Human-Subject Virtual Experiments for Social Sciences

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Outline

- Introduction
- State of social sciences: are we really doing science?
- Projects related to social sciences: **Big Data social networks & social simulation**
  - Applicable to arts and humanities
- Lessons learned

How should sensing and computing support social scientists, humanities scholars, and artists, and foster

- Computational social sciences
- Computational humanities
- Computational arts

- New computing system for human-subject experiment

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Institute for Computing in Humanities, Arts, and Social Sciences

- The Institute for Computing in Humanities, Arts, and Social Sciences (I-CHASS)
  - A unit within US National Center for Supercomputing Applications http://www.ncsa.illinois.edu/
  - Focuses on the interface between computation and the humanities, art, and social sciences
  - Foster computational art, computational humanities, and computational social sciences
  - Mixed researchers with diverse backgrounds
  - http://chass.uiuc.edu/

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Current State-of-the-Art of Social Sciences

- Surveys/paper interviews: costly
- Phone interviews: 5% response on average
- Face-to-face interviews: most costly
- Web-based surveys: faster & less costly
- Agent-based simulation (e.g., using NetLogo)
- Focus groups, role playing: costly, experiment limits
- Correlations, but few causations → experiments needed

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Goldilocks Zone for Human-Subject Experiments

- Real world experiments on human-subjects need IRB approvals and usually
  - Impractical due to cost and time
  - Unethical due to human subjects
  - have Irreversible, direct consequences
- Scientific simulations turned into serious games is realistic enough for training → good enough for experiment
- Gamified scientific simulations need to be well defined, well designed, and focused (narrow) in scope.
- Goldilocks zone: realistic enough for experiment with no direct, irreversible real-world consequences (except PTSD)

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Representative Projects

1. Virtual Worlds Observatory
   - analyzing virtual worlds; big data social networks
2. Group Scope
   - audiovisual data gathering and analytics of groups
   - selfie multi-camera interface
3. Serious Game Human-Subject Experiment:
   - gamified scientific simulation experiments
4. Social Sensing
   - fact-finding from noisy social channels; big data social net

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1. Virtual World Observatory

- Observing the Virtual Worlds / Online Role-Playing Games as a proxy of the real world.
- Sony's EverQuest II's logs and surveys data
  - Fight monsters, buy & sell armor

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Virtual World Observatory Results

- EverQuest II is good as roles are defined, SecondLife is bad as what you see in avatars is NOT what you get (e.g., roles)
- Does in-game behavior correlate with the real world?
  - Yes, for certain behaviors (e.g., trust behavior)
- How does leadership emerge in-game?
  - Relationship-oriented and task-oriented
- Other findings:
  - mimic real world economic patterns
  - “illegal transaction” patterns of gold miners
  - individuals’ relationship-oriented behaviors in the virtual world correlate with leadership status in non-profit organizations
  - social structures & communication processes contributing to trust
  - complementary skills, similar age & skill-level → teaming

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2. Group Scope

Instrumenting Research on Interaction Networks in Complex Social Contexts via AudioVisual Analytics

- Gather audiovisual data with cameras
- Transcribe and annotate data
- Analyze audio and vision data
- Applications:
  - School bully detection
    - a series of bullying cues
  - Emergency response field exercise
    - effective activity patterns
  - 3D interface ← selfie cameras

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3. Serious Game Human-Subject Experiment

- Probe how multiple teams operate to achieve a shared goal
- Use serious game
- Serious game = gamification of scientific simulation & visualization
- **Interactive**, immediate response
- 52 human-subject experiment sessions

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Gamified Scientific Simulation

- Scientific simulation = accurate but hard for the public to engage
  - Non-experts do NOT believe in scientific simulation
- Games for entertainment = fun, great public engagement but not accurate
  - Non-experts FEEL, immerse, present in games
- Best of both worlds:
  - Gamified Scientific Simulation = fun, engaging, and accurate scientific simulation useable for experiments
  - Belief might not be necessary → feeling could be enough

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Serious Game Experiment Results

- Synchronization/reciprocity of communication correlates with team performance
  - Reciprocity/synchronization indicates healthy communities or social networks
- Cross-team communication correlates with team performance
- Cross-team communication fosters trust to handle false information
  - Social groups should talk to other different social groups to obtain ground truth → avoid Groupthink

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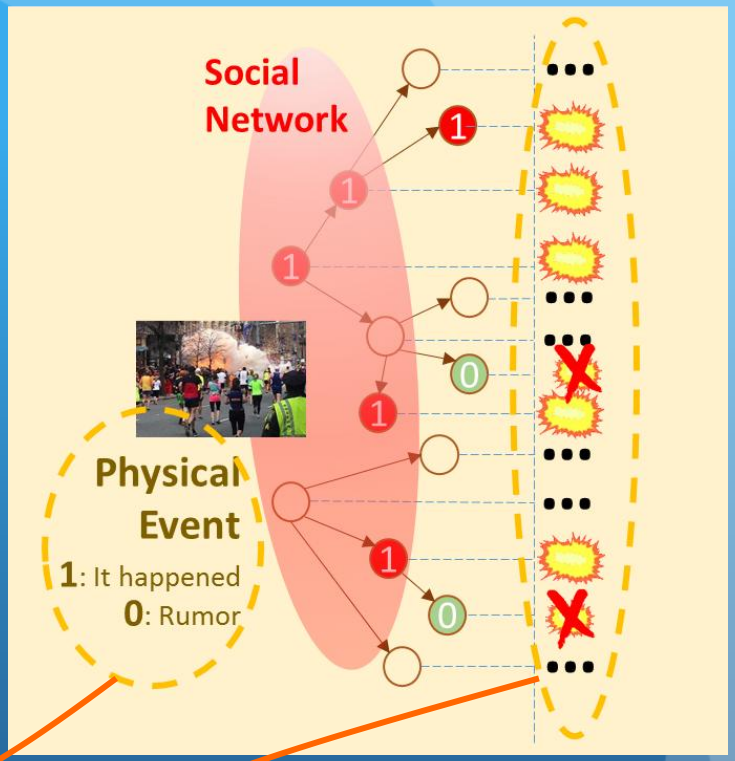
4. Social Sensing

Model the social network as a noisy channel that transforms "ground truth" into noisy observations

- Tweets data
- Large-scale, but noisy, graphs



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Methods for Social Sensing

- Quantify error bounds of social networks
- Use information theory to understand the fundamental performance limits of social sensors
- Use estimation theory to build optimal channel decoders or fact-finders
- Use human-subject experiments to evaluate impact on team performance

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Social Sensing Results

- New fact-finding algorithms
- New source-selection algorithms
- Apollo http://apollo2.cs.illinois.edu social sensing tool
- Detected tweet patterns for Egypt, etc.

- Adding physical sensors → socio-physical sensing

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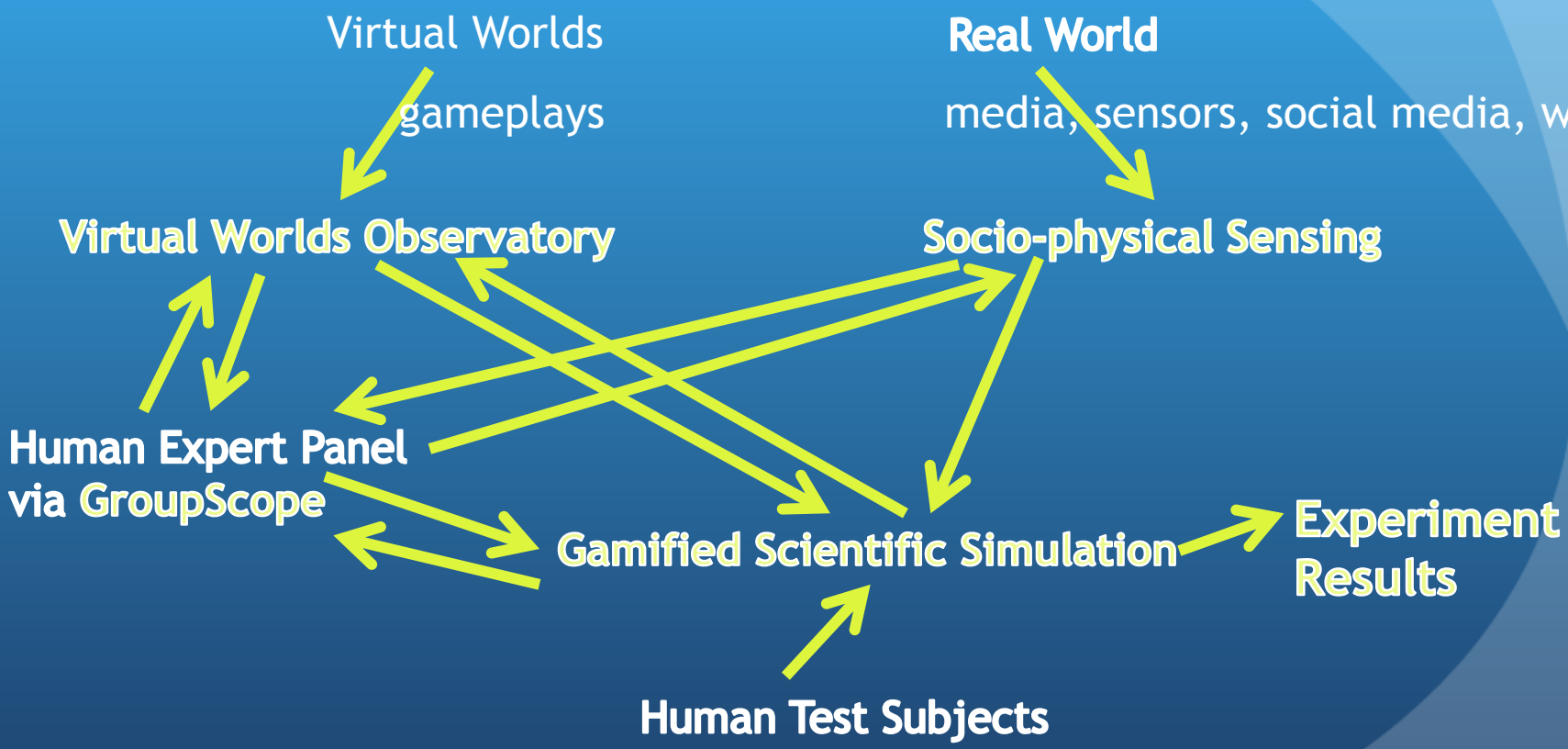
Serious-Game-based Human-Subject Research



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Limitation of Results

- There may be no ground truth, or multiple conflicting ground truth
- There may be ground truth but its interpretation is non-trivial and complex
- “Quantum” effect: when measured or observed, people inherently change behavior → social identity, roles, self-perception
- Tweets can be self-selecting and tech influences content (e.g., friends @ FB)

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Complexity of Meanings

- Serious Games have design semantics that should be clear and targeted at specific niche
- The treatment of meanings / semantics from humanities and art is lacking
  - Ground truth is assumed to be Boolean when it may not be Boolean, it might even be “quantum” in a sense that people change behavior when observed.
  - Perception matters, it becomes reality vis-a-vis reality filters into perception
- Need the humanities to delve into deep meanings

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Hardware: High-Performance Computing for Serious Games

- Interactive serious game HPC & supercomputers; connected with mobile devices & game consoles
- Data-driven processing of all relevant social information
- Large-scale graph computation and social simulation
- Gamified, free, open-source virtual worlds open to stakeholders and general public

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WetWare: Expert Panel & Players for Serious Games

- Panel of world-wide experts: humanities scholars (historians, culture scholars, etc.), artists, doctors, nurses, sociologists, anthropologists, computer scientists, general public, etc.
- Assisted by Group-Scope-like interface
- Quality of serious games = event forecasts & gameplays fidelity

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Acknowledgment