ERGONOMIC CONTRIBUTION TO ARCHITECTURAL PROGRAMMING IN HEALTHCARE

Christian Martin[1], Jacques Escouteloup[1], Jérôme Grall[1], Elise Ledoux[2], François Daniellou[1]

[1] Laboratoire d'Ergonomie des Systèmes Complexes, Université Victor Segalen Bordeaux 2, France
[2] ASSTSAS, Montréal

Abstract : Ergonomic methodologies are developed to gain upstream influence on the architectural design projects of healthcare systems. Two steps are described : 1) reaction to existing drawings, by means of simulations of future possible activity ; 2) ergonomic contribution to the architectural programming.
Keywords : Healthcare systems, Architectural design, Simulations, Programming.

Working conditions in hospitals or other healthcare services, as well as living conditions for the patients or residents, are closely related to the architectural design of these buildings. Ergonomists have therefore an important role to play in this design.

The evolutions of the contribution of ergonomics to architectural design of hospitals or other healthcare buildings can be described as a continuous attempt to gain upstream influence on the project (Martin et al., 1995, Goumain et al., 1994).

This paper will concentrate on two steps of this evolution : the methods developed by the ergonomists to react to existing drawings; and their possible contribution to architectural programming.

REACTING TO EXISTING DRAWINGS

In many cases, the ergonomist is called once the architects have already designed more or less detailed drawings. These can be sketches, drafted for instance for the architectural contest, preliminary drawings or detailed drawings in a more advanced phase of the project.

When he/she is consulted on this basis, what is at stake is :
- to assess to which extent the planned building will determine the future working and living conditions, and which difficulties are likely to arise both for the workers and for the patients or residents;
- to gain modifications of the features that are found inappropriate.

Starting from methods used in industrial projects (Granath, 1991, Daniellou & Garrigou, 1992, Bellemare et al., 1995), our approach to such cases considers "possible future activity" in the premises that are being designed. This method links two components : an analysis of existing "reference situations" and simulations of possible future activity.

Analyzing current activity in reference situations

The objective of these analyses in existing situations is to spot events and features of work activity that might escape the designers' notice. As stressed by many authors referring to "activity" as a core concept for ergonomics, work is never the mere execution of prescriptions (e.g. De Keyser, 1991, Engeström, 1987). Workers do not only "carry out" their tasks. A number of sources of variability are to be found, and operators have to develop original adjustments and work strategies to cope with them.

The reference situations that are likely to be analyzed are of two kinds :
- the existing departments that are to be restructured, modernized, extended, moved etc.
- work situations in other places, that already use such technologies or organizational structures as are planned in the project.

In the reference situations, the ergonomist aims at detecting sources of variability, and "typical action situations" that the workers have to deal with. Among these "typical actions situations" some are well known by the designers, due to the fact that they are connected to the main tasks, the "core business" of the department. But many others might be neglected. A senior surgeon operates simultaneously in different operating theatres, without going through the anteroom each time; an elderly person dies in his/her room; a truck delivers deep-frozen food to the kitchen; a nurse's aide puts away the dishes after breakfast; a bottle of medicine falls and stains the floor. Have these situations been taken into account when the existing building was designed ?

In the future building too, workers will have to cope with such situations. The conditions of their future activity can be approached through simulations on the drawings.

Simulations of possible future activity

The organization of simulations of future possible activity on the basis of drawings is not a merely technical problem. The ergonomist will have to call together around the drawings or a model a number of operators of different groups, including staff members. The aims and conditions of these simulations must also have been presented to the personnel representatives. A "social construction" of these conditions must therefore take place prior to the simulations.

Typical action situations found in reference situations are used as "seed" for the simulations. The scenarios that will be simulated are based on these observations.

Different outputs can result from the simulation sessions :

- in some cases, the future operation is forecast as satisfying ;
- minor modifications of the design are required, and immediately accepted by the design team ;
- major problems are foreseen. In this case, negotiations between the Client group and the design group will be required.

Simulations may also lead to detecting needs that do not belong to the architectural field: e.g. equipment, organizational problems, training needs.

Fig. 1 sums up the methodology based on analysis of existing situations and simulations of future work.

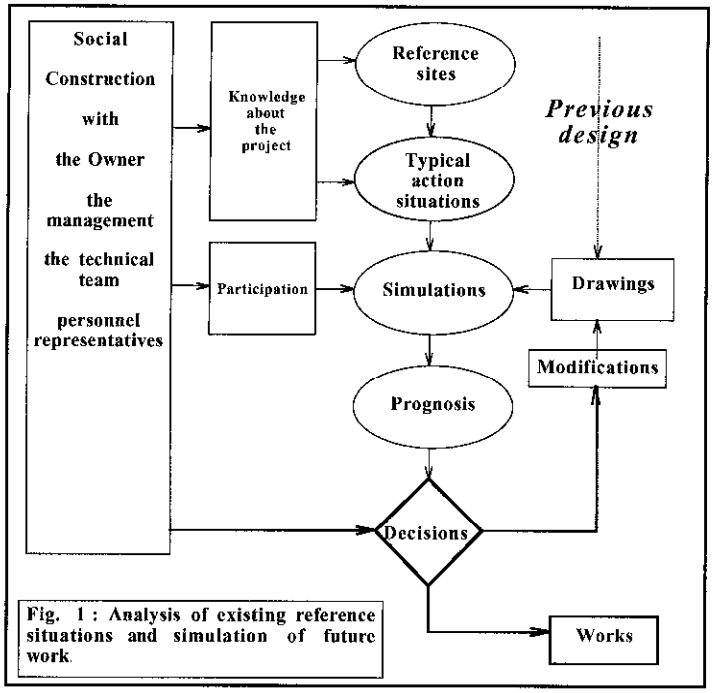

Fig. 1 : Analysis of existing reference situations and simulation of future work.

JOINING IN AT PROGRAMMATION STAGE

Simulations are a very powerful means to detect likely malfunctionings. But they induce a positioning of the ergonomists that is merely "reactive". Could not these typical action situations be used in a more "proactive" way ?

The phase when the objectives of the project are defined involves a number of actors.

• The **Owner group** (i.e. the Client) is not homogeneous. It comprises local, regional, national political decision-makers and financiers, as well as operational top managers (e.g. clinic director). The latter are usually not familiar with the leading of large architectural projects (Escouteloup et al., 1995).

• The **Design group** (often referred to as "the architect" as if this professional worked on his/her own) is made of professional designers, who master the project processes, but who may not be fully interested in the future working conditions of the building users.

• The personnel which is concerned includes many groups. Except for some leading doctors, these are seldom consulted at the early stages, and if such is the case, they may not be given methods to master and influence the design process.

When joining in the project at this stage, in order to take part in the architectural programming, the ergonomist should be aware that **what is at stake is not the building at first**. The Project should not be considered as the erection of a building, but rather as a political will about healthcare services that will be provided to patients by healthcare workers (and others). In many cases, precise architectural programming is required by the Owner group, while their objectives are still quite fuzzy : which kind of services should be offered ? to which categories of patients or residents ? with which personnel ? Vague objectives are most frequent as regards catering, linen processing, waste management policies, etc. But they may even affect the medical and nursing projects.

The first role of the ergonomist is to help the actors define their wills for the future operation of the system, negotiate them and build the necessary compromises before programming the building.

When consulted for the project definition, the main tasks of the ergonomist are following :

• identify the components of the Owner group, and contribute to the clear appointment of an Owner Project Leader who will coordinate the whole project;

• identify other actors who should be associated (e.g. administrative supervision, municipality, medical and non-medical personnel, patients, families, etc.);
• trace the history of the project, its current status, the options that are being considered by different categories of actors (e.g. day hospitalization, local linen processing or subcontracting, etc.);
• analyze reference sites, and **list relevant typical action situations to feed the discussions about major options;**
• contribute to these discussions by developing the advantages and disadvantages of alternative options as regards future work and living conditions. Simulations can sometimes be used for this purpose.

Once an agreement has been reached about the major options for the future services, and only then, it becomes possible to translate them into an architectural program. The ergonomist's contribution can then be twofold:
• he/she can feed the program with information about future work situations and the consequences on required premises, their proximity, accessibility, surface, cleaning facilities, environmental conditions etc.
• but, he/she may also act as an adviser of the Owner Project Leader, to influence the project management. One of the first important issues will be the procedure chosen for selecting the Design team. Alternative procedures may not for instance open the same possibilities for workers' participation in the subsequent stages of the project. This issue is very dependant on national regulations and cultures.

One of the ergonomist roles is to empower the Owner group (seen as the locus of negotiation of political compromises between a number of stake-holders) in their confrontation with the Design group, whose approach is usually mostly technical and/or esthetical.

The aim of the architect selection procedure should not be to select a "fully-designed" project but rather to select a design team which have understood the project fundamentals and are likely to accept interactions during the whole design process. Therefore, the architectural program should not aim at being exhaustive. It should allow the competing architect teams to provide not detailed drawings but sketches. This production makes it possible for the Owner Group to understand the architect teams' working style and willingness to interact with other actors (Barthelot et Wallet, 1996, Ledoux, 2000). Detailed design will then start with the selected team.

The kind of simulations that have been described in the first section of this paper will be used to assess the successive drawings that will be produced by the Design team.

Programming is not only an initial task

Taking part in the definition of the project objectives is an important opportunity for the ergonomists. They should be aware that, from a cognitive point of view, the design process cannot be described as made up of two phases, one of problem setting and one of problem solving. The setting of the objectives cannot be completed without hypotheses about feasible solutions, and the production of solutions will lead to refining the objectives, thus leading to more precise solutions that may again require clarification of the objectives. Therefore, programming is a continuous process, which does not come to an end with the drafting of the original program.

There is a need for organizing continuous interactions between the Owner Group, as described above, and the Design team, which reflect ongoing negotiations between the Will, as expressed by the Owner, and the Feasibility, as described by the designers (Martin, 1998). The Owner Project Leader,

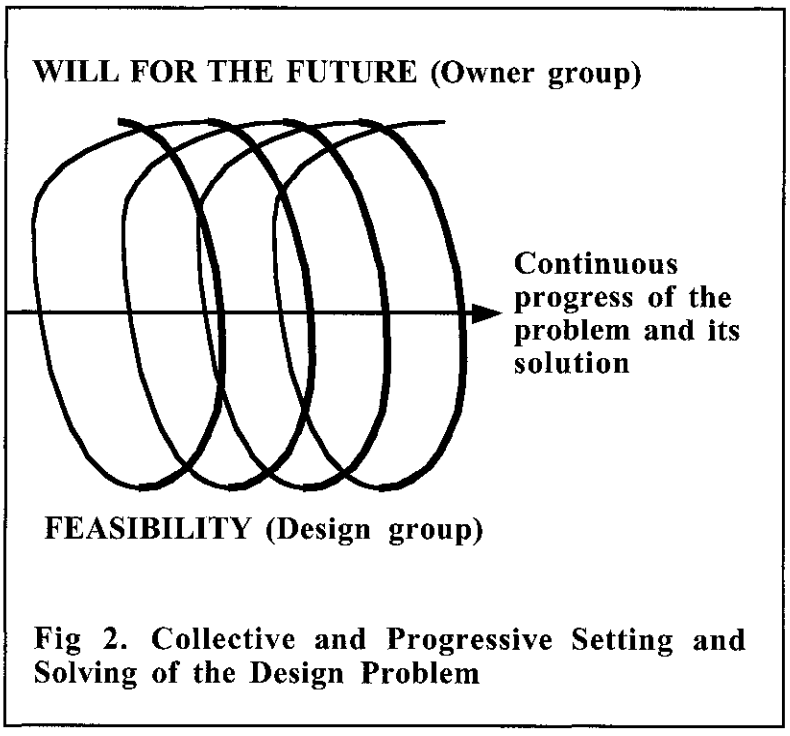

Fig 2. Collective and Progressive Setting and Solving of the Design Problem

advised by the ergonomist, plays a major role in this process and will make the necessary arbitration.

Fig. 2 shows this "meshing" of the processes of problem setting and problem solving.

RESEARCH PERSPECTIVES

The ergonomic methodologies that have been described above call for new research developments in several directions :

• Research about the activity of designers and other actors of the design process (e.g. the Owner Group). Such methods that are used by ergonomists to understand operators' work can be used to understand that of the design process actors (de Terssac & Friedberg, 1996, Martin, 1998, Ledoux, 2000). Better models of that activity will foster the development of ergonomic methodologies that are found acceptable by the ergonomist's partners.

• The upstream movement that is described in this paper, from a reactive position to a more proactive one, can be continued. The next step, (before architectural programming), is the contribution of ergonomists to the design of "Master Plans" or "Leading Plans", the role of which is to anticipate the coherency between future projects. In an hospital, or any healthcare system, a number of projects are led at a time, including medical developments, computerization, new catering services, parking sites, etc. In many cases these different projects are led by different groups, without any coordination between the current projects and those that are somewhere in the files or under consideration. The drafting of a "Master Plan" is a good opportunity to foster debates about future orientations, on the basis of a precise analysis of the existing situations. The ergonomists' contribution to the preparation of "Master Plans" is a challenge for the next years (Martin et al., 1999).

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