Virtual Meetings and Tasks: From GSS to DGSS to Project Management

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Abstract

Much of the work in today's organizations is accomplished by distributed, or "virtual" project teams, rather than by work groups meeting in traditional face-to-face meetings. This paper investigates to what extent results from earlier GSS research are being applied to distributed environments, and to what extent more recent research in distributed GSS (DGSS) acknowledges and supports the evolution of work to a distributed project management context. The paper begins with a summary of GSS in face-to-face (FTF) settings, based on two recent meta-analyses, and then analyzes recent selected research literature focused on DGSS and distributed project teams. The results of the analysis provide a foundation for identifying gaps in virtual project team research, and for discussing implications for research and practice.

1. Introduction

The term "virtual" has been applied to meetings, groups, teams, organizations, communities, work, and reality (among other things). Although researchers often define the term within their particular research context, a shared meaning of "virtual" remains elusive. In the interest of working toward that goal, this paper will focus on the use of the term virtual as it applies to groups, teams, and meetings that are partially or fully distributed across time and space, and share a common task or goal.

In traditional organizational settings, regularly scheduled face-to-face meetings have often been the primary means of information distribution, performance reporting, and team development. However, much of the work in today's organizations is accomplished by distributed, or "virtual", work groups, often formalized as teams organized around projects. As organizations have become more distributed geographically and temporally, project teams and managers have needed to substitute alternative tools and methods for traditional face-to-face meetings, such as e-mail, bulletin boards, chat rooms, intranets, audio-conferencing, and video-conferencing. Each of these tools has benefits but also limitations in simulating face-to-face meetings.

Akin to information usage types suggested in [1], a meeting can have the purpose, often implicit rather than explicit, of creating trust, clarifying a power struggle or positioning, or as a background for other processes, even if no other information is exchanged. For example, virtual team researchers have already identified two factors as important issues in virtual team effectiveness: trust (e.g., [5]) and power (e.g., [7]). These factors are two among many other explicit and implicit dimensions of group meeting processes that also apply to distributed project teams.

More than 200 empirical studies have examined the relationships among factors that potentially influence successful use of Group Support Systems (GSS) (see [4]), and a growing number of studies examine the extension of GSS in the distributed setting (DGSS). We propose that in addition to focusing on creating toolsets and environments that simulate the face-to-face meeting format, we should explore the underlying goals and processes of meetings, which now often take place electronically and frequently asynchronously over the life of a project. This approach will provide a richer framework for studying distributed project teams, discovering their needs, designing better toolsets, and determining best practices for their use.

This paper begins with a summary of GSS in face-to-face (FTF) settings, based on two recent meta-analyses, in which we discuss what we have learned about FTF meetings using GSS that may be relevant to distributed settings. We then proceed with an analysis of recent selected research literature focused on DGSS and management of distributed project teams. The purpose of this analysis is to investigate the degree to which DGSS research is both drawing upon and extending GSS

meeting research, and at the same time moving away from a meeting setting toward a project setting. To limit the scope of this examination, we are focusing initially on recent HICSS papers that study DGSS and group project-oriented tasks.

1.1 Electronically Supported Meetings

One thesis of this paper is that the nature of electronically supported meetings changes in moving from the same time-same place (aka face-to-face or FTF) to the distributed (DGSS) setting, and that this evolution has been underestimated by those shifting from GSS to DGSS research.

Face-to-face (FTF) meetings, whether or not they are electronically supported, are complex human activities. Events occur simultaneously on multiple levels. Most visibly, meetings frequently are called to further progress on one or more tasks with speech acts used to move these tasks forward. The same speech acts, however, can establish authority (based on inflections, sequence, duration); can reinforce (or challenge) social norms; and can support or weaken alliances and social relationships. Detailed study of actual behaviors during meetings shows a wide range of communication purposes including coordination/organization, motivation, affiliation, information dissemination, and off-topic comments [10]. The FTF meeting acts as a kind of glue that holds these various purposes together. When the "meeting" is shifted from FTF to a distributed GSS, the glue that is taken for granted in the FTF setting must be purposefully constructed by group members or leaders if the meeting is to succeed. For example, we have learned many blatant and subtle signals in FTF meetings to know when to move from discussion to resolution of an issue. In the DGSS setting, signals that are often based on body language and voice tone are no longer automatically present. Group members or leaders must consciously act to provide signals for moving from one to another meeting activity.

For individuals working at different times and places on a common activity or toward a common goal, information dissemination may be more effective as a series of email messages or comments on a bulletin board than in a formal DGSS "meeting." Coordination/organization may become embedded in computerized routines (e.g. document routing for sequential processing by different agents) that are sometimes called "workflow" systems, thus also diminishing the need for a "meeting." Where GSS does not erode the variety of purposes for conducting FTF meetings (though most GSS technology aims at supporting fairly rational processes like planning, brainstorming, and voting), DGSS challenges the nature and necessity of a "meeting" per se. This paper proposes that DGSS should more properly be aligned with the "project" than with the "meeting" metaphor, but at the same time we need to understand more about the underlying dimensions of meetings that still need to be addressed in a distributed environment.

1.2 GSS and Face-to-face Meetings

Two recent studies have surveyed experimental GSS research results. Fjermestad and Hiltz [4] provided a comprehensive quantitative study regarding the 200 or so prior laboratory studies of GSS experiments published in refereed journals and conferences. Dennis and Wixom [3] examine a smaller subset of GSS research, but use more sophisticated statistical methods to investigate the accumulation of knowledge on the topic. Findings of both studies show equivocal overall results regarding the effectiveness of GSS for supporting meetings. (We will hereafter refer to these studies as F&H and D&W.) F&H found only 16% of hypothesized GSS-favorable relationships to have been supported in the literature. D&W describe a fairly narrow meeting type where GSS seems to provide significant benefits.

Most relevant to our discussion is the area of task. Within the category of technology variables, F&H (p. 16) lists 22 "tasks" (plus "other"), none of which are tested in the underlying studies. The term task is put in quotation marks because these are not distinguished from GSS tools. In other words, use of a particular tool implies performing the task for which that tool was intended. Most frequently observed "tasks" are electronic brainstorming (44 studies); voting (35 studies); and ranking (20 studies). A "General Package", presumably a toolset of multiple GSS tools such as GroupSystems, is examined in 13 studies, which means it is difficult to distinguish the specific tasks for which the tools are used or the task-oriented results for which the meeting was intended.

The variable of "task" is studied in a few other papers in terms of complexity (3 times); equivocality (3 times), and structure (1). The bulk of task content are described by McGrath's eight category typology [8]. The tasks studied and their frequencies were: preference or decision-making (104 times); creativity (brainstorming) (79 times); intellective tasks (62 times); planning (4 times); and mixed-motive, resolving conflict (1 time). The authors point out that several studies put the same actual task into multiple categories and that at least one, the intellective, overlapped decision making tasks.

D&W report two findings related to task. They found that satisfaction with the outcome is higher for idea generation than for decision making tasks, and they also found no difference in number of ideas generated using level 1 and level 2 tools. For F&H, task entered into one or more hypothesis in these studies 68 times, with only one study showing GSS outperforming non-GSS groups, while non-GSS groups outperformed GSS groups 11

times, and 56 showed no effect. It is a bit difficult to interpret these results as task is frequently a constant in these studies, and all groups in different treatments perform the same task. However, in some studies the same type of task is varied in its complexity (e.g., more elements are added for groups to sort through).

1.3 DGSS and Project Management

Projects are distinguished from on-going operational tasks in that they are temporary, have a unique and specific goal, have a specific start date and end date, and require a diverse set of human resources, each of whom brings specified needed skills and knowledge to the project tasks [9]. Successful project managers plan and implement formal communication and coordination processes that include both task-related and process-related information [9]. Project tasks, however, do not correspond very neatly with GSS tasks. Project tasks listed in the PMBOK include initiating, planning, executing, controlling, documenting, and managing cost, time, people, risk, quality, and procurement. Very little GSS or DGSS research has focused on tasks from a Project Management (PM) perspective. If DGSS research is to bridge the gap between meetings and projects, a different definition or categorization of tasks may be needed.

2. Methodology

In order to gain an initial overview of what is known about distributed meeting support, we chose to survey the *Proceedings of the HICSS* conferences from 1999-2002, available on the HICSS web site (http://www.hicss.hawaii.edu/diglib.htm), and extract the most relevant papers. HICSS, particularly the tracks on Collaboration Technologies, provide one of the few concentrated outlets for current research in this area, and thus offers a reasonably representative convenience sample.

We reviewed the titles, abstracts, and full text of the articles as needed to determine the way in which each study contributed to knowledge about distributed group work. We attempted to determine the task and media of interest in each study, as well as methodology, theoretical foundation, variables, and results. Initially, we focused on tracks and mini-tracks that were explicitly about DGSS and Project Management. However, as we reviewed the HICSS proceedings, we realized that a number of other tracks contained studies that might be helpful in understanding distributed project management. Thus, the ultimate set of papers (65) includes content from a variety of the HICSS tracks.

The bases for inclusion were as follows. A paper was included if: 1) it was explicitly about DGSS or distributed Project Management; 2) it addressed what we considered to be project-related tasks and/or media in a way that would be helpful to distributed project teams; 3) it addressed team process or task issues relevant to distributed teamwork. We did not include studies explicitly about FTF GSS or FTF project management issues. We did not include learning-related studies unless they addressed tasks relevant to practitioners. We did not include papers about support for decision-making unless they specifically addressed group or collaborative decision-making, in a distributed setting.

Appendix A lists the papers alphabetically by author and includes numbers for reference in some of the following tables. Table 1 displays the general approach of each study. Clearly the majority was empirical of some kind, that is, some kind of data collection, analysis, and results. Table 2 further categorizes those 46 empirical papers into specific methodologies used. An additional finding is that 18 out of the 46 empirical studies used students as subjects (39%).

Paper Category	**Number of Papers**	
Empirical	46	71%
Framework	6	9%
Tool Design	5	8%
Meta-analysis	4	6%
Theory	2	3%
Methodology	2	3%
TOTAL	65	100%

Table 1. Approaches

Research Method (Empirical)	**Number of Papers**	
Case Study	16	35%
Lab Experiment	14	30%
Field Experiment	5	11%
Action Research	4	9%
Survey	4	9%
Field Study	3	7%
TOTAL	**46**	**100%**

Table 2. Methods

3. Results

Our initial goal was to compare these to the findings from the meta-analyses of GSS research discussed in the previous section. Unfortunately, the categorizations into which the set of papers could be divided did not easily map to those discussed above for GSS.

3.1 Tasks

Nineteen distinct tasks were observed from a total of 65 observations (see Table 3). Note that some studies used multiple tasks or characterized the same task using multiple labels (similarly to the GSS studies above). In most cases, we categorized the task as named explicitly in the individual study. In a few cases, we combined tasks. For example, a "brainstorming" task was added to the "idea generation" category and a LAN project was considered to be a "software design/development" task.

We can distinguish at least two levels of aggregation. We use the term "at least" because the term project management is applied to several of the tasks in the studies observed. However, this may represent either a generalization among projects of many types or simply be a specific, but unstated type of project. At the lower level, activities such as idea generation and voting pertain to elemental tasks that can be used in meetings of many different types. These are activities that generally occur in the face-to-face setting within a particular meeting. They can be started and completed in a single session. In extending these into a DGSS setting, some of the management issues must be addressed more explicitly (e.g., when to shift from discussion to voting, when voting must be completed, etc.). From another perspective, in the distributed project management (DPM) setting, these become tasks that are embedded at various times and in various ways into the project activity agenda.

Task	Number	References
software design/development	**9**	11,25,31,34,38,40,44,52,53
decision-making	**6**	8,20,32,36,55,64
project management	**6**	9,17,27,46,47,59
knowledge management	**5**	21,27,37,49,54
learning	**5**	16,18,23,56,60
coordination	**4**	3,15,44,63
discussion	**4**	2,3,16,28
idea generation	**4**	20,35,36,58
planning	**4**	8,17,64,65
writing	**4**	3,6,8,39
communication	**3**	14,16,24
problem-solving	**3**	4,35,51
product design/development	**3**	26,46,61
facilitation	**2**	33,51
meeting	**2**	22,50
collaboration	**1**	19
judgment	**1**	57
negotiation	**1**	1
voting	**1**	64
TOTAL	**68**	

Table 3. Tasks

3.2 Media

We listed an individual medium where it was specified (see Table 4). As with task, however, in many cases the medium was not explicit, or else multiple media were assumed, or else different names were used in different studies but represented the same medium or tool. Thus, we made some subjective assignments. For example, in general where the term "asynchronous learning network" was used, we classified that as a multi-tool set under DGSS. For particular products, we attempted a generic classification. For example, Lotus Notes was classified as DGSS, NetMeeting was classified as Chat. Asynchronous computer conferencing was classified as Electronic Bulletin Board (EBB). Also, a single study may have used more than one medium. In a few cases, especially some project management case studies, no particular electronic media was specified, which is why a few papers are missing from the table. If it were possible to learn more details about specific studies, we might expect to find that the "elemental" tasks as mentioned above in the GSS discussion were supported by specific single media, while higher level tasks, as discussed in the previous section, would be supported by multiple tools or toolsets.

Medium	Number	References
DGSS	**16**	1,3,4,6,14,15,17,20,26,31,32,48,49,51,54,64
EBB	**9**	2,16,34,35,38,39,42,52,58
e-mail	**7**	8,16,34,36,49,52,53
GSS	**6**	2,5,12,13,28,55
VTC/video	**6**	7,22,23,24,52,57

chat	**4**	16,42,52,62
Intranet	**3**	8,37,58
TOTAL	**51**	

Table 4 – Media

3.3 Variables

Clearly the most common goal in this set of studies was to determine the effect of an electronic medium or tool on some group process or outcome. In lab and field experiments, this was usually compared with FTF interaction. In F&H, discussed in the first section, communication mode (analogous to medium) was part of the hypothesis in one-third of the GSS studies. Both sets of variables from our survey (Tables 5 and 6) reflect additional issues that are important for projects but that often may not be issues during individual meetings: e.g., coordination, group development, availability, implementation success.

Independent Variables	**Number**	**References**
medium	12	14,22,23,24,34,35,36,37,38,39,49,62
training/team building	4	4,20,30,58
structure	3	6,63,64
coordination	2	32,44
facilitation	2	28,51
task	2	7,48
culture	1	1
gender	1	2
leadership style	1	59
project complexity	1	47
roles	1	34

Table 5. Independent Variables

Dependent Variables	**Number**	**References**
productivity/performance	8	14,18,23,32,38,40,51,59
participation/attendance	7	2,8,18,36,42,51,62
satisfaction	7	2,6,20,35,38,39,62
consensus	4	1,55,62,64
group development/cohesion	4	38,39,48,64
knowledge creation/sharing	4	49,56,60,61
output/result quality	4	23,28,30,35
technology acceptance	3	5,37,58
coordination strategy	2	3,63
decision quality	2	20,57
decision speed	2	36,64
discussion quality	2	35,55
use of media	2	16,63
utility/usefulness/ease of use	2	7,15
availability	1	24
creativity	1	38
decision confidence	1	57
equality of participation	1	8
implementation success	1	47
information overload	1	14
meeting type	1	22
report quality	1	3
risk	1	62
shared understanding	1	9
trust	1	4

Table 6. Dependent Variables

4. Discussion

We can learn only a limited amount about tasks and GSS performance either from the two meta-analyses of GSS, or from our preliminary review of DGSS. Both GSS and DGSS studies suffer from inconsistent task categorization. Thus we are unable to compare GSS to DGSS directly. We can note that some tasks appear to carry over from one to the other (e.g., negotiation, decision-making, idea generation), while others apply mainly to distributed settings (e.g., coordination, project management, and knowledge management).

Higher level tasks such as software design/development, product design/development and knowledge management represent types of projects. In each of these cases many activities are required to move the project from initiation to completion. Many of the more elemental tasks are likely to be included in each of these. For example, idea generation, voting, coordination, learning, discussion, writing, planning,

judgment and negotiation are all likely to be contained within these tasks. These elemental activities may be handled in the DGSS environment by same time/different place "meetings" – generally using audio or video conferencing – or they may be reengineered such that their purposes are achieved within the project context without necessarily being isolated as distinct activities. For example, drafts and revisions of manuscripts may be circulated in many ways to address the writing activity as part of the larger project without a separate "meeting."

Having identified these higher level tasks, what is the right categorization for them? There are different sets of activities for the design of a software product than, for example, a new line of furniture, but there would also be some set of activities common to both. This is recognized in the PMBOK [9], which provides general guidelines for tasks that apply to most projects, but also acknowledges that projects have domain-specific dimensions. The content or domain of the project is important, but the nature of the group working on the task, its resources, history, approach, and specific goals could also be an important source of categorization for the study of projects supported by DGSS technologies.

Particularly from the practitioner perspective, there would be value in examining the commonalities among diverse projects as well as the unique or unusual elements needed to support the range of projects. DGSS and PM researchers can also study the arrangement and execution of specific elemental tasks as well as the elemental communications technologies that support them.

4.1 Media and Methods

As with task, media are difficult to compare between GSS and DGSS because they are not always clearly specified or defined. Much of the research that has informed DGSS comes from computer-mediated communication (CMC) research that has focused on a specific medium (most frequently e-mail). Another stream is that of technology-supported learning. Learning systems such as EIES-Web and WebCT combine media (e.g., e-mail, bulletin boards, chat) in ways that are difficult to separate. We therefore classified these systems as general DGSS, but are limited in our ability to compare them directly with a GSS such as GroupSystems which uses a significantly different toolset.

From a methodology perspective, the lab setting has well-known limitations. Foremost is the fact that the number of subtle things that can vary and that can affect meeting process and outcomes is enormous (see [2]). The FTF setting, particularly with active facilitation, is also more likely to emphasize a tight integration between activities (such as voting) and specific tools that support them. In the DGSS environment, groups are more likely to vary their use of tools from how they were intended. This may have positive consequences for innovation or negative consequences for inefficiencies or frustrations for the group members.

The most interesting result from looking at the list of methods in Table 2 is the predominance of qualitative methods. Case studies, field studies, and action research comprise half of the data set. Commenting on the rigor of the individual studies is beyond the scope of this paper, but it is clear that qualitative approaches will be increasingly necessary to gain a richer understanding of the complex phenomenon that is a technology-supported team. As the number of qualitative studies grows, there will be opportunities to consider the degree to which findings are consistent and whether more generalizable patterns begin to appear.

4.2 Variables and Results

More than a dozen variables are shown to affect assessment of one of the five moderators noted by D&W in the GSS section above. To examine the factors that genuinely affect real meetings requires a finer granularity of data collection that precludes comprehensive accounting for all attributes (and makes the creation of realistic control groups virtually impossible.) Likewise, the list of variables from DGSS research shown in Tables 5 and 6 above further demonstrates the large range of possible factors that combine to create outcomes.

The list of outcome variables in Table 6 suffers from the same problems that the GSS meta-analyses demonstrate. The most significant and important outcomes are the also the most difficult to measure. Measures of number of ideas and time to generate ideas often do address meeting quality to some extent, although indirectly, and certainly more than satisfaction. Less explicit meeting outcomes in real meetings such as building relationships, establishing interpersonal understandings, transferring knowledge, communicating about sensitive topics, and surfacing disagreements may very well reduce the assessment of satisfaction for a particular meeting but be quite important in generating organizational value over the life of a project.

4.3 Project Management: The Ultimate DGSS Task

From a research perspective, one view of Distributed Project Management (DPM) is that it comprises a subset of DGSS research; that is, PM is simply one application of DGSS. For example, we used "project management" as one of the list of tasks listed in Table 3 above. A broader view, however, is just the reverse. We found a number of papers outside the specific tracks for DGSS and PM, that represent research that could be useful to both practitioners and researchers in DPM (e.g., [1],[41]). That is because DPM includes a

variety of tasks and activities (e.g., planning, executing, controlling, documenting) that may appropriately require a variety of media (e.g., synchronous and asynchronous, e-mail and DSS, etc.).

There were several interesting findings from the set of DPM papers we analyzed. First, it seems to be a growing field, albeit somewhat "unknowingly." Many times we found that researchers from more traditional DGSS streams are venturing into DPM, but without acknowledging that, partly because they may not have been exposed to the traditional PM literature, and therefore are not familiar with the similarities between that literature and their work. This observation, coupled with the actual emergence of specific HICSS mini-tracks on the topic, would buttress the argument that DPM may be a "sleeper" topic that is starting to permeate a large part of the MIS collaboration literature.

Second, the more explicit DPM literature appears to be divided between: (a) papers describing sets of mini-case studies typically leading to either claimed conceptual improvements in DPM or actual implementation of DPM control software that inevitably seems to deal well with the issues uncovered in the case studies, and (b) conceptual or implementation descriptions of prototypes which are supposed to deal with problems which were raised elsewhere or are argued by the author based on his or her experience. As a set, these papers raise several interesting points. One, there is no accepted methodology dealing with DPM, and many flavors both at the conceptual and tool level exist, apparently focusing on specific subsets of DPM problems. Two, the "better mouse trap" DPM prototype implementation approach largely ignores what the other mousetraps have done before, one of the characteristics of a pre-paradigmatic field [6] where stakeholders are trying to position for developing a "standard." There is much room for joint work in this area, both at the practitioner perspective (joint development to avoid rediscovery of the wheel) and applied research (testing tool solutions via either field or laboratory experiments).

Third, many of the manuscripts are addressing the same areas, something interesting considering the wide range of possibilities not explored. For instance, several papers describing DPM tools address the problem of stakeholder visualization of what is happening in the multiple tasks scattered across the multiple locations. Another relatively common topic – particularly at the conceptual level – is project portfolio assessment and selection. Notably absent, for instance, are evaluations of risk across locations, one of the topics that used to be very common in the more traditional project management literature.

In reviewing the set of papers, we note that a number of those specifically focused on Project Management are case studies of individual organizations or projects, to which the rigorous methodologies of qualitative analysis have not necessarily been fully applied, or else descriptions of custom-built tools, which have not been tested in use. These studies are interesting in that they provide us with some initial information from practitioners in context, and/or raise some design issues, but offer little solid knowledge.

Thus, the DPM case studies are good but need to be more rigorous qualitative studies in order to gain respectability and make comparisons based on cumulative tradition possible. In addition, post-tool implementation testing has not been done to a large extent. Part of the reason may be that many of these tools are being developed in Europe, where the intellectual tradition is so different than the eminently positivistic approach adopted in the U.S.

Today's DPM researchers could be said to be in a similar "pre-paradigmatic" period, experiencing growing pains similar to the early days of GSS. At that time, field studies like this, using a variety of GSS tools (e.g., VisionQuest, OptionFinder, and others) were common, as well as numerous CSCW studies that build tools but provide little understanding. In GSS, these served an important role in gaining some initial knowledge. In GSS research, though, this was eventually accompanied by enough lab research, as reviewed above, to gradually gain some knowledge over time. Thus we could expect and hope to see a similar pattern emerge with DPM research.

4.4 Limitations

This analysis is limited to a subset of the relevant literature. The basis for selection and categorization of articles in the review was somewhat subjective and may reflect our own biases and interpretations of the authors' intentions. We most likely left out some papers that should have been included, and possibly included some that should not have been. Our next steps will be to extend the literature base, and to re-examine some of these issues in a broader context.

5. Conclusions

One of the most interesting conclusions here is the apparent overlap of similar goals between GSS, DGSS and DPM. The convergence of interests becomes obvious when retrospectively analyzing the separate HICSS mini-tracks, but it is doubtful that the researchers from all the areas involved have realized the significance of this fact, which would enrich the theoretical and practical background of all the areas involved.

We have learned a great deal about meetings, tasks, and technology from GSS research. However, since the development of distributed activities supported by new technologies shifts the emphasis from formal units of work done in FTF meetings, it becomes increasingly valuable to modify the unit of analyses to include both

elemental activities (e.g. brainstorming and voting) and larger units such as project management of various stripes. The complexity of this type of research, largely due to the interaction of so many organizational, technology, and individual participant variables, points toward the high value of multiple qualitative research studies. DPM action researchers who are attempting to glean what they can from organizational case studies are on the right track. However, what will help in the future is more formalization of research methods, more standard specification of task and medium, and more cross-pollination from related areas. In particular, more researchers studying collaboration should consider the perspective of Project Management in framing their work, because this is the perspective from which more and more organizations are viewing their practices and processes and outcomes.

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Appendix A
Selected HICSS Papers 1999-2002

All listed papers are taken from Proceedings of the Annual Hawaii International Conference on System Sciences (HICSS), 1999-2002, IEEE Computer Society Press, http://www.hicss.hawaii.edu/diglib.htm

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