class room environment
- Three options (competitively selected by students):
  - **Internship** in a partner company (> 100 agreements signed)
  - **Innovation project** in startup-like environment
  - **Research project** within a NOVA LINCS team
- ~ 100 students per semester

APDC course (mid program)
innovation project 2017

- Students work in specially prepared rooms
- Groups of 5-6 students
- Initial “academy” on cloud, security, web frameworks, testing
- Basic “problem” proposed by selected external partner
- Groups develop fully functional app + new functionality

APDC course (mid program)

innovation project 2017

- 2017 Project: Participative Event Management System

APDC course (mid program)

innovation project 2017

- Final presentations workshop w City Council representatives
- Open to the school faculty, students, and partner companies

4th year Social Aspects Course

- Organised as a series of invited talks by "professionals"
- Ethics, Professional matters, Legislation, History, Social Impact
- Open to all faculty and students at the school

Informatics for Science and Engineering

- Course offered by Department of Informatics (6 ECTS)
- Replaced old "Computer Programming" course in 2011
- Mandatory for all 10 core FCT engineering programs
- **LEG** (Geological Eng), **MIEA** (Environment Eng), **LBCM** (Celular and Molecular Biology), **LQA** (Applied Chemistry), **MIEQB** (Chemical and Biological Eng), **MIEC** (Civil Eng), MIEM (Mechanical Eng), **MIEGI** (Industrial Management Eng), **MIMN** (Micro and Nano Eng), **MIEM** (Materials Eng)
  - Common knowledge body / different application domains
- Special courses offered to some programs (OOP, Databases, Algorithms and Data Structures, Machine Learning)

Overview

- **Knowledge**
  - Thinking Computationally
  - The fundamental components of a computer system.
  - The tools of a software development system.
  - Basic concepts of imperative programming.
  - Some fundamental notions of relational databases.
  - Some basic concepts involved in the World Wide Web.
  - Some basic concepts involved in an API.

Overview

- **Application**
  - Decompose a problem into simpler problems.
  - Design an algorithm for solving a simple problem.
  - Write small programs, making a correct use of the basic constructs of an imperative programming language
  - Check (test) a program to see if it is working correctly.
  - Define database tables and simple database queries in SQL
  - Write programs that access resources on the Web.
  - Write scripts and small apps that usefully explore an API in the student study domain (scope of final project)

Example (Seismic wave propagation)

Exercício 3

Relembre o exercício 6 da Ficha Prática Nº 2, onde calculou a magnitude de um sismo por recurso à formula empírica de Lillie, a qual se reproduz seguidamente:

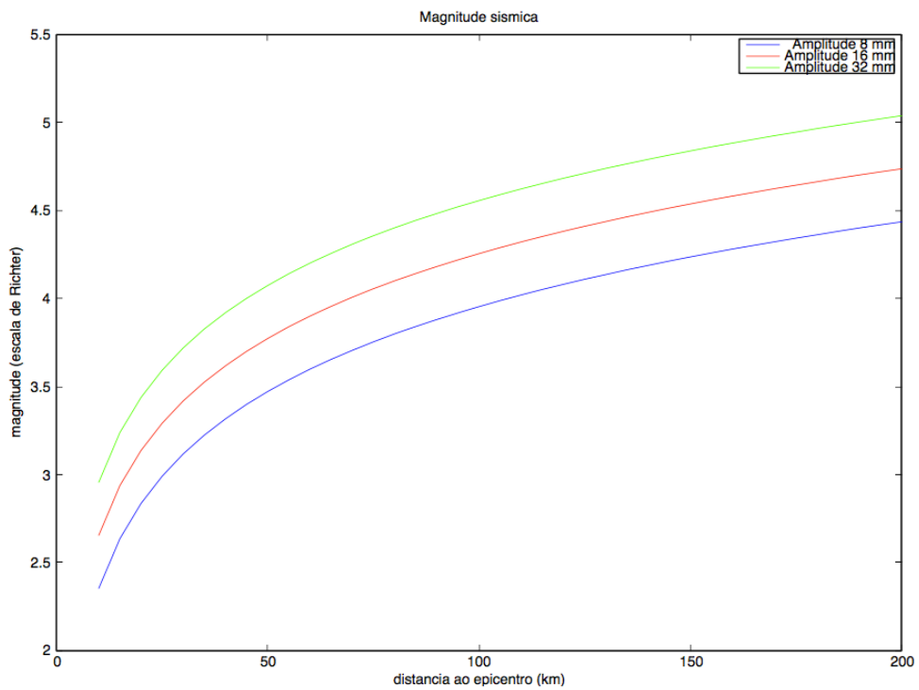
$$M = \log_{10} A + 1.6 \log_{10} d - 0.15$$

onde M é a magnitude (na escala de Richter), A é a amplitude das ondas sísmicas (em milímetros) e d é a distância ao epicentro (em km).

(a) Utilizando a instrução *plot*, desenhe um gráfico da magnitude de um sismo registado no sismógrafo com uma amplitude de 8 mm, em função da distância ao epicentro (avaliada entre os 10 km e os 200 km, em intervalos de 5 km).

(b) Desenhe um novo gráfico, nas mesmas condições da alínea (a), mas adicionando duas novas séries, correspondentes às amplitudes de 16 e 32 mm. Utilize cores diferentes para representar cada série.

(c) Complete o gráfico anterior adicionando a legenda, etc.



Student Evaluation Results

UC	Inscritos	1ª Insc	Aprov	% Aprov	Dif. % Aprov	Média
ICE	21	0	13	**62%**	**32%**	123.8
ICE A	135	76	62	**46%**	**-1%**	130.9
ICE B	66	58	55	**83%**	**12%**	162.3
ICE B	3	0	2	**67%**	**27%**	133.8
ICE B	130	79	106	**82%**	**34%**	144.6
ICE C	160	65	70	**44%**	**4%**	129.4
ICE D	146	93	98	**67%**	**13%**	150.2
ICE E	101	62	66	**65%**	**9%**	146.8
ICE E	70	49	55	**79%**	**18%**	149.5
ICE E	24	14	16	**67%**	**50%**	130.1
	856	496	543	**63%**	**15%**	

Routine Visits from Schools

Routine Visits from Schools

- We regularly host visits of classes from secondary schools
- Students come with a couple of teachers for half day
- Typically from 8th to 11th grade
  - Group size ranges from 10 to 40 approximately
- We handle 1 visit per month (sometimes 2)
- Typical Program includes "Computational Thinking" presentation and very simple hands-on activity
  - CODE.ORG type activity, or ..
  - Modify existing code and see what happens

Routine Visits from Schools

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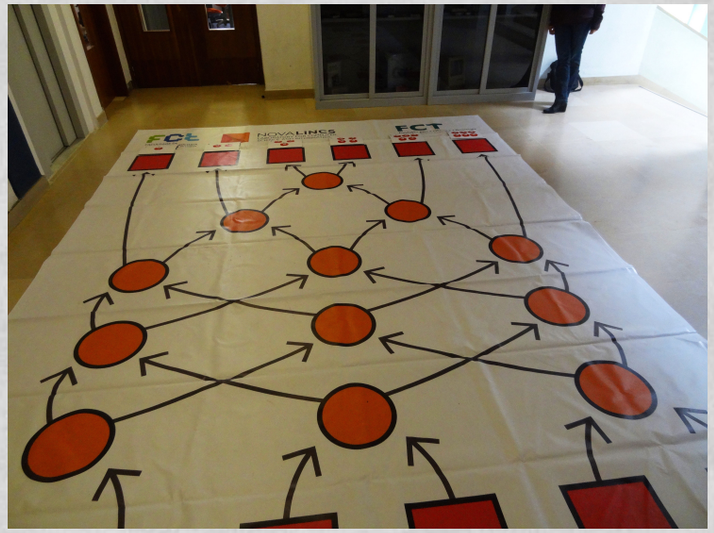
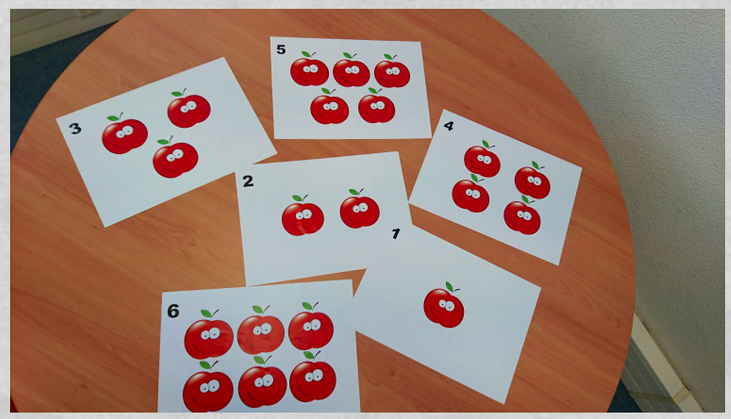


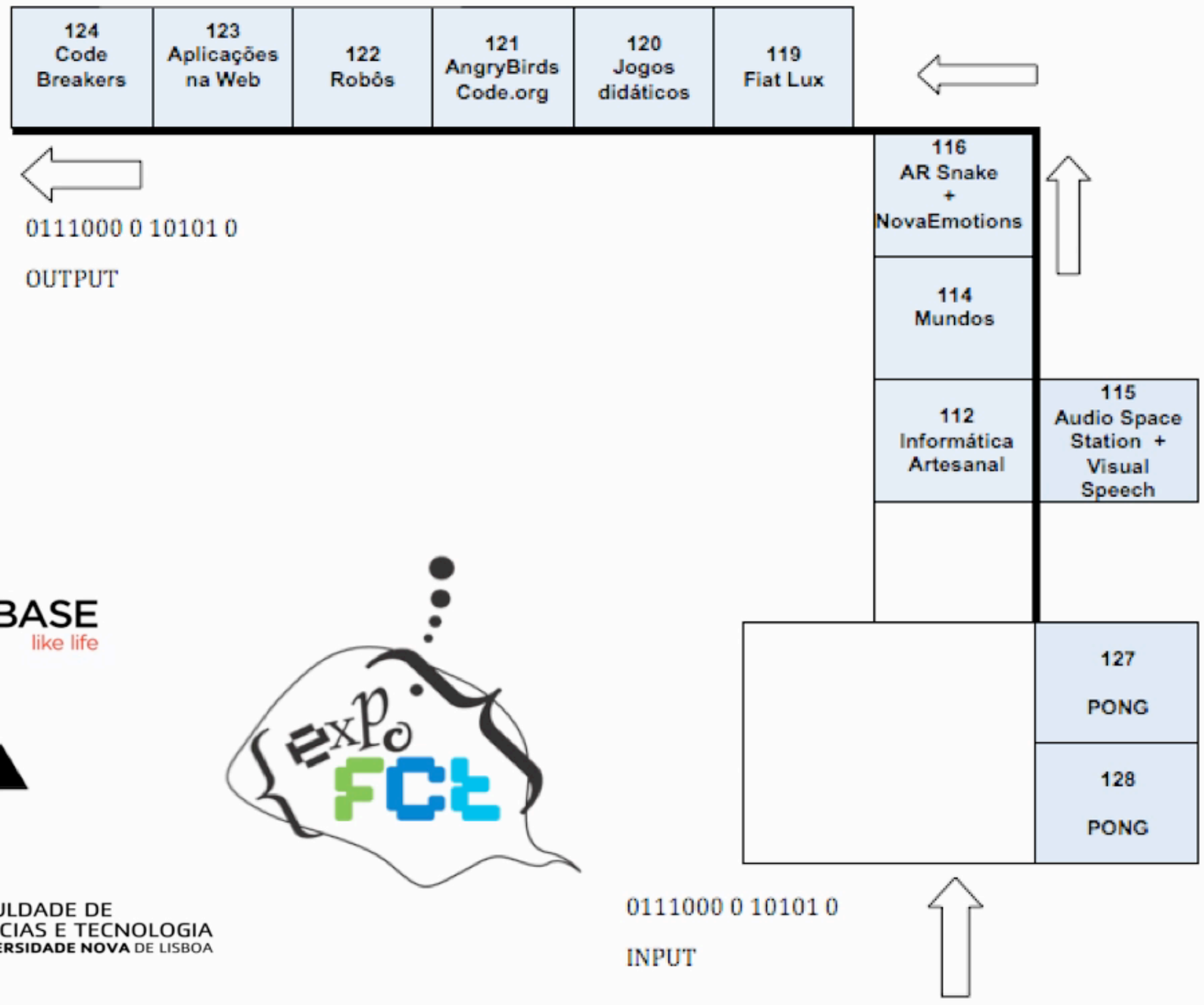


- Teaching a class of children with disabilities about sorting

EXPO FCT DI@FCT UNL

- Open House annually organised by the School
- Students from secondary schools from all over Portugal
- We receive > 1000 students at the Department in one day
- Main Reception activity (PONG Competition)
- Several Booths (10-12 activities)
- Visiting students circulate around freely
- > 20 faculty and > 80 Department students involved

Activity Overview

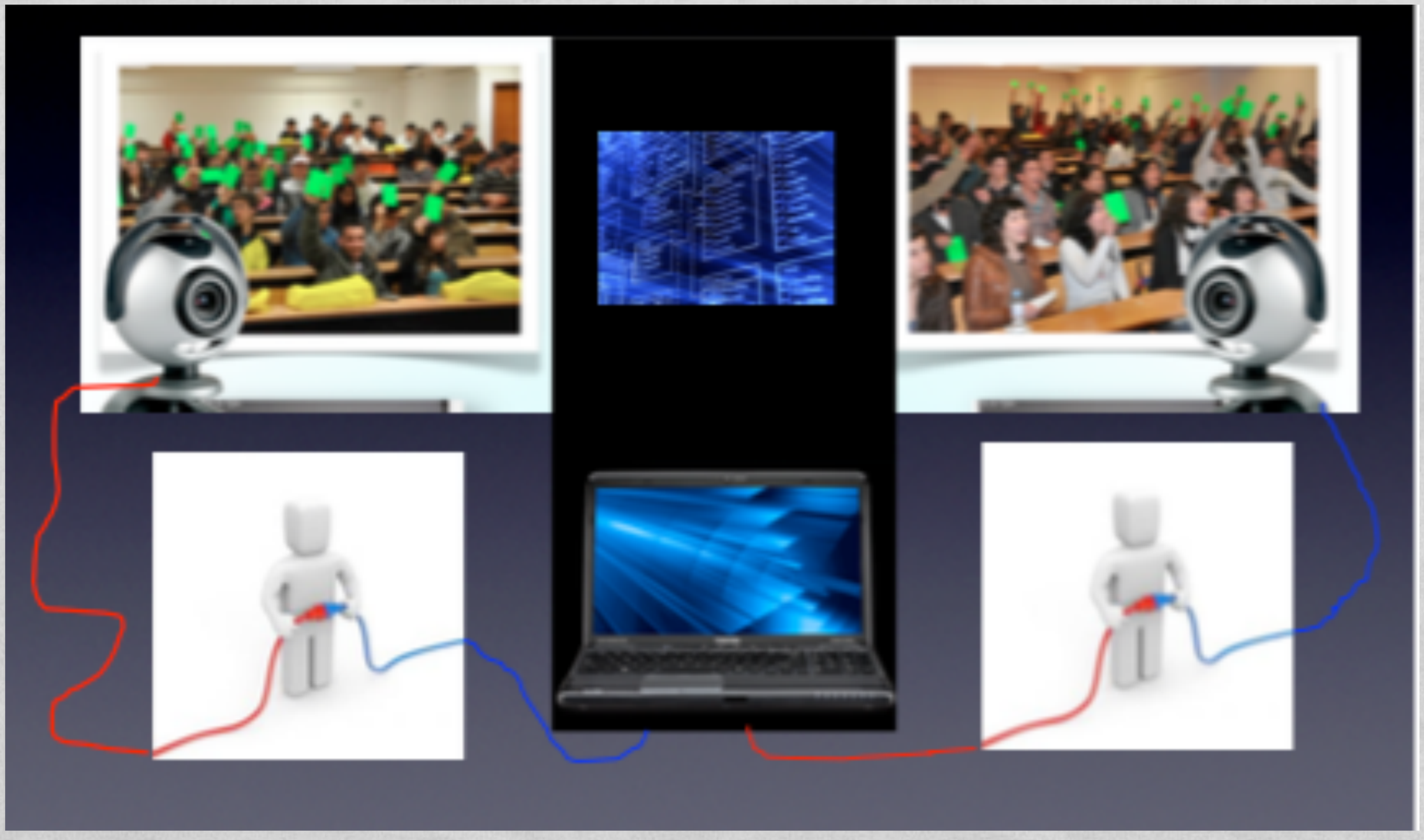


NOVABASE
like life

ARTiCA

FACULDADE DE
CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA

The Virtual PONG Game



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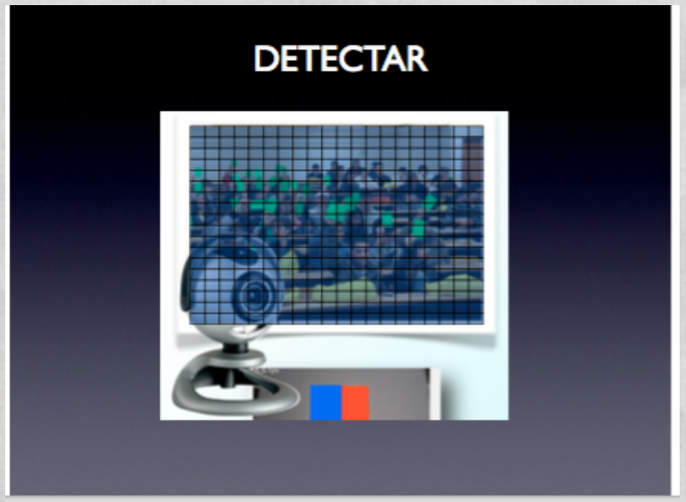

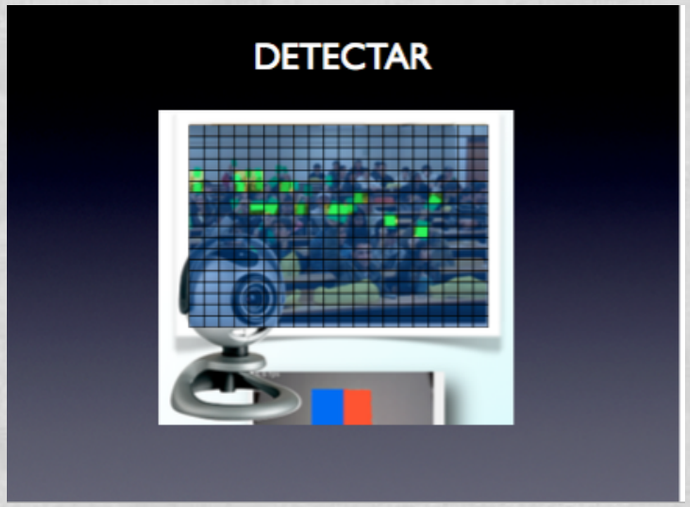

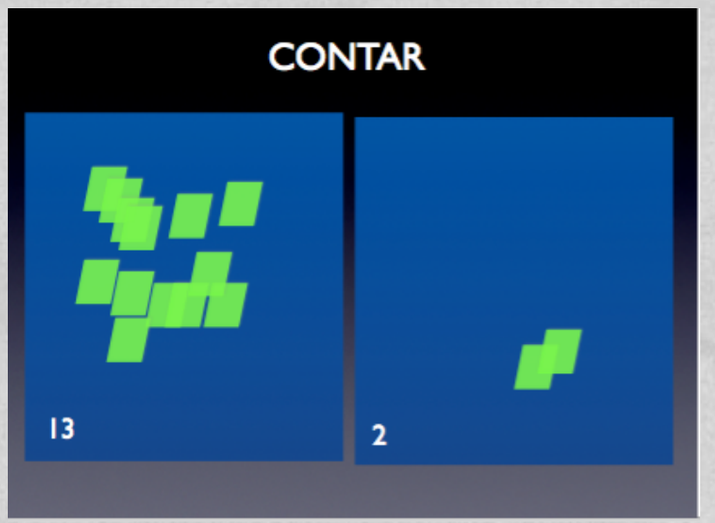

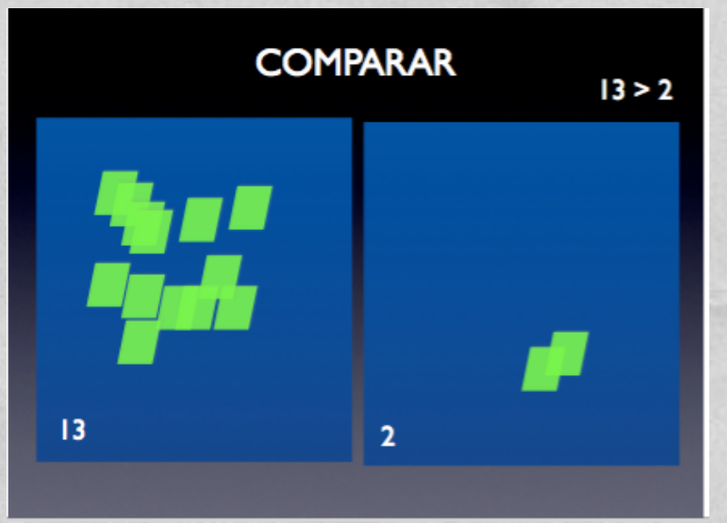

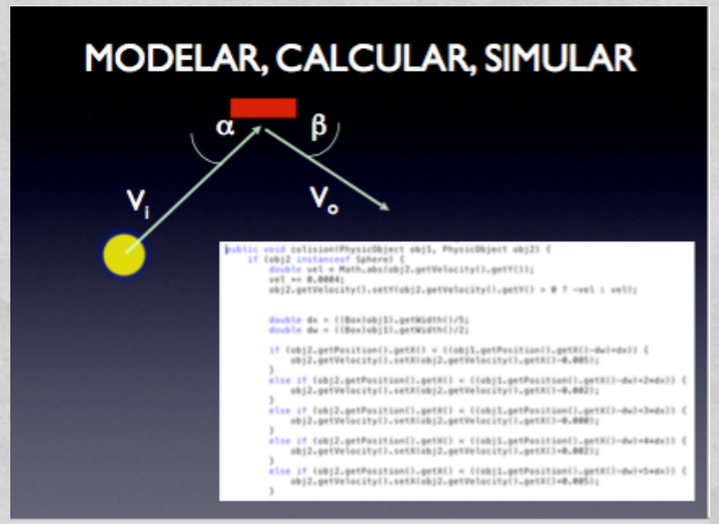

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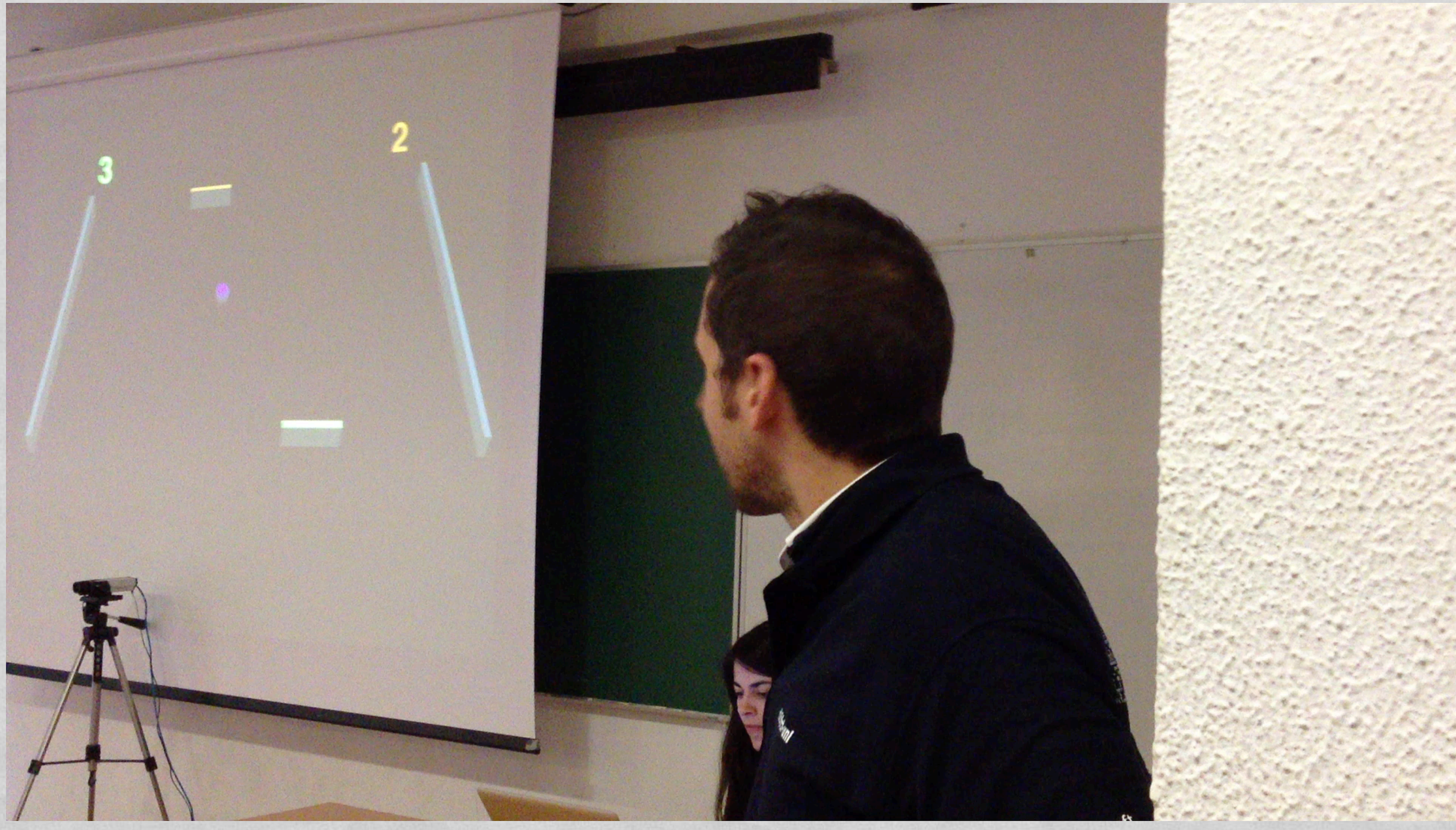

The Virtual PONG Game

EXPO FCT DI@FCT UNL 2017
Student Independent Project Exhibition

- Come and imagine the future of the informatics revolution !

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Enforcing Students Motivation

Jogo desenvolvido por aluno MIEI no top 3 da AppStore da Apple

04-05-2017

"Tenho 20 anos e desde muito novo que lanço jogos para iPhone, daí ter optado, aos 18 anos vir para a FCT para o MIEI." recorda-nos Pedro Cabaço, estudante de Engenharia Informática na FCT NOVA.

Super Crossbar Challenge, o jogo que concebeu e programou desde o passado mês de Setembro, foi aceite para publicação na AppStore da Apple em todo o mundo, tendo sido referenciado pela empresa como um dos melhores jogos de semana e posto em destaque na página principal em 80 países.

- iPhone game developed by students ranks 3 at Apple Store
- News in web site, facebook posts, e-mail appraisal,

Enforcing Students Motivation

- iPhone game developed by students ranks 3 at Apple Store
- Attracting attention from the press ("Público")

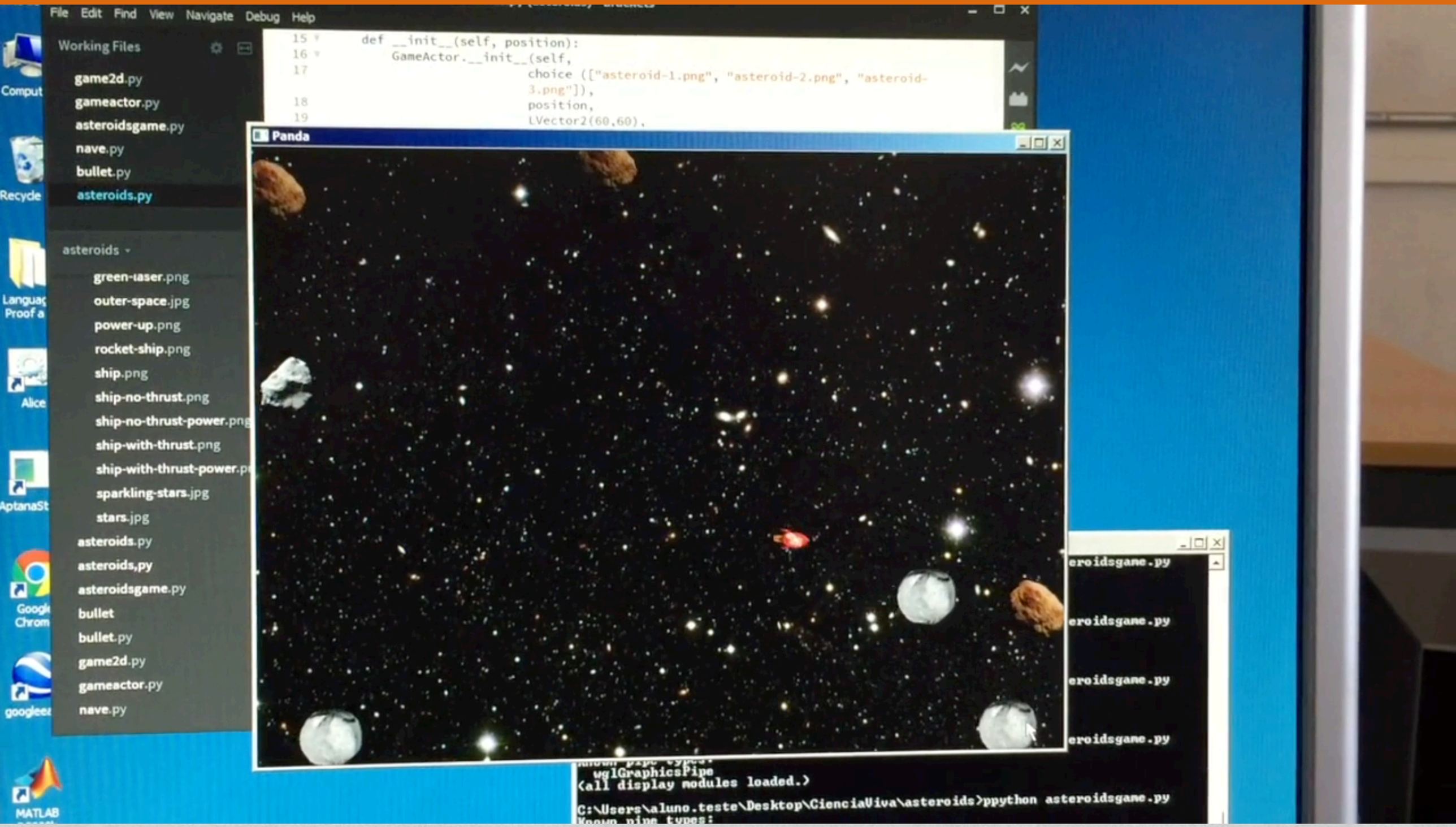
Enforcing Students Motivation

- iPhone game developed by students ranks 3 at Apple Store
- Presentation by co-author at CS Freshmen Welcome 2017

Summer 1-3 day courses

- Co-promoted with national initiative "Ciência Viva"
- Typically from 8th to 11th grad (Group size 20-25)
- Typical Program includes "Computational Thinking" and small programming course
  - Basic concepts of OO programming
  - Basic concepts of modelling
  - Develop a Arcade Game in Python
- We handle 2 editions year
- Very successful to attract good students

Summer 1-3 day courses



Distinguished Lecture Series

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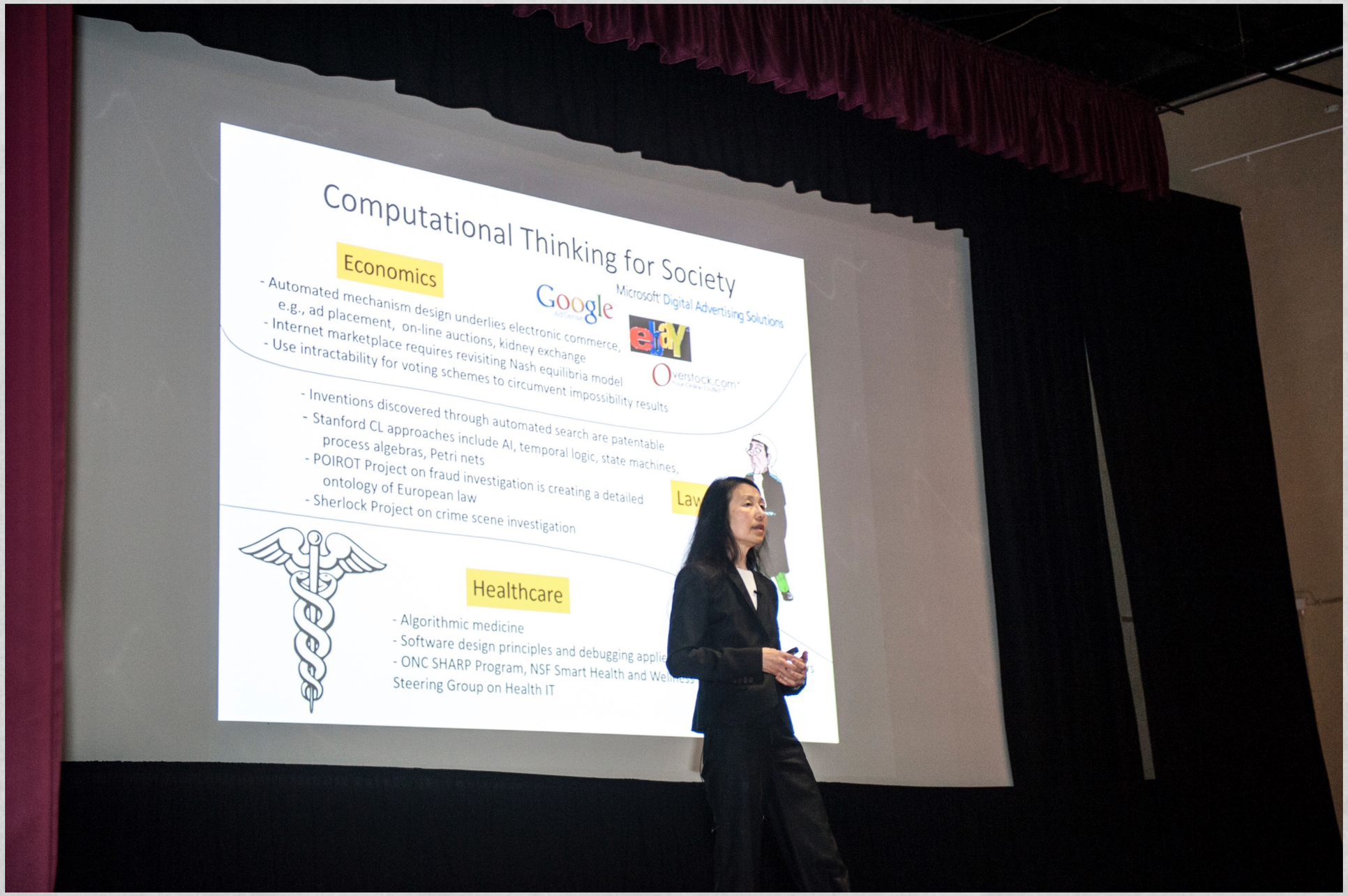


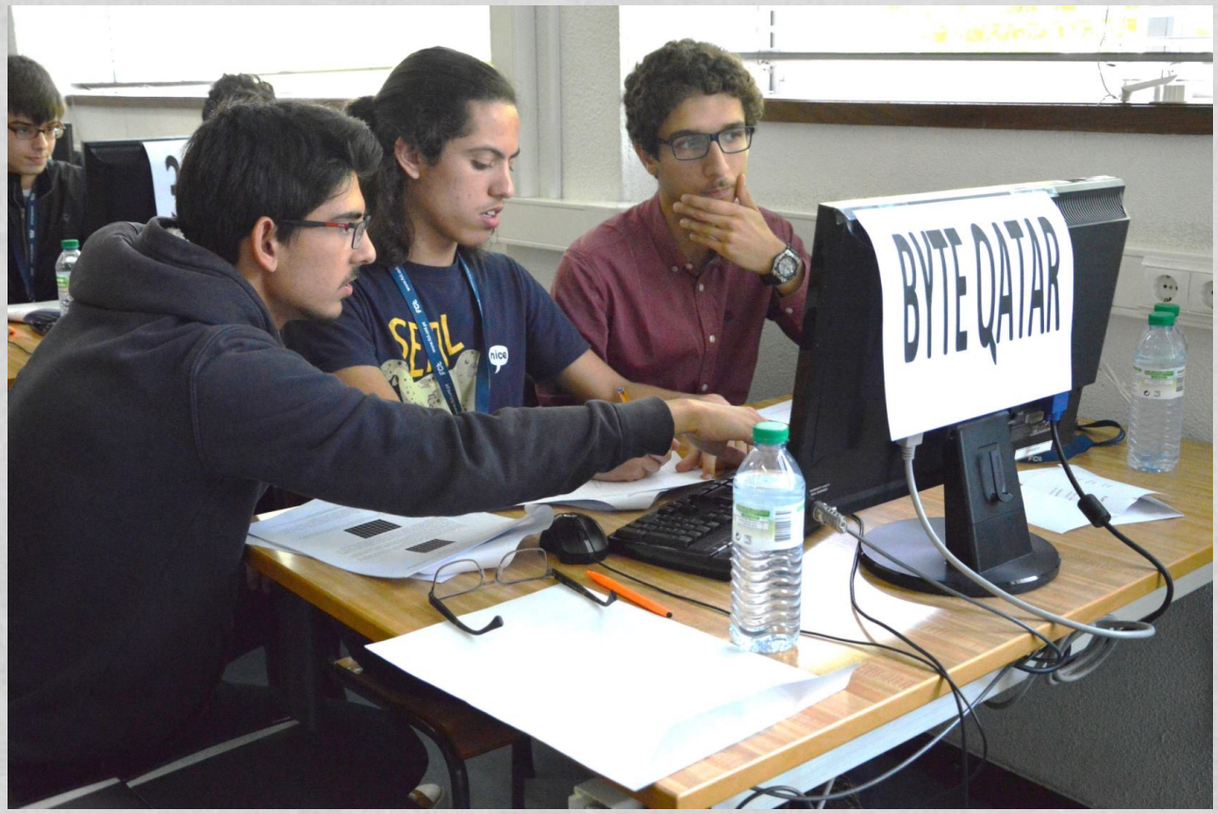
- Liskov (12), Henzinger (13), Lamport (14), Wing (15), Cardelli (16)

Distinguished Lecture Series

- > 450 attendance (students, faculty, partner representatives)

Programming Contests

Programming Contests



- We organize two annual programming competitions for secondary school students (in around 10-15 teams)
- TOPAS LX (in collaboration with local schools)
- MIUP (used as national selection for SWERC)
- More than 50 undergrad students involved in the organisation

CODE.MOVE 2016

- National event organised in partnership with Ministry of Education, Ministry of Science and Higher Education, and "Ciência Viva"
- Mobilised more than 1100 secondary schools nationwide
- Based on specially developed cloud based "hour of code" platform developed by a joint faculty + students
- Intense press (printed and TV) coverage

Girls in ICT 2017

- Special event to increase awareness of girls towards informatics and computer science
- Special hands-on event Ms Pacman (customize game)
- Plenary Session with alumnae and faculty (many generations)

Girls in ICT 2017

Sample Research Outreach

Sample Research Outreach

- Exhibition "Sem Rede" Joana Vasconcelos (Advanced HCI)

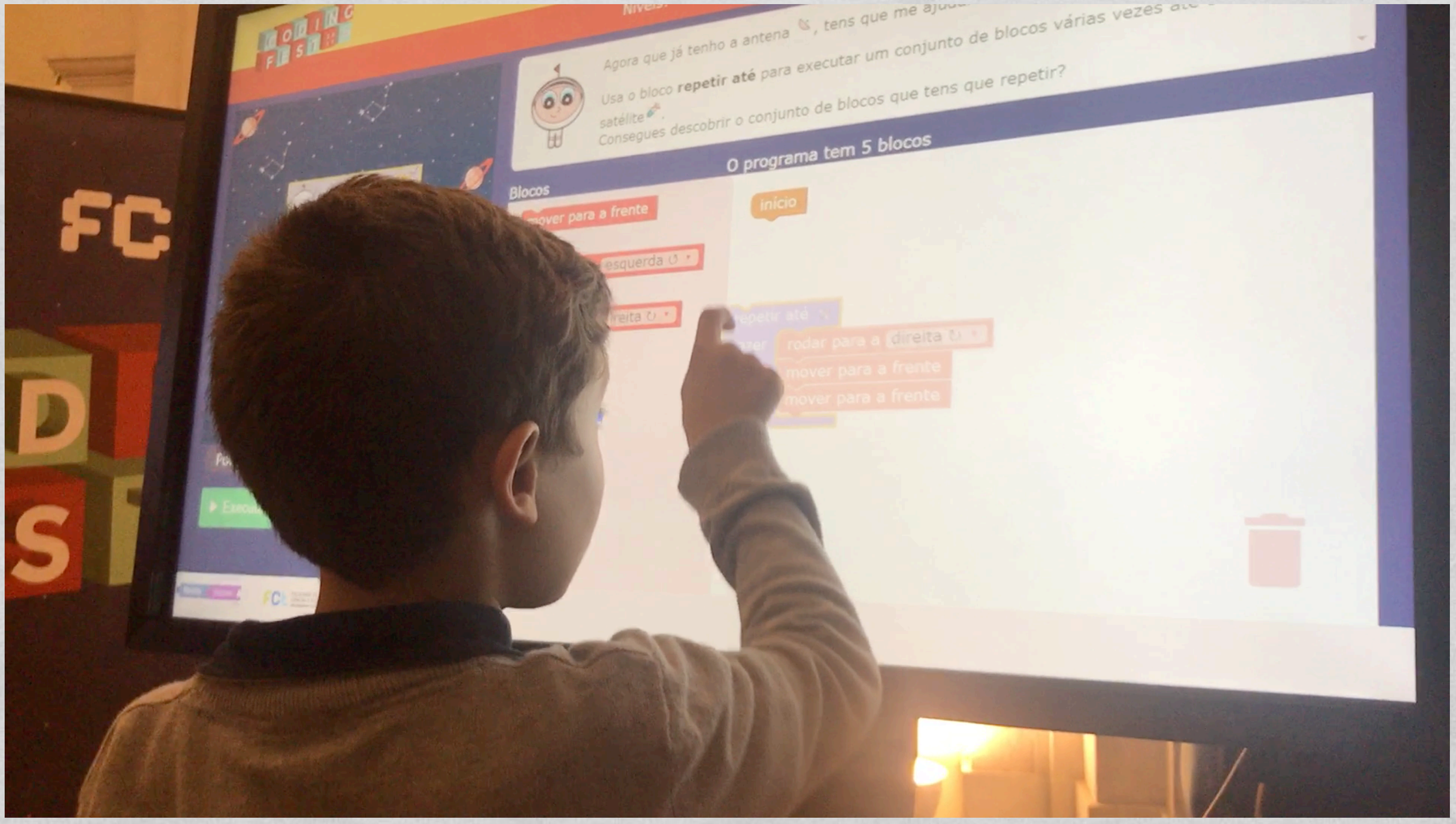
Sample Research Outreach

- ICT related exhibitions (Software Development Tools)

Sample Research Outreach

- Researchers' Night 2016 (Gamification for Speech Therapy)

Sample Research Outreach



- Researchers' Night 2017 (Cyberphysical Systems)

Sample Research Outreach

- Researchers' Night 2017 (Cyberphysical Systems)

Students' Promoted Activities

Students' Promoted Activities

- Students always called to participate in Department Activities
  - In close contact with the Department Exec Committee
  - Active coaching by Department Faculty
  - Excellent personal relationship between students and faculty
- Several leading groups:
  - PhD Students (NovaStudentTalks)
  - Undergraduates "Núcleo de Informática" (NINF)
  - These strongly network with students of other programs

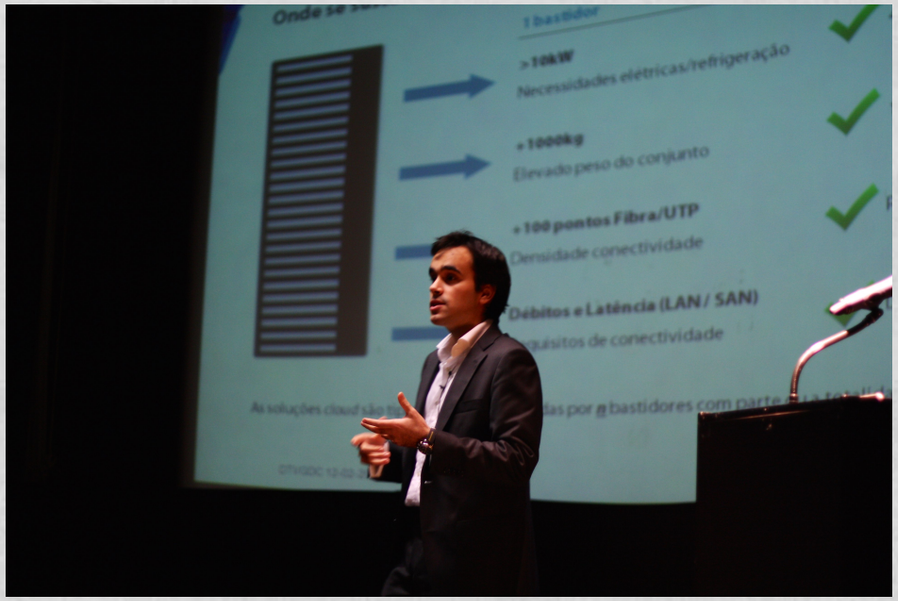
Hackathon (NINF)

- Annual event organised by undergraduate students
- 24 hour App-Dev Hackathon (attracts many outside studs)
- Awards supported by partner companies

JORTEC (NINF)

- Annual event organised by undergrads, school-wide

JORTEC (NINF)



- Annual event organised by undergrads, school-wide
- Technical Talks, Workshops, Panels, Networking, Job-shop

NovaStudentTalks

- Organised by PhD and MSc students, open to all school
- Technical Talks about "hot topics", "tools", "products"

Annual PhD Program Workshop

- Organised by PhD studs + faculty , attended by MSC students
- Presentations by PhD students in various stages of work
- Invited Keynote (international guest)

Wrapping Up

- "Informatics for all!" benefits from integration of efforts
  - Research + Education
  - Relationship with external partners (companies, schools, …)
- And integration of roles, skills, and motivations
  - Set up a core team (outreach committee - 5 people)
  - Involve all faculty, adopt reasonable incentives & appraisal
  - Involve students and students' associations
  - Support bottom-up initiatives under a shared vision
- Important to strengthen image of CS and Informatics within the campus, and outside among the general public