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Ad den Otter & Stephen Emmitt

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ARTICLE

Design Team Communication and Design Task Complexity

The Preference for Dialogues

Ad den Otter and Stephen Emmitt

Abstract

The way in which dialogues and group meetings affect the progress of multidisciplinary architectural design teams can be easily underestimated by managers. This is due to the importance of group meetings to review designs, share information, make decisions and hence progress the design. The aim of this paper is to discuss how design dialogues and design team meetings facilitate team communication. A review of research into design team communication and performance using a project website provides an insight into how design team members used and changed their synchronous and asynchronous communication while adopting the project web. Case studies were used to investigate changes in communication practices affecting team performance due to project web use. Research findings reveal a preference among design team members for dialogue as their favourite communication medium despite the growing use of asynchronous communication by teams. Results are discussed against research findings from communication in design and management team meetings. Implications for design managers, concerned with improving communications and the management of design, are discussed in the light of the research findings.

■ **Keywords** – Communication tools; design management; design tasks; dialogues; group meetings; synchronous and asynchronous team communication

INTRODUCTION

Architectural design is a collaborative act that relies on effective interaction between project actors and stakeholders. Interaction affects the strength of relationships between the actors and ultimately colours their ability to work together successfully. Teambuilding, the discussion and subsequent sharing of values, resolution of minor differences and conflicts, question asking and the creation of trust between team members are just a few of the factors that are crucial to the smooth running of projects and which are reliant on the ability of the actors to communicate effectively and efficiently. Despite this there appears to be very little evidence of applied research into interpersonal communication in design

and construction teams (Dainty *et al*, 2006; Emmitt and Gorse, 2007).

In a comprehensive review of the communication literature, Gorse (2002) found a paucity of scientific research. The early work by the Tavistock Institute – *Communications in the Building Industry: The Report of a Pilot Study* (Higgin and Jessop, 1965) and *Interdependence and Uncertainty* (Building Industry Communications, 1966) – did not form a catalyst to research into interpersonal communications. Indeed, few researchers have attempted to observe or examine the nature of communication as it happens in live design and construction projects. The exceptions are a small number of doctoral projects (Wallace, 1987; Gameson, 1992; Pietroforte, 1992; Loosemore, 1996; Hugill, 2001; Gorse, 2002; Abadi, 2005; den Otter, 2005) which collectively have helped to emphasize the importance of interpersonal design communication while at the same time highlighting the difficulties of

collecting robust data from live, commercially sensitive design projects. The theme running through this small body of work is the importance of synchronous (face-to-face) communication in developing and realizing architectural design. This is also evident in the doctoral research that has investigated the effectiveness of project web tools to facilitate communication (e.g. Abadi, 2005; den Otter, 2005).

The aim of this paper is to discuss the way in which design dialogues and design team meetings facilitate team communication. A review of research into design team communication and performance using a project website provides an insight into how design team members used and changed their synchronous and asynchronous communication while adopting the project web. Case studies were used to investigate changes in communication practices affecting team performance due to project web use. The research findings reveal a preference among design team members for dialogue as their favourite communication medium despite the growing use of asynchronous communication by teams. The results are discussed against research findings from communication in design and management team meetings. Implications for the management of design by using both dialogues and team meetings to enhance team communication are discussed in the light of the research findings.

COMMUNICATION IN ARCHITECTURAL DESIGN TEAMS

Design teams for architectural projects can be defined as temporary, multidisciplinary and network-based organizations. These groupings of specialist designers (Dainty *et al*, 2006) are managed by one of the design team members, usually the architect or a project manager delegated by the client. A specialist designer can be an individual, independent designer or the representative of a collaborating design organization. They are usually designers with a management task or managers with an additional designing task and can be characterized as creative, visionary, spatially aware and abstract-thinking practitioners with a high level of technical knowledge and experience (Schön, 1987; Lawson, 1994).

As a result of the multidisciplinary aspects of architectural design, the growing number of

participants and increasing legislation and governmental rules, the task complexity of the individual team members is increasing. Members of a design team repeatedly generate new knowledge about the design by collecting, sharing and transforming information. Although team members usually work on design tasks themselves in their design offices, team communication via face-to-face communication is essential to facilitate and stimulate design processes. Thus from the perspective of the design team, specialist design knowledge is usually embedded in the team and needs to be communicated to become useful knowledge for the design to be produced. To distribute generated design knowledge among design team members for the progress of design, they need to process their own specialist data before useful information can be delivered to others. Designers participate in various ways in the team and are depending on each others' output. Many participate as individuals, working alone for crucial periods and then return to the network process (Dainty *et al*, 2006). Thus, team communication of a design team may be defined as the compilation of all processes for sending and receiving messages between team members individually and collectively, using all the available means of communication. Generally, team managers only partly organize synchronous and asynchronous communication as part of their formal duties.

CHARACTERISTICS OF COMMUNICATION INTERACTION

Communication can be defined as a system of interaction between sender and receiver (Schramm, 1957). More specifically, communication is the sharing of meaning to reach a mutual understanding and to gain a response: this involves some form of interaction between a sender and receiver of the message. The creation of meaning between two or more people at its most basic level is an intention to have one's informative intention recognized (Sperber and Wilson, 1986). Informing someone by any action that information is to be disclosed is considered to be an act of communication. In the research-based literature on interpersonal communication there are two dominant themes. The first is concerned with the interaction between two to three individuals via

dialogue (e.g. Newcomb, 1953). The second is concerned with the interaction of three or more people in small groups, via group communication (e.g. Bales, 1950).

Newcomb (1953) developed a model based on empirical research into interaction between two persons in a social environment from a psychological perspective. The ABX model (Figure 1) illustrates the interaction between two communicators (A and B) and their attitude towards a shared object of orientation (X) in their social environment. There is strain towards symmetry in the ABX system as the communicators share their likes and dislikes and move towards some form of understanding. This relationship is present in design dialogues as designers attempt to develop and define the design through understanding, negotiation and discussion of the design concept, ideas and experiences with the aim of reaching some form of equilibrium (Schön, 1987). Such relationships have not been discussed in papers reporting design conversations and interaction behaviour of design team members (e.g. Luck and McDonnell, 2006).

Bales (1950) was instrumental in pioneering work into interactions within small groups. He developed the interaction process analysis (IPA) model to help researchers investigate and better understand face-to-face communication within small groups. Bales' IPA model is used extensively in many fields and has also been used to investigate the interaction of designers and other project stakeholders in architectural projects (e.g. Wallace, 1987; Gameson, 1992; Gorse, 2002). The Bales model is applicable to groups of between three and 15 people, up to a

maximum of 25, which tends to cover the vast majority of meetings that occur during architectural projects.

RICHNESS OF COMMUNICATION

Daft and Lengel (1984) introduced the media-richness theory for processing ambiguous information in an organization or group, based on equivocality and uncertainty of tasks and the use of a variety of media commonly available. Their theory is based on a hierarchy of information richness of the commonly available media using four criteria for ranking:

- availability of instant feedback
- capacity of the medium to transmit multiple cues such as body language, voice tone and inflection
- use of natural language
- personal focus of the medium.

They argued that team performance improves when team members use media with higher information richness for equivocal and uncertain tasks. Using the four criteria of ranking, synchronous communication is ranked higher than asynchronous communication. Thus dialogues and meetings should be the best medium for exchanging meaning and reaching understanding. This tends to be supported by empirical work, which has found that design team members have a clear preference for interpersonal communication through meetings and dialogues (Gorse, 2002; den Otter, 2005).

Face-to-face communication means are rich instruments to communicate design, especially in the early design stages when most of the design is still implicit (and fragmented) in each participant's mind (Nonaka and Takeuchi, 1995). Sketches and images are the most important carriers of the design because they are commonly used to communicate design ideas and concepts (Bates, 2008), although verbal explanation of the symbolic sketches and drawings is needed by its creator to derive the right understanding (Lawson, 1994).

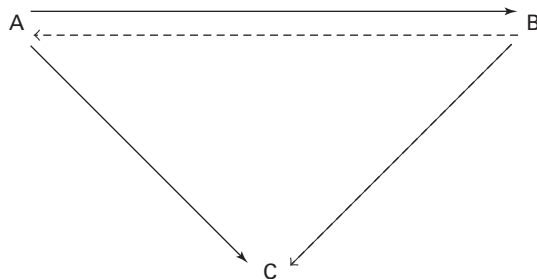


FIGURE 1 The ABX model

(Source: Newcomb, 1953)

TEAM MEETINGS

Team meetings can be used for several reasons. First, these meetings are used for understanding and discussing the designers' interpretation of the product

to be designed and for reaching consensus about the design in progress. Second, they are organized for the tuning of design parts and for the exchange of experiences (Schön, 1987). Third, team meetings allow for the planning, discussing and evaluating of progress and, finally, team meetings are organized to advise the client about the design progress and the latest insights with regard to particular design problems (Emmitt and Gorse, 2007). For these reasons, team meetings are mostly formally organized using an agenda and taking minutes. Usually, a kick-off meeting is planned at the start of the design process to introduce team members and their role and task in the project in relation to project goals, to discuss the design, to exchange experiences and to tune design tasks. Becoming acquainted socially with each other is also important and brainstorm sessions of design teams may be organized to aid this process. Essential aspects of regular team meetings are discussions of progress of the design, design changes and proper closure of design tasks. Team meeting frequency varies during the design project. Usually meetings will be held every two or three weeks; but in the planning phase, especially in the early design stages, the frequency may be higher. Design dialogues are used more frequently, depending on the organizational situation, distances between design organizations and the availability of asynchronous communication tools and skills: individual preferences for use of certain tools also play a role.

DESIGN DIALOGUES

In design dialogues, both sender and receiver are able to communicate directly to each other by use of face-to-face communication, consisting of voice and tone of voice for the messages spoken, and making sketches and images to visualize their spoken message. Body language is also an essential part of dialogues. This differs from team meetings in which more receivers of the message are present and have to take turns in responding and listening to other participants.

A dialogue is used for several reasons. First, it is a very effective tool to discuss design problems related to other's design tasks. Second, dialogue can be used for a better understanding of each other's parts in the design and to fine-tune each other's design tasks specifically for dialogues between the

architect and one of the specialist designers. Third, it can be used for visualizing the design using handmade sketches at the spot and explanatory stories to others. Dialogues can be organized formally; however, informal dialogues also take place spontaneously, for example in corridors and other places (Sproull and Kiesler, 1991). Design dialogue is a means of communication that offers the highest possible exchange of signals, clues and messages (Fiske, 1990) and is usually easy to organize compared with group meetings; potentially it has the highest chance of promoting understanding of the design and its attributes. These features are especially important in the early design phases when most design information is still in the designer's head and needs to be explicitly generated.

RESEARCHING COMMUNICATION INTERACTION

Gorse (2002) investigated and explained the functioning of design team meetings and their effectiveness for team communication. A review of design and construction professionals' use of communication media identified a clear preference for face-to-face communication over other forms, e.g. drawings, e-mails, etc. This was because the participants had the opportunity to ask questions and explore issues in detail. The survey revealed a clear preference for meetings to discuss design development and review progress. This led to a focus on progress meetings to collect interaction data. Data were collected using Bales' IPA model from three consecutive design and management meetings for 10 design and construction projects. The interaction data were then compared with the effectiveness of projects and team leaders. The research revealed a clear link between the efficient management of meetings and team performance. Efficiency was linked to the way in which the meeting was organized and chaired and also to the communication traits of the chairperson.

Communication must be understood within the environment in which communication takes place because the environment will colour interaction (Bales, 1950; Newcomb, 1953; Gorse, 2002). In design and construction projects there are many different phases of interaction between the project participants. The challenge is to be able to collect

data in a scientific manner. One of the biggest challenges to researching communication is associated with access to live projects (Gorse and Emmitt, 2003). This is linked to the type of tools used to collect data. One way around the problem is to design laboratory type experiments that rely on the artificial assembly of project team members. Although the research environment is relatively easy to control, the results are known to differ from research conducted into real project teams and so the results may be misleading. The alternative is to use ethnographic methods. The argument for this type of approach is that the natural, social environment in which the communication takes place is not changed or simulated (Newcomb, 1953; Gold, 1969; Rosen, 1991).

In a review of research methodologies for studying communication in design and construction teams, Gorse and Emmitt (2003) argue for a reductive approach, focusing on a discrete event in a natural setting. This sentiment was echoed in the research methodology adopted for the project reported here.

DESIGN TEAM COMMUNICATION USING A PROJECT WEBSITE

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 were collected from a large real-estate organization, divided into three regional units that dealt with building design and construction projects. In each region, a design team using the project web available in the organization and a team that did not use it were identified, making a total of 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.

RESEARCH METHOD

Measuring the actual use of a project website by design team members is relatively easy and practical

to perform. Actual use of a project web was defined as the daily use of the tool for all design tasks generating electronic output. This use was investigated by measuring the frequency of activities for storing, reading and changing the status and version of documents for all members of the experimental and control group as registered in the project web's history log and by comparison of the outcomes.

Measuring team communication practically is more challenging. It is not restricted to transfer of information, but concerns all activities of information handling needed for the exchange and storing of information through specific channels between persons, individually and collectively. Discrimination between synchronous and asynchronous communication is necessary because of substantial differences in face-to-face information flows using voice, ears and brains compared with information flows at a distance at a different time using a) paper using postal mail channels and paper dossiers for storage and b) electronic communication using IT means for storage.

According to the conceptual framework described, the mixed use of these means of communication is required to improve team communication. Thus, team communication of the selected design teams was investigated by measuring the frequency of using the available means of communication and the information handling activities for collecting, storing, reading, exchanging and maintaining information before, during and after the introduction of the project website. The frequency of the use was identified by asking questions about use, information handling and preferences for using particular means of communication. Finally, effectiveness of the use of a project website for team communication was assessed by measuring changes in the frequency of using other means of communication, affected by project web use.

Synchronous team communication was measured by observing team meetings. Of particular interest during the team meetings were discussions about the use of the project web and solutions to problems caused by its use, and the change to electronic distribution of relevant documents. It was expected that changes in use of means and tools could be observed after the introduction of the project web. For example, instead of distributing paper minutes of meetings and other documents by office mail,

electronic minutes were stored and viewed on the project web. Also, the change of status of documents for electronic filing using the project web may be discussed in team meetings.

Structured interviews were used to gather information on daily time spent on formal and informal communication by team members and teams. No additional accurate measurements about informal communication were executed because, for this purpose, all that was needed was an indication about such spontaneously happening events that occur with a random frequency.

DATA GATHERING AND TRIANGULATION

Data were gathered from multiple sources as explained above. Changes in team communication and team performance were compared at the same points as the interviews, with the exception of the use of the project web, which was monitored continuously from the start until adoption effects disappeared. Data triangulation through convergence of the data assembled was used to formulate valid answers to the multiple case study questions. By comparing the answers generated for each organizational unit, final answers on the case study questions were formulated, corroborating fact extraction (Yin, 1994).

OUTCOMES OF THE RESEARCH

At the outset of the research, it was assumed that collective use of a project website may stimulate interaction and information sharing between team members because of the better overview, status and up-to-date design information provided. The findings showed that the project website was not used as prescribed and users experienced fewer benefits than was expected by management. 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 team members, which is ineffective for team communication. Team members mostly used the internal computer network for daily file storing and updating instead of the project website and contacted each other frequently via dialogues, informal contacts, e-mail and telephone, thus

circumventing the new tool. Thus, less current information was stored and maintained in the project website and such handling did not become a routine activity in daily work. The project website became an information archive containing design information for reuse purposes in new projects.

The outcomes of the multiple case studies clearly showed that the use of a project web by team members hardly changed their common use of means and methods for team communication. This indicates evidence of the so-called IT productivity paradox, which shows that investments in IT do not always result in higher productivity (Brynjolfsson and Hitt, 1998). The new tool showed to be a pushing technology (from management to users) that did not attract use in daily work. Team members did not change habits and preferences for specific means. They did not change their preference for using dialogues exclusively (Table 1).

DISCUSSION: MANAGING DESIGN TEAM COMMUNICATION

The effect of design dialogues and design team meetings on the interaction affecting team communication needs to be better understood. Both media need to be utilized by design team managers to stimulate team performance and help to encourage creativity and collaboration within design groups; this should help with the management of design task complexity and hence help to progress the design. From the research outcomes it was found that dialogues affect team communication, because information richness stimulates individual understanding of the design, which needs to be produced collectively. The outcomes indicate possibilities for the use of dialogues and team meetings by management as instruments to stimulate a team's understanding of the design task(s), thus helping to improve team performance.

Kernan *et al* (1994) indicate that task complexity interacts with information to affect performance only under individual goal setting. Groups were generally unaffected by both information and task complexity. Gorse (2002) found that effective managers used a narrower range of communication acts and communicated less than the managers who were less effective. This would suggest that the use of

TABLE 1 Number of members of a team of eight persons who prefer particular communication means

TYPE OF COMMUNICATION MEANS	UNIT A				UNIT B				UNIT C			
	PREFERRED MEANS 2001		PREFERRED MEANS 2004		PREFERRED MEANS 2001		PREFERRED MEANS 2004		PREFERRED MEANS 2001		PREFERRED MEANS 2004	
	AE	AC	AE	AC	BE	BC	BE	BC	CE	CC	CE	CC
Formal meetings	1	0	0	0	3	0	2	0	2	3	3	5
Dialogues	7	6	6	6	5	6	5	4	6	6	7	5
Informal meetings	1	6	2	2	4	5	5	3	2	4	6	5
Brainstorm sessions	0	0	0	0	1	0	0	0	0	0	0	0
Postal mail	0	1	0	0	0	0	1	0	0	0	0	0
Telephone			0	0	3	2	4	2	0	0	4	7
Facsimile	0	1	0	0	0	1	1	0	0	0	1	1
Outlook e-mail	5	3	0	0	2	0	5	4	2	1	4	6
Outlook calendar	2	0	0	0	0	0	1	0	0	0	0	2
Shared project disk	0	0	0	0	0	0	0	0	0	0	0	0
Project dossier	0	0	0	0	0	0	0	0	0	0	0	0

Source: Otter (2005)

dialogues may be timely and needs to be considered in terms of their effect on team communication and group meetings.

The research reported here found that most team members preferred dialogues because they offered the best control over communication acts. Opportunities for instant feedback is lower in group meetings compared with dialogues, according to the information richness theory of Daft and Lengel (1984), because group members have different preferences for communication, because of group dynamics and finally because group members are not all able to respond at the same time. Use of electronic communication means for dialogues, such as the telephone or mobile phone, although lower in the hierarchy, may fill specific individual communication needs of team members and be effective for team communication as shown in Table 1.

Weaknesses of a team meeting relate to the time required to prepare, attend and subsequently act on the decisions made. Benefits relate to the ability of key project stakeholders to interact and discuss problems, hopefully resulting in decisions that allow the design, and hence the project, to progress smoothly. Benefits of meetings also appear to be related to the ability of the meeting chair to conduct the meeting in a professional manner.

Weaknesses of a dialogue may be its informal nature and the lack of a written record of the outcome

of the interaction. Benefits of dialogues appear to relate to a better mutual understanding of the design problem through face-to-face discussion. The mutually agreed outcome of the dialogue can then be taken into the formal design team meeting, allowing better-informed discussions/arguments. If more members of a team support a solution, the chance of getting the support of the team is higher. For that reason, dialogues can be an important tool for the team leader to establish team members' opinions about design issues and progress as well as other matters related to the social dynamics of the team (Dainty *et al.*, 2006).

Dialogues and design meetings will serve as a 'glue' to maintain the collaborative nature of design teams if used effectively and deliberately by a design manager. Design managers should regard dialogues and group meetings as important instruments for improving team communication and encouraging socio-emotional interaction, with the aim of better understanding the design task. This is especially important in the early design phase when individual team members' design knowledge needs proper assimilation within the team.

By regularly having dialogues with the individual team members, design managers will get a thorough insight into individual design tasks and hence get a better insight into task complexity and interaction. Such information will help them to focus on the most

pressing tasks, to tune differences in design visions of team members and to steer team meetings effectively. Discussing effective interfaces between the various design work packages may be better done in dialogues because of the detailed nature of the discussions. This is especially important for tuning and synchronizing activities in concurrent design teams. In these settings, the design process is divided into specific parts that are worked on concurrently. In such communication environments, dialogues can function better than meetings for avoiding miscommunication, fine-tuning and synchronizing aspects of the design between specialist designers and to resolve sensitive issues related to the effective participation of underperforming team members.

CONCLUSIONS AND RECOMMENDATIONS

Management of interpersonal communication in design teams affects efficiency and performance, as clearly showed by the research results. Design dialogues were the favourite means for interpersonal communication despite the growing use of asynchronous communication. They were favoured because interaction enabled understanding, stimulated sharing of expert design knowledge and encouraged team building, helping actors to complete design tasks effectively. Design team meetings served a complementary function, providing team members with a forum to exchange ideas and reach mutual understanding. However, unlike dialogue, the team meetings were found to be effective only for design communication and efficient (in terms of the duration of the meeting) only when well managed.

Design team managers may encourage the use of dialogues for design knowledge assimilation to adequately fulfil design tasks and hence reach a better understanding of design tasks. Similarly, managers need to encourage interaction in well planned and managed meetings. This is especially important for sharing knowledge, reaching mutual understanding and fine-tuning design in integral design processes with a high concurrency level. Managers should pay attention to efficient time management and information exchange during team meetings. Similarly, managers could use dialogues to gain a better understanding of the team's social

dynamics and design team members' capability to perform tasks in time and to budget, while also achieving the specified design quality. Planning and management of a design team's communication must be grounded in a better understanding of how designers use the communication means (both synchronous and asynchronous) available to them in the workplace, which implies the need for more applied research.

Further research into how design dialogues (with high and low information richness) and group meetings affect team communication, and the effects of using asynchronous communication, will help to provide a better insight into communication effectiveness; this may be beneficial to design knowledge assimilation, task performance and design progress. Additional research could provide design managers with greater knowledge about how contributors to the design process from different backgrounds and environments use the communication means available to them to achieve their objectives. This may help to improve the effectiveness of design teams in carrying out their work.

AUTHOR CONTACT DETAILS

Ad den Otter (corresponding author): Department of Architecture, Building and Planning, University of Technology, PO Box 513, VRT 6.10, 5600MB, Eindhoven, The Netherlands.

Tel: +31 40 247 2367, fax: +31 40 243 8595,

e-mail: a.f.h.j.d.otter@tue.nl

Stephen Emmitt: Department of Civil and Building Engineering, Loughborough University, UK. E-mail:

S.Emmitt@lboro.ac.uk

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