

8-15-1997

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Recommended Citation

Dalmadge, Cretson L., "Designing Information Systems to Support Groupwork" (1997). *AMCIS 1997 Proceedings*. 90.
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Designing Information Systems to Support Groupwork

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Introduction

The paper discusses the factors influencing design quality of group support systems. The relationships among four constructs are discussed. The dependent variable "group support system (GSS) quality" features further development on an existing construct. A new construct "semiotic process quality" is introduced to capture the information generation/dissipation quality in the logical phase of system development. Two established constructs: task complexity and group cohesiveness are used to complete the model. The constructs are displayed in Table 1.

Semiotic Process Quality

The process of system development is comprised of two phases: a logical process, that is information processing and a physical process of implementation. The two phases are overlapping as information generated during the implementation phases often results in changes to the logical design. The concept of logical versus physical work is discussed in further detail by Ramaprasad and Rai (1995).

The information processing phase is comprised of a constant flow of information between the designers and the intended user group. As information is generated within the groups it needs to be dissipated to allow for effective performance of logical work. Semiotics describes the process by which information is generated and dissipated within the user/designer groups (Ramaprasad and Rai 1995).

Semiotic process quality is a measure of the extent to which the information generation /dissipation within the user/designer group describes the group processes and functions and the functionalities expected of the system, and hence support the development process. As shown in Figure 1, semiotic process quality has two components: (i) richness of the process, and (ii) velocity of the process. While the two components are not additive, their combined measure effectively defines a scale for the construct. A development process with low semiotic process quality is low on both dimensions. One with high semiotic process quality is high on both dimensions.

Richness of the information generation/dissipation process is a measure of the depth and breadth of the information being utilized in the process. Richness of the process is achieved through user participation. User participation refers to those activities performed by the intended user group targeted at influencing the final design of the system (Barki and Hartwick, 1989). While the two constructs are often used separately, user participation in this context is taken to incorporate the concept of feedback. High user participation enriches the process, since it taps into the knowledge of a wider cross-section of potential users and as such is likely to extract a broader collection of input concerning user needs.

Velocity of the information generation/dissipation process is a measure of the rate of which new information is generated and dissipated within the user/designer group. It is influenced by the quality and speed of the prototyping process. Faster, higher quality prototyping increases the velocity of the process.

| Constructs | Definitions |
|---|--|
| Semiotic Process Quality | - measure of the extent to which the information generation /dissipation within the user/designer group describes the group processes and functions and the functionalities expected of the system, and hence support the development process. |
| <ul style="list-style-type: none">• <i>richness of the information engineering</i>• <i>velocity of the</i> | - a measure of the depth and breadth of the information being utilized in |

| | |
|--------------------|--|
| <i>process</i> | the process. - a measure of the rate of which new information is generated and dissipated within the user/designer group. |
| GSS Quality | - measure of the extent to which the final product meets the needs of the user group. • <i>depth of analysis</i> - the thoroughness of the analysis allowed by the GSS during problem solving. • <i>degree of structure</i> - extent to which the GSS allows for user initiative in the decision making process. |
| Task Complexity | - the degree of complication involved in the decision making process. |
| Group Cohesiveness | - measure of the group's ability to work together as a cohesive unit. |

Table 1

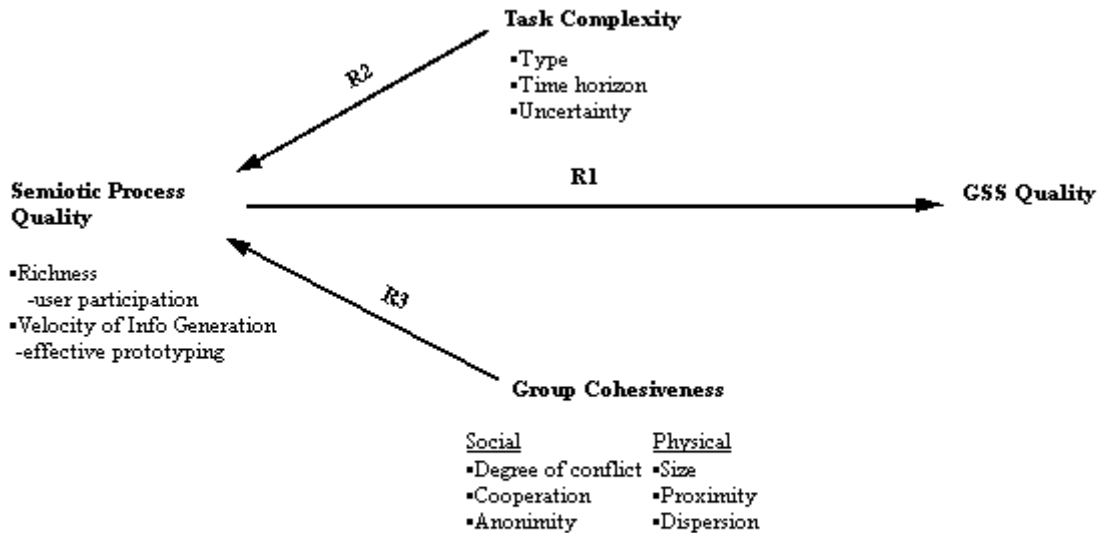


Figure 1. Framework for Logical Design of Group Support System

GSS Quality

GSS quality is a measure of the extent to which the final product meets the needs of the user group. A low quality product is one that possesses a gap between the needs of the group and capabilities of the GSS package. A high quality product is therefore one that possesses no such gap.

The variables that define this gap may be grouped along two axes: decisional content and the collaborative content. Decisional content is the measure of the extent to which the GSS supports the process of decision making. Collaborative content is a function of the information sharing and communication capabilities of the GSS. For this paper discussion will be restricted to the decisional content.

Decisional Content

As shown in Figure 1, the quality of the decisional content is a function of three factors: depth of analysis and degree of structure allowed or imposed of the decision making process. As further developed, degree of structure impacts the restrictiveness of the system.

Depth of analysis refers to the thoroughness of the analysis allowed by the GSS during problem solving. Problem solving may be broken into three phases: intelligence, design and choice (Simon 1960). Massey and Clapper (1995) further describes intelligence as the process of defining the problem, design as the means of generating alternatives and choice as the selection and implementation phase. Satisfactory depth of analysis should be allowed in especially in the intelligence and design phases.

Degree of Structure: Gorry and Scott Morton (1971) builds on Simon's work on problem solving. They categorize problems as being structured, semi-structured or unstructured. Structured problems such as economic order quantity (EOQ) are suited for automated or programmable methods, whereas unstructured problems such as most job-shop scheduling problems require additional insights on the part of the user.

The extent to which the problem solving tools are automated will therefore affect the ability of the GSS to handle unstructured problems. A quality GSS should allow for cognitive input from the user. Indeed there should be a balance between structure and facilitation of end user insight in the problem solving process. Unduly high degree of structure increases the restrictiveness of the system.

Restrictiveness: Information technology designed to aid the decision making process have in cases reduced the solution space of the problem being solved. Silver (1990) examined restrictiveness in the context of decision support systems. He defined restrictiveness as:

the degree to which and the manner in which a decision support system limits its users' decision making process to a subset of all possible processes.

Group support system packages have in many cases incorporated automated group decision making tools. Examples are "What if analysis", PERT, budget allocation models, choice models (Pinsonneault and Kraemar, 1989), Delphi method and Nominal Group Technique (Turoff and Hiltz, 1982). As these tools automated the possibility of decreasing solution space becomes a factor. Maintaining a low degree of restrictiveness i.e. large solution space is a measure of the quality of the group support system.

Group Cohesiveness

Group cohesiveness is a measure of the group's ability to work together as a cohesive unit. The literature in the field points to two groups of factors that influence cohesiveness. These may be divided broadly into physical and social characteristics of the group. The physical make characteristics of the group includes size, proximity, dispersion (Gavish et al. 1995). The social characteristics include degree of consensus among group members, degree of anonymity required, and group conflict (Dennis et al. 1988, Pinsonneault and Kraemar 1989).

Task Complexity

Task complexity has been identified as one of the dimensions from which group support systems need to be studied (Gavish et al. 1993, Gopal et al. 1992). In the context of this paper, task complexity refers to the degree of complication involved in the decision making process and is described in terms of those factors that define the nature of the problem being solved and the degree of difficulty involved in reaching a solution. The characteristics will be addressed here are: type of task, time horizon, degree of uncertainty.

Type of task has been identified as a key dimension in the study of GSS (Gavish et al. 1995, Dennis et al. 1988, DeSanctis and Gallupe 1987, Turoff et al. 1993, Nunamaker et al. 1991). In this paper, type of task will be viewed from the standpoint of its impact on task complexity which in turn influences the

relationship between semiotic process quality and GSS quality. For example a problem involving strategic planning normally incorporates a greater degree of complexity than an operational control problem.

Degree of uncertainty refers to the degree of indeterminateness involved in the problem solving process. Pinsonneault and Kraemar (1989) describes degree of uncertainty as being two-fold. It may relate to the uncertainty about the consequences of the decision or to the information provided to make the decision or both. Time horizon adds further complication to a problem. For a given problem, as the time constraint increases (time horizon shorten) so does the degree of difficulty.

Conclusion

Based on the description of constructs above, the following theoretical relations exist:

R1 - Semiotic process quality is positively related to GSS quality.

R2 - Semiotic process quality is positively related to task complexity. As task complexity increases semiotic process quality must also increase in order to maintain GSS quality.

R3 - Semiotic process quality is negatively related to group cohesiveness. As group cohesiveness decreases semiotic process quality must also increase in order to maintain GSS quality.

These three hypotheses have important implications for the development of group support systems. Designers of GSS needs to focus on the semiotic process quality. Indeed as task complexity increases and/or group cohesiveness decreases, greater focus needs to be placed on the semiotic process quality.

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