### The Intelligence of Agents in Games

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**Understanding Society** 



















#### Game Al Research









XF

Greetings, What may humble Mongolia do for the mighty Russia?

We would like to make a trade proposal. What are the current deals we have together?

3

X

X



100)

#### Final Fantasy (1987)



#### Final Fantasy VI (1994)



#### Final Fantasy VII (1997)



#### Final Fantasy IX (2001)



#### Final Fantasy XIII (2009)









Q

>Move-knife To Sout⊾.

Drambuie: ≻Get−a knife

"Stop Thief!!!"

Drambuie:

Ultima VI: The False Prophet (1990)



#### 



# ClientThief

O Tourist O Vandal O Window Specificase Gratisus Hero O Murderer O Clown

SW

Ċ1



#### 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 Al

- 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**





#### **Typical Fitness Progression**

Absolute



• Average over last 10 encounters







#### 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

Al should *be able* to play stronger than the human player
Al should *adapt* to the level of skill of the human player
Al should constantly offer *new challenges*















LAWFUL NEUTRAL TRUE NEUTRAL CHAOTIC NEUTRAL







LAWFUL EVIL



**AL EVIL** NEUTRA





#### **Player Modeling**





The glass is half full! The glass is half empty. 8 Щ W ы Half full. No! Wait!) Half empty !.. No, half... What was the question? Hey! I ordered a cheese burger! ш Law

The four basic personality types











#### McCrae









#### Nelson Millar

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?

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



Aaron Aardvark: Sounds interesting. What do you need?

Nelson Millar; 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?



F12

F11

D

Talk:



#### 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



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?

## FALLOUT. 3

- First 45 minutes
- 165 variables
  - 107 conversation
  - 37 G.O.A.T.
  - 20 movement
  - 1 miscellaneous



#### Neverwinter Nights: 80 test subjects Fallout 3: 37 test subjects







#### 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













### 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

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