

Synchronous Communication Scenarios in Online-Cooperation Virtual Environments

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Abstract

Communication and collaboration in Online-Cooperation Virtual Environments (OCVE) are characterized by technical and organizational constraints. Based on well-established theory and research, necessary adjustments of pedagogical concepts for this scenario are presented here. Oriented towards practical use, considered topics include: (1) general features of communication, verbal and nonverbal behavior, and processes of moderating meetings as to their relevance for OCVEs and (2) the communication scenario of the OCVE in the project Moderation VR. Thereby, specific opportunities and limitations of communicating in an OCVE are integrated into general considerations on group work and learner support.

Introduction

Educational software on computer systems provided with high-speed Internet access is already offering new opportunities for effective distance education. However, the limitations of current communication and collaboration tools demand for further technological enhancements according to didactical and pedagogical requirements (Lowyck, 2002). One opportunity for educational use is created and presented by the use of Online-Cooperation Virtual Environment (OCVE) technology. Up to now, the underlying technology has been too difficult to be of use for widespread implementations. Today, however, OCVEs are becoming increasingly accessible to the public.

Group work offers substantial improvements on participant's motivation and how they perceive a task's difficulty, thus supporting students' achievements (Lowyck, 2002; Slavin, 1995). The cooperative learning process is based on the individual learning processes of all group members, but has substantial benefits to each participant (Slavin, 1995). Learning becomes more effective and powerful, when the active construction of knowledge is enhanced by intensive collaboration and communication (Duffy & Jonassen, 1992). Consequently, the pedagogical adequacy of technological tools must be guaranteed by bearing educational and instructional theory in mind when developing the learning platform's concept (Lowyck, 2002). Here, OCVEs provide various interesting features, which promise to overcome some of the typical problems of traditional virtual seminars. Based on general considerations of the communication scenario in OCVEs, a prototypical OCVE (called Moderation VR¹) with its virtual course room is presented to show how to learn and apply creativity techniques in an online scenario effectively.

Online-Cooperation Virtual Environments (OCVEs)

In general, the use of the term "virtual environment" is not clearly defined and covers the whole range from 3D-desktop-based scenarios (standalone or via Internet connection) up to virtual realities which are accessible through a Head Mounted Display and DataGloves only (see Kalawsky, 1993, for details). According to the definition of "Desktop Virtual Systems" as provided from Blade and Padgett (2002), OCVEs can also be seen as "virtual experiences that are displayed on a two-dimensional desktop computer; the person can see through the eyes of the character on the screen, but the experience is not three-dimensional" (Blade & Padgett, 2002: p.18). This definition of virtual environments and of the similar OCVEs also includes the fact that the experience of being in a virtual environment is based on a quite sophisticated technological basis.

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Whereas technology offers new tools for communication, the resulting social and cognitive processes of the participants shape their actual behavior. Therefore, OCVEs can be defined (1) by a three-dimensional representation of worlds, objects, and relations between them, (2) by their more or less extensive level of real-time interaction, and (3) by different levels of multimodal interaction between participants (e.g. using gestures to express personal feedback or opinions; Wickens & Baker, 1995).

The psychological experience of being in the virtual environment, as is described by the concept of "presence", the notion of "being there" inside the virtual environment, contributes to a definition of virtual environments in terms of human experience (Steuer, 1992, Slater & Wilbur, 1997). In the case of multi-user environments, participants are represented by avatars in a OCVE or are accompanied by software agents (probably the most prominent example is "Second Life", www.secondlife.com). An avatar can be defined as a "character that represents a player in second-person virtual systems" (Blade & Padgett, 2002: p.17). Thereby, avatars are anthropomorphic, human-like representations or artificial instantiations (i.e., animals or cartoon figures) of a person acting in the virtual environment. The actual location in the virtual environment is determined and visible through the avatar's position for the interacting person, as well as for other participants. This expands the notion of being "present" inside the virtual environment to the concept of "social presence", which describes the aspect of "being together" inside the virtual environment. In communication scenarios, aspects of "social presence" become increasingly important as they mediate intra-group processes (Short et al., 1976; Schroeder, 2002). In this respect, several aspects of communication processes in OCVEs are similar to well-known computer-conferencing or video-conferencing scenarios. However, some distinct characteristics of the communication processes in OCVEs need to be taken into account as well.

Communication in OCVEs

In general, five characteristics form the basis for categorizing communication technologies (Ellis et al., 1991; Harasim, 1988). First of all, the underlying *symbol system* (Salomon, 1979) determines the cognitive transformation required of the participant for recoding processes and for elaboration processes of the presented information. Second, *spatial relations* between participants embrace their spatial distance in reality and the perceived distance inside the virtual environment. Third, *temporal relations* between participants comprise the temporal delay in communication within synchronous communication settings. Fourth, the produced *utterances* via audio-chat are only temporarily available, but might be recorded with appropriate software. Text chat utterances can be made more permanent by storing them directly into files. Fifth, a variable, but limited *number of addressees* are involved in the communication process, allowing primarily small-group interaction scenarios. In addition to these five characteristics, the *representation of participants* establishes a sixth factor of the actual communication scenario. In real-life settings persons are bodily present. In contrast, in mediated settings they are present via voice (on the telephone), name or picture (i.e., in computer conferences), live video-stream (i.e., in video conferencing) or as avatars (in virtual environments). Especially, a comparison of DVE systems with computer-conferencing and video-conferencing systems can show relevant characteristics and clarify the communication scenario in an OCVE.

OCVEs and Computer Conferencing

Schwan (1997) describes computer conferences as primarily characterized by the text-based information transmission, the spatial and temporal relationships between communicators, and the number of participants if this setting is used for communication and knowledge acquisition. In comparison to computer conferencing, group awareness is enhanced in the OCVE, because participants are present via a personal avatar. It can be assumed that text-based information transmission (text-chat) as it is used in most computer-conference systems will be substituted with auditory information transmission (audio-chat) in the near future. The spatial and temporal relationships between participants in a collaborative OCVE consist of their actual real world distance and are mediated by transmission delays. Usually, the personal representation of participants takes place via avatars. In addition to the actual features of an OCVE, most participants contribute substantially to the group interaction process thus fostering group salience, leading to reduced nonverbal and verbal communication. Whenever auditory information transmission is offered, it can present delays between speaking and receiving the message in comparison to face-to-face communication. Therefore, an instantaneous reaction or an adjustment of someone's own contribution to a listener's expressed emotion might be limited.

OCVEs and Video Conferencing

Another well-known aspect in this context has to deal with the differences between communication in video-conferences and in an OCVE, because the visual prominence in video conferencing points toward special requirements concerning the communication in OCVEs. During a video conference, communication partners are made visible on television screens. Usually, the person speaking fills the whole screen. Hence, the visibility is limited to one person, and especially the awareness directed towards the group is reduced (Fussell & Benimoff, 1995). As participants are represented as avatars in an OCVE, they are visible all together at the same time. In comparison to video conferencing, group awareness is enhanced in the OCVE and awareness directed towards the person speaking is only slightly reduced, because the speaker's voice demands attention. These differences will influence individual speech behavior in characteristic ways. When group awareness increases, the expression of personal opinions should be enhanced. Usually, the prominence of an individual is strengthened by its visual presence in video conferences. This presence may lead into a situation when longer contributions ("monologues") support a feeling of watching television for other participants, as it this situation does not demand for a more active participation (Salomon, 1979). In contrast, in an OCVE participants observe and perceive the behavior of the whole group stronger and have more opportunities to pose questions or to express opinions by using a text chat or gestures. Thus, active participation from all participants is quite likely to increase in OCVE settings.

Verbal and Nonverbal Communication

The characteristics of a computer-mediated communication scenario in an OCVE are based on the opportunities and limitations of verbal and nonverbal communication therein (e.g. the immediate identification of another participant might be reduced). Therefore, despite the broad functions of OCVEs, there are some limitations of communication modes, which should be considered to clarify the different aspects of communication in an OCVE.

In general, verbal and nonverbal communication modes differ substantially in their functions. Whereas verbal communication means all explicitly spoken or written words, nonverbal communication consists of the gaze, facial expression, body posture or spatial distance between participants ("proxemics"; Hall, 1966). In the communication scenario of an OCVE, nonverbal communication gains special importance because of its limitations in other settings like phone conferences, net meetings, or video conferences. To clarify the differences in nonverbal communication between these scenarios even further, they are analyzed here according to the terms of semantic, syntactic, pragmatic, and dialogic functions as they were introduced by Scherer (1980).

First, semantic communication enriches the meaning of verbal signs semantically and fulfils the four sub functions of substitution, amplification, contradiction, and modification of verbal communication. In the case of substitution, a verbal utterance is substituted by nonverbal behavior and the intended meaning is delivered by a nonverbal sign only. In amplification, nonverbal and verbal signs are used together, as in illustrations or deictic movements (Scherer, 1980). In contrast to amplification, a contradiction occurs when verbal and nonverbal signs relate to different meanings (i.e., ending a lengthy conversation gracefully). Finally, the modification sub function covers all nonverbal signs as they modify verbal signs by a moderate add-on (i.e., adding an ironic twist to an utterance).

Second, the syntactic function of communication helps to order the sequence and the occurrence of verbal and nonverbal behavior (Scherer, 1980). They are described in segmentation (changes in body posture as topic changes) and synchronization sub functions (i.e., pointing towards a detail in a graph). Third, pragmatic functions serve to communicate information concerning permanent characteristics and signaling reactions to acts of the interaction partners (Scherer, 1980). They can be distinguished in terms of expression functions (social identity, long-term states, such as emotions or attitudes) and reaction functions (short-term reactions to utterances of an interaction partner, i.e., nodding).

Finally, dialogic functions concern the assertion of an existing relationship between participants in a conversation and the regulation of their contributions (Scherer, 1980). They are described as relation functions (indicating relationship dimensions, such as status or intimacy) and regulation functions (i.e., turn-taking).

In applying Scherer's (1980) differentiation of verbal and nonverbal interaction in OCVEs, several characteristics highlight the differences between interaction styles. In using semantic functions of communicative behavior, a gesture shown from an avatar might substitute or amplify a verbal utterance in a limited, but sufficient way. But, contradictions in behavioral expressions might be hard to interpret by other participants and may lead to confusion or might be understood as improper use of a sign (Scherer, 1980). Modifications in behavior are equally hard to interpret, because of its limited expressiveness. However, OCVEs still allow for nonverbal behavior through avatars in expressing gestures or by signifying content (using arrows or highlighting on a shared screen). In the second instance, syntactic communication might not be easy to decode in OCVEs, because of technological influences: speech fluency and behavior synchronization between speech and behavior are strongly dependent on connection speed and quality. The pragmatic communication in OCVEs is strongly influenced by communication bandwidth and perceived distance between participants, limiting spontaneous reactions. Similarly, regulating contributions and turn-taking among participants is limited in the field of dialogic functions in a OCVE. Taking these limitations of communicative functions into account, it seems clear that the perceived level of individual and group salience might be an important determinant of participation in ongoing behavior and resulting group productivity, not only in real life (Worchel et al., 1992), but also in OCVEs.

Moderating Group Work in OCVEs

In supporting the knowledge acquisition processes while presenting information, the role of the moderator becomes crucial. To support the ongoing communication, the primary tasks of moderation involve the different aspects of meta communication and the coordination of interaction.

An experienced moderator bears different ears aspects of the first aspect of moderation, the *meta communication* in mind (Feenberg, 1989), and can address them explicitly. In doing this, communicational aspects, the communication processes and structures themselves, are mentioned and the process ("Which point on the agenda is this matter related to?") or the content ("What is meant by proposition X?") of communication is stated explicitly. Three functional areas of moderation within the context of meta communication are defined by Feenberg (1989): contextualized functions, monitoring functions and meta functions. First, *contextualized functions* encompass the opening of the discussion and the setting of norms and the agenda. Successful communication is based on familiar rules of conduct and communication („standards“). By sticking to the agenda, progress in the discussion is guided by a clear and engaging framework. Second, *monitoring functions* cover the explicit inclusion of participants with upcoming events, such as direct addressing and the demanding of contributions from participants. Third, *meta functions* consist of meta comments and weaving comments. Meta comments are used to solve problems in their context, by arranging them in the order of the agenda or in standards or to clarify problems or to avoid information overload. Weaving comments deal with the content of the discussion. They resume the status of the discussion and disclose common lines in the participant's contributions.

The second task of the moderator is the coordination of interaction during a meeting. Turn-taking and topic maintenance contribute substantially to interaction coherence within computer-mediated communication (Herring, 1999). In short, the interaction in mediated communication scenarios can be described as: the medium dictates the size and the time of a "turn" (Looi, 2002; Murray, 1989). In comparison to other scenarios, the coordination of interaction between participants in an OCVE is restricted in several aspects. In the case of audio-chat, restricted audio quality and transmission delays of audio data limit instant message delivery (some transmission delays cause interruptions for up to one second). Nonverbal communication in general is not supported and if gestures or other signs are implemented, they might be misinterpreted easily. Therefore, the moderator is responsible for addressing other participants explicitly to demand for and to coordinate their contributions.

Moderation VR – A Case Study

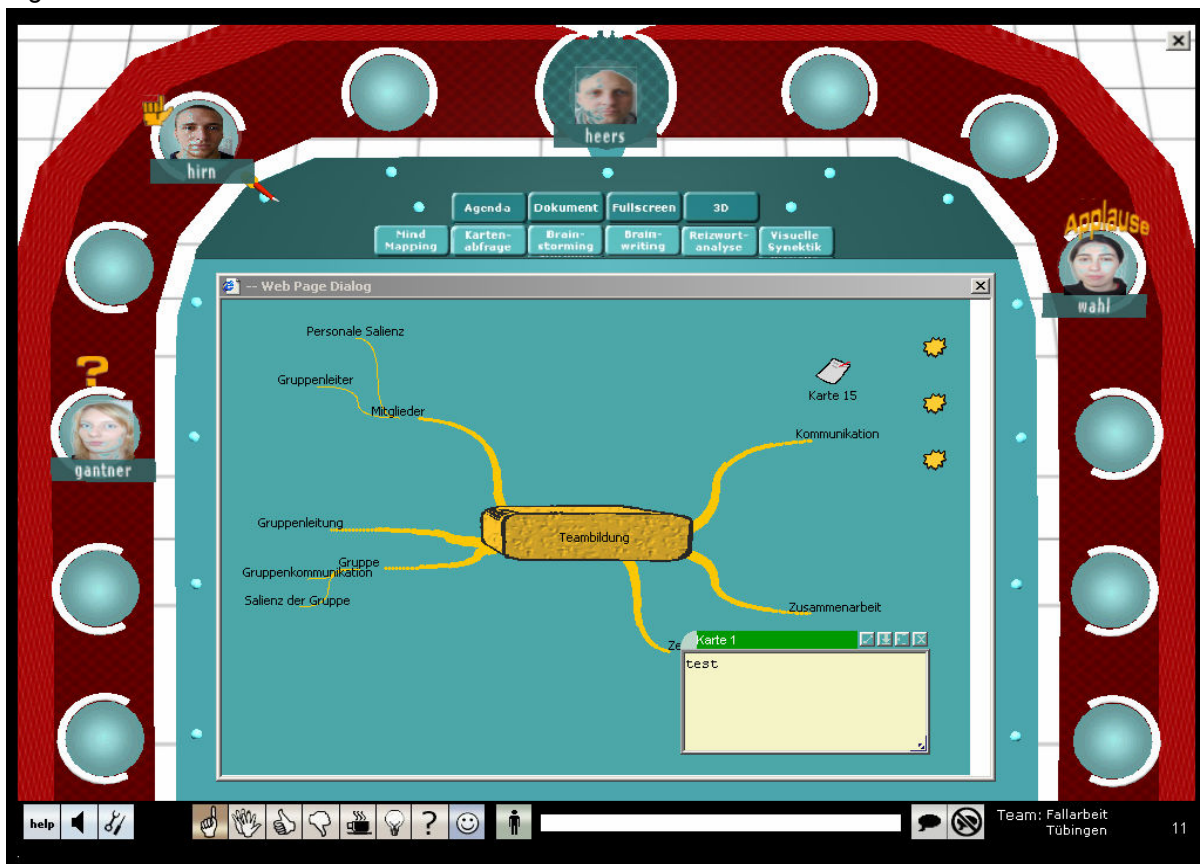
The considerations mentioned above were taken into account when conceptualizing the communication scenario of the project "Moderation VR". The aim of the project Moderation VR is to develop an OCVE, which allows for online learning and online application of moderation and creativity techniques. Integrated into the educational context of participating universities, the use and application of moderation and creativity techniques builds a framework for courses of practical use beyond the

individual's regular study subjects. The OCVE concept of Moderation VR is based on a pedagogical design framework (Lowyck, 2002). The Moderation VR pedagogical design framework integrates especially the *situated learning* perspective (Lave & Wenger, 1991; McLellan, 1996) which comprises cognitive aspects of instructional design to support the individual construction of mental models (West et al., 1991). On one hand, the technological basis of the learning platform is built on a client-server architecture. On the other hand, every normal user needs a Standard PC with Internet access only. Thereby, a browser-based Internet connection is used for all aspects of online communication ensuring that the velocity of interaction is limited only by today's high-speed Internet connection speed. In summary, the OCVE concept in Moderation VR offers a location-independent communication opportunity, with functionalities far beyond video- or computer-conferencing systems and with low technical demands on the user side.

The functions of the learning platform in Moderation VR cover primarily three areas. First, the community platform provides asynchronous communication facilities, offers distributed data mining, supports contacts between participants and enables access to learning modules, as well as the virtual course room. Second, the data mining system provides folders for online file management and is accessible for all participants (thus contributing to a community of practice). Working groups' folders are organized in a data mining system by assigning access rights to participants. Thereby, access to group files is limited to workgroup participants exclusively. Third, apart from the actual workgroups, discussion forums and e-mail lists are implemented and are used by participants and moderators intensely.

The learning modules are built to cover two different aspects. First, in general modules, knowledge and information on creativity and moderation in general is presented. Several facts are integrated in a focused manner to deepen participants' knowledge about the creative process and to deliver results of scientific research on creativity. Second, the technique modules cover a range of creativity techniques like Mind Mapping, Visual Synektics, or Brainstorming. In each module, several examples and practice lessons support a transfer-oriented learning process.

Figure 1: The virtual course room in Moderation VR.



Finally, the virtual course room (Figure 1) offer extensive opportunities for distributed work and informal meetings of student work groups. This virtual course room is supplied with a whiteboard area and a shared application space, in which specifically developed creativity tools (i.e., for mind mapping or brainstorming) or files from other programs might be inserted. A pointer and any changes in this area are equally visible for all participants. Communication among participants is provided via text chat and audio-chat functionalities and a repertoire of gestures. Avatars are allocated to participants individually by providing them with the participant's name or photo. Two interchangeable photos (smiling and neutral) show an overall positive and personal attractive image of each participant. Standardized gestures provide frequent and non-disruptive feedback for the person speaking (i.e., the question mark – „I have a question“; applause/hand-clapping – „acclamation“; hand-raising – „I would like to add something“).

Every group meeting in Moderation VR is attended by a moderator, who is presented at his highlighted position in the center above the working area. He controls the main functions, the group's behavior and communication processes as described above. This moderating function can be exchanged between participants in a flexible manner, if participants are trained in online moderation. The moderator simply leaves his place and another participant takes over his seat and function. The audio-chat facilitates this high-level natural interaction, without requiring special technical skills. The one participant or the moderator, who is currently speaking, gets a microphone-symbol to make it clear to all participants who is speaking at the moment.

All these functions in the virtual course room of Moderation VR support a pleasant work atmosphere, stimulate the group salience positively, and guarantee a constructive interaction between participants. Moderating a synchronous meeting in the virtual course room contributes to positive results by its problem- and solution-oriented focus of cooperation. The virtual course room enhances emphasis on group work and on the overall acceptance of the work groups' results. The online scenario in Moderation VR is characterized as a synchronous communication platform, which requires the integration of technical and organizational aspects. By using its broad interaction and communication possibilities, especially the advantages of computer-supported creativity techniques, the originality and quality of generated ideas (Edwards, 2001) is exploited to their fullest potential in Moderation VR.

Moderation VR – A Sample Communication

The sample conversation provided below will provide in-depth insight on the communication and cooperation scenario in Moderation VR (Figure 2). In this brief conversation several important points become obvious. All participants can communicate not only by using voice-chat but also can use text chat and gestures to improve and to facilitate the communication flow in general. Especially in experienced groups, the moderator will be able to act more and more in the background. Thereby, he can focus more on a structuring of the content provided by participants to prepare it for later discussions. In the Moderation VR communication process, especially gestures allow participants to express a wish for a contribution (e.g. expressing an opinion, raising a question) without interfering with other participants.

Moderator "Paul": Good morning everybody. Welcome to our today's Brainstorming session on the topic "Improving Internal Communication through an Online News Journal". As everybody can see, today we have Christian, Sarah, Thomas, and Andrea in the room. As you already know from previous meetings here in the "Moderation VR" course room, we have a variety of gestures available to support communication effectively. Please use them extensively. Again, we are also able to use voice and text chat. If everybody feels comfortable right now please give me a "thumbs up" gesture. (*Participants respond with a "thumbs up" gesture*).

Participant 1 "Christian" (*showing a "raised finger" gesture*)

Moderator "Paul" (*moves microphone icon to Christian*)

Participant 1 "Christian": I would like to propose, to start with an analysis of our existing paper-based employee journal. From my point of view, we have implemented a good communication platform in the past years. However, I agree we need to reduce costs, enhance timeliness of information, and to include color pictures.

Moderator "Paul" (*opens Brainstorming session, opens card, making public notes on Christian's requirements and proposals*)

Participant 2 "Sarah" (*showing a "raised finger" gesture*)

Participant 1 "Christian" (*moves microphone icon to Sarah*)

Participant 2 "Sarah": In addition, we could use this opportunity to ask employees to contribute more directly to our news jour. E.g. there might be more room for project reports, presenting recent achievements or presenting some detailed information about people's jobs to let everybody understand how they contribute to the business.

Moderator "Paul" (*opens a new card, making public notes on Sarah's suggestions*)

Participant 3 "Thomas" (*showing a "light bulb" gesture*)

Participant 1 "Sarah" (*moves microphone icon to Thomas*)

Participant 3 "Thomas": Last week I got a sample of another internal news journal from a chemical company. They included information on recent research findings and patent filings for their company in it. ... Andrea, you have a question?

Participant 4 "Andrea" (*showing a "question mark" gesture*)

Moderator "Paul" (*opens a new card, making public notes on Thomas's suggestions*)

Participant 3 "Thomas" (*moves microphone icon to Andrea*)

Participant 4 "Andrea": Yes, thank you. Probably we need to think about in further detail, what information several subgroups of our employees already know and what might help them in understanding more details of our business

[...]

Moderator "Paul": Thanks you very much for all your ideas and suggestions. I will prepare a consolidated overview including all of them for you in the next days. For today, I have already seen major progress. Our next meeting is scheduled next Wednesday at the same time. Thank you again and good bye.

All Participants: "Good bye".

Conclusions

New communication opportunities, which arise in the context of a OCVE, contribute to new forms of cooperation and demand a comprehensive consideration of its related technical, as well as organizational features. In particular, restricted feedback as to the participant's awareness and participation demands a high level of both technical expertise and communication competence from the moderator. In applying creativity techniques in the virtual course room of Moderation VR, we developed a scenario, which provides useful and concrete design suggestions to further increase online communication and application of creativity techniques. The concept of the educational system in Moderation VR offers Hypermedia self-training to acquire, broaden or deepen knowledge in Web-based learning modules, in which moderation and creativity techniques and underlying concepts, theory, and actual research results are presented. Transformation of the acquired theoretical knowledge into actual use takes place in a virtual course room. The design of the virtual course room offers a broad range of tools to support online communication and to ensure group productivity. The role of a moderator in virtual meetings is supported efficiently and in detail.

Unfortunately, electronic brainstorming in small groups does not ensure idea quality in every case (Barki & Pinsonneault, 2001). If a work group's focus is the acceptance of generated ideas or overall satisfaction with results, face-to-face settings might be still preferable until now. However, in the OCVE of Moderation VR a strong enhancement of group awareness and social presence is provided through individual representation by avatars inside the virtual course room. Therefore, an effective way to support the participants' commitment and to enhance the acceptance of discussion results is given. Substantial feedback from learners clearly supports the finding that collaboration features implemented in the virtual course room lead to an efficient and pleasant work atmosphere. In using Moderation VR and similar systems, continuous application of OCVEs and accompanying studies will further illuminate possible areas of improvement for synchronous group work in virtual environments and their specific benefits.

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