The Intelligence of Agents in Games

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WHICH PICTURE COMES NEXT?

Educational Games For Kids

Pull back the spring to the yellow, green or the red light. How far does the magnet travel in each case?
That's right, keep picking up trash, do-gooder. You know who else squats all over town? My cat.
Game AI Research

- Player Modeling
- Search & Planning
- AI-assisted Design
- General Game AI
- Behavior Learning
- Believable Agents
- Procedural Content Generation
- Computational Narrative

Player interaction with Game:
- Content
- Agents
- Player

Believable Agents

Game AI Research
Game Agents
Final Fantasy (1987)
Final Fantasy VI (1994)
Final Fantasy VII (1997)
Final Fantasy IX (2001)
Final Fantasy XIII (2009)
AI has not changed at all

Ultima VI: The False Prophet (1990)

-{knife}
To South.

Drambuie:  
>Get-a knife

"Stop Thief!!!"

Drambuie:  
>4
Game AI Tech Situation

• Game worlds are ever increasing in realism and possibilities
• Even keeping old features working is hard
- Client
- Thief
- Tourist
- Vandal
- Window Shopper
- Famous Hero
- Murderer
- Clown
The Illusion of Natural Behavior

- Smart, to a certain extent
- Unpredictable but rational decisions
- Emotional influences
- Body language to communicate emotions
- Being integrated in the environment
- Adapting to dynamic circumstances
Evoking the Illusion

- No obvious cheating
  - they should be situated
- Variety
  - ability to explore new behaviors
- Avoiding stupidity
  - they should understand their own behavior
- Using the environment
  - they should understand their environment
- Self-correction
  - they should be able to recover from mistakes
- Creativity
  - they should be able to come up with new solutions
(Online) Adaptive AI

- Self-correction
- Creativity
- Scalability
Implementing Adaptive Game AI

• High complexity
  – State-action space
  – Uncertainty
  – Real-time

• Computational reqs.
  – Speed
  – Effectiveness
  – Robustness
  – Efficiency

• Functional reqs.
  – Clarity
  – Variety
  – Consistency
  – Scalability
Dynamic Scripting

Knowledge Base A: generate script → Script A → script control → AI team

Knowledge Base B: generate script → Script B → script control → human-controlled team

Combat
0.3.2: Chromatic Orb hits Blue Wizard B. Saving throw fails (1 < 12). Blue Wizard B receives 3 points of damage.
0.3.3: Blinding hits Red Fighter B. Saving throw fails (11 < 14).
0.3.3: Blinding hits Red Wizard A. Saving throw fails (9 < 12).
0.3.8: Red Fighter B hits Blue Wizard B’s Minion 3 for 3+3 points of damage. Red Fighter B hits Blue Wizard B’s Minion 3 for 2+1 points of damage.
0.3.8: Blue Fighter A hits Red Fighter B for 5+3 points of damage. Blue Fighter A hits Red Fighter B for 5+1 points of damage.
Typical Fitness Progression

- Absolute

- Average over last 10 encounters

"turning point"
Why Does Dynamic Scripting Work?

• Scripts are readable (clarity)
• Scripts are always different (variety)
• Script creation is almost instantaneous (speed)
• Knowledge base avoids bad behavior (effectiveness)
• Redistribution of weights allows knowledge to return even if it was discarded before (robustness)
• Every trial is used for adaptation (efficiency)

• Exploration and exploitation happen simultaneously
• AI should *be able* to play stronger than the human player
• AI should *adapt* to the level of skill of the human player
• AI should constantly offer *new challenges*
Player Modeling

- **Player Model**
  - Actions
  - Preferences
  - Style
  - Personality
  - Skills

- **Human Player**

- **Game AI**

- **Game World**

   - similarity?
   - biometrics?
   - updates
   - predictions
   - observations
   - actions
   - observations
   - actions
The four basic personality types

The glass is half-full!
The glass is half-empty.

Half full... No! Wait! Half empty! No, half... what was the question?

Hey! I ordered a cheeseburger!
You are too far away!
You are too far away!
You are too far away!

Lestrange’s Prayer of Healing heals Janie for 517.
Lestrange’s Prayer of Healing heals you for 513.
Your Frost Shock hits Creeping Sludge for 358.
You suffer 285 Nature damage from Creeping Sludge’s Virulent Poison.
Creeping Sludge is afflicted by Frost Shock.
We haven't heard from our son Pedro in weeks now. Usually he writes once a week. My wife is a bit worried. She has prepared a letter for him, which we would like you to deliver to him personally. Would you be willing to do this for us?

1. Certainly. What should I do?
2. No, I am not interested.
3. I am no postman! Get someone else to deliver your stupid letters!

Aaron Aardvark: Sounds interesting. What do you need?

Nelson Miller: We haven't heard from our son Pedro in weeks now. Usually he writes once a week. My wife is a bit worried. She has prepared a letter for him, which we would like you to deliver to him personally. Would you be willing to do this for us?
Some Findings

- High Openness correlates with fast choices and movement
- High Conscientiousness correlates with ethical decisions
- High Agreeableness correlates with friendly behavior
- High Neuroticism correlates with taking long to finish
• First 45 minutes
• 165 variables
  – 107 conversation
  – 37 G.O.A.T.
  – 20 movement
  – 1 miscellaneous

You didn't fool me. I just pretended not to know. <lie>
Great party, Amata! Thanks for doing this for me.
Is this it? Or hasn't the real party started yet?
Neverwinter Nights: 80 test subjects
Fallout 3: 37 test subjects
THANK YOU BATTLEFIELDERS FOR 13K SUBMISSIONS
Collected Data:
1. Player name
2. 100-item IPIP
3. Age
4. Country of residence
5. Gaming platform
6. Credits
Personality and play style:
- Conscientiousness relates to speed
- Unlock score relates to multiple personality dimensions
- Work ethic relates to performance
• Age explains ~45% of variance in play style
• Older players focus more on the game's goals
• Older players are less successful at achieving the game's goals
• For most play style variables, players peak around 20
• Effect sizes are very high for age groups
KEEP CALM
AND
PLAY VIDEO GAMES
THANK YOU MARIO!
YOUR QUEST IS OVER.
People Involved in the Research

- Prof.dr. Jaap van den Herik
- Prof.dr. Eric Postma
- Prof.dr. Arnout Arntz
- Dr. Sander Bakkes
- Dr. Marc Ponsen
- Dr. Giel van Lankveld
- Shoshannah Tekofsky, MSc
References

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