

# **Working in the Zone of Proximal Development**

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## **Abstract**

Open, flexible and technology rich working environments have the last decades become more common in order to facilitate innovations in organisations. Integrated spatial form and technology are supposed to enhance flexible and collaborative work. In addition to the spatial design, this paper focuses on the human and social aspects of working in open and flexible office premises. Analyses of work processes are important during the design process, but also in the organization's actual application of the space. This paper reports on findings from an empirical study of an open space-in-use in a post-design phase. The unit of analysis is the relationship between the intentions behind the spatial design and people's use of the space. Collaborative activities such as project team's use of the technical solutions are taken into consideration. In order to ascribe value from the spatial form and technology, the personal and socio-contextual aspects of the life in space need more priority. Activities that facilitate interactions and communication, creation of boundary objects and community building, are suggested focus areas for the organization. In the paper I see the physical space as a zone of proximal development with a potential to become a collective learning community.

## **Introduction**

Research & Development (R&D) is often described as knowledge work, and capitalizing on the usefulness of human resources is important in knowledge intensive organizations. Open and flexible workspace with integration of technology has become important means for R&D organizations in order to facilitate innovations. The focus has, however, to a large extent been on how Information and Communication Technology (ICT) can be utilised in order to improve information sharing and learning processes, both locally and geographically distributed. There is also an increased interest in how the use of computers can support R&D work and subsequently how architecture as spatial form gives the physical framework for how people interact and work together. Understanding work processes and activities in organizations are also of significance in design and use of open and flexible computing work environment.

There is an acknowledgement among researchers that the relationship between the spatial design of work place and productivity is difficult to measure. However, several case studies indicate interdependency between the way design processes is carried out and the resulting design of the new workplace (Horgen 1997). Also, organizations tend to change during the time of a redesign, building and moving process, so a focus on work processes might be a necessity in any phase of a developmental process. It is not until the people are established in the redesigned work premises that the organization can figure out if the goals of the design process are successfully achieved. The purpose of this paper is to describe the open “space-in-use” after the studied case had gone through a design and moving process. In this post-design phase, the new work premises might be seen as a zone of proximal development.

## **Theoretical framework**

Designers and researchers claim that spatial design might play an important role in facilitating or inhibiting innovation in organizations. Research shows that the spatial structure of buildings itself can influence patterns of interaction in the work environment (Penn, Desyllas, & Vaughan, 1999). Information sharing and creation of new knowledge through social interaction is often of significance for innovations. Workplace designers argue that the structuring of the new offices is compelling people to behave and interact in ways that they otherwise would not. Gladwell (2000) argues that ideas arise as much out of casual conversations as they do out of

formal meetings. He claims, however, that getting people to bump into each other does not just happen from placing them under the same roof. Innovation comes from the interactions of people at a comfortable distance from one another, neither too close nor too far.

In his research, Allen<sup>1</sup> found that the likelihood that any two people will communicate drops dramatically if the distance between their workstation increases; we are four times more likely to communicate with someone who sits six feet away from us as we are with someone who sits sixty feet away. People seated more than seventy-five feet apart hardly talk at all. Some even found it easier to make a phone call and communicate with people outside the immediate proximity in the office than to walk across the room. Allen's study was conducted before the days of digital communication, so the advantage of the technology has worsened these problems (Gladwell, 2000). It is easier to send e-mail than to make a phone call, so the frequency of the walking across the room is assumed to decrease.

According to Gladwell (2000), innovations are fundamentally social because they are results of interactions among people. However, learning and knowledge creation does not take place isolated from interaction; it must be an intrinsic part of the constitution of communities (Lave & Wenger, 1991, Nonaka & Takeuchi, 1995). In addition to physical aspects, aspects of more socio-contextual and personal type<sup>2</sup> are important for interaction in the workspace. The personal context includes people's motivation and expectations to participate in the environment, their prior experience and interests, and their ability to make their own choices. The socio-contextual environment includes collaboration amongst members within each research group or project team, but also incidental interaction between people having their work desk in the open space. Community building in the organization is important in order to facilitate interaction in the space.

The utilization of open and flexible working environments can be analysed by theories developed by Vygotsky and Engeström. Work premises with its physical and technical solutions can be seen as components in Zones of Proximal Development (ZPD). Vygotsky describes the ZPD as the functions that will "mature tomorrow but are currently in an embryonic state". According to Vygotsky (1978), people need to be in a ZPD in order to learn and develop, and Engeström (1999) see this as a potential expansive learning cycle. Components and activities in this zone are, in other words, characterized by their potentiality. Processes of trial and error, and creative problem solving could typically be collaborative activities in the zone of proximal development. Collaborative activities and strategic use of technology

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<sup>1</sup> Thomas Allen is a researcher at MIT that conducted a decade-long study in the sixties and seventies of the way in which engineers communicated in R&D laboratories.

<sup>2</sup> The idea about physical, personal and socio-contextual environment is inspired by Falk & Dierking (2000) *Learning from Museums*.

has a potential to become powerful tools in facilitating innovative work processes in organizations.

Gladwell (2000) argues that a vital community require more than the appropriate physical environment. Physical and technical solutions are only seen as tools to support work processes going on in the organization. It is important that the people in the community have the ability to orchestrate the flow of information and building of trust. Open workspaces do not necessarily result in learning communities or Community of Practice (CoP), even if this is the intention with the design. According to Wenger et al (2002), “a CoP is the source of creation, expanding, and exchange of knowledge, and to develop individual capabilities”. CoPs are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge in this area by regular interaction. People connect and knit social systems together around core knowledge requirements.

By the use of “boundary objects” it is possible to connect or “create knots” between different activities that usually are not connected (Engeström, Engeström & Vähäaho 1999). Wenger (1998 s.105) describes such “boundary objects” as *artefacts, documents, concepts, and other forms of reification around which “communities of practice” can organize their interconnections*. Many forms of connections can enhance “boundary objects”; shared projects between people, but also having people assigned to the role as “knowledge brokers” (Wenger, McDermott & Snyder, 2002). In addition to create knots, activities around “boundary objects” can also function as community building tools. Especially in new organizations, community building is an important aspect.

## **Case and context**

This paper is based on an empirical study of an open workspace in a remodelled Campus building, here called the Z-house, located at a private University in the United States. The Z-house opened in the beginning of the 21<sup>st</sup> century, and is designed to provide facilities for research in use and development of new technology in learning and education, both locally and in collaboration with international partners. The Z-house was designed by one of America’s leading design companies, and integrated technology was the driving force in the design process. Architects and designers strove to build an infrastructure that could support whatever technology developed. The open floor has an industrial design, focusing on the integration of architecture, furniture and technology.

Important elements in the open environment are the design of the infrastructure of technology, prototyping space, furnishing, and other material artefacts. The open

workspace is supposed to be an experimental lab for development of new ideas and technical tools in a collaborative computing environment. The intentions behind the design are to have people and groups using the open space on a more temporary or drop in basis. Today, however, the Z-house's open floor plan functions mostly as office space with permanent workstations. The groups in the community are organized in research teams working on R&D projects. In addition to the 40-50 people who use the open space as their main work base, the facilities also function as work or meeting space for projects, classes and people affiliated with the research community.

Flexibility and availability of technical tools is a carrying idea. The research facilities include wireless technology, server and media authoring tools, and prototyping space on the open floor. The desks are mostly grouped 3-4 desks together, and the dividers between the desks reach about 2 feet above the desks. People can constantly see others when they are sitting on their workstations, and flexible furniture is configured to enhance interaction among the researchers. 8 smaller cubicles with sliding doors, here called "boxes", provide private work or meeting space. The boxes are supposed to be used for people that need a project intensive workspace for a period, or used for work that requires use of videoconference equipment or media tools.

The prototyping space is bigger than the boxes, and is supposed to function as a flexible common workspace. There are 3 sliding doors that can change this open space into one room or two smaller rooms. The sliding doors consist of whiteboards on both sides for prototyping. In addition to the open prototyping space, there are also an "open lounge" and an "open meeting area" on the floor, - both with more "casual" furnishing. According to the consultants from the design firm, these open parts of the space are common area, and are where interactions among people are supposed to happen.

## **Research method**

The research project was carried out in a period of 3 months during the Z-house's first year of operation. Information was collected through the use of ethnographic methods: including observational techniques (both systematic and ethnographic), conversations with people in the community, collecting of relevant textual information ("house-rules" of the space, space plans) and information from official websites (Z-house, project websites, and design firm). The data material also includes 10 one-hour formal interviews with some of the "inhabitants"; including both in-depth (semi-structured) and artefact-based interviewing (interviews focusing on drawings of the space made by the informants). Weekly project team meetings

were observed in order to get a sense of the kind of work going on in the space, but also to see the technology and space in use. Through conversation with consultants from the design firm, I got information about the design intentions behind the space, the results from their “post-occupancy” study and their suggestions for improvements in the space.

This study belongs to an interpretative approach (Erickson, 1986), and the process of making sense of the sources of data is done by iterating between more theoretically motivated notions and “raw” data. The analysis relies on four types of collected data: observation notes, transcripts from interviews, notes from informal discussions, and electronic and paper based documents. Documents and field notes from observations and conversations in the environment are used as background material, while interview transcripts are the main data source. The unit of analysis is the spatial design of the open space in relation to how the people working in this environment choose to utilise it. By using the activity system (Engeström 1999, 1999b), the use of the space is analysed on three levels: individual, group and community.

The fieldwork emphasize how the inhabitants are interacting and working in the open space in relation to the design intentions and the organization’s overall vision. An important aspect is how to ascribe value to the designed spatial solutions from the perspective of the users. The products or delivery of the project work is not taken into consideration in this paper, but how they use the open space and available technology in their work processes, both individually and in collaborative projects. While a study of the results of the R&D work also could be an interesting aspect, it would, however, require a more extended time line than was possible for this project.

## **Findings**

The spatial design, furnishings and wireless technology are supposed to facilitate flexible R&D work in the space. By the use of the activity system, the activities in the space are analysed on three levels: with the individual, project team or community as the subject. Much of the work is individual computer work; people using or developing technology. The work processes also include collaborative project work - both planned and spontaneous meetings - sometimes with the use of technology. In addition to differentiation between individual work and collaborative project work, interaction among the people in Z-house community as a socio-contextual context is in focus. Worth mentioning is that the 40-50 people are affiliated with three different research groups at the University, and the groups have different purpose with their work. Also, the community is a non-homogenous group

of people that consists of faculty, students and staff. The group of people that today uses the workspace is a different group of people than the designed space was intended for.

### **Project work in the space**

Analysing planned project meetings in the framework of the activity system, I find that project teams use available technology as a mediating artefact in order to reach a predefined goal. It seems that the rules and roles are clearly defined in the project teams. Wireless connection and the available technology is something all the interviewed informants said to be useful in project work. People can link their work to websites, and write interactive texts that through projectors can be made available in the meetings. Whiteboard walls and hurdle boards are used frequently in meetings; to make visualizations, draw timelines for projects or to display websites or documents on a projector.

The boards are functioning mostly as a tool to negotiate meaning “in the moment”, and there is also a tendency to use the same whiteboards with sketches from earlier meetings in the project work. It is possible to picture drawings on the boards and transfer them to documents for later flexible use. The projects’ choices of meeting place are often determined by where the whiteboard sketches are, and later use of pictured boards is less frequent. This implies that re-use of the whiteboards were more common than re-use of digital pictures of the boards.

From observing weekly project meetings of two different projects over a time period, the impression is that computer support in meetings seems to facilitate more effective work processes. One project team is using collaboration technology during the project meetings, but also an application for continuous updating and coordination of project activities. Using a digital camera, they systematically picture writings and drawings on the whiteboard walls and hurdle boards. These are transferred to documents or website after the meetings, and sometimes re-used in later meetings. However, the project members cannot concretise *how* these pictured boards are useful. Also, project members that do not participate in creating a certain document have sometimes difficulties in understanding its content when they read them after meetings. These findings show that effective use of collectively created documents to some extent is dependent on ownership to the information and actual participation in the process. Computer support cannot compensate for personal participation.

The other project team is to a lesser extent using collaboration technology during their meetings, and have a more traditional way of carrying out the collaborative work. Usually, one person is taking notes from the meetings, and the team do not focus on creating collectively owned documents. This project is spending more of the meeting time on updates from last meeting and discussing what happened then,

whereas the first team have collectively created reliable documents and could thus spend their meeting time on other activities. Analysing the two projects by the use of the Activity System (Engeström 1999b), the two projects practiced a different set of informal rules and working routines. Also the roles and division of labour among the project members in this latter team seem less equal than the first project. Awareness of the project work as a collectively created and owned process can result in better use of the available technology.

### **Interaction in the space**

Gladwell (2000) argue about the importance of constructing an inviting space where people can hang out; kitchen or lounges where people can sit down and chat. This is especially relevant if the people in the space do not know each other or there is a lack of connections between peoples work. The “open meeting” and “lounge” areas are not frequently used as a place to hang out, nor to enjoy lunch. There is a lack of places suited to sit down and talk informally *without* disrupting other people working at their desks. Moving from one place to another in an open workspace is often perceived as an important element in the interaction with others. Penn et al (1999) also claim that in an open environment, the best sign of *availability* is walking around in the space.

In addition, Gladwell argues about the importance to creating a series of “touchdown” spots in workspace that can trigger people to stop and talk, such as the printer, fax and water cooler. One important factor in the design of workspace is to bring people past other people’s desks in ways that open for potential interactions. Several of the informants said that water cooler chats seldom reach any further than talks about the weather, and they do not want to disrupt people working at their desks without having a relevant purpose. People who are sitting at their desks working at their computers signalize some kind of *unavailability*. In an open environment, it is not possible to “open your door” while you are working in order to signalize that you are available for interaction. In this sense, an open work environment might interestingly enough be perceived as more closed than a row of offices with open doors.

Spatial structure of buildings can influence patterns of interaction in the work environment (Penn, Desyllas, & Vaughan, 1999). The findings show that proximity, an already established professional or social relation, or a need for something, are factors that seem to lead to some kind of interaction between people. The space itself does not seem to initiate interaction as intended by the designers; touchdown space and open hangout areas. These findings support Gladwell’s idea that putting people under the same roof does not necessarily lead to interactions.

## Concluding remarks

There is various use of available technology in the project teams. The findings conclude that efficient use of computer support require an awareness of the *process* itself, not only the delivery of the project. Also, focusing on project work as a *collectively* created and owned work based on equal status in the project group seems to utilize technology in an efficient way. This supports the theory of the physical (such as the flexible meeting space with whiteboards) and technical (camcorder, projector and software) surroundings as a zone of proximal development with a potential to mediate project work *if* the collective work processes, but also the individual's roles and tasks are brought into focus. The conclusion is that the personal and socio-contextual aspects of the work environment are important in order to utilize the spatial design and the technology.

Thus the task of any working space may be to invite to a particular kind of social interaction (the casual and non-threatening) that makes it easy for people who hardly know each other to start talking. If there are no visible connecting points amongst people, it might be necessary to create and use "boundary objects" (Wenger 1998) in order to facilitate interaction. Boundary objects, such as oral presentations, creation of physical artefacts (posters, exhibits), and visualizations of people's work in other ways, can function as triggers for interaction in the space. Focusing on interaction and communication in the workspace are also being seen as community building tools. However, the people need to be motivated and interested in active interacting with others and in the creation of boundary objects, hence understanding the rationale behind such work.

Interactions with others are important for individuals as well as for the information sharing and thrust in the community. Seen from a personal aspect, others in the community can be seen as a mediating artifact that can be useful in their individual work. Focusing on the community as a whole, interactions across the space need to become a rule, either informal or formal, in order to ascribe value to this ZPD. If interactions do not just happen, it is possible to facilitate interactions by integrated focus on the spatial, personal and the socio-contextual aspects - if they are supposed to happen. Also, collective activities such as strategy workshops and anchoring of the vision are important in relation to the further development of both the spatial design itself and the learning community. The new organization in the Z-house's open floor plan is now in the ZPD, and seems to have a great potential to develop if they figure out the direction of their learning process.

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