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Validating Agent Based Models Through Virtual Worlds

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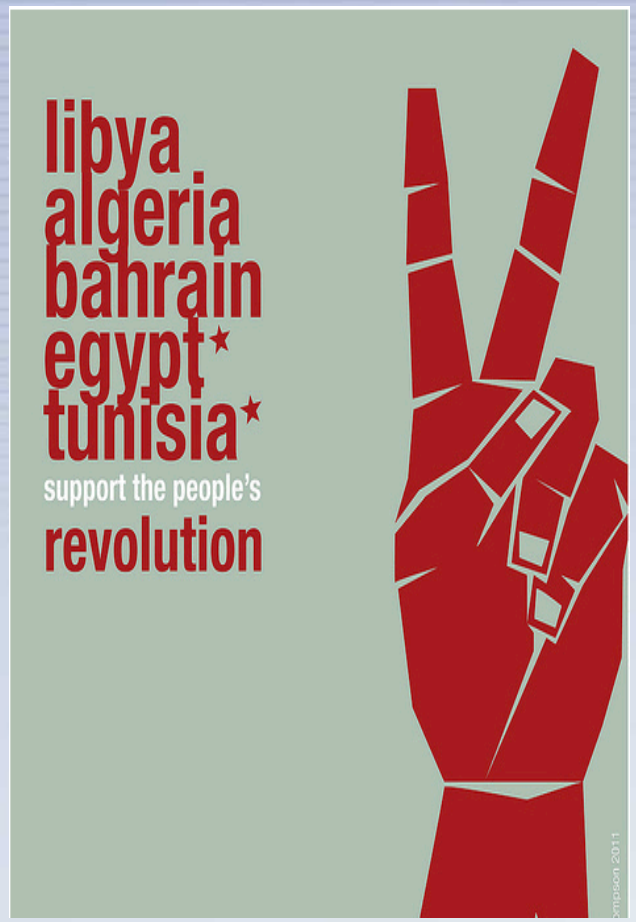
Problem Statement

- **Agent Based Modeling (ABMs) a powerful tool for analyzing societal behaviors**
  - Rooted in psychological, economic, and social theoretical foundations
- **Rapidly changing political climates quickly obsolesce known models**
- **Need new techniques to better *inform* and *validate* ABMs**



How To Improve Model Generation?

- **ABMs require real world examples of social behavior to *inform* and *validate* models**
  - Difficult & time-consuming to obtain data
  - Data not always sufficient in fidelity or completeness

- **Social media has potential as data source**
  - But does not always provide link between what people say & what they do

- **Data source wishlist:**
  - Observing all communications within a population
  - Quantifiable measures of people's actions & their repercussions within the world
  - Data sampled at high frequency (near real-time)

The Data Gap

Model

Data Source	Issues
Lab Experiments	Small scale, lacks diversity
Surveys	Data sampling too long, hard to acquire detailed information
Direct Measurement	Expensive, privacy issues

Real World

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The Potential of MMOGs

- **Our argument: Massively Multiplayer Online Games (MMOGs) could serve as that data source**
  - Ability to capture data on thousands of people simultaneously interacting within virtual world

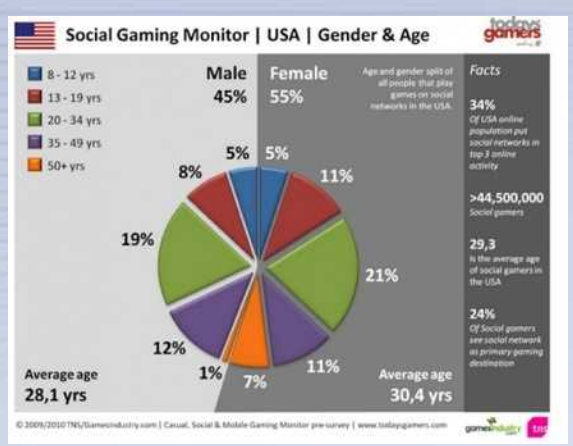
- **Biggest advancement of games: Social Realism**
  - Reflects social constructs
  - Mimics how we communicate in real-world
  - Player groups must interact with & compete against large differing populations

Nefarious deeds

- **EVE Online**
  - Corporations formed by players to seek economic & political advantages
  - Corporations collect taxes & develop infrastructure to support their own
  - 2009: “Band of Brothers breaks apart in EVE: Goonswarm Responsible” – Massively.com
    - Reported BoB director turns out to be a spy for opposing corporation
    - Sells off BoB assets, destroys their sovereignty

The Potential of MMOGs

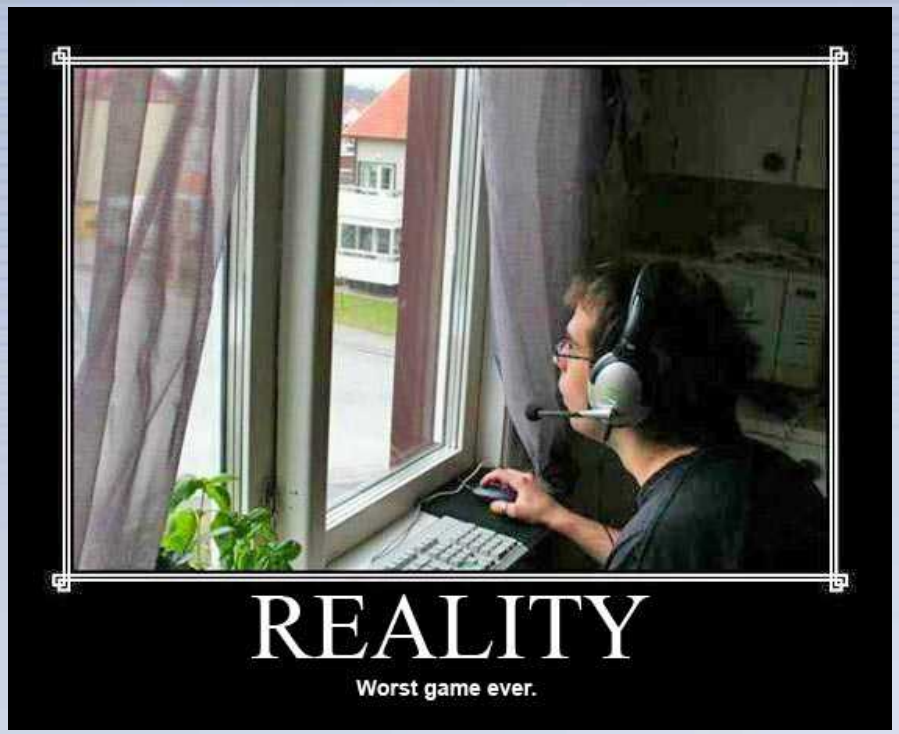
- **MMOGs now capture wider audience who are spending more time online**



- **MMOGs popularity not limited to western culture**
  - *Travian:* Active player population over 50,000
  - Popularity of *Travian* website by region[1]:
    - 7th: Iran
    - 9th: Libya
    - 5113th: USA

- [1] **https://www.strategicsocial.com/archives/861**

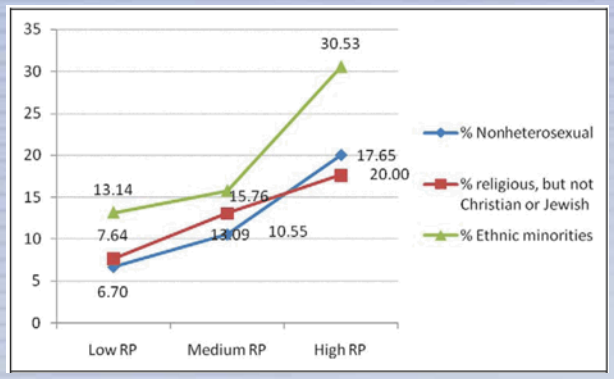
But Games as a Solution?



- Aren’t games an escape from the real world?
- Why would games have any relation to real world?

Real World Mirrored in Game World

- **USC: People reflect true selves during game play**
  - Similarities between actual players and observed character behaviors in *Everquest II*



- **Tufts: MMOGs can mimic real world phenomena**
  - Corrupted Blood spell in *World of Warcraft* had players reacting similarly to recorded behavior from pandemics
    - Based only on qualitative observations

- **Growing area of research on how to use games to study real world phenomena**

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Center for Game Science

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R&D Plan

- **Acquire data from a MMOG where exemplar behaviors on political shifts occur regularly**
  - Must find external MMOG developer to provide data
- **Develop automated processes to analyze player behaviors to *inform* development of ABMs**
  - Leverage Sandia investments in deriving empirical models of human behavior (STANLEY, CorText, Cognitive Foundry)
- **Demonstrate how to *validate* and improve known ABMs through data from MMOGs**
  - Leverage Sandia investments in ABMs for analyzing political factions (Behavior Influence Assessment)

R&D Plan: Acquiring MMOG Data

- **Obtaining data from *GAME X***
  - Browser-based space adventure game
  - Active player population > 30,000
  - Players have agreed to have data from their game play collected for scientific research

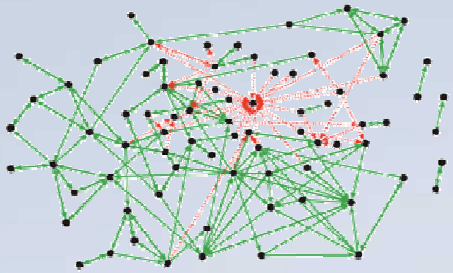
- **Features of the game include:**
  - Alliances with corporate structures
  - Market-based economy
  - Explicit friends and enemies networks
  - Open forums for public communication
  - E-mail / IM for private communication

- **Many examples of covert behavior by players to overthrow opposing alliances**

R&D Plan: *Inform* Development of ABMs

- **From GAME X data, we will perform:**
  - Sentiment analysis of open forum data
  - Social interaction network generation from private messages
  - Correlate all communications to actions of select players
  - Build classifier based upon examples of selected disruptive behavior (e.g., political coups, espionage)

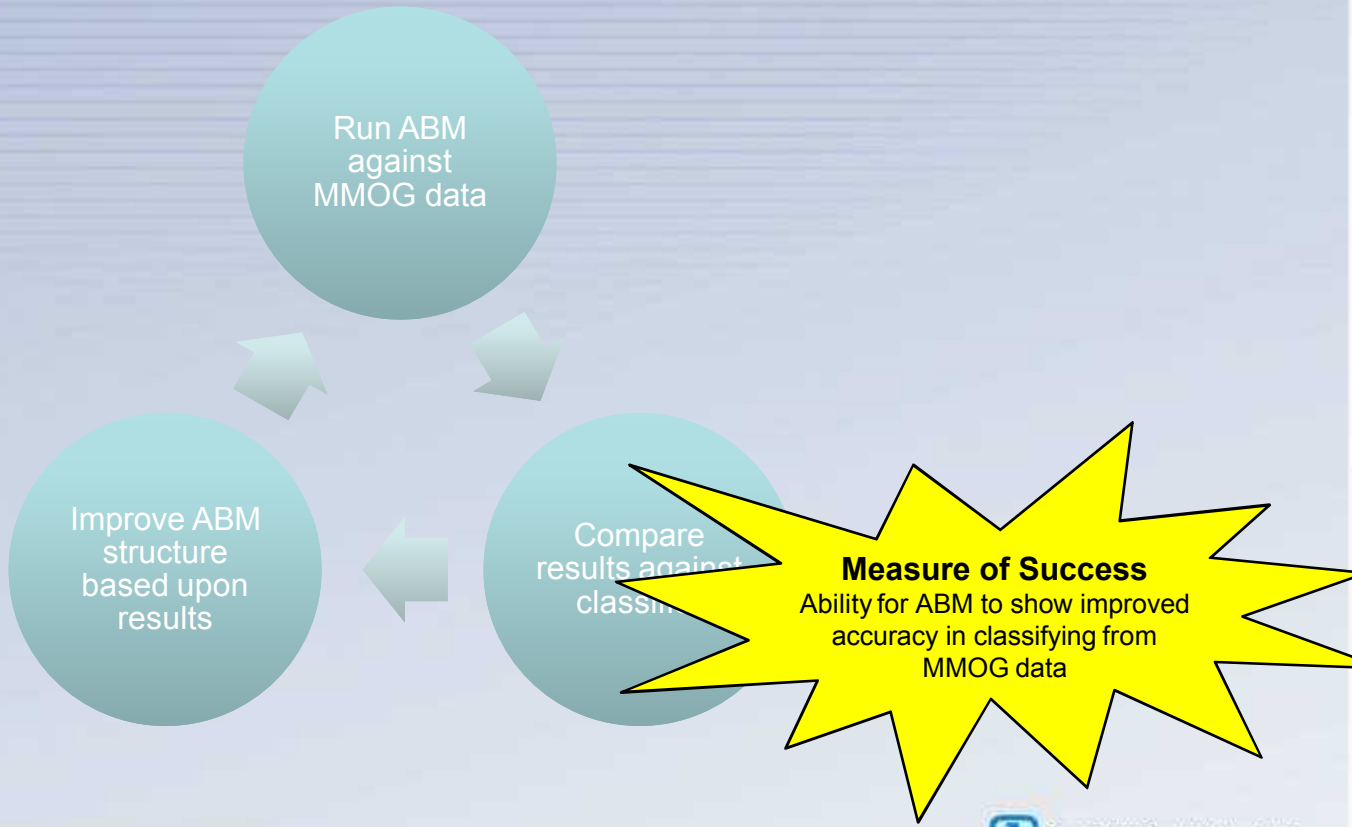
- **Classifier will identify disruptive actions in-game based upon observed communication patterns**
  - Features used by classifier will highlight aspects of behavior to *inform* ABM development



Measure of Success
Ability for classifier to accurately find examples of disruptive behavior in MMOG data

R&D Plan: *Validate* Known ABMs

- **Iterative approach to assess and improve ABM through using MMOG data as test platform**



Thanks

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