



## **Workspace Deisgn in an industrial company** Staging the meeting between users and designers

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# **Workspace Design in an industrial company - Staging the meeting between users and designers**

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*The concept of workspace design has been introduced as an alternative to traditional design processes in order to ensure creation of healthy and efficient work places. The concept entails a participatory design process with numerous participants – including OHS consultants and employees – actively involved in the process. The objective of this paper is to demonstrate how such a participatory design process can be viewed as a staged meeting between different communities of practice – with emphasis on employees and designers. This is done by reporting of a case study where the workspace design concept as been applied.*

*Macro-ergonomics, Participatory design, Design game,*

## **1 Introduction**

Ergonomics is seldomly addressed directly in design and re-design of workspaces. Often architects, engineers and other actors design the workspaces with for example spatial, technological or financial considerations thereby making ergonomics a by-product of the design process. The Danish research program ‘Workspace design’ introduces the concept of workspace design as an alternative to traditional design of workplaces. The core of the concept is an inclusion of OHS consultants and employees in the design process with the intent of creating healthy and efficient workplaces through a participatory design process. However, introducing these new groups of actors to the design process give root to several new challenges; like how can the meeting between designers on one hand and employees and OHS consultants on the other be staged, and how can a healthy and rewarding dialogue between the different groups be secured?

The purpose of this paper is to explore these challenges further and demonstrate how the workspace design concept can put ergonomics on the design agenda along side spatial, technological and financial criteria. This is done by reporting from a case study where the workspace design concept has been applied by staging the meeting between employees and designers as a design game.

## **2 The workspace design concept**

As mentioned the ‘workspace design concept’ has been developed as part of a research program named “Workspace Design: Intervention in technological and organizational changes in three sectors”. The research program includes interventions in major changes in three companies belonging to different sectors; industry, health care, and service sector. The purpose of these interventions is to develop and test various approaches and

methods in designing new production systems that are able to sustain healthy and efficient work; one of these approaches being the 'workspace design concept'. The research program is based at the Department of Manufacturing Engineering and Management (IPL) at the Technical University of Denmark (DTU). The research team consists of researchers from IPL and the National Center for Design Research as well as consultants from the Danish Technological Institut and OHS consultants from two occupational health and service units.

The main idea in the research program is to stage technological and organizational changes in companies as a participatory design process with numerous participants actively involved in the design process. In the 'workspace design concept' the workplace and the work practice are regarded as a whole, consisting of for example space, organization, technology and finance. Therefore representatives from all the different groups - that either influence the coming work (architects, engineers, machine suppliers etc.) or is influenced by the work (different groups of employees etc.) - should participate in the design process. Embedded in the concept is the notion that the employees are experts in their own work, therefore the employees' considerations should contribute to the alterations in the workplace. The employees are co-designers of their future workspace along side the professional designers.

The staging and facilitation of a participatory design process requires numerous competences such as insight in the interests and agendas of the different actors, and the ability to create a safe environment for the actors to communicate in. Also the means of communication used in the design process should be considered thoroughly. All actors should feel comfortable communicating their thoughts. Traditionally, technical plans such as AutoCAD drawings and architect plans are used in design processes; however laymen often experience difficulties deciphering these and relating them to their reality. Therefore other, more visually accessible communication tools must be developed to support the design process. In this case study, the layout game - with game board and gaming pieces - formed basis for the jointed design process.

### **3 Co-design in an industrial company**

The case company is an industrial company undergoing a major technological change, going from labour intensive manual work to highly automated production. The company produces coated plastic tubes used in the renovation of pipes and sewers; the production of the coating material entails labour intensive work causing numerous ergonomic problems such as heavy lifting. Furthermore, the production involves manual mixing of chemical components resulting in chemical vapours in the work area. The technological setup of the mixing plant has been changed on several occasions; it now appears as a confusing layout with many haphazard technological solutions. The obsolete layout of the plant in it self causes inefficient work conditions as well as ergonomic problems.

The company had long been aware of the many ergonomic problems in the existing mixing plant and wanted to reform the work conditions and at the same time increase the production capacity by constructing a new mixing plant based on newer, highly automated technology. A project team was appointed consisting of the production manager and two external engineers - a contractor specialized in production systems and a consulting engineer (in this paper these are referred to as the designers). The Workspace Design-Team (WSD-team) intervened in the change process planning the intervention in collaboration with the company management. The intervention was

designed as a series of structured events were the meetings between the employees, the management, and the designers were staged:

1. The work conditions and ergonomics were screened by members of the WSD-team - an OHS consultant and a researcher. Simultaneously, very brief interviews with operators, planners and managers revealed what different people saw as problematic situations or non-utilized opportunities for improvements.
2. Guided by the WSD team the safety representative and operators carried out a workbook session (Horgen et al. 1999) in which they pointed out problem areas as well as what they considered good solutions which should be transferred to the new mixing plant.
3. The WSD team planned and facilitated two workshops - called layout sessions - in which the participants played a design game which focussed on the layout of the new facility.
4. The WSD team planned and facilitated two workshops in which the participants took part in use scenarios in which the work processes in the new production facility were simulated.

This paper will focus on the layout sessions as an example of the staging of the meeting between users and designers.

### *3.1 The layout sessions*

All of the operators employed in the mixing plant, the production manager, the production planner, the safety coordinator, the safety representative, and the two designers participated in the two layout sessions facilitated by the WSD-team. At the beginning of the layout session the consulting engineer briefly presented the technology of the new machine and the two different layout solutions using a 2D CAD plan drawing as illustration, where they believed one of the solutions to be the optimal and ultimate layout of the new mixing plant. After that the main findings of the different workbooks were presented and discussed. These findings for the most part dealt with the ergonomic problems in the existing work place, such as heavy lifting. The OHS consultant from the WSD-team took an active role in this discussion.

The main element of the layout sessions was a design game – more specific a layout game. The WSD-team had prepared the materials for the game in advance, including game boards and gaming pieces. At the first layout session there were two versions of the board corresponding to the two layout proposals. The participants were divided into two groups. The workshop leader made sure that there were representatives from the different actor groups (designers, management, employees and WSD-team) in each workshop group. A member of the WSD-team took the role as facilitator in each group. The game was played without formal game rules. The only instruction the participants received initially was that the purpose of the session was a collaborative design process where all the participants should actively unfold the possibilities and limitations of the layouts together. The facilitator made sure that the game session ran smoothly and assisted the participants when necessary. If the discussion moved away from the game the facilitator intervened reminding the participants, that the discussion should relate to the game and that the game board afterwards should illustrate the discussions the group have had during the session.

The game board consisted of a simplified plan drawing of the existing mixing plan and the adjacent hall where the new mixing machine was placed. Two different versions of the game board were used corresponding to the two different layout solutions. The

gaming pieces consisted of coloured cardboard that the participants could cut out in different shapes. The different colours correlated to different themes such as places (control room, workshop, storage etc.), artefacts, and working procedures. The WSD-team had in advance printed different words on the different coloured cardboard. For example on the orange cardboard there was words relating to places.

During the first session it became clear that neither of the two proposals made by the designers lived up to the expectations of the employees. So it was decided that between the two layout sessions the employees should work on a layout plan for the new plant that would be optimal in their eyes. The WSD-team supplied the employees with materials similar to the ones used at the session, except this time the game board only illustrated existing walls - all the new machine parts were to be placed by the employees.

At the second session the employees' layout plan was used as an inspirational starting point, and formed the basis for a new round of the layout game. This time all the participants worked together on the same layout. They were given game board and gaming pieces similarly to the one the employees had used. The group started by discussing the placement of the machine parts. The employees explained the reasoning behind their layout proposal and the group agreed on using is this layout. Most of the employees' ideas were employed in the new layout solution designed in cooperation between designers, management and employees. However during the session several new ideas came to light and some of the employees' ideas were further developed.

#### **4 Discussion – design game as staging a social learning system**

Using the theoretical framework of Wenger's definition of learning as a social activity (Wenger 2000) the attempt of establishing the layout sessions as a co-design process can be seen as creation of a social learning system consisting of different communities of practice.

In this case study you can view the co-design process a meeting of four different communities of practice: The employees – the coming users of the mixing plant, the management (including the safety coordinator), the designers, and the WSD-team. Such communities of practice has their own perception of competence an their own culture, language, and routines embodied in physical artefacts, tools and stories. For instance; the employees has a sort of 'non-verbal' manner in which they communicate with one another, a lot of the knowledge they posses is not articulated. Furthermore the employees have a certain amount of mistrust to the designers that they see as theoretical and with a know-all attitude. In contrast the designers have a very technical way of communicating using technical phrases and 2D CAD plan drawing. The management is able to understand the designers' means of communication to certain extend. However, in this case the management did not see the necessity - as is often the case - of establishing a dialogue with the employees. Instead the management merely informed the employees of the decisions made by the designers. The WSD-team's knowledge of participatory methods helped staging the meeting between the different groups and developing a common language; the layout game. The inclusion of the OHS consultant in the WSD-team helped integrate the ergonomic considerations in the planning and execution of the intervention.

In Wenger's optic the boundaries of communities is particular important to learning system. Boundaries are areas were perspectives meet and new possibilities and radical new insight arise. When members of a community interacts with another community

they are exposed to a different type of competence resulting in reconfigurations of the relation between experience and competence (Wenger 2000). Such boundary interactions are seen several times in the case study. For example; the designers had – in their own words – optimized the original layout solution according to the piping, and they had in their proposal solely focus on the machine and the pipes not taking the future work in to consideration. At the layout session it became apparent that the employees on the other hand focus on the many different work procedures that are a part of the production such as cleaning, service, testing of the finished material etc. And the members of the safety organization (the safety coordinator and the safety representative) and the OHS consultant (member of the WSD-team) had considerations regarding the ergonomic in the future work practice. As a result the initial layout solutions were rejected, and at the second workshop the new layout was compiled with regard for the considerations of all the participants.

The communication between the different practices is crucial in strengthening the social learning system. Star and Griesemer (1989) have introduced the concept of boundary object, which is object that support the connecting between communities. In the case study the design game personified in the game board served as a boundary object offering a common, visual based, language that allowed the participants to communicate and negotiate across the boundaries.

How radical this experience as affected the participants is hard to predict. However, subsequent interviews with the participants indicate that the management and the employees have learned a great deal in this process. The production manager and the safety coordinator both stated that they would like to use similar methods the next time the company is undergoing major changes. Whether the designers will focus more on ergonomic consideration in their future work and have a more active dialogue with the end-users of their design - the employees - is still an open question.

## **5 Conclusions**

The use of the ‘workspace design’ approach in this specific case study resulted in some very concrete changes in the proposed design layout; the placement of the machine components were altered and some major changes of the building interior, that had not been part of the initial project, was integrated. These changes can be traced back directly to the employees. Subsequently interviews with the involved actors – designers, management and employees – were carried out with the purpose of illuminating the process from the different actors’ point of view. These interviews revealed the significance of the layout design game as a way of staging a meeting between several communities of practise thereby establishing a joint design process and a social learning system. The different communities of practice – employees, designers, OHS consultants etc. - had different requirements for the new design. By involving OHS consultants in the design process along side engineers, employees and management ergonomic considerations were established as design criteria.

The case study illustrates the importance of communication and negotiation between groups. In this case the layout game functioned as a boundary object creating a common, visual-based language. However, I envision that ergonomists could take the role as boundary object/boundary spanners acting as brokers between communities in participatory design processes. I see the ergonomist as particularly suitable for this role because they are able to communicate with different communities of practice and they are familiarly with participatory methods. The ‘workspace design concepts’ presents

new possibilities as well as new challenges for ergonomists. Initially the concepts and methods of the approach must be acquired, but also personal competences required to facilitate participatory design processes must be cultivated before the ergonomist can take a more design-oriented approach.

## **6 Acknowledgements**

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