Exploring effectiveness of team communication: Balancing synchronous and asynchronous communication in design teams

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**EXPLORING EFFECTIVENESS OF TEAM COMMUNICATION:
BALANCING SYNCHRONOUS AND ASYNCHRONOUS
COMMUNICATION IN DESIGN TEAMS**

Dr. Ad den Otter

Department of Architecture, Building and Planning, University of Technology,
Eindhoven, the Netherlands. (a.f.h.j.d.otter@tue.nl).

Professor Stephen Emmitt

Department of Civil Engineering, Technical University of Denmark, Kgs. Lyngby,
DK-2800, Denmark. (se@byg.dtu.dk).

Purpose - Effective teams use a balance of synchronous and asynchronous communication. Team communication is dependent on the communication acts of team members and the ability of managers to facilitate, stimulate and motivate them. Team members from organizations using different information systems tend to have different understanding, opinions, and rates of adoption and skills levels regarding specific IT tools. The purpose of this paper is to explore the effective use of tools for communication in design teams and the strategies for the use of specific tools.

Design/methodology/approach – A review of the potential effectiveness of synchronous and asynchronous communication means and tools for team communication leads to a review of research conducted into the use of two relatively new electronic tools for team communication by design teams in the Netherlands.

Findings – The research results revealed that a collective framework for team communication and collaboration using electronic tools was missing. There was also evidence of a lack of understanding by the users of the proper use of the tools, a lack of training, poor management competences to stimulate proper use. There was also evidence that the rivalry of tools tended to hinder, rather than improve, effectiveness of team communication.

Research limitations/implications – The findings are limited to the cases investigated, however, they tend to support earlier findings into construction team communication. There is a need for a better collective understanding of team communication, which should be supported with training to develop appropriate skills, both for use of new technologies and the use of team rules.

Originality/value - The results provide information and advice for design and project managers concerned with improving communications in design and construction projects.

Keywords – Communication; Design Management; Project Websites; Rivalry of tools, Synchronous and asynchronous communication.

Paper Type - Research paper.

INTRODUCTION

Effectiveness of team communication for the design of buildings is becoming increasingly important due to the growing technical and organizational complexity of construction projects. The development and use of information communication technologies (ICTs) has been seen as one way of improving the performance of design and construction teams (e.g. Love *et al* 2001). ICTs have also become synonymous with the better integration of project participants (e.g. Warning and Wainwright, 2000) and also a means of improving collaborative working; something which is proving to be elusive in practice (Damodaran and Shelbourn, 2006). There is also growing recognition of the need to understand the needs of the individuals and how they communicate within project teams if communication is to be effective (Emmitt and Gorse, 2007).

In multidisciplinary design teams, members come from different organizations, which have different organizational cultures and which also use a variety of information systems. Individuals also have different levels of understanding, opinions, skills and rates of adoption of the available communication tools as well as preferences for specific means of communication (Tuckman, 1977; Robbins, 2001; Gorse, 2002). Effectiveness of design team communication appears to be highly dependent on two inter-related factors. First, the communication acts of team members, their preferences for using specific communication media and access to easy to use tools. Second, the competences of team managers to facilitate, stimulate and motivate their members to communicate effectively as a team.

Effective design teams use a balanced mix of synchronous and asynchronous communication. Balancing use of available communication means might to be made more than once during a design process, depending of the phase of design, the usefulness of high or low interaction and feedback to stimulate design progress and considering risks of miscommunication and failures. Time for design is often limited and team members might run several design projects in different stage of development. Due to the use of the various communication tools, team

communication might become ineffective without clear guidance from management and involvement and commitment from all team members.

Managing collective communication

Collective communication in design teams is dependent on the willingness of all the team members to act and react, to listen and share as well as develop their skills for using communication effectively (Forsyth, 2006). Thus design team communication is most effective when all members contribute using the available communication media in the same way, and as agreed to at the start of the project. Design managers need the means and skills to steer design team communication in the most appropriate way for the team to be effective (Emmitt and Gorse, 2007). Leading and stimulating effective communication is a challenging task. First, the number of electronic tools for design team communication is increasing and therefore both users and managers need to develop specific skills for collective use (Otter, 2005). Second, differences between participants' mother organization's use of electronic information systems and variety of communication practices may create problems with compatibility. Third, differences in opinions and understanding on an individual level, including differences in the use of specific electronic means for team communication (Orlikowski, 1994) and the lack of a collective framework for meaning (Mulder, 2004).

There is a tendency to use new tools because these are advocated by vendors to greatly improve team communication and collaboration; claiming better assimilation of design information in the team, transparency of team communication and improved overview of design information (Otter, 2005). Overview and transparency are essential for design progress and to prevent design failures due to outdated and conflicting information. Research into the collective use of two relatively new electronic team communication tools in design teams, project web (Otter, 2005) and video conferencing (Mulder, 2004) suggests that a collective framework for team communication and collaboration is missing. Such a framework is important because if a new tool for team communication is not used by all members in the correct way, the effectiveness of the team may suffer. This might be caused by differences in rates of adoption by team members (Rogers, 2003) and preferences for using established but still available tools (Otter, 2005). For this reason there is also a need for

discussion and reflection of the team (Reymen, 2001) as being one body (design team members and its team managers together) on the effectiveness of team communication for design progress and the purpose of using specific tools. By demonstrating, training and discussing new collective tools to be used in the team, the potential for effectiveness of the team's communication can be demonstrated. Such an approach might increase the awareness of the whole team to the fact that collective change is needed to increase the effectiveness of team communication in daily work. By stimulating team members to the proper use the new tools for team communication (as collectively agreed to); use might become more effective because team members experience the benefits of sharing their design knowledge. Such an approach needs specific management interventions to achieve these goals. The purpose of this paper is to explore the effective use of tools for communication in design and construction teams and the strategies for achieving effectiveness of team communication using asynchronous means for team communication.

COMMONLY USED COMMUNICATION MEANS IN DESIGN TEAMS

Design team communication can be explained as interactions between a group of senders and receivers using a web of communication flows and available communication means. Communication means can be discriminated to face-to-face means, paper means and electronic tools. The most commonly available means in design teams for face-to-face communication are dialogues and meetings, and at a distance by using postal facilities, telephone, cell phone, tele- and video-conferencing and instant messaging (Kvan, 1998). Team members communicate individually and collectively both synchronous and asynchronous (Davenport, 1997). Synchronously, by using face-to-face means like meetings and dialogues to communicate at the same place and time, and using electronic means for communication like video conferencing and messenger services to communicate at different places at the same time. Members communicate asynchronously by using postal mail and paper delivery services, and using electronic means to communicate at different time and mostly at different places.

Today the most commonly available means in design teams for asynchronous communication are by paper means using paper mail and a project dossier to collect

all project files (documents, sketches, drawings, images and tables) and electronically using email, sms, electronic calendars, protected url's and Project Websites facilitated by the Internet. Figure 1 shows an overview of commonly available means of design teams for synchronous and asynchronous communication, structured by their time and place relationship.

Figure 1. Time / space matrix of commonly available communication means for design teams.

	Same time	Different time
Same place	Dialogues Informal meetings Formal team meetings	File management Bulletin board Paper project dossier
Different place	Telephone Tele conferencing Video conferencing Instant messaging	Postal + interoffice mail Facsimile Computer network Email MS-outlook calendar

(Matrix adopted from Baya, 1995, Milad, 2001)

Synchronous, face-to-face communication, by means of dialogues and team meetings might be used well in early design phases when reaching consensus is on the agenda or discussions are needed for decision making and less design information is made explicit by sketches, drawings and documents. Asynchronous design team communication might be appropriate for effectiveness and design progress when overview, assimilation of design information and exchange, sharing and conveyance of information (Robert, 2005) is on the agenda and for avoiding miscommunication by double or outdated information and design failures. These aspects are essential for progress in teams configured for integral design in which concurrency between design tasks needs to be managed on tuning and overview and sharing of design information by the whole team to prevent misunderstanding and design failures. Using the history log of groupware systems like a Project Website or Lotus Notes might assist team management in showing the team both ineffectiveness and effectiveness in information exchange and sharing (Wiegeraad, 1999).

Properties of synchronous and asynchronous communication

Dialogues and team meetings are the most commonly used form of synchronous communication by design teams. Participants commonly use dialogues during the design process to discuss the design in detail, i.e. the parts of the design one is working on, and to fine-tune each other's design tasks (Kvan, 1997). Team meetings are commonly used to; discuss and understand designers' interpretation of the object to be designed; reach consensus about the design (Dennis, 1998; Robbins, 2001; Robert 2005); fine-tuning the design and exchange of knowledge and experiences (Schön, 1987); review, plan and evaluate progress; advise the client and other key stakeholders, and assist in team building (Emmitt and Gorse, 2007). Daft and Lengel (1984) stated in their media richness theory, based on social presence and face-to-face communication that team meetings and dialogues are highest in richness and electronic communication like email and groupware tools are ranked lowest. Sproull and Kiesler (1991) argued in their studies, based on experiments and empirical research, that synchronous communication is more effective for reaching consensus in a team than asynchronous communication. It might be concluded that dialogues and team meetings should be used when social presence and consensus is required (Dennis, 1998). Similarly, it may be that electronic communication tools are more effective if there is no need to reach consensus, e.g. if information is needed about design progress, and/or design information of participant designers (Robert, 2005).

The means of communication are summarized in Table 1 with reference to their ease of use, feedback, interaction, overview, informal and formal nature and their status. This theoretical mapping allows tentative grading from high to low in terms of their value to a design team. It might be concluded, based on the overview of properties of table 1, that electronic, asynchronous communication tools for collective team communication: video conferencing and Project Website use might add specific values to team communication. However Mulder (2004) found that an important disadvantage of video-conferencing might be the lack of a collective framework for meaning. The challenge appears to be associated with identifying how design team members prefer to communicate within design and construction projects. This requires research into live projects. The effects of Project Website use for team communication and its influence on team performance were investigated.

Table 1: Properties of synchronous and asynchronous means of communication

Means of communication	Ease of use	Feedback	Interaction	Overview	Informal	Formal	Status
Dialogue	x	X	X	-	x	x	x
Group meeting	-	X	x	x	-	x	x
Informal meeting	-	X	X	-	x	-	-
Telephone	X	X	X	-	x	x	x
Facsimile	x	-	-	-	-	x	X
Postal mail	-	-	-	-	-	X	X
Project dossier	x	-	-	x	-	X	x
Email message	X	X	x	-	x	x	-
Messenger service	X	X	X	-	x	-	-
Video conference	x	X	X	x	-	X	x
Outlook calendar	X	-	-	X	-	X	-
Computer network	x	-	-	-	-	x	-
Project Website	X	X	-	X	-	X	X

X = high level, x = average level, - = low level

Ease of use = the interface of the means with the user(s) is simple and easy
 Feedback = direct feedback of the receiver to the sender
 Interaction = immediate repeated feedback between sender and receiver
 Overview = the information collected is complete and can be viewed in total
 Informal = without restrictions or rules
 Formal = with restrictions and rules to follow
 Status = the status of stored information; new, updated, final

METHODOLOGY

A multiple case study approach was used to monitor changes in communication within design teams using a Project Website in a research project in The Netherlands. Data was collected from a large organization, divided into three regional units that dealt with building design and construction projects. In each region a design team using the PWS available in the organization and a team that did not use it were identified, giving six teams. Permission to research their activities in the workplace was sought and granted. Those that did not use the project web functioned as a control team to compare changes in team communication in the other team caused by the use of the project web. Each design team consisted of eight people, including the project leader, and comprised a multi-professional group including architects, engineers and managers. Measurement of design team communication was achieved by investigating the frequency of use of all available means for communication and comparison of results between the pairs of teams. Communication media comprised: face-to-face communication through formal team meetings, design dialogues,

discussion sessions, informal meetings, telephone, facsimile, postal mail, email, outlook agenda, computer network and a Project Website.

Data were gathered from participants through: 1) structured interviews at three junctures; before, during and after the introduction of the project website; 2) by (self-completed check lists of participants about their use of communication means in daily work; 3) monitoring team meetings; 4) analyzing the history log data of PWS use by team members and (5) by analyzing the filing of project paper documents. Changes in team communication and team performance were compared at the same points as the interviews, with the exception of the use of the PWS, which was monitored continuously from the start until adoption effects disappeared.

RESEARCH FINDINGS

At the outset of the research it was assumed that collective use of a Project Website might enhance interaction between team members because of the better overview, status and information about changes and updaters of design information. The findings showed that the project website was not used as prescribed by managers and users experienced fewer benefits than they expected. Only minor changes in team communication were found after the implementation of the Project Website. The new means for team communication was not fully adopted, with the maximum use being five out of eight, which is insufficient for effective team communication. Team members mostly used the internal computer network instead of the Project Website and contacted each other frequently via dialogues, informal contacts, email and telephone, thus circumventing the new tool. Where people were co-located and working in different offices the use of the Website was more frequent, but mostly for copying files from the computer network to the new tool. The computer network file management package was used primarily for design information storage and the Website was used as an electronic information archive. Thus less current information was stored in the Project Website compared to the computer networks and storage was dependant on the occasional copying activities of the team members instead of a routine activity in daily work. Analysis of the project website history log of the viewers of design information in the best performing unit showed that colleagues looked more often at the stored design information compared to the other teams. The

reason may be the re-use of stored information in new projects or checking design information for possible inclusion in a new project.

IT Productivity Paradox

Vendors advocate Project Websites (PWS) as an important tool for design and construction projects because these websites are supposed to greatly enhance team communication. The vendors also claim substantial improvements in terms of time, cost and quality. However, the outcomes of the research indicate evidence of IT productivity paradox, which shows that investments in IT do not always result in higher productivity (Brynjolfsson, 1993, 1998). Moreover, the effective use of IT tools has been shown to vary according to mismanagement of information and the technology (Brynjolfsson, 1993), lacking drivers of technology change (Brockhoff, Chakrabarti and Hauschildt, 1998), and insufficient changes in workflow to use IT effectively (Martinsons, 2002). These studies, however, do not focus on the actual use of PWS by teams in general or by multi-disciplinary design teams in particular. Moreover, they are not concerned with the improvement of productivity as a result of better communication by using a PWS.

Rivalry between PWS use and the IT tools available

Full adoption of a PWS by architectural design teams did not happen and no changes in the use of communication media were found during the research period. Rivalry between PWS use and the IT tools available to the participants appeared during the research period. The use of a Project web could be too prescriptive to be used effectively, because design teams members are creative and visionary individuals with uncertain and equivocal non-routine tasks (Schön 1987). For that reason design teams members might not use PWS for storing information, but will continue using the easier to use shared project file management created in the computer network for storing information. Similarly, they will use the PWS after the event to store/archive information by dragging and dropping files. Such behavior will hinder the optimal use of a PWS. There may also be rivalry between a PWS and other IT tools supporting shared project file management because it is common for the PWS package to be used as a 'jacket' to cover the use of all software already implemented in an organization's computer network. Users are acquainted with the functionality of the present package

and interface, which can cause frustrations and conflicts if PWS has to be used together with, for example, MS-Outlook in a mixed setting.

Second order planning of change

By performing mini cases, involving different organizations in the Dutch construction sector and the offshore industry that use the same and different PWS, the results were subsequently generalized to other design teams in various organizational settings in different sectors. Based on this comparison similarities and differences were identified in collective PWS-adoption affecting team communication and performance. Similarities in outcomes suggest that the findings of the research have a wide application and do not depend on a single organizational setting, management style or culture. The findings of these mini cases lead to the conclusion that the IT productivity paradox as observed in the multiple case studies, is not unique and can also be observed in other firms using project website packages. There are also some differences compared with other sectors. Comparison between design firms and design and construction firms showed that design and construction firms appear to have better results with the adoption of a PWS. Those firms planned change as a second-order change (Levy 1986), redesigned workflow processes to optimize PWS-use and avoided rivalry of tools, tested PWS-users on their PWS-competences, pro-actively used change agents, and reported a bottom-up approach by organizing user meetings to stimulate PWS-use. However, a direct relationship between improvement of team performance and team communication was not found.

In the multiple case studies, the use of a PWS by team members did not change their preference for using dialogues exclusively (Table 1). The majority of the team members and their leaders disliked team meetings. They found the meetings to be inefficient, too often used only to inform, take too long (often more than 2 hours) and were not organized sufficiently well to allow considered discussion of the work and progress. This emphasized the need for the managers to organize and manage meetings more effectively, which supports earlier research (Gorse 2002).

DISCUSSION

Considering the features for effectiveness of the electronic tools it cannot be concluded, as the media richness theory argues, that synchronous communication is more effective than asynchronous media. Hastings (1998) argues that IT tools are more important for team communication if it concerns the communication of facts. Dennis (1998) and Robert (2005) discuss the effectiveness of communication means if conveyance or consensus is needed by the team. They argue that both are needed for effective communication and social presence can be disturbing as well, which is contrary to arguments for media richness (Daft and Lengel, 1984). Groupware tools like a Project Website and an electronic calendar can be very effective when general information has to be provided, progress and overview on activities is needed, for exchange of actual information and facts between design team members needed to execute own tasks and progress and for reasons of status, version, overview and transparency. Video conferencing as a synchronous communication means although being higher ranked in media richness also faces problems for implementation because a collective framework for meaning is missing as found by Mulder (2004). Consequently, today's asynchronous communication of design teams often is a mixture of paper and electronic information exchange. This may change in the future, but it is not expected to change very quickly.

Table 1 illustrates that a lack of overview, and status of available information exists if a project website is not used that increases risks of failures, however teams fail in using the tool collectively as a team in the same way as the research results suggests. Asynchronous means are easier and more convenient to use individually. Thus, a problem for design teams using asynchronous communication means and not using a Project Website package might be ill-structured information storage and updating process that could slow down design progress and adversely affect productivity, caused by badly recorded changes and redundancy of information. In addition, it may increase the number of design errors (and hence costs). Design teams using electronic media and not meeting face-to-face on a regular base might experience some degree of misunderstanding. Video conferencing requires specific management to be effective.

Appropriate and effective use of communication media and tools by all project team members in the same (structured) way can be improved through training, mutual understanding and skills development (Otter, 2005). Thus team meetings and/or workshops are needed to involve and commit all design team members. The results of the research indicate that design team meetings were highly effective to improve the adoption of the Project Website. Although these workshops only took place once instead of repeatedly to assure that the full team adopted the technology, the effects of the workshop show an increase in use and frequency of use that would not have happened otherwise.

Design team management approach

These aspects bring forward the question of how to best manage design team communication. For effective design progress and team performance it is necessary to set goals, tasks and responsibilities. Thus design team members need to both understand and agree to systematic communication based on team rules. This should bring about both individual and collective benefits. Collective adoption of a Project Website by a group might require change promoters, in particular for the stimulation of the collective adoption of a tool by the team, involving team members and more specifically architects and structural engineers in this new type of communication flow. It seems that these team members of whom the architect mostly hold a key position in the team have more difficulties in using a new collective to be used tool like a Project Website than others (Otter, 2005).

The research reported above indicates that team management need to take strategic decisions and local interventions to change from a push to a pull position (Figure 2). This is because the Project Website package does not attract all team members to use it in their daily work. If management interventions are effective in changing the use of the package into a pull position and showing its attractiveness for direct access of design documents, providing overview and status to team members, its use in daily work might influence the communication behavior of team members. Such a position needs to be achieved also because of the rivalry between IT tools. Rivalry of tools combined with insufficient user insight into the use of the tool in their daily work and insufficient changes in workflow leave opportunities open for the development of incongruent technological frames (Orlikowski, 1994) between individuals and groups.

Such frames easily destroy collective thinking about the use of electronic tools for team communication. A top-down approach of management interventions may encourage the development of such frames because prescriptive rules for team members to follow may create resistance among professionals and might disturb team dynamics (Forsyth, 2006). A bottom-up management approach of interventions, involving team members collectively in the change process and making them aware that the tool's features are beneficial in daily work easily can stop high professionals from feeling forced to use a specific technology. Rather, regularly promoting tool features that are beneficial in their daily work may constitute a pull factor and make them wishes to adopt and use the new tool.

Figure 2: Management approaches and push-pull settings

	Push	Pull
Top-down	Users not involved Individual use Tool does not attract a user	Users not involved Individual use Tool does attract a user
Bottom-up	Users involved Collective use Tool does not attract all users	Users involved Collective use Tool does attract all users

CONCLUDING COMMENTS

Balancing team communication is a team effort and it would appear that a bottom-up approach to the management of team communication is required to improve effectiveness. Developing a common understanding of effective communication in the team and using the most appropriate means for the purpose is a fundamental aspect of team performance. The competences of all team members to use both synchronous and asynchronous communication should be at the same level, so that the most effective tools and media can be chosen for a specific context. Team members have to experience the practical and effective use of new communication technologies in their daily work. To reach these goals, face-to-face communication using dialogues, meetings and workshops are necessary. Interaction is needed for common understanding of communication processes and can also function to stimulate the team's social development.

In our review of research we found a paucity of research that has tried to observe communication in live design and construction teams. Research by Gorse (2002), Mulder (2004), den Otter (2005) and Emmitt and Gorse (2007) have collectively demonstrated the need to research how project participants communicate in real life settings. With the increased promotion of collaborative working, partnering and integrated teams that rely on effective and efficient communication there would appear to be an urgent need to better understand interaction within design and construction teams. Further research into the effectiveness of synchronous and asynchronous communication, particularly the balance between management decisions and user requirements, could offer some practical benefits to practitioners. Rivalry of tools is an important characteristic that needs to be recognized and addressed in early team assembly and subsequent team maintenance to mitigate the negative effects and maximize the positive effect on team performance.

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