



Having Fun while you learn: Motivation, Learning and Games

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Outline

- Paradigm Shifts
- Motivation and engagement
- Games
- Simulation games
- Context of use
- Conclusions and future work



Paradigm shifts in Computing - I

- Three major phases in computing:
 - First: mainframes, one CPU to be shared, rigid command line interfaces – computers as powerful calculation and administration tools - Assembly
 - Second: PCs at home, user-centred interfaces – computers as personal tools – Pascal, C, ...

C#, Java ...

Slowly dawning upon us the third phase ...

- Ubiquitous computing: computing becomes part of nearly every human activity – agent programming



Paradigm shifts in Computing - II

- People's attitudes/expectations/perceptions of technology and how it can be used in learning and teaching have changed
- Different means of communication: email, text messages
- Learners:
 - much more familiar with digital technologies than students were 20 or 10 years ago
 - short attention span
 - thrill-seekers
- As educators, we have to cope with all the above...



Motivation and Engagement – I

- Engagement and motivation play fundamental roles in the learning process
- Knowledge cannot simply be *transferred* – it needs to be *internalised*
- Active learning strategies involve students:
 - solving problems
 - answering questions
 - formulating questions of their own
 - discussing
 - brainstorming, etc.



Motivation and Engagement - II

- A prerequisite for engagement is motivation
- Students are not a homogenous group: they learn in different ways, at different paces, for different reasons
- As educators we can *engineer* incentives by setting hard to reach but achievable goals, interesting problems, challenges

Motivated students learn better, progress faster and retain more



Games – I

- Fascinating: they engage and challenge us and are fun
- What are games?
- “A game is a system in which players engage in artificial **conflict**, defined by rules, that results in quantifiable **outcomes**” (Salen & Zimmerman, 2003)
- ... may not cover all types of games
- ... does not mention *fun*
- Your definition?



Games – II

Different types of games (Herz, 1997):

- Action
- Adventure
- Fighting
- Puzzle
- Role-playing (MMORPGS)
- Simulations
- Sports
- Strategy games

The legend of Zelda: Twilight Princess



Some games may be a combination



Games – III

Essential elements of games (Prensky, 2001):

- Goals and objectives
- Competition/challenge/opposition
- Outcomes and feedback
- Interaction
- Narrative or story line
- Rules



Games – IV

- *Magic circle* (Huizinga, 1938): players obey the rules willingly in order to gain some perceived benefit (fun, high score, monetary gain etc.)
- While all players follow the rules you have a game – breaking the circle is *cheating*



Fun – I

- Fun is relative: there are different degrees of fun
- Fun is subjective:
 - Depends on mood and idiosyncrasies
- Fun depends on the mechanics of a game
 - Very few restrictions – no fun!
 - Too many restrictions – constrains imagination!
- Fun depends on context (*reskinning*):
 - Solving a riddle/puzzle to save the lovely princess is perhaps more enticing than solving the same riddle to progress to the next level in a maths game



Fun – II

- When playing games people are trying to master them – they are trying to *grok* the games
- *Grokking* a concept/activity: you internalise a concept/activity to such an extent that you treat it as unitary/fundamental and don't have to think about it any more, i.e. riding a bicycle
- When you master a game, it usually stops being fun
- If the game is too easy, you get bored, if it is too difficult, you get frustrated – in both cases you stop playing the game!



Flow – I

- Csikszentmihalyi (1975) *“chicks sent me high”*
- A mental state in which a person is fully immersed into an activity that is neither too easy nor too hard for them
- Flow is characterised by the following:
 - Clear goals
 - Concentration and focus
 - A loss of the feeling of self-consciousness
 - A distorted sense of time
 - Direct and immediate feedback
 - Balance between ability level and challenge
 - A sense of personal control over the activity/situation
 - The activity is intrinsically rewarding



Flow – II

- Though “flow” is not a synonym for fun, flow can contribute to fun
- If you get to the stage where you experience flow in a game, then it can be fun, but you may be having fun already before you get into a state of flow
- When players are immersed in a game, they project their identity into the game object



Games and Pedagogy – I

- Games have a number of characteristics that make them attractive from a pedagogical point of view:
 - They immerse users into a world
 - They are interactive, engaging and fun
 - They encourage and promote active learning
 - They motivate participation
 - Provide instant feedback on the user's actions
- But don't mention "*Edutainment*"



Games and Pedagogy – II

- What can be taught through games?
 - Facts, principles, cause and effect, complex problem solving
- Successfully integrating gaming principles and techniques into a learning environment could:
 - Make learning itself more fun
 - Provide a challenge for the students
 - Help them learn more effectively



Simulation games – I

- In some knowledge domains simulation games may be the only way of simulating and practicing real world problems
- Known uses in military, aviation, medicine where alternative methods are high-risk and high-cost
- Simulations simulate a real life situation, but they are not games as such - additional structural elements (fun, rules, competition, story etc.) need to be built in



Simulation Games – II

- *“You can have a game that’s not a simulation and a simulation that’s not a game, but when you get one that does both, it’s a real kick-ass situation” Elliott Masie*
- The Sims, Sim City ...
- High fidelity vs low fidelity simulations
- The use of simulation games may enable students to put into practice knowledge/principles/skills and help them gain a deeper understanding and retain knowledge
- Enable students to experiment (in a realistic environment) and discover on their own and learn from their mistakes



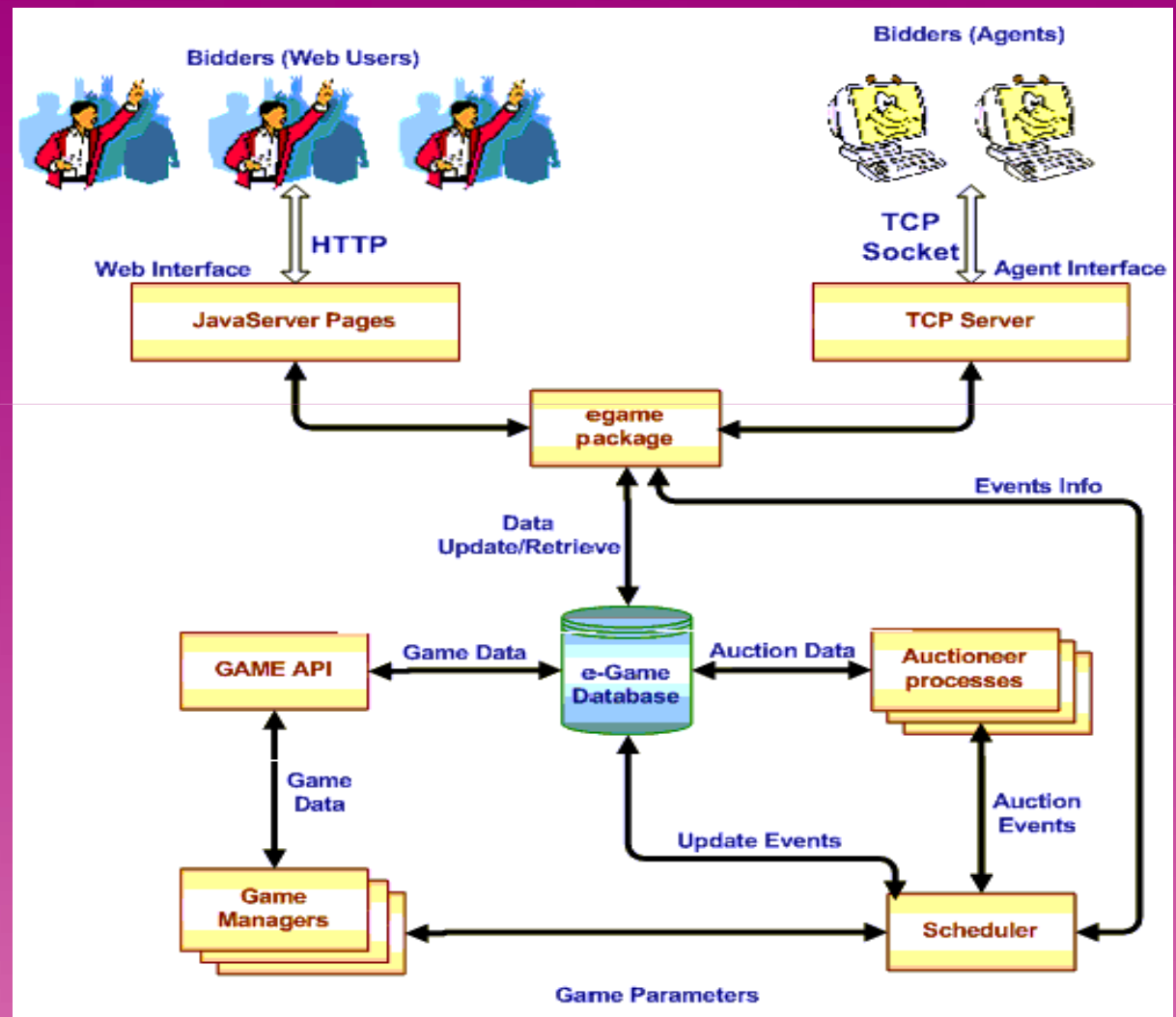
Context

- Agents: semi-autonomous pieces of software that represent the user and act on their behalf
- In e-commerce: continuously running entities that can negotiate for goods and services on behalf of their users reflecting their preferences and negotiation strategies
- Core topics: negotiation protocols such as auctions and other bargaining protocols and “strategic” behaviour, other AI topics such as search
- How to provide students with hands on experience
- Only realistic option: use simulations



electronic Generic Auction MarketplacE

e-Game: an auction platform that allows the development, running and administration of multiple-player simulation games





Use in Teaching & Learning

- e-Game can be used to:
 - Teach principles of market institutions, negotiation protocols and strategies, agent design and implementation in a systematic way
 - Design and implement new simulation games (simple and advanced) to suit particular learning outcomes
 - Run competition tournaments in which the students have to participate
 - Provide online feedback while an exercise is running as well as at the end with the final results



The Computer Market Game

Agents

Monitors (M)

Clients

Agent	Client	MB2	MB3
C	1	110	150
C	2	130	200
C	3	120	170
C	4	150	184
C	5	100	156

Continuous Single Seller M: 30

Mth Price MB1: 17 MB2: 8

Mth Price

250 (MB2, MB3)

(C2)

1

5

A

F

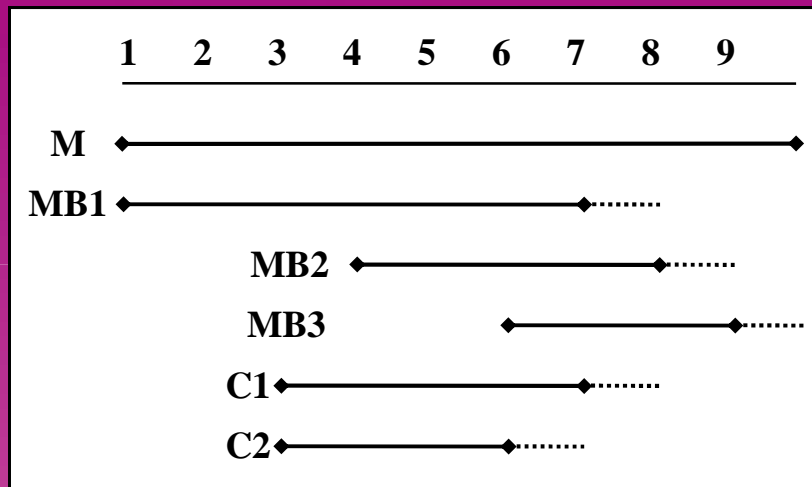
$$CU_i = 1000 + \text{Motherboard Bonus} + \text{Case Bonus}$$

$$AU = (CU_1 + CU_2 + CU_3 + CU_4 + CU_5) - \text{Expenses} - \text{Penalties}$$



The Computer Market Game – II

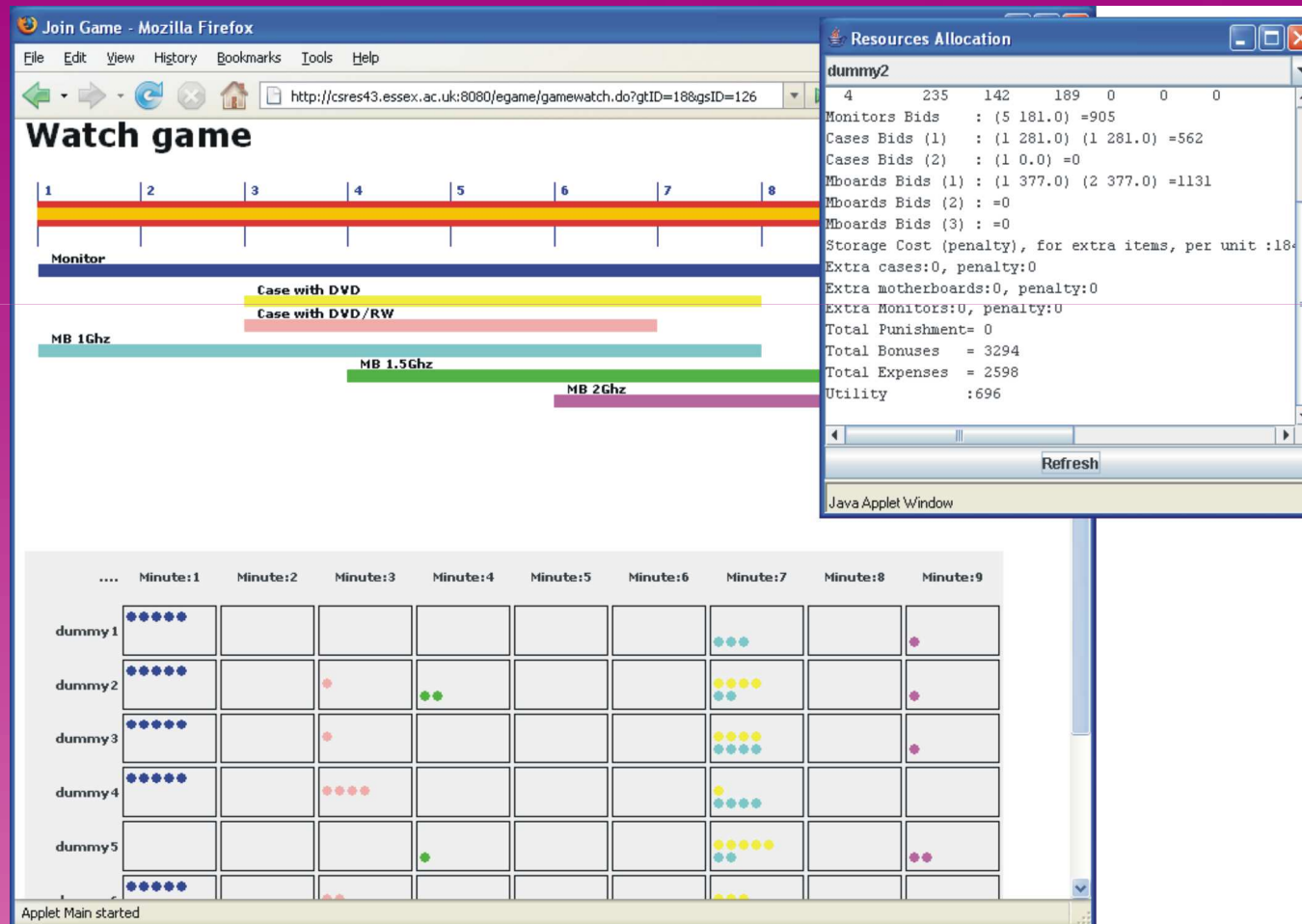
Auction Scheduling





The Computer Market Game – III

The CMG Applet showing game progression and acquired goods





In practice – I

- Theory is given in a mixture of lectures and labs where the students practice at the same time in a controlled environment: interactive/integrative learning
- CMG and other games are used to set up coursework
- Students are brought into direct conflict/competition
- Sample “dummy” agent is given: weaker students (in programming) are encouraged to build on this
- They can practice as much or as little as they like
- Non-deterministic environment
- Weak participants may alter the course of the game



In practice – II

- Collaborative learning
 - Experiments run in a controlled environment facilitated by staff with a version suitable for humans
 - Students are divided into teams and compete
 - Staff lead the debriefing: students discuss and reflect
 - * argumentation is a strong learning mechanism *
- Forum facilitates further collaborative learning outside the class
- The competition provides another opportunity to discuss and reflect
- Students identify themselves with their agents



The CMG Long Play



University of Essex

e-Game

Electronic Generic Auction Marketplace



[Home](#) | [About eGame](#) | [Documentation](#) | [Agent Games](#) | [Create Auction](#) | [Submit Bids](#) | [Search](#) | [My Auctions](#) | [Register](#)

Current User: **62|mfasli** ([Register/Change User/Logout](#))

Computer Market Game - Long Play

Auctions bidding for game 1796

AuctionID	Description	Items won	Quote	Auction State	Bidding
10665	Some Monitor	You do not have a winning bid...	289	1M,20S	Quant.: <input type="text" value="1"/> Price: <input type="text" value="100"/> <input data-bbox="1832 890 1886 928" type="button" value="Bid!"/>
10666	MotherBoard (A) 1 Ghz	You do not have a winning bid...	0	1M,20S	Quant.: <input type="text"/> Price: <input type="text"/> <input data-bbox="1832 986 1886 1024" type="button" value="Bid!"/>
10667	MotherBoard (B) 1.5 Ghz	You do not have a winning bid...	0	6M,20S	Quant.: <input type="text"/> Price: <input type="text"/> <input data-bbox="1832 1082 1886 1120" type="button" value="Bid!"/>
10668	MotherBoard (C) 2.0 Ghz	You do not have a winning bid...	0	7M,20S	Quant.: <input type="text"/> Price: <input type="text"/> <input data-bbox="1832 1177 1886 1216" type="button" value="Bid!"/>
10669	Case (1) - with DVD	You do not have a winning bid...	0	3M,20S	Quant.: <input type="text"/> Price: <input type="text"/> <input data-bbox="1832 1273 1886 1311" type="button" value="Bid!"/>
10670	Case (2) - with DVD/RW	You do not have a winning bid...	0	3M,20S	Quant.: <input type="text"/> Price: <input type="text"/> <input data-bbox="1832 1369 1886 1407" type="button" value="Bid!"/>



Conclusions – I

Student:

- Deeper learning experience
- Hands on practice of applying principles in a realistic scenario
- Immediate feedback on the students' efforts and coursework
- Discover themselves the principles governing a situation
- Peer feedback – collaborative learning
- Observation of one's efforts in comparison to others



Conclusions – II

(cont.)

- Students can progress at their own pace: weak programmers persist
- Comprehend cause and effect
- Competition: enthusiasm, incentive for more work, disincentive to plagiarism
- Opportunities to conduct research (the *research-teaching nexus*) by tackling challenging problems
- The gender issue: girls engage and participate
- From “?!*?!*?” to “Axa...”



Conclusions – III

Teacher:

- Better delivery of material
- The continuous interaction enables the teacher to identify difficulties with parts of the material and take immediate action
- A repository of exercises can be built over time
- The material can be taught in a different form from year to year with minimum effort
- Savings in time and effort, but original investment may be significant



Conclusions – IV

- Introducing gaming principles and techniques in a learning environment can have significant pedagogic benefits as games:
 - Provide a valuable and effective means to engage the students
 - Help them learn more effectively
 - Enable them to put into practice principles taught
 - Allow them to learn at their own pace
 - Allow the creation of communities of learners; students develop a sense of camaraderie and they can learn with and from each other



Conclusions – V

- But, **game content** needs to be well-engineered and targeted at clearly defined learning objectives regardless of the type of game (simulation etc.)
- Other experiences: Terrarium





Acknowledgements

The e-Game platform has been developed jointly with Dr Michael Michalakopoulos

e-Game servers:

<http://csres43.essex.ac.uk:8080/egame/eg/index.jsp>

<http://sh718.essex.ac.uk:8080/egame/eg/index.jsp>