Stakeholder Identification and Assumption Surfacing in Small Groups: An Experimental Study

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Abstract

The increasing complexity of decision situations has required organizations to integrate more types of expertise and consider more criteria for effective group decision making. This study investigated the impact of a GDSS, based on the Stakeholder Identification and Assumption Surfacing model, for strategic planning impact analysis. A controlled laboratory experiment was used to compare the results of 4-person groups which had GDSS support, comparable manual support, and no support. Measures were taken on decision outcomes (quality, time, and satisfaction with the outcomes) and decision process variables (quantity of unique alternatives, distribution of individual participation, and satisfaction with the process). Observational data was recorded through the use of videotape of the sessions. Results of the experiment are presented.

1 Introduction

The organizational environment is becoming increasingly complex [1]. Greater organizational complexity in the environment also causes strategic planning and decision making to be more complex, requiring faster and more frequent decisions. This had led to the need for more group interactions to solve decision problems. One proposed solution to assist managers in decision making has been the development of Group Decision Support Systems (GDSS).

GDSS aim to improve the process of group decision making by removing common communication barriers, providing techniques for structuring decision analysis, and systematically directing the pattern, timing, or content of the discussion [2]. The natural decision process of a group is more affected as the sophistication of GDSS technology increases.

This paper addresses the following question:

> How will the three processes, group decision support systems, structured manual process, and unstructured manual process, compare in their affect on group performance and attitude in decision making for strategic planning impact analysis?

The broad categories this research evaluated were the impact of the GDSS on the decision process, and the impact on the decision outcomes. The research was conducted through a lab study comparing groups with computer support, groups with comparable manual support, and groups with no support. Data was collected through questionnaires, decision materials, and videotape analysis.

A review of experimental GDSS literature applicable to this study is presented in the following section. The remaining sections, in order, discuss the GDSS model, the research methodology, the results, their meaning, and our conclusions.

2 Literature Review

Group decision support systems in operation are rarely encountered today. Kraemer and King [3], in an extensive review of GDSS, found that currently there were only three GDSS which they considered operational. Yet, an emerging body of research suggests that group decision support systems have the potential to increase group decision-making effectiveness [4, 5, 6, 7, 8]. This previous research into GDSS has involved issues in the design of a GDSS [9], and fundamental features of a GDSS and environments to support a GDSS [10]. Current research at the University of Arizona and the University of Minnesota is involved in analyzing different aspects of GDSS effectiveness and operation.

The research reviewed for this paper included work conducted by six different researchers, using five different computer systems. These studies have been built around small groups, with membership varying from 3 to 5 people. Problem-solving tasks were used in these studies. Additionally, the decision process used by the groups has varied in all of the studies. These previous studies have resulted in conflicting outcomes in the variables that were measured. Two of these previous studies [8, 6] have compared groups with an automated structured decision process to groups without automated support and without a structured decision process. A question that naturally follows these studies is: Are the benefits, if they exist, derived from the decision process being structured, or from the structured process being computerized?

A summary of these studies of GDSS is presented in Table 1. The table organizes the findings according to variables of interest to this study.

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Table 1

Summary Table of Experimental GDSS Research Results

Variables/ Researcher	Decision Time	Decision Quality	Satisfaction w/ Decision	Satisfaction w/ Process	Participation	Number of Alternatives Generated	Group Size
Steeb & Johnston (1981)	GDSS > No GDSS	GDSS > No GDSS	GDSS > No GDSS				3
Lewis (1982)		No Difference			Less Domination with GDSS	GDSS > No GDSS	3
Gallupe (1985)	No Difference	GDSS > No GDSS		GDSS < No GDSS	No Difference	GDSS > No GDSS	3
Watson (1) (1987)	Structure> NS	No Difference	No Difference	(GDSS < SM) < NS	No (2) Difference		3,4
Beauclair (1987)	No Difference	No Difference	No Difference		No (3) Difference		3,5
Zigurs (1987)		GDSS better			More even influence		3,4

Notes:

1 He compared structure through a GDSS and a manual process to no structure (SM = Structured Manual, NS = No Structure)
2 Measurement was of Equality of Influence
3 Measurement was of More Active Participation

For a further development of this table see Easton, A. [11]

The results of these prior studies present obvious contradictions, indicating the need for future research to provide support to the hypothesis that GDSS can provide benefits to a decision-making group. DeSanctis and Gallupe [2] present a model for future GDSS research. They suggest that Group Decision Support Systems can be designed with three levels of support. Incorporating these levels with McGrath's [12] "circumplex model" for different task types, they suggest that future research of the impact of GDSS should address questions of the effectiveness of GDSS combining these three support levels with different task types. This may provide indications as to what type of GDSS, coupled with what type of task, is appropriate and/or beneficial to decision-making situations.

No previous GDSS research was found to deal specifically with the planning process. In this regard, this present study is a first attempt in investigating the effectiveness of a GDSS for planning. The research used groups of four persons to conduct an impact analysis of a policy statement. Additionally, the GDSS used is based upon the Strategic Assumption Surfacing and Testing Model (SAST) [13, 14]. SAST has been used by its developers and has proven useful in planning by groups. Although this previous work has been with non-computerized usage, it provides a history for use of this model. The task, analyzing the impact of a policy statement, is also realistic. Organizations must be concerned about the impact of a policy under consideration. A final point regarding this study is the use of three different manipulations of the type of support. Groups were assigned to either a GDSS treatment, a structured manual treatment or an unstructured manual treatment. This will assist in determining if it is simply structure that causes the differences, or if there are differences between automated and manual structure.

3 GDSS Model and Design

SAST is a participative planning process designed to help identify stakeholders and their assumptions of an organization. SAST has been found to be helpful in uncovering the critical assumptions that underlie policies, plans, and strategies. The process has been specifically designed to uncover and challenge the key assumptions on which every business plan or action rests. Further, it helps managers make better judgments with regard to the reasonableness of their assumptions [13].

Using SAST as a model, the Stakeholder Identification and Assumption Surfacing (SIAS) GDSS was created. It has been designed to electronically accomplish tasks similar to those performed in SAST. SIAS has four main phases; 1) Identify Stakeholders, 2) Surface Assumptions, 3) Rate Assumptions, and 4) Graph Assumptions.

During the Identify Stakeholders phase the group generates their list of stakeholders who will be impacted by or who will impact the policy statement. Capabilities to add, delete, and edit are provided in the software.

The Surface Assumptions phase allows the group to identify the assumptions that the stakeholders hold about the policy statement. The software prompts the user to proceed through the list of stakeholders in an orderly manner. The software also provides the capability to adjust the stakeholder list during this phase. All of the functionality provided in the Identify Stakeholders phase is replicated.

The Rate Assumptions phase is the third task the group performs. The group rates each assumption according the its importance to the stakeholder and its importance to the policy statement. The rating scale is from zero to ten, with ten being the most important. The ratings of assumptions are not mutually exclusive, more than one assumption can have the same rating. Additionally, each assumption is classified as either supporting the policy or resisting the policy.

The final phase is Graph Assumptions. While viewing a graph of the assumptions according to their ratings, the group identifies the assumptions that are most important and need attention to ensure that the policy will not fail. Assumptions with high importance to the stakeholder and high importance to the plan are likely to become bedrock assumptions. Assumptions with high importance to one faction and low importance to the other should be carefully reviewed as they may represent potential problems. In addition, these assumptions may be used as bargaining chips. Assumptions with low importance to both factions are likely to be disregarded. Changes in the ratings or text may be performed at this time.

The outcome of SIAS is a list of the stakeholders and their assumptions that are deemed important with regard to the policy decision being considered for implementation. Reports generated by supporting software include a list of all stakeholders and assumptions, a list of stakeholders and assumptions by quadrant, and a list of supporting/resisting stakeholders and assumptions.

Currently SIAS is a stand-alone tool. The design of the software allows it to be operated by a member of the group, or by a facilitator. Sample screens of the software are included. Figure 1 details the surface assumptions phase, Figure 2 shows the Rate Assumptions phase, while a sample graph is shown in Figure 3. A research study analyzing the result of a recently completed networked version of SIAS is underway.

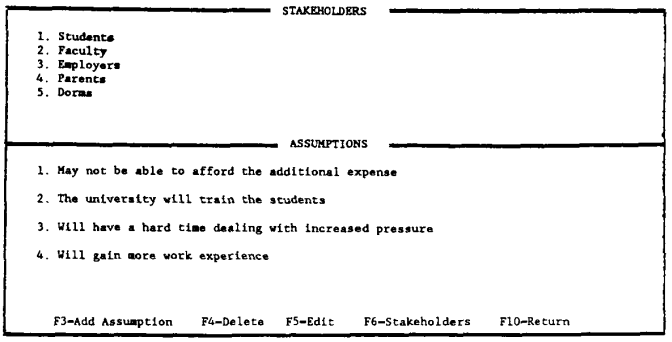

Figure 1 - Surface Assumptions Screen

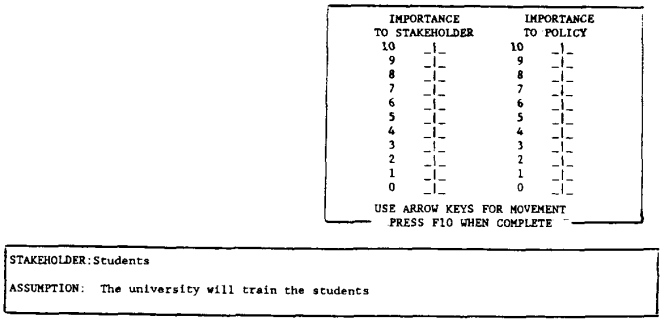

Figure 2 - Rate Assumptions Screen

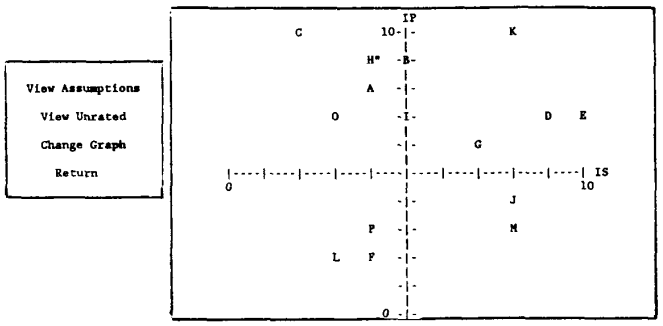

Figure 3 - SIAS Graph Results

4 Research Methodology

4.1 Research Design

The design upon which this study was based involved a random assignment of groups to one of three experimental situations: no decision support, manual support, and computer support. Subjects were assigned randomly to groups. There were six groups in each treatment, resulting in a sample size of 18 groups. The group size was four members. The research participants were junior and senior business students from the University of Arizona. The average age was 24 years. 70.8 % of the subjects were male and 29.2 % were female. The participants received extra course credit for participation in the experiment. While some of the group members had worked together previously, others had not. This simulates a practical situation where group members may or may not have worked together previously.

The decision task was constant across all treatments. The task selected for this research was to perform an impact analysis of a policy statement. Groups were required to analyze the impact of having a policy requiring undergraduate business students to have individual access to a personal computer for admission to a business college. The groups were instructed to derive a concise list of the most critical issues that the policy makers should consider in order to ensure success upon implementation of this policy.

4.2 Research Variables

The nature of technological support was the only independent variable. This variable was manipulated by providing three different types of decision support: none, manual, or computer.

The dependent variables measured the process and the outcomes of the decision making session. The decision process itself was investigated in terms of quantity of unique alternatives, distribution of individual participation, and process satisfaction. The specific outcomes of the process that were investigated were decision quality, decision time, and decision satisfaction.

Quantity of Unique Alternatives was determined by counting the number of stakeholders and assumptions that were generated by each group.

Distribution of Individual Participation was obtained by analyzing audio-video recordings of each experimental session to count the number of comments presented by each individual member of a group. The percentage of participation was then calculated by dividing an individual's total comments by the group's total comments. If all members participated equally, their percentages would all equal 25. To find the amount of variability in each group from this mean value, each individual's percentage was subtracted from 25. The absolute value of this deviation was then used as a measure of distribution of participation.

Process satisfaction was recorded on a self-report, post-session questionnaire given to each group member. The questionnaire had been previously developed and tested [15]. and has been used in GDSS related research at the University of Minnesota [16, 4].

Decision quality was measured for each group's solution based on the number of stakeholders and assumptions that they identified that were also on a predetermined solution list. The higher the quality number, the more completely the group covered the list of valid stakeholders and assumptions; indicating a higher quality solution.

Decision time was the length of time it took each group to complete the task. The maximum time allowed was 90 minutes.

Decision Satisfaction was recorded on the same self-report questionnaire used to measure process satisfaction.

4.3 Hypotheses

There were six major hypotheses of interest in this study. A summary table of the hypotheses and their expected outcomes is presented in Table 2.

Table 2

Summary of Hypotheses and Expected Outcomes

DECISION PROCESS	
Quantity of Unique Alternatives	(AS > MS) > US
Distribution of Individual Participation	(AS > MS) > US
User Satisfaction with Decision Process	(AS > MS) > US
DECISION OUTCOMES	
Decision Quality	(AS > MS) > US
Decision Time	(AS < MS) > US
User Satisfaction with Decision Outcomes	(AS > MS) > US

Legend:
AS - Automated Structure Groups
MS - Manual Structure Groups
US - Unstructured Groups

Notes:
1. There are two components to each hypothesis; comparing the results of the structured treatments to the unstructured treatments, and comparing the automated structure to the manual structure.

2. The > sign in the distribution of individual participation hypotheses indicates a greater degree of equality in the distribution.

4.4 Procedures

The meetings for all of the sessions were held at the University of Arizona's MIS Department PlexCenter. All groups followed the same basic guidelines for the experiment. The subjects filled out a pre-session questionnaire, were read instructions by the facilitator, given a copy of the policy statement with five minutes to read the information. The groups then began the experiment. When they had completed their concise list of stakeholders and assumptions they notified the facilitator. They filled out a post-session questionnaire and were debriefed. All of the sessions were recorded on audio-video tape.

In the GDSS and Manual Supported Treatments the facilitator was present to aid the participants in the use of the tool, either manual or electronic, and to guide the groups through the decision making process, without providing assistance in solving the problem. The facilitator ran the SIAS software in the GDSS sessions and provided comparable manual support in the structured manual sessions. The facilitator did not provide any input as to the decision of the group. The groups in the unstructured manual process received no guidance in determining what process they should use to arrive at a solution. However, they also had a facilitator available to assist them in recording information, voting or other tasks suggested by the group.

5 Results

Our data were analyzed using the SPSS-PC+ ONEWAY analysis of variance (ANOVA) with planned comparisons of means. The planned comparisons specified a priori contrasts between the combined means for the tests of the hypotheses. The statistical results are presented in terms of the decision process variables and decision outcome variables. Additional observations of the studies are described in 5.3. The interpretation of these findings will be discussed in section 6.

5.1 Decision Process Variables

Quantity of Unique Alternatives - There was a significant difference between the structured groups and the unstructured groups ($p = .000$) for quantity of stakeholders and ($p = .000$) for quantity of assumptions. There was no significant difference between the computer supported groups and the manual supported groups.

Distribution of Individual Participation - The structured groups had a more equal measure of participation compared to the unstructured groups ($p = .000$). There was no significant difference between the computer and manual supported groups.

User Satisfaction with Decision Process - There was no difference between the structured and unstructured groups. However, the computer supported groups were more satisfied than the manual supported groups ($p = .000$).

5.2 Decision Outcome Variables

Decision Quality - The structured groups arrived at decisions of a higher quality than the unstructured groups ($p = .000$). There was no difference between the supported groups.

Decision Time - The structured groups took more time to arrive at a decision than the unstructured groups ($p = .024$). Again, there was no difference between the structured treatments.

User Satisfaction with Decision Outcomes - There was no difference between the structured and unstructured treatments. However, the computer supported groups were more satisfied than the manual supported groups ($p = .059$).

5.3 Observations

Several observations were made on the behavior of the groups during the experiment based on review of text and videotapes. First, the groups that were exposed to the structured methodology identified more unique alternatives without rehashing old ideas. The groups with no support many times got

stuck on one idea and could not seem to move past it. If they were able to move past the idea, they often returned to it many times in the discussion. Frustration between these group members was apparent.

A second observation can be made about the distribution of participation. In the unsupported groups, at least one person in each group contributed less than 15% of the total comments; with some groups having members contribute as few as 2% of the total comments. This did not necessarily occur because someone was dominating the conversation, often there was ample time for someone else to contribute. Many times other members in the group tried to coax the member into participating by asking questions directed to that person. It appears, however, that having a common structure or plan of attack may have caused people to participate more evenly.

A third observation deals with what can be classified as unfocused behavior, i.e., comments made by the groups that were unrelated to the task at hand. Generally these comments dealt with class assignments, courses, or other personal interests. All of the unsupported groups had some uninhibited comments, while in the structured treatments some groups had uninhibited comments and others did not. Overall, the unsupported groups made far more uninhibited comments than the structured groups.

Finally, the groups who used the structured methodology had a clear plan to follow in selecting the items for their concise list items from all of the items that were generated during the discussion, resulting in a more selective concise list. In the unsupported groups, no mention was made as how to arrive at the concise list items, resulting in most of the concise lists containing all of the items generated, regardless of their importance.

5.4 Summary of Results

The results of this study can be summarized in terms of comparing the supported groups to the unsupported groups, and the manual supported groups to the computer supported groups.

The groups supported by structure were found to produce decisions of higher quality, generated a higher number of unique ideas, and had a more even distribution of participation. However, they did take longer than the unsupported groups to finish the task. The observational analysis revealed that the groups exposed to the structured treatments performed a more thorough analysis of the problem. They had fewer uninhibited comments and did not tend to rehash old ideas, instead they searched for new ones.

The groups supported by computer structure were found to be more satisfied with the decision outcomes and the decision process than the groups supported by manual structure. The computer supported groups also exhibited less negative behavior in the session than the manual supported groups.

6 Discussion

6.1 Decision Process

Our finding that the groups supported by structure identified significantly more unique alternatives than groups not supported by structure is consistent with previous research [17, 18, 8, 7, 6]. The lack of a difference between the structured treatments, i.e., manual versus computer structure, may be due to several factors, but the most likely is the design of the GDSS. A different type of GDSS which allows for simultaneous input of ideas or anonymous input from all participants may result in the GDSS treatments identifying significantly more ideas than the manual support groups.

We also found that the groups supported by structure had more equal participation rates. Previous research [7, 6] suggests that structure does provide a framework which encourages all members to participate. We found no differences between the structured treatments . Watson [16] also found no differences in equality of influence between manual and computer structure groups. Again, it is believed that a GDSS that significantly alters the communication medium from that which occurred in the structured manual treatments would result in differences in this measure.

We found no differences in user satisfaction with the decision process between the structured and unstructured treatments. Van de Ven and Delbecq [17] and Steeb and Johnston [8] found that groups supported by structure tend to be generally more satisfied than groups not supported by structure. This may be attributed to increased member participation afforded by a structured methodology. However, Gallupe [6] and Watson [16] found that the structured groups were actually less satisfied than the unstructured groups. Perhaps the type of structure being used has an affect on satisfaction. Some methodologies may be easier to understand and use, and may consequently be perceived as more or less satisfying. However, the groups supported by computer structure were more satisfied than the groups supported by the manual structure. Watson [16] found that the GDSS groups were less satisfied than the manual supported groups. The differences we found may be because the computer provided an easier mechanism to record and analyze the data than the use of flip charts.

6.2 Decision Outcome

We found that the structured groups produced a decision of a higher quality than the unstructured groups. This result is consistent with previous researchers [19, 20]. However, differences in the source of structure, manual or computerized, did not result in differences in quality. This result may be affected in a GDSS that significantly alters the structured support from that which occurs in a comparable manual setting.

We also found the decision time to be longer in the structured groups than in the unstructured

groups. Previous research [21] suggests that as member participation increases with structured approaches, decision times will also increase. This is consistent with prior GDSS research [8, 16] who found that the GDSS structure groups took longer than unstructured groups. There was no difference between the structured treatments.

Although the groups in the structured treatments did take longer to reach a decision, they produced a much higher quality decision. This tradeoff between longer decision time and improved decision quality appears to be quite reasonable.

No differences were found in satisfaction with the decision outcomes between the structured and unstructured treatments. Reasoning similar to that applied for satisfaction with the decision process can also be applied here. Groups who are supported by structure are often more satisfied than unsupported groups [18, 8]. We did find that the computer supported groups were more satisfied than the manual supported groups. Watson [16] found no difference in computer structure compared to manual structure. The difference found in these results needs further validation, as the other GDSS researchers who investigated this variable compared a GDSS, imposing a structure, to no-GDSS, which had no structure. Further investigation into comparing differences in computer structure versus manual structure is necessary.

With no differences found between the structure and no structure treatments, one may consider that perhaps the fact that the unstructured groups finished quicker resulted in them being more satisfied. Another interesting note is that although there was no difference in this perceived satisfaction with the solution, the structured groups actually created solutions of higher quality. Future research could address these differences. The differences found in this study between computer and manual supported groups could be attributed to the idea that computer groups thought a GDSS should help them produce a better decision. This may relate to the novelty of using a computerized system. Future research could address the issue of novelty of using a new system affecting the users' satisfaction.

6.3 Practical Significance of the Research

Implications of these findings may be of interest to both users and creators of group decision support systems for strategic planning impact analysis.

Current and planned users of Group Decision Support Systems can be encouraged that the use of a structured methodology improved the decision quality over that which would occur in an unstructured setting. More alternatives were generated in the structured treatments and participation among members was more evenly distributed. The main benefits of the GDSS over a comparably-run structured manual meeting appear in satisfaction measures. The GDSS groups were more satisfied with both the decision outcomes and the decision process.

The results of comparing the GDSS structure to the manual structure should be of interest to GDSS developers. In terms of decision quality, decision time, quantity of alternatives generated, and distribution of participation no significant differences were found between the two treatments. The only results in which the GDSS was better than the manual process appeared in the satisfaction measures. The importance of this may affect the future of GDSS development. Many companies may question the cost/benefit of changing from a manual approach which works, if the only apparent benefit is increased satisfaction. This may indicate a need to design systems that are different in some respect from the manual structure, creating additional benefits. An example would be in changing the communication channel to allow for anonymous or simultaneous input of ideas. However, the effects of this type of change still need to be investigated.

6.4 Strengths and Limitations of the Research

This study has several strengths which can be viewed as contributions of the research. The first is that the study measured key variables in a rigorous experimental setting. The groups who were assigned to the structured treatments were required to follow the structured procedure. Additionally, the presence of the structured manual condition allowed us to address the question of whether benefits/problems were due to the structure or the structure being computerized.

The second major strength is the selection of the task and setting. This experiment used a "real" task, which is recurring more frequently in organizations. The task was appropriate for use with students as the decision makers since they had both a knowledge of and an interest in the solution. Additionally, the decision room used in the experiments is one which is used by actual decision making groups. These strengths appear to outweigh the possible limitations of the study.

The use of a laboratory experiment in this research is the source of the first limitation; low external validity. Conclusions must be limited to small groups, performing an impact analysis of a policy statement, using the SIAS methodology. While the methodology has been used successfully with "real" decision making groups, caution must be used in extending the results to different populations, settings, and situations.

6.5 Future Research

Future research into the effectiveness of group decision support systems is necessary. This research has several possible extensions resulting from variations in controlled variables. One of the extensions involves varying the planning task to determine if the results are affected by the task. Perhaps a more complicated planning problem

may result in different answers. Group size is another variable that should be manipulated. As the size of a group changes some of the benefits or difficulties in the SIAS methodology may become more apparent. The nature of the GDSS design is another factor which can be modified. Altering the GDSS may result in different outcomes. Currently, the authors are studying a networked version of the SIAS methodology has recently been completed at the University of Arizona. This version alters the communication medium, providing simultaneous and anonymous input of ideas. The results of research using this new version should add to the GDSS body of knowledge.

7 Conclusions

This study was designed to add to the expanding body of experimental research regarding the effectiveness of group decision support systems. The findings of our study provide mixed results as to the benefit of a GDSS. We found that the SIAS structure led to higher quality decisions, more equitable participation among members, and the generation of more unique alternatives, compared to the groups not using the structure. However, the decision time was longer and there was no difference in satisfaction. In comparing the automated and manual structures, the only difference was that the groups in the automated structure were more satisfied. These results, however, hold only for this particular task and for the SIAS GDSS. It is anticipated that more significant differences between the automated and manual structure will appear when the task, group size and GDSS design are manipulated. The future of Group Decision Support Systems is good. However, more research is needed to determine exactly what the benefits are, and under what conditions they are best obtained.

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