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# CASOS Web Design and Development Examples

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*By Matthew J. DeReno*

What follows are select screenshots for a sampling of projects pages I was tasked to build for Carnegie Mellon University's CASOS (Computational Analysis of Social and Organizational Systems) Center in the School of Computer Science. All in all, there were 18 project pages.

Current URL for these pages as of **June 18, 2010**:

- [http://www.casos.cs.cmu.edu/projects/all\\_projects.html](http://www.casos.cs.cmu.edu/projects/all_projects.html)

The project pages were achieved using the following tools and scripting languages:

- CSS
- HTML
- PHP
- PHPMyAdmin
- Dreamweaver, Photoshop

300 Cities - Mozilla Firefox

http://www.casos.cs.cmu.edu/projects/300Cities/index.html

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300 Cities

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### The 300 Cities Project

Census Data → Variables related to Information Diffusion in Social Networks → New Social Distance Metric(s) → ORA deep-structure analysis → City Clusters

Household record

Person record 1

Person record 2

Person record 3

Person record n

The goal of the 300-cities project is to find a small number of city clusters, where the cities within each cluster provide similar social constraints on the behavior of their populations. The identification of city clusters provides a means for economy of effort for simulation studies, which examine the dynamic impact of social constraints on agent behavior, because we can run simulations using canonical cities that represent city clusters rather than having to run simulations for each of the individual cities. In the long term, it also provides guidance for prudent application of IRS interventions – perhaps in the form of *smart-cards* that describe the most effective interventions for each city-cluster.

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Summer Institute 2010:  
Location: Carnegie Mellon University - Pittsburgh Pennsylvania  
Dates: June 7-13, 2010

SORASCS 2010:  
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Dates: May 4-5, 2010

Ph.D. Program:  
The Ph.D. program in Computation, Organization and Society (COS) prepares students to be tomorrow's leaders in constructing and assessing technology and its societal impacts that is responsible to society, business, policy, and law. The program builds on COS world-class faculty, drawn from several academic disciplines, but primarily from computer science and social/policy science.

CASOS: Projects - BioWar - Mozilla Firefox

http://www.casos.cs.cmu.edu/projects/biowar/index.html

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## Overview - BioWar: A City Scale Multi-Agent Network Model of the Impact of Weaponized Biological Diseases

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In trying to prepare for attacks, policy makers need to be able to think through the consequences of their decisions in various situations. Consider, for example, trying to decide if all US citizens should be vaccinated for smallpox. Speculations abound as to the potential devastation that smallpox could wreak. Medical experts, scientists, and policy makers need a way of thinking through the morass of complex interconnections to understand whether different inoculation or containment strategies will be effective. Unfortunately many existing models are quite limited in that they only apply to a single disease, discount factors such as the urban geography which can influence disease spread, or discount how people use their social networks (who is friends with whom) to pass information such as when to go to the doctor to be treated. In general, being able to estimating the impacts of large scale biological attacks and the efficacy of containment policies is necessary from an intelligence and planning perspective and requires reasoning about social response and disease processes as a complex social system.

In BioWar we are combining state-of-the-art computational models of social networks, communication media, disease models, demographically accurate agent models, wind dispersion models, and a diagnostic error model into a single integrated model of the impact of an attack on a city. Unlike traditional models that look at hypothetical cities, in BioWar the analyst can examine real cities using census, school track, and other publicly available information. Moreover, rather than just providing information on the number of infections, BioWar models the agents as they go about their lives - both the healthy and the infected. This enables the analyst to observe the repercussions of various attacks and containment policies on factors such as absenteeism, medical web hits, medical phone calls, insurance claims, death rate, and over the counter pharmacy purchases. BioWar moves beyond existing epidemiological models that do not consider the heterogeneity of social networks and the geographical distribution of people when predicting disease outbreaks.

BioWar is an effort to develop a scaleable and precise simulation tool to examine disease propagation and agent behavior in response to disease and illness. We believe it will serve to help researchers understand, predict, and analyze weaponized biological attacks at the city level and engage in "what-if" analyses to help inform decision-making in this complex socio-technical policy domain. For example, it can be used in a "what-if" mode to examine the impact of and response to various weaponized attacks for contagious and non-contagious diseases under high-alert and no-alert conditions.

Version 2.1 has been tested on 3 cities, can handle 2.5 million agents and 2 years of interactions in 1 day of processing on a 4 processor system, and contains models of 60 diseases. Core modules include: City Generation, Social Network Generation, Agent Behavior, Disease (Transmission, Progression and Diagnosis), Weather (wind and climate), Attack Generation, Aerosolized Dispersion. Actual census, geographic, and behavioral information used as inputs. Outputs designed to reflect actual data streams for absenteeism, ER and Dr visits, OTC purchases, etc.

Version 2.2 had been optimized and tested on 5 cities.

At the CASOS Summer Institute, CASOS Ph.D. students have the chance to display and discuss their projects and work, including work on BioWar. The 2008 CASOS Summer Institute poster for BioWar is:

["Infectious Disease Modeling Using BioWar"](#)

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Assessing and Changing Population Behavior - Overview | CASOS - Mozilla Firefox

http://www.casos.cs.cmu.edu/projects/project.php?ID=19&Name=Assessing and Changing Population Behavior

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## Assessing and Changing Population Behavior - Overview

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The IRS project explores the feasibility of using computer simulations and computer based decision support tools to address present and future taxpayer needs via the delivery of IRS services. The goal of this project is to help IRS decision-makers choose the service or combination of services that most effectively improve taxpayer compliance. Our approach generally involves simulating how the populations of U.S. cities respond to IRS service bundles.

To do this, we augment IRS data on taxpayer behavior with census data that reflects city population characteristics. Using the augmented data, we build populations of agents for each city and then overlay a theory-based social network on the agents to account for the effects of networks on information diffusion throughout a population. The samples of agents representing real-world cities, along with IRS services of interest, are submitted to a multi-agent simulator, Construct, to obtain data regarding taxpayer compliance. Finally, the results of the simulations, along with sociodemographic data from the census, are placed into the SmartCard to provide decision support to IRS personnel.

```

graph TD
    IRS[IRS Data] -- Taxpayer Behavior --> Cities[300 Cities]
    Census[Census Data] -- City Population Characteristics --> Cities
    Cities -- City-specific Samples of Notional Taxpayers --> Construct[Construct]
    Construct -- City Responses to IRS Services --> Cities
    Cities -- Information for IRS Decision Makers --> SmartCard[SmartCard]
  
```

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MMOG - Cosmopolis - Overview | CASOS - Mozilla Firefox

http://www.casos.cs.cmu.edu/projects/project.php?ID=7&Name=MMOG - Cosmopolis

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## MMOG - Cosmopolis - Overview

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The Cosmopolis project is a joint program between the [USC GamePipe Lab](#) (under the direction of Dr. Mike Zyda) and CASOS.

The goal of the project is the development and release of a free Massively Multiplayer Online Game in which players develop relationships, acquire property, and align with each other for territorial control. Cosmopolis will be designed around a growing set of subgames, and it is only through mastery of different subgames that players will be able to gain new resources and grow their property and territory. It will be maintained and administrated with the intent of fostering an active player community. The USC GamePipe Lab is handling all of the coding and implementation of Cosmopolis, and has the primary responsibility for game design.

In addition to providing its players with a collective social gameplay experience, Cosmopolis is also designed to serve as a platform for research into social science and games research questions about human interactions at the levels of the individual subgames and the larger Cosmopolis game itself.

Through the process of nurturing, catering to, and interacting with the game's player community, we hope to better understand questions of computer-mediated communication and how virtual behaviors and scenarios do and do not map to real-world activities. At CASOS, our goal is to ensure that the research perspective is well represented in the implementation process and to provide design input as requested.

To complement our research into how Cosmopolis can best facilitate the research community, CASOS is actively modifying the Construct modeling engine to facilitate study of game-like communities. Construct can be used to express a variety of relationships between different individuals and the information and beliefs that can be transferred between them, and is currently being modified to specifically support those relationships expressed in virtual worlds and online games.

In addition to modeling various game relationships, we also anticipate doing careful examination of the different relationships between people, places, objects, and metrics, and will be modified as appropriate to support easy analysis of the data produced by Cosmopolis.

knowledge within Cosmopolis using ORA, our dynamic network analysis tool. Like Construct, ORA is also under continuous development to support additional functionality and metrics, and will be modified as appropriate to support easy analysis of the data produced by Cosmopolis.

**Publications:**

- Landwehr, P., Diesner, J., and Carley, K.M. The Words of Warcraft: Relational text analysis of quests in an MMORPG. Proceedings of the 2010 DiGRA Conference, Brunel University (2009).



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SORASCS - Overview | CASOS - Mozilla Firefox

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**SORASCS - Overview**

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SORASCS (Service Oriented Architecture for Socio-Cultural Systems) is a project to develop a coherent, flexible, extensible data-to-model service oriented architecture for socio-cultural modeling and analysis to support military intelligence and modeling community. Enables reach-back cells, military analysts, and field operatives to rapidly make use of tools and models from diverse sources. Supports model re-use through sharable reports and configurations. Supports rapid terrain assessment. Supports strategic planning by reducing gap between field/ethnographic data and models.

**Architecture to Support Socio-Cultural Modeling**

Over the past decade there have emerged a large variety of tools supporting analysis of large volumes of heterogeneous information to understand complex real world relationships and trends, including natural language processing, network analysis, simulation, and what-if reasoning. Most analysis ensembles assume a relatively limited set of model types and input sources. They are wired together with special purpose, tool-specific and ad hoc integration code, making them brittle and requiring low-level systems expertise to reconfigure them in new ways or add new capabilities to the system. The underlying problems stem from the lack of a coherent and flexible architectural framework that will allow tools and models to be seamlessly incorporated and composed by end users. Having such a framework would ideally allow information analysts to bring together tools from various vendors and research groups, dynamically compose their analyses in new ways, store and reuse previous workflows and settings, ingest new forms of information, and interactively fine tune analyses, simulations, and report generation through consistent and uniform forms of interaction.

[Data Requirements](#)      [Model Updates](#)

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**VIBES**  
VISUALIZATION OF BELIEF SYSTEMS

VIBES – Visualization of Belief Systems – is a powerful web applet for studying the dissemination of beliefs through a social system. Real-world social systems are complex, with the spread of new knowledge through networks of people depending on factors ranging from peoples' prior knowledge to the level of trust in their close relationships to their contacts with influential people and sources of propaganda.

Existing analysis tools fall short of accurately describing this kind of system; they fail to fully integrate human dimensions, such as social, behavioral, and cultural characteristics, with state-of-the-art dynamic network analysis and visualization.

VIBES corrects this problem by wrapping three functions into one focused product powered by AutoMap and ORA. First, VIBES provides a toolkit for extracting from a community beliefs and attitude changes that are driven by underlying social networks and related to activities, key actors, environments, and resources. Second, it acts as a workspace for visualizing, reasoning about, and predicting the effects of new strategies and tactics, such as spreading propaganda and observing its influence on beliefs. Finally, its architecture supports both remote and centralized analysis – it can be accessed in web applet form on the Internet or downloaded as a package onto a local computer.

These capabilities can enable the user to gain insight into the belief systems of particular organizations, communities, and geo-spatial areas of interest, and therefore to better conduct intelligence and information operations.

VIBES is a CASOS joint collaboration with Alion and the Army G2



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