

Game and Interactivity in Computer Science Education

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Abstract

Interactive computer graphics and games are powerful tools that can be used in the educational process. Much research shows that the learning process is highly enhanced when this kind of approach is used in computer science teaching, not only because of the motivation they engender, but also because high end results can be easily generated with relatively little effort.

In fact, both interactive and game tools are growing in importance for supporting computer science learning, since they are capable of covering many of the typical topics included in the curriculum: Linear Algebra, Artificial Intelligence, Computer Graphics, Network, Real Time Simulations, Human Computer Interaction, Software Engineering, among other important topics.

1 Purpose and Premise

The main goal of this panel is to discuss and present different solutions and educational tools being used or developed by professors, researchers and companies, based on game and/or interactive technologies. The presenters will show examples from their own experience and their opinion for existing programs and tools being used at various institutions around the world.

In addition, other related activities and their results will be presented and discussed, including Microsoft Imagine Cup, RoboCup and the Independent Games Festival, from the Game Development Conference. Also the Brazilian experience conducted by a nationwide academic network for game teaching and development will be reported.

This panel will be useful for many professionals, but especially for computer science educators, video game research and teaching centers, developers of interactive and virtual reality tools and companies interested in improving the quality of the computer science educational process.

As complementary material, the panelist will generate a document, containing their experiences, advices, and a list of recommended web links and tools.

2 The Panelists

Esteban Clua is lecturer in the Computer Science Department of the Catholic University of Rio de Janeiro, which is the only CS Department in Brazil to get the topmost grade for post-graduation programs issued by the Brazilian government. Also he is research manager of VisionLab, an important R&D laboratory on digital entertainment content, and one of the creators of SBGames (Brazilian Symposium of Games), an important and large conference on digital entertainment. Moreover, he is member of the Game and Entertainment Special Commission of the Brazilian Computer Society.

He is teaching introduction to computer science for first year engineering students using game engines and defends that the principles of computer algorithms can be more motivating and easily understood when using script languages of game engines.

Also he has been teaching collaborative work among these students using typical game production workflow.

Bruno Feijó is Associate Professor and director of undergraduate studies in the Computer Science Department of the Catholic University of Rio de Janeiro. Also he is general manager and founder of VisionLab, a R&D center for special effects, digital TV/cinema, games, and visualization. He is the president of the Game and Entertainment Special Commission of the Brazilian Computer Society. He is co-founder and one of the directors of the Visualization Brazilian Network, which is part of the Brazilian government policy for research, development, and teaching of game technology in Brazil. Furthermore, he was the advisor of the first PhD and MSc students on games in South America.

He believes that the way we currently introduce the concepts of computer science to young people is old and boring. Games, simulations, and interactivity might be the solutions we are looking for, but they should be much more than mere subjects for the students' final projects.

Jason Della Rocca is the executive director of the International Game Developers Association (IGDA), a professional society committed to advancing the careers and enhancing the lives of game developers. Jason and the IGDA focus on connecting developers with their peers, promoting professional development, and advocating on issues that affect the developer community - such as quality of life, creative freedoms, workforce diversity and credit standards. As the spokesperson for the IGDA, Jason has appeared in countless news outlets and has spoken at conferences around the world.

In his opinion, computer and video games are an amazingly powerful medium for learning and self expression. Despite this power, the innate ability of games to teach goes unnoticed by most - often distracted by the sometimes questionable "surface details" (eg, non-stop action, mature themes, etc). In many ways, it is this covert learning that makes games so powerful, since the player is just having fun and doesn't realize that learning is taking place. So, what happens when we "expose" the learning and make teaching a more overt part of the gaming experience - either as platforms for learning external skills or the intrinsic learning within the game itself? For the most part, the mainstream game industry is simply interested in making fun games that entertain and make money. Any educational value is more so a byproduct of those primary goals.

Jon Schwartz is a founder of Morrison Schwartz, Inc., a software development and consulting company. Morrison Schwartz is a software development and consulting company based in the Seattle area. In 2005, Morrison Schwartz created and released the Kid's Programming Language (KPL), a freeware programming environment that engages beginning programmers by emphasizing game development, graphics, sounds and animation.

His work consists at creating, evangelizing and supporting the freeware Kid's Programming Language (KPL). This is the best evidence that can offer of his own belief in the importance and usefulness of games and interactivity in Computer Science

education. KPL is a programming language and IDE designed for beginners, and engaging beginners specifically by making it easy to program graphics and games. The importance and usefulness of this approach are being demonstrated by the global response to KPL, and feedback from teachers, parents and beginners who are using it. KPL is also presented in detail as a separate SIGGRAPH 2006 paper.

Ken Perlin, founding director of the Media Research Laboratory, is a Professor in the CS Department at NYU. He received an Academy Award for his procedural texturing algorithms (widely used in movies), NYC Mayor's award for Excellence in Science and Technology, Sokol award for outstanding NYU Science faculty, and an NSF PYI Award. Perlin directed the NYU Center for Advanced Technology (1994-2004). He received his PhD in CS from NYU, BA in theoretical mathematics from Harvard, headed software development at R/Greenberg Associates and MAGI, and worked on various films, starting with TRON. He serves on the Board of Directors of NYSIA. He is currently Principal Investigator, together with Professor Mary Flanagan of Hunter College, on a three year NSF funded project that designs computer animated constructivist dance games to motivate middle school girls to learn Java programming.

He believes that computer games will some day lead to universal programming literacy.

Romero Tori is Associate Professor at University of Sao Paulo (USP), a Full Professor at SENAC University, and general manager of Interlab (Interactive Technologies Laboratory) at USP. Romero was one of the pioneers in researching Computer Graphics in Brazil, and he's been teaching Computer Graphics in computer engineering undergraduate and graduate programs since 1984. Romero's approach for teaching computer graphics is based on game technology and in customized software tools, including a Java 3D game engine, called "enJine", and an interactive learning tool, called "Interlab 3D", both of them developed at his research lab. Recently Romero was the General Chair of VII Symposium on Virtual Reality and the Program Chair of WJogos (Brazilian Game Technology Symposium).

Romero has a long term experience on teaching Computer Graphics (CG) to both Computer Science and Computer Engineering Programs, covering undergraduate and graduate levels. At each new release of our CG courses more and more interest in game technology has been showed by our students. By year 2000, he decided to incorporate game development as experimental activities in an introductory CG course. More recently he developed a special didactic game engine based on Java 3D (TORI, 2006) as a support tool for lab classes. He also have been studying the possibilities of motivational and multidisciplinary natural characteristics of game development to support and integrate undergraduate courses in a more complex and compelling experimental project (FERREIRA, 2002). In this panel he will be discussing some issues and benefits regarding using game as didactic tool for teaching computer graphics, as well as how can permeate game technology and projects through Computer Science Syllabi.

Maria das Graças Chagas works as Computer Graphics and Game Design Lecturer at the Art and Design Department, at the Catholic University of Rio de Janeiro (PUC-Rio), Brazil. In 1990 she started to merge her computing and art skills, when she went to Dundee, in Scotland, to get the post-graduate diploma in Electronic Imaging, at the Jordanstone College of Art/University of Dundee, with a British Council Cheevering Student Grant. In 1992 she returned to Brazil and since then she is been working as Computer Graphics and Game Design Lecturer at the Art and Design Department, at the Catholic University of Rio de Janeiro

(PUC-Rio), Brazil. She is also the Computer Graphics Supervisor of the Art and Design Department, and head of Multimedia Division of PUC-Rio. For the last 14 years she has been teaching Computer Graphics and Coordinating Projects for development of Multimedia and Interactive applications. At the moment she is studying to get the PHD in Design at PUC-Rio. Her research work has been dedicated to improve the teaching of Game Design in Brazil. In 2002 Maria das Graças implemented a pioneer interdisciplinary game design course in Brazil, gathering together in the same classroom undergraduate students from Art/Design and Computing/Engineering courses working in complementary tasks and roles of a common electronic game project. Four years after its implementation, the experience has been very successful in developing a teaching methodology that leads the students to develop both creative and technical skills.

Her experience of teaching has proved that a game course with an interdisciplinary approach can bring a positive contribution to the learning process of Computing/Engineering and Art/Industrial Design undergraduate students. It can also offer a very productive environment for learning specific contents and understanding the connections that exist between the design elements and the computing technology applied in the work flow of a game design project. Computer Science/Engineering students have found through this course a path to become creative programmers, as they encountered motivation to learn the necessary basics of computing programming in a environment they find far more interesting than the traditional computing science class. The courses's interdisciplinary approach has also helped them to understand the relationship between the roles of Artists, Designers and Programmers when developing a game or any other interactive piece of work. The level of motivation in this course is very high, with students behaving in a very professional and autonomous way. Since its implementation in 2002 the course has proved to be a very successful experience in developing a teaching methodology that leads the students to develop both creative and technical skills.

Tiffany Barnes, founding director of the Game2Learn Research Laboratory, is an Assistant Professor in the Department of Computer Science at the University of North Carolina at Charlotte. She received her PhD in computer science, and Masters degrees in mathematics and computer science from North Carolina State University. Dr. Barnes has taught summer game programming camps for middle school, high school, and college students, where a creative context has inspired students to learn more and see computing in a different light. She began teaching Computer Game Design in Fall 2004, and is working to create both graduate and undergraduate Certificates of Game Development at UNC Charlotte. She recently received a National Science Foundation "Broadening Participation in Computing" grant, for building the STARS Alliance, a partnership to engage more young people, and particularly underrepresented minorities, in computing.

As a member of the North Carolina Serious Games Initiative, Dr. Barnes believes that the real power of game and entertainment technologies is people: these technologies have the potential to allow people to create, communicate, visualize, learn, and solve problems more quickly and intuitively. Her Game2Learn Research Lab is developing an interactive role-playing game to teach computer science, where students must solve computing problems, and create new game behaviors and content, to achieve game-related goals. Our first game quest is designed for learning introductory programming, but game quests centered on learning other computing topics including Artificial Intelligence are planned. One of our major goals is to develop a game that is motivational, fun, and effective, for a diverse population of students.