Distributed and United

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Contents
- Individualization
- Learning communities
- I-Help
- The issue of motivating participation
  - Through compassion
  - Through money
  - Through friends
- Creating a culture

What makes a good teacher?
- Mastery of material
- Ability to organize the presentation and interaction with the learner
- Pedagogical skills
- Understanding the learner

These features have been addressed by research in AI and Education

This talk is dedicated to my 9th grade math teacher
Emil Popov
What makes a great teacher?

- Ability to guide “discovery”, leadership
- Ability to motivate and push
- Spontaneity and surprise
- Personality and artistic skill
- Charisma ...

We have tried to simulate the teacher

- CAI in the 60’s
- Multimedia courseware continues to be “best-seller” in the 90’s
- Web-based courses – big and growing market now
- Pedagogically – not too successful

Focus on the individual

- Dynamic Courseware Generation (DCG)
- Reactive Planning of:
  - Contents
  - Presentation strategy
  - Problem-solving (coaching)
- Overlay Student Modelling

Dynamic Course Generation (DCG)

(Vassileva, 1992, 1994, 1997)
Pedagogical Planning in DCG

Instructional Tasks and Methods

Coaching Users in Problem Solving

DCG: Adaptive Teaching: Planning contents and delivery

The ultimate result?
- Instruction ultimately tailored to the individual
- A system that truly “cares” for the learner
- But maybe sometimes the learner should adapt, not the environment?
- Otherwise it would be a very lonely learner

I too want individualized instruction!
Learning is adapting

- Dialectic between Cognition and Experience (Immanuel Kant, 1781).
- Maturana & Varella

Learning is communication

- Conversation Theory of Cognition (Pask, 1973)

Focus on the learning experience and communication

- In the last 10 years we have seen:
  - Constructivism
  - Social cognition
  - Collaborative learning environments
  - Open learning environments

Technology development

- Distributed Environments
  - distributed applications: plug-ins, applets, shared object libraries
  - connected users, resources, applications
  - hybrid societies
Learning communities

- How to provide continuous support for a community of learners?
- How to provide a shared medium?
- How to cater to the individual?
- How to motivate participation?
- How to ensure focus and guidance?
- These are some of the features that make the great teacher!

I-Help: a community of peers

What is the shared medium?

- Public discussion forum (asynchronous)
- E-mail (asynchronous)
- 2-line chat tool (synchronous)
- Chatrooms (synchronous)

Large classes
- No possibility for individualized feedback
- Various levels of knowledge in the class

→ Students could help each other!

(Jim’s and Gord’s idea)
Individualization in I-Help

- In matching people with appropriate partners → depending on their
  - Knowledge
  - Cognitive style
  - Star-sign
  - Eagerness
  - Helpfulness
  - Social ranking
  - Relationships

Different Matchmakers

- From self-evaluation
- From diagnostic application
- From peer-evaluation
- From agent-evaluation

Distributed learner modelling

“Active”

- No predefined behavior to be adapted → Behavior Emerges!
- "Just in time" generated models
- Depending on:
  - The purpose of adaptation
  - The available user model information
  - The trust relationships with other agents
  - The circumstances (who is around) and resources
- Focus on the process, not representation

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I-Help deployment results

- Deployed for 2 years, 2000+ users, all undergrad CS classes, in the UK, France and Colombia
- Lessons learned:
  - Usage / participation varies greatly
  - Should be perceived as adding value
    - Initial knowledge investment from instructor is crucial (apprenticeship)
    - After reaching a "critical mass" becomes self-feeding

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The most important lesson

- The most exiting technology is worthless, if not embraced by a large user community
  - Example: NAPSTER, KaZaA
- A very simple technology can be invaluable, if supported by an active user community
How to motivate participation?

- Why do people offer their time and resources?
  - Different people have different motivations
  - Some are altruists (intrinsically motivated)
  - Some would like to make friends and hope to make new friends through helping
  - Some seek glory
  - Some seek attention
  - Some seek high marks
  - Some seek money… (extrinsically motivated)

We need to provide a mechanism that appeals to every individual, depending on his/her motivation.

Appealing to the compassionate

- Animated, believable interface Agents
- Personal agent as a persona
- Goal:
  - to invoke emotion (compassion) in the user
  - to persuade user to help
- Study:
  - the persuasive power of an “emotional” agent

Experiment with Emotion

Goal: to find if integrating emotional qualities into personas impacts the student’s performance and perception of learning

- Experiment:
  - An introductory interactive course on C++ delivered by an animated persona
  - Material presented by human voice
  - Users have to answer test questions
  - Persona responds to test performance with facial expression
- Two test conditions:
  - Emotional engine = "on"
  - Emotional engine = "off"

Emotional Engine in the Persona

Valenced Reaction To

- Consequences of Events (Pleased, Displeased, etc.)
- Actions of Agents (Approving, Disapproving, etc.)
- Aspects of Objects (Liking, disliking, etc.)

Facial expression for six major emotional states (Ortony, 1988)

Happy, Sad, Pleased, Surprised, Neutral, Angry
**Preliminary Results**

- Girls felt a pressure to perform better in order to please the persona!
- All participants preferred the emotional persona.
- No significant difference in the student's performance.

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**Appealing to the materialistic**

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**The I-Help economy**

- Human help has costs (time, effort)! → It shouldn't be misused!
- Market regulates the supply and demand:
  - Help in exchange for currency
  - Rate of pay negotiable (by agents)
  - Users can set parameters of agents
  - Pay a penalty if agent's deals are ignored.

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**The agent negotiation**

- Each agent decides to counter-offer or accept an offer by calculating a utility function with factors:
  - Money importance (greediness, stinginess of user)
  - Importance of the current goal
  - Importance of the relationship between the users
  - Risk attitude
  - Perceived utility function and factors of the other agent → agents model each other.
The currency

- A bit like Sun java’s “Duke Dollars”
- Everyone gets an initial allotment
  - helpees pay, helpers earn
  - what happens when someone runs out?
  - finding useful course resources pays
- Redeemable for “prizes”

How to cash in the end?

- Depends on the values of the community
  - Marks – in a real classroom setting
  - Real money – in a workplace setting /distance educ
  - Reputation (top 10 list) – always useful
  - Visibility in the society based on reputation
  - Slashdot.com, thewines.com
- In our case
  - Marks – not allowed
  - Souvenirs not stimulating
  - Reputation, visibility – a better way

How to steer the economy?

- Resources
  - Pull money out by rewarding
    - student with marks / name
  - Free instructional resources

- Money out by rewarding
  - Allowance or “salary”

- Big Brother’

Simulations:
- Electronic marketplaces
- Agent society, emerging norms
- Emerging groups

Real world evaluations:
- Real rewards
- Monitoring user activity
- Comparing with agent models
- Reconstructing scenarios
- Questionnaires

Supporting social relationships

- Agents can take into account interpersonal relationships
  - In seeking help
  - In negotiation
- Agents can help in building new relationships among users
  - Agent coalition formation
  - Trust-based mechanism
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Simulation results

- In the agent world, simulation shows that coalition formation brings:
  - Stability, predictability in the agent society
  - Increased benefits

- In the human world, still to evaluate:
  - Can people become friends through their agents?
  - Does agent coalition help build stable and productive learner teams?

Create a learning culture!

- The 5 “R”s (Hilari Davis):
  - Roles – people who sustain the community
  - Rules – ethics of behaviour, reward system
  - Rituals – routines, predictable things, to make the participants feel safe
  - Rounds – regular events, customs, things to expect and look forward to
  - Rings – surprises, interesting unexpected things, “be always there or you’ll miss it!”

How to ensure focus and guidance?

- Rituals – How to make users feel safe:
  - “Anonymous” users
  - One user → different roles
  - But then how do you find your new I-Help friend in the real classroom?

- How to plan surprise?
- How to make them come back again?

Conclusions

- Ultimate Individualization → Distributed, Lonely Learners
- Learning Communities → United Learners
Conclusions

Supporting Learner Communities
- Multi-Agent Architectures provide a lot of useful tools and metaphors
- Individualization is important
- Motivation is important (individualization here too)
- Research into heterogeneous agent economies is needed (differently motivated agents)
- Studying the culture of the user population and creating a productive learning culture is vital!

Questions?

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