ENHANCEMENT OF SYSTEM DESIGN AND SIMULATION VIA GENERAL SYSTEM THEORIES

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My research into system design and simulation indicates at least two areas where General System Theories (GST) can provide insights and support for more detailed efforts. These areas are (I) system design as approached in a hierarchical fashion, and (II) system simulation by relatively naive users for systems that contain complex control or decision structures.

As an example of a problem in area I, some designers of large software system have advocated a hierarchical structure to represent the interaction of the components of the software system. Structured Analysis (Ross 1977) is an example of such a methodology. An implicit assumption of such methods is that of closure of certain system properties under interconnection. That is, given functional or realizable components, the series, parallel, or feedback interconnection of such components is assumed to be again a functional or realizable component. An application of GST to this problem area has shown that, for both static (i.e., no concern for time-behavior) and dynamic perspectives, the assumed closure is certainly satisfied in the "bottom up" direction (i.e., connecting components together). However, in both cases, a well-established GST foundation for closure in a "top-down" direction (i.e., breaking a system into components) is not yet evident (Talavage). In fact, further developments in GST will be necessary before that issue can be settled.

The major instance of problem area II that I have in mind is that of process-oriented simulation languages. Such languages can allow relatively naive users to model many real-world situations with satisfactory fidelity. However, my research involving simulation of complex automated manufacturing systems has clearly demonstrated the need for relatively complex decisions to be made in such an automated environment (Talavage 1977). Representing such decisions within the context of current process-simulation languages has proven to be inractable. The incorporation of complex decision structures within a process-simulation language therefore seems desirable. One GST framework which may enhance this effort is that of Zeigler (1976).

Another instance of problem area II is that of using control system theories to aid System Dynamics simulation modellers. These GST modeling support tools have been developed pieace-meal for about eight years (Cuypers and Rademaker 1974, Talavage 1980) and promise to provide a scientific basis for policy-assessment applications of this class of simulation languages.

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