CONFERENCE POSTER presented at 19th International System Dynamics Society Conference, August 6-10, 2001, Atlanta, GA.

Preliminary Development of a Web-based Learning Environment for the Las Vegas Water Model

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Abstract

This poster describes preliminary development toward a web-based learning environment that could allow unfacilitated use of the Las Vegas Water System model by a broad audience. The learning environment builds on a study described in two companion posters (Stave Part I and Cloud and Stave Part II), Based on interest generated by the initial parts of the study, we wanted to explore the possibility of broadening the audience for the model by creating a more user-friendly learning environment that could ultimately be used for a web-based interface. The process of developing the learning environment raised issues regarding unfacilitated use of system dynamics models. A major question that emerged is how to balance user flexibility and user specific debriefing, given the technology available.

Introduction

How can increased numbers of the general public be brought together with system dynamics modeling to gain insight about environmental systems and the potential consequences of policy ideas applied to those systems?

Stave Part I showed that system dynamics modeling has the potential for helping stakeholders understand the consequences of environmental management decisions. Cloud and Stave Part II showed stakeholders can be introduced to system dynamics modeling in facilitated workshops, which provide the opportunity for participants to interact with both a model and a system dynamics modeler.
The results of several facilitated workshops demonstrate that it is possible to introduce the concept of system dynamics modeling to an untrained and diverse group of stakeholders, while providing that group with the benefits of insight into the environmental system being modeled as well as an awareness of the potential consequences of policy ideas applied to that system.
While facilitated workshops are effective, they are limited in the number of participants and the availability of events. The question addressed in this poster is how to create an unfacilitated system dynamics modeling interface that can be continuously available to the general public, while also promoting similar results to facilitated workshops. The ultimate goal is to provide users with an interactive platform that supports systemic learning and understanding about environmental systems and the potential consequences of policy ideas applied to those systems.

Purpose

This poster presents a preliminary investigation into the possibilities for constructing a widely available
unfacilitated web-based system dynamics model interface.

Problem Statement

In order to create an unfacilitated system dynamics model it is necessary to consider the range of design objectives as well as the technology available to support those objectives.

Design

Voinov and Costanza (1999) point out that the internet has many attributes that make it a suitable platform for engaging stakeholders. However, there are remaining questions about the scale and design of web interfaces and the acceptability of those interfaces by the public.

The design objective of this web-based model interface for the Las Vegas Water model is to create a learning environment that promotes similar results to the facilitated workshops demonstrated in Cloud and Stave Part II. The facilitated workshops employed a sophisticated matrix of small steps that were integrated into a Ascript@ according to the group model building approach described by Anderson and Richardson (1997).
The script developed by Cloud and Stave Part II supports three main elements:

I. Information Delivery
2 II. Participant Interface with Model
III. Debriefing

I. Information Delivery

Within the general population there are different learning styles and varying amounts of background knowledge, as a result the design for information delivery needs to be developed so that it gives the user a basic general introduction and overview and then allows for independent investigation of different parts of the Las Vegas water system.

II. Participant Interface with Model

The actual model interface that allows participants to interact with the model should be designed to provide easy model operation for first time users while also providing as much model simulation control as possible. Participants should be presented with a modeling environment that encourages interaction and exploration

III. Debriefing

The debriefing design should provide participants with information that explains what happened in their model simulations, as well as providing insight into the structure of the system being modeled. In addition, the debriefing section should provide analysis characteristics that are flexible and responsive to the individuals learning style and pace.

How well does this implementation meet the design goals?

Screens 1-3 Information Delivery

The first three screens are constructed using static web pages. These screens provide a clear introduction and then allow the user to explore different parts of the Las Vegas water system. By utilizing standard web pages and Hyper Text Transfer Protocol, the user is in a familiar environment that can supply a vast amount of information with

links, while also allowing the user to pick and chose what areas to explore and how much information to seek. This portion of the implementation appears to meet design goals

Screens 4-6 Participant Interface with Model

The model interface section is based on SableNet7 software from Ventana Systems UK. This server allows a web user to operate a Vensim7 model over the internet. The interface represented here is based on a standard template for a Vensim7 Venapp, and seems to provide the user with basic controls that are easy to operate. However, the sparse nature of these screens might not encourage a high degree of interaction and exploration. In addition, there is a software download that is necessary in order for the user to operate the live model interface. This portion of the implementation appears to partially meet design goals in terms of the model being easy to operate. However, there could be difficulties with the required download, and screen design is stark and could offer the user more control.

Screens 7&8 Debriefing

The debriefing section is based on the same implementation as the participant interface section. The SableNet7 software links the user to the live model and the actual interface is based on the standard Vensim7 Venapp template. The implementation of this section appears to be somewhat lacking with respect to meeting the design goals. While there is a degree of information available in the form of additional model output graphs, causal loops, cause and effect trees and model structure diagrams, it would be beneficial to provide additional learning tools that could be responsive to specific user questions and interaction.

How can this implementation be improved to better achieve design goals?

Information Delivery

By utilizing static web pages it is possible to provide a vast amount of information and additional resources to the user. Improving the information delivery section would be based on how well the user is able to access and navigate the various pages and how well those pages convey information. In order to optimize this section for the general public, it would be beneficial to get feedback from a cross section of users, in order to enhance the design for ease of use and educational value.

Participant Interface with Model

One consideration for improving the interface screen would be to use the same schematic of the water system that was used in information screen #3. Utilizing the same drawing could possibly make the model more user friendly. The Schematic could be set up to include hot spots, which would display model operations in frames. When

a user clicks on a specific part of the schematic drawing, model controls would appear and be be visually associated with that specific image. This would provide the user with controls and results specific to each image representing different parts of the system. This type of setup should be possible to construct using the Sable7 software, server, and activeX tools, or by combining the Sable7 package with web programming that will integrate static and active pages along with live model communication.

Another consideration for addressing design goals is the ease of establishing the live model interface. As the current technology requires an on-line download in order to operate the model, the use of static web pages might be considered. These static pages present images of modeling activity that have been specifically tailored by the designer. While static web pages can provide a sense of actual model operation and give the designer complete control, they do not offer the user flexibility and actual model control.

Debriefing

The considerations for debriefing are similar to those for model interface because both operations are occurring on the same basic platform. One way to enhance debriefing might be to provide complete designer control through the use of static web pages. This would allow the designer to create custom explanations for each and every model input and output. However, the user flexibility would be limited, which could possibly limit the educational value of user specific debriefing and learning. One potential solution might be to implement the idea of combing static and active web pages along with the Sable7 package and integrate web programming along with web tracking and a data base, to deliver debriefing that becomes user specific and user responsive.

One possibility for an enhanced and interactive debriefing environment would allow the user to ask different types of basic questions. Possibly there could be a number of question icons or a menu of question types that could be invoked by the user. There could be several basic questions that a user could ask about a specific model output such as:

AWhat does this graph represent?@ -AWhat things effect this graph?@ -AWhy did this graph change this way?@ - Why don=t I understand?@

The first question about what the graph represents could be a standard embedded explanation. A question about what things effect a certain output could be a combination of the standard model output graphs, causal loops, cause and effect trees and model structure diagrams combined with verbal explanations.

Questions about the exact behavior of a specific model output could possibly be answered by utilizing if/then statements constructed either inside of the Venapp or utilizing a web data base. While this might require some extensive programming, it could be possible to construct this site so that model output data is analyzed, and then based on the direction of certain trends in model behavior, explanations could be provided to the user that describe the causes and feed backs associated with certain

categorical model behaviors. In addition, the associated graphs, causal trees and model structure could be possibly be called up based on the same type of logic. The result would be the presentation of one of many pre-defined verbal explanations developed to cover certain categories of model behavior, accompanied by the specific graphical, causal and structural elements of the exact model run. The resulting web output for the user would be a display that integrates analysis tools displaying the specific model run and verbal explanations describing general model behavior.

It should also be possible for the user to ask for some type of help when they don=t understand. This could possibly be an overall integration of all the other question types and logic, accompanied by web tracking of user movements. One possibility would be to create a database that tracks user navigation through the web site. When a user investigates the behavior of certain model output the program could direct the user to information that was skipped over in the introductory part of the website, and based on input from the user, step forward one concept at a time until the user=s question is answered.

Remaining Questions

There are specific issues left to resolve regarding the implementation of specific design and programming specifications. However, the broader issue is a question of functionality in terms of presenting the Las Vegas Water model to the general public.

Given the existing technology and potential for further development in the immediate future, where is the balance between user flexibility and effective debriefing design? And, what are the costs to develop this platform relative to the potential benefits for stakeholders?

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