Group prerequisites

The aim of collecting group prerequisites was to investigate the structure and the organization of the group during the problem-solving process and to investigate how the group approached the problem in terms of behavioural patterns that may be responsible for producing the observed design representations. It was decided to focus on group interaction processes and to describe these in terms of individual and group behaviour patterns. Consequently, we chose phases of group interactions during the design processes and described them in terms of individual and group behaviour patterns. Another important diagnostic situation was a third computer-simulated problem that was given to the designers as a group.

Whereas the problem-solving activities demand a high degree of goal-analysis and emphasizing of priorities, the group situation necessitates that each individual expresses his or her own ideas and strategies of proceeding. Getting his or her own suggestions accepted is linked to the different characteristics of the individual – mainly, the concept of social competence, which includes several abilities of acting in groups (e.g., the ability to cooperate and the ability to communicate).

The results of the computer simulation were compared with the results of specific periods in the observed design process. The same encoding system was used in both cases, based on the phases of action regulation developed by Dörner (1998). Additionally, socio-emotional behaviour and organizational aspects were categorized.

A summary of the data of the different elements of the initial model – the domains of influencing factors – is given in Table 5.2.

Selected Results

The analysis of the design processes can proceed in different directions. First, attention can be directed to limitations at the organizational level. Second, the different motivational and cognitive processes of the individual, which play an important role during the whole process, can be addressed. Third, forces that have effects on the modes of communication in the group can be investigated.

Table 5.2. Methods for compiling data on the elements of the initial model

Methods	Domains of influencing factors			
	Design process and result	External conditions	Prerequisites of the individual	Prerequisites of the group
Interviews	●	●	●	●
On-line-protocols	●	●	●	●
Diary sheets	●	●	●	●
Marks-on-paper	●		●	
Questionnaires			●	●
Computer-simulated problems			●	●

Following our investigations, we accumulated extensive data on design work that allowed us to analyze several result- and process-related questions. Concerning the role of information transfer in the design process, we have three questions. First, what are the situations in which information transfer has the greatest impact on further processes? Second, which design representation is the most common form of information transfer in these situations? Third, how do specific kinds of information transfer influence further design processes and the final design result, in terms of success and failure? It is in terms of these questions that we present our analysis in the following sections.

When does information transfer have the greatest impact?

The analysis of design work reveals that not every moment is of the same importance for subsequent design activities and for results obtained later. For example, at certain moments we may observe designers sitting at their CAD station adding holes and screws during the embodiment design phase of a component; at other moments they are engaged in deciding on concepts or solution principles. Obviously, we can distinguish between "routine work" and important "critical situations" that determine "choice points" in the process and thus in the whole project. These critical situations underlie the remaining design process in a positive or negative way. Consequently, critical situations are of specific importance to the success of the design process.

Critical situations are therefore of special interest in isolating the main influences on the design process. In order to extract these influences and explain the effect of a critical situation, we developed a submodel of the interdependencies between the influencing factors and the process characteristics for each critical situation (see Figure 5.5). Evidence for each identified relation was gathered separately. Special interviews with the designers, combined with video-feedback of selected critical situations, helped us to revise the submodels.

The sum of the different interrelations in the individual submodels led to a model of relations between influencing factors and process characteristics in all critical situations of the design process. Altogether, 265 critical situations

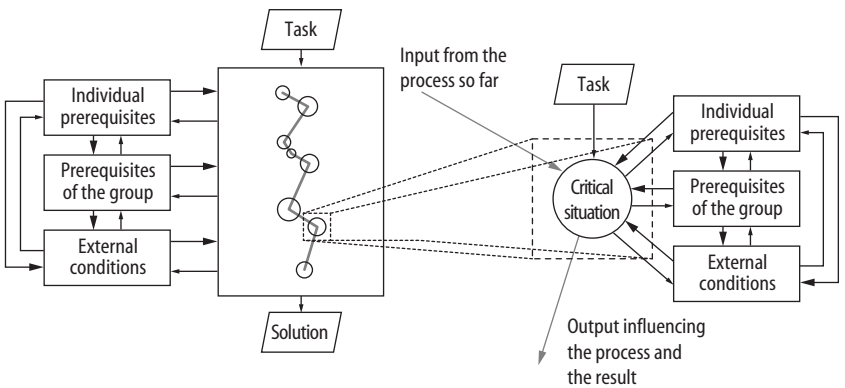

Figure 5.5 Influences on the design process as influences in "critical situations."