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STELLA, STELLA Stack and Hypermedia in Information System Design and Assessment

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Abstract

This paper describes the contribution of recent Apple Macintosh and system Dynamics software to improving the interaction between analyst and user in the development and use of strategic models for assessing and designing large scale computer information systems (CIS).

Introduction

System Dynamics as a methodology for problem solving is a well established technique used widely in military and management circles. The authors of this paper have been using such methods, for over 20 years (Wolstenholme 1990).

The powers of these methods is not in question. The problem has been in improving their impact and usage, and this has been limited by the hardware and software available. The complexity and learning overhead associated with the current modelling technology has limited modelling to a technical backroom activity. The methods described in this paper are capable of changing this role of modelling. They hold the potential of bringing computer simulation modelling into a domain where it can be used directly by practising managers.

The paper will, firstly, give a brief outline of the System Dynamics (S.D.) software used in the work described in this paper (STELLA and STELLA STACK) (Richmond 1989). Secondly, it will describe a derivation of the System Dynamics methodology, created specifically for the analysis of computerised information systems (CIS). Thirdly, it will explain how S.D. and STELLA were used interactively to develop a

model of a particular C.I.S within this methodology and how the model was further developed using STELLA STACK to provide a 'Microworld' in which managers are able to experiment and analyse the effectiveness of the CIS.

STELLA

STELLA (Systems Thinking and Experiential Learning Laboratory with Animation) is a System Dynamics Simulation Package which, by its use of diagram based models and the Macintosh Interface, has revolutionised the modelling process (Richmon et al 1989). It is also marketed as 'ithink'.

Traditional System Dynamics tools such as DYNAMO (Pugh and Roberts(1988)) or DYSMAP2 (Dangerfield and Vapenikova (1987)), which were written for PC's, are essentially customised programming languages, in which the model consists of a list of equations. This style of model representation and the compiled nature of these packages inhibits interactive use and limits the assessability of the methodology to those with a technical orientation.

In STELLA the model is represented as a flow or "plumbing" diagram, the user draws the model on the screen using a set of tools. Structural and parameter changes can therefore easily be made between simulation runs. The simulations themselves are interactive in nature, graphs and tables are continually updated as the simulation progresses and the model diagram has simple animation capabilities to show the flows of materials and information.

STELLA STACK

STELLA STACK (Richmond, and Peterson) is a three card HyperCard stack that allows simulations created using STELLA to be integrated into HyperCard or SuperCard. The simulation may be controlled and values can be exchanged between the model and HyperCard during the simulation run. This allows the construction of front ends and learning environment which are another step forward from STELLA in terms of ease of use and skills required by the user. The user cannot see and may be unaware of the nature of the underlying model. However the greater the understanding of the model the more the user will learn from using such packages.

A Methodology for the Design and Assessment of Computer Information Systems (CIS)

Large scale CIS are often only assessed in terms of their timeliness and accuracy. That is, in terms of their own ability to transform and display information. In practice, many such systems fail to live up to their expectations. The methodology developed here was aimed at investigating why this should be and at creating a new method of assessing CIS in terms of their success in improving the performance of their host systems (Wolstenholme, Gavine, Henderson and Watts (1990)). A three stage procedure was evolved.

Firstly, an S.D. model was constructed of the host system and it's environment, without incorporating the CIS itself. Secondly, various attributes of the CIS were superimposed and thirdly, experimentation carried out to determine how changes in the operating policies within the host system might improve the benefits to be gained from the CIS.

To date this methodology has been used to derive models of two large military CIS. STELLA was used as the software for one of these models and has proved beneficial by allowing military officials to be involved in the modelling process. In particular, this involvement assisted with defining the model boundaries and the way in which attributes of the CIS were to be modelled.

A Front End to the Defence Model

In order to allow the finished model to be used by those consulted during the development phase and other interested parties, it was decided to produce a front end for the model so that it could be used without the need for experience of the STELLA package. The front end was designed to allow users to investigate the effects of individual and combinations of CIS attributes via individual switches for each attribute. SuperCard was used to build the Front End, this was chosen instead of HyperCard because of it's support for menus and the improved animation features.

The Front End consists of a Control Panel, Tables and Graph cards. The Control Panel card allowed the user to control the simulation, enter the simulation length and select which C.I.S. attributes to be active. Animated graphics were incorporated to display the performance measures used.

The Table cards contained a time sequence of selected model variables and the graph cards allowed these to be plotted. A portfolio of graphs and tables could be built up by the user, Graphs and Tables could be printed and data exported in spreadsheet format. To aid the user as much as possible a comprehensive help facility was included.

Conclusions

Experience so far with STELLA and STELLA STACK for System Dynamics modelling in the assessment of C.I.S has been good. The use of STELLA has enabled system actors to be deeply involved in the modelling process. The use of STELLA STACK has provided a means for system actors to experiment directly with the models created. This has helped them to understand the relative contributions of various components of a CIS over a range of measures of system performance.

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