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The Design Game in Participatory Design and Design Education - Chances, Risks and Side Effects

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ABSTRACT

In this contribution, the design game as a method in Participatory Design is discussed. The focus lies on the organizational design game. For using the design game *relations of power*, *socio-technical textures* and *forms of work and organization* are treated as concerns that need to be addressed carefully. Cases from student projects are used as illustrating examples; work environments were redesigned and design games played. It turns out that degrees of freedom are present for the choice of (gaming) method as well as the ways of using the selected method. These degrees of freedom should be used in a way that will be labeled as »*interested*«, rather than in a way labeled as »*taking for granted*«. It is not possible to guarantee an interested and beneficial approach; yet the paper argues on the grounds that reflective gaming practice can be supportive in this direction.

Keywords

Design game, organizational design game, relations of power, socio-technical textures, forms of work and organization.

INTRODUCTION

It sometimes appears as though the book "Design at Work", edited by Joan Greenbaum and Morten Kyng and appeared in 1991 [16], has had the status of a universal guide to Participatory Design (PD). The book is extremely popular within the PD community; an indicator is that 12 out of the 23 full papers presented at the Participatory Design Conference 2004 [8] contain at least one reference to this book. It contains, among other things, descriptions of practical procedures typical for the Collective Resource Approach in PD. The procedures and concepts introduced in the book have become widely internationally acknowledged and have increasingly acquired the status of measures beyond dispute. Sometimes, it almost looks as though PD largely becomes equated with the specific PD efforts represented in the book; and the treated methods almost appear as though they can universally and immediately be utilized in any PD project. One of the procedures treated in the book is the *organizational design game* [14]. Here and in other descriptions of this specific frame for design games (cf. especially [13]), the impression can emerge that design games are actually universally appropriate and beneficial in participatory processes of designing computer applications in concrete work environments, thereby re-designing and/or re-organizing workers' work, division of labor and organization. Design games of any kind, including design games of the kind of the organizational design game, can certainly not be universally applicable or appropriate. The same is also true for all PD procedures, including the ones in the book. Yet, the descriptions of the organizational design game provide a frame that leaves ample space to accommodate concrete circumstances. The organizational design game also fits particularly well when the focus is on redesigning work environments, including the design and introduction of IT work means.

In this contribution, the following is elaborated. First, in section 1, it is delimited and described what within the context of the presented argument is referred to as »the« design game and what the design game is supposed to afford. The focus will in fact lie on the organizational design game of the Collective Resource Approach. To prepare and embed illustrating examples along with illustrative statements, a number of games played as part of the design projects in the course "Workspace Design" at the Technical University of Denmark are introduced in section 2. This requires that the setting, content and purpose of the course are first introduced briefly. Subsequently, a set of concerns is presented in section 3, namely the concerns of relations of power, socio-technical textures and forms of work and organization. They are of relevance, on the one hand, for planning and performing design games and, on the other hand, for PD processes in general. The concerns are somehow usually addressed by the actors involved in design gaming. It will be argued that some ways of addressing them are better than others. The possibilities of dealing with these mentioned issues of concern are formulated in the form of polarities. The concerns and ways of dealing with them are illustrated using the design games

performed as part of the project course "Workspace Design". Implications of the results are discussed, and conclusions for conceptualizing and utilizing design games are drawn in section 4.

1. DESIGN GAMES AND THE ORGANIZATIONAL DESIGN GAME OF THE COLLECTIVE RESOURCE APPROACH

The kind of design game to mainly be treated here is the one described under the label "organizational design game" and has extensively been described as part of the repertoire of the so-called "Collective Resource Approach". Proponents of the Collective Resource Approach take an explicitly partial/partisan approach to developing IT work means, favoring and supporting who they assume to be the weakest parties in the societal and local conflicts they assume, usually referred to as "the workers". Important references treating the Collective Resource Approach in PD are e. g. [7,10,12,16,20].

The *organizational design game of the Collective Resource Approach* (sometimes also referred to as "work organization game"; the main texts I am referring to are [7,13,14]) was conceptualized with the purpose of helping the participants understand the current work organization in their settings where the projected computer applications are to be introduced, and of preparing the changes of the settings' work organization in a realistic, appropriate and desirable direction. In order to achieve this, aspects of the current and future work organization are literally played through and acted out. Metaphors from both game and theater are used in the descriptions of how to proceed in the organizational design game. The notion of "game" here is conceptualized as playful, with rules, with the possibility to alter rules in the course of playing, referring to and reminding of aspects of reality, usually without actually being these aspects of reality, playing through "as-if" situations, often social game-playing situations as a means of preparing oneself for real-life situations.

Focusing here on this class of design game has the following reasons:

1. The description of the organizational design game is, in many regards, more open and »generic« in comparison to other design game descriptions. This way, it allows for *several kinds of specific design game exemplars*. This differs from very *specific games* or even sequences of games, as for example the specific sequence of games in [4] or in [18].

2. The organizational design game is a procedure as part of a notion of participation where *end-users*, workers and those, whose work changes as part of introducing the computer application under development, are principally admitted to participate directly. Such a notion stands in contrast to versions of the design game where *other stakeholders,* but not necessarily end-users, participate. For example, in [4], the participating stakeholders include designers, researchers and sales people; who let end-users,

their needs and possible use situations emerge and concretize in their imagination, supported by empirical data on them; the process of imagining is structured through the design game.

3. The organizational design game stands in relation to *many kinds of (IT) work means*. The focus here is on work and work organization, and not on specific work means. This is in difference to versions of the design game that are very specifically geared towards developing a *special kind of computer application*, such as for [4] where the focus is on developing specific products in the area of ubiquitous computing.

4. The organizational design game is actually geared toward the *change of concrete work in concrete organizations*. This stands in difference to versions of the design game that are geared toward *specific IT products* where the *work setting in which they will be used is not concrete*, instead of focusing on concrete work in concrete organizations (for the difference of developing for specific settings vs. developing products for a market cf. [1,15]). [4], for example, focus on product development in the field of ubiquitous computing.

The original function of the organizational design game was embedded in the PD process of the Collective Resource Approach. The game here was geared towards making intelligible and towards expressing the interplay of work organization and tools, with special regard to the projected computer application. Another function of the organizational design game was to project, in the double sense of the word: 1. with the connotation of acting within a planning frame and 2. helping to imagine possible changes, providing an appropriate background, in such a way that these changes are realistic, appropriate and beneficial for those whose work will change. The objectives addressed using the organizational design game originally included (according to [13,14]): (changes in) work, working relations, the overall work organization, the division of labor in the organization and the cooperation in the work process. This was supposed to happen by utilizing the knowledge, experiences and creativity of the participants.

For different possible varieties of the organizational design game and ways of playing them, no concrete cookbook-like directions are given. The authors rather indicate that many possibilities exist and a choice should be made that fits to the respective work environment. Examples they refer to in their texts are "capentrypoly", the "Organizational Design Kit", the "Desktop Publishing Game" and a fictitious "Future Game" for organizing work at a locomotive repair shop. The set of artifacts around which the organizational design game revolves seem to mostly resemble board games. The game elements then typically symbolize constituents of work and its organization, e. g. the spatial layout of the work environment in the form of the game board; machines, tools, materials and products as bricks; and events and responsibilities as cards.

A part of the design game group usually prepares the game. This group in the examples in [13] and [14] seems to always have included the authors of the contributions. Here, the power of defining relevant conditions for others on the side of those who invent, prepare and set up a first version of the concrete game is high: they define categories for capturing and expressing work organization. In the articles, such categories are, for example: work tasks, materials, tools, responsibilities, roles, commitments, problems and breakdown situations. Such categories are then translated and captured in the form of a concrete game. There are always many different possibilities to translate the categories into game manifestations. Yet, the choice aspects regarding the used categories and their translation into game elements are not treated in the papers.[1] Of course, the power of defining the game can and has been distributed amongst different participant groups as well - e. g. by involving them in preparing or supplementing PD measures, such as the future workshop (cf. [7]). The resulting specific organizational design games can incorporate diverse elements, such as a "playground", e. g. with functions, materials and tools, actor/player scripts, e. g. expressing their responsibilities, cards, that e. g. remind participants of typical breakdown situations, and rules. The descriptions of examples of the organizational design game in [13] and [14] contain two important phases in playing the game: the first phase serves to assess and express the current work organization; the second phase serves to explore and delineate future possibilities for the work organization.

According to the authors, the language used as part of the organizational design game has to be one with which the participants are familiar from their everyday work practices. Furthermore, the procedure was devised so that the participants should enjoy participating. The organizational design game is seen by the authors of the referenced introductory texts as a more viable alternative compared to using the system specifications common in Software Engineering, including such notations as JSD, SA/SD or ISAC.[2] One of the experiences the authors report of their attempts to use the conventional specification approaches is that the workers/participants did not understand the formal notation, became bored and/or did not enjoy working with them and, hence, could not utilize their own experiences and ideas to contribute to the process while being confronted with the notations.

The design game has not only played an important role for the participatory design of computer applications; comparable activities of playing things through and thereby using »low-tech« artifacts, as part of participation in design, has been a common practice in diverse areas, including architecture, urban and regional planning, production planning, citizen participation, grassroots approaches, organizational restructuring and consulting. The labels vary and include "simulations" and "planning game".

2. DESIGN GAMES FOR REDESIGNING WORK ENVIRONMENTS - AND IN WORKSPACE DESIGN COURSES

The teaching program in product development "Design and Innovation" at the Technical University of Denmark (cf. [9]) was established in 2002. Each year about sixty new students are admitted into the program. The overall program comprises a 3-year undergraduate part and a subsequent 2-year master part.[3] Each semester, a substantial part of the students' activities and learning occurs in a project course. In these project courses, students work on real life (re-) design tasks; the problems to be worked on have become issues in organizations (business enterprises and non-commercial organizations) that participate in the course as providers of design tasks with engaged contact persons. In the fourth semester project course "Workspace Design", the student projects all have the purpose of (re-) designing work environments. Students work in teams of ca. six students. Their task consists of understanding the work settings and making well-founded suggestions for (re-) designing them along the dimensions that turn out to be relevant, including space aspects, organizational aspects, economic aspects, artifacts and technologies in use, particularly the used work means.[4]

The students' project work typically includes several semester weeks with at least one day of ethnographic work to understand the respective settings, identify aspects that would benefit from re-design, and elaborate re-design suggestions. The students are encouraged to collaboratively inquire and design together with actors in the settings as much as possible. One of the methods they are encouraged to use here after their initial hypothetical problem formulations is the design game. In the spring semester 2005, eight student project groups were formed, six of which carried out design games.[5] These project groups,

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[1] [3] provides useful concepts, insights and suggestions for dealing with this power of definition when using highly formalized procedures.

[2] These were notations often used when the mentioned articles on the organizational design game were written. Today, a comparable and wide-spread notation system is UML, cf. [22,23].

[3] In Denmark it is common to finish one's studies with a master's or comparable degree; bachelor's degrees are not perceived as full degrees.

[4] Again, here, the tasks are real-life tasks that have emerged and have to be worked on within real-life settings within organizations. A description of the course "Workspace Design" has been published by [5].

[5] One group, the *scaffolding work group*, decided to not play a design game that the members already had prepared;

their target work environments, their task and problem formulation, the design game carried out and the proposed re-design solutions are now sketched. Aspects of the students' projects and the design games played are referred to later in the text.

The *pharmaceutical production unit group* conducted their project in a unit of a pharmaceutical company where rechargeable pens for patients who need to self-inject a particular substance on a daily basis were produced. The task was to re-design the work environment so that filling, stapling, transporting and storing boxes with spray-cast plastic parts was less straining for the musculoskeletal system than when the group initially entered the company. The problems identified by the group included that, 1. workers had to perform turning movements with the boxes, which was rather straining; 2. stapling the boxes on pallets included physically straining movements above the shoulder and 3. space in transport and storage was wasted because boxes could not entirely be filled due to the weight restrictions of boxes carried by the workers. The group had practitioners in the production unit play two design games. The first game was played with casting operators. Problems identified by the group so far were written on playing cards and had to be supplemented and prioritized by the players. Inspiration cards were additionally used to provoke discussion, critique and new ideas. For balancing the discussion and avoiding solution directions where well-functioning aspects were changed, rounds in which players formulated approval and positive aspects were taken. The project manager, an operator and a machine technician participated in the second design game. The student group members presented elements of their solution ideas, always immediately followed by intense discussion. The final re-design suggestion comprised a new production hall layout, a palletizing machine, filling devices for the boxes, a gripping device and a gripping robot.

The target organization of the *supermarket group* was one particular store of a supermarket chain in an upper middle class residential area. The supermarket wanted to attract more customers. After their ethnographic work, the students' line of argument was that more customers could be attracted if customer satisfaction could be enhanced. This could, in their view, be achieved by enhancing customer service from the side of the service workers in the store. The design game consisted of having service personnel in the store prioritize aspects of customer service that had been pinpointed in a customer survey the students had conducted. The game was played in several one-by-one situations comprising a service worker and a student who asked questions. The student group's re-design suggestion consisted of an action plan geared towards creating

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the description of their project work is nevertheless included.

sensitivity, competence and incentives regarding customer service.

The organizations with which the *first aid training dummy group* collaborated included, on the one hand, a manufacturer of supplies for first aid courses. On the other hand, the group collaborated with first aid trainers and with representatives of one of their umbrella organizations. The device in focus was a first aid instruction dummy: a plastic human-size doll where first aid activities such as mouth-to-mouth resuscitation could be demonstrated and practiced. The task to be tackled was to improve the bag for wrapping and transporting the dummy between first aid course supply storage rooms and the course facilities. Lifting and carrying the dummy bag put rather high physical strain on the first aid trainers. The design game the group elaborated and had actors play was a double prioritization game that had to be played in two phases. In the first phase, players were to arrange game bricks (all of equal size) on which potentially problematic aspects were written. They were placed on a triangular game board. This way, players were forced on finding a clear order of the importance of challenges. Players could also add new challenges during the whole game, also in the course of the second phase. In the second phase, the problematic topics to be addressed and improved could be written on bricks of different sizes and arranged on a round game board. The larger the brick the more dedication needed for this problem. The problems with high priority for all players were related to lifting and bearing the dummy. The proposed solution included a stackable scalable backpack that could be transformed into a trolley with retractable wheels; the wheels facilitated transporting the trolley up and down stairs.

The *package sorting and transportation group* carried out their project in an organization responsible for shipping packages. The problems they were encouraged to work on occurred in a package sorting and transport unit. The problems to be tackled were related to packages that were heavy and/or bulky. Workers handled them manually, i. e. they almost habitually lifted and carried weight higher than the allowed upper limit. Two design games were played. The first game was based on a booklet with photos the students had taken of work situations and processes they somehow found typical, characteristic or interesting. They had tried to capture the whole spectrum of work in the unit on their photos. Workers in individual sessions had to point out where problems and where good practices - related to aspects such as work routines, machines, solutions - existed. The second design game was played in a group of workers with one student as game facilitator, one student as co-participant and one student who took notes. It consisted of three parts. In the first part, identified problems were sorted and prioritized. In the second part, causes of the highest prioritized problems were explored. In the third part, solution ideas for the high-priority problems were generated. The students' redesign proposal was a largely automated system for lifting, sorting, stapling and

transporting packages, operated by the workers now lifting the packages.

The *surgery mask group* collaborated with a manufacturer of hospital supplies and devices. The manufacturer had recently newly marketed a disposable laryngeal mask. Laryngeal masks warrant patients' respiration under surgery with narcosis, and, at the same time prevent air from entering the gastro-intestinal system which could result in patients vomiting in the course of the surgery. The project group's target work environment was in a hospital where these disposable masks already had been in use for a while. Within the hospital the group focused on the work of such nurses and assistant nurses involved in anesthesia and who worked with the masks. It turned out that the disposable masks required much storage space and that the personnel was required to unpack the sterilized masks and store a number of them locally on their wards. In the design game the participants were invited to prioritize aspects around the mask and its use. The aspects were written on game bricks. The students had compiled 25 of such aspects which could be supplemented by the players as part of playing the game. In a first round, the prioritization was done in several situations where only one nurse, or other hospital personnel, played the game individually, with at least one student present as game facilitator. In a second round, the game was played by a group comprising nurses, assistant nurses and a senior physician who all worked with the disposable masks. They were instructed to take turns. Players could add a brick or move a brick already set by another player. In the latter case, a good reason had to be given. Additionally, the game was played by a physician who worked in the development department of the mask supplier. The students always asked about the reasons for the prioritization favored. The solutions proposed by the students were modes of packaging that required less space than the existing packaging. The most comprehensive solution was a mask dispenser to be put up on the wall of the operating theater. The group expected this solution to enforce a very far-reaching re-organization of work processes and responsibilities.

The *anesthesia nurse group* carried out their project in a hospital with focus on the work of anesthesia nurses. They delimited their task as contributing to the improvement of the nurses' work so that it became less prone to hazard, was more ordered and manageable, and was characterized by an extended sense of influence and codetermination. Two design games were administered. The first design game built on the use of a disposable camera. Each anesthesia nurse was invited to take up to three photos each of positive and negative events in their work. For each photograph, a sheet of paper was to be used for writing a short description of what the photo displayed. These photos and descriptions were planned to be used in a discussion round to generate improvement ideas. The students had expected the camera and the description forms to be visibly put on a table or in another accessible spot within the nurses' area. But both

camera and forms disappeared into a cabinet and were only used for a few pictures. The second design game was carried out later in the design process: nurses and other actors involved in anesthesia were to choose, evaluate, discuss and agree on groupings and color codes of tubes, in- and outlets and cords of devices in use. The proposed solutions included injection devices pre-filled with drugs, prepared and sterilized by the manufacturer, and a color code system for tubes, in- and outlets and cords.

The *scaffolding work group* collaborated with several actors in the scaffolding branch, namely within a number of scaffolding firms, the work security consulting organization, a local union club and the employer organization. The task they identified was to improve the working conditions, particularly with regard to heavy horizontal and vertical transport and the associated movements when assembling and removing the scaffolds, for example, moving the parts from and to the transport vehicle. Doing this, the group members wanted to take into account the harsh competition between the scaffolding firms, the harsh tone amongst the workers, and the dominant piece-rate payment system. The planned design game especially included that different actors were provided the possibility to articulate their views on aspects of the scaffolding work. This was planned to comprise a confrontation between the actors' different views and provide the opportunity to engage in discussions and constructive dialogue toward solutions. As a solution concept, the group presented a semi-automated system for collecting and stapling scaffold parts, and moving them from and to the transport vehicle. The game was not played because it was not possible to have the players to participate, partly due to the piece-rate system and to other commitments of potential players who were not scaffolding workers.[6]

3. ISSUES OF CONCERN AROUND THE ORGANIZATIONAL DESIGN GAME

In the following, the issues of *dealing with relations of power*, *socio-technical textures* and concrete *forms of work and organization* are presented and treated. It will be made plausible why it is worth addressing and reflecting on them when planning, playing and drawing consequences of a participatory design game. The issues are introduced, each highlighting specific relations of chances and challenges that have to be dealt with. Options for dealing with them are expressed using the polarity of *interested* vs. *taking for granted*. The label "interested" is used to indicate openness, an inquiring attitude, the awareness that neutrality and a comprehensive overview are never possible and that therefore a partial/partisan approach cannot be avoided, the

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[6] The described student projects may seem small, overly harmless and of little influence. Yet, they are suitable for elaborating - and learning - what in larger, more important and more influential projects could cause considerable problems.

willingness to challenge things as they are if they turn out not to be beneficial yet can be re-shaped, and not excluding explosive developments. The label "taking for granted" is used to indicate an attitude of knowing instead of curiosity, assuming without inquiring, following the ideal of neutrality and comprehensiveness, and executing what is assumed to be right and necessary. Examples from the projects of the "Workspace Design" course are given.[7]

3.1 Dealing with relations of power

Preparing a design game, playing it and utilizing its results happen in concrete work environments. These concrete work environments are a part of a larger societal environment with its conflicts and relations of power. At the same time, the possibilities elaborated in concrete local work environments can impact society at large. If actors in local work environments have different, maybe conflicting, backgrounds, perspectives, interests etc., then it is to be explored how a good interplay of the actors can be achieved. Within the field of PD, this problem has been discussed, and particularly proponents of the Collective Resource Approach have proposed to explicitly and responsibly deal with differences, power relations and conflicts between interest groups, on a societal and local level. One concrete measure proposed by proponents of this approach consists in temporarily separating interest groups while carrying out PD procedures such as the organizational design game.

In the Collective Resource Approach, it is not only assumed that different interest groups are present but that relations of power, conflict, struggle and submission exist between uneven parties. In the light of this assumption, it makes sense that Collective Resource Approach proponents propose to separate the weak and the strong parties from each other, so that the strong parties cannot dominate the situation, exert their power of shaping and defining topics, functionality, meaning, relevant work/life conditions etc., for example, by means of their abilities and experiences such as rhetorical skills. In such a view, it is »the right thing to do« to strengthen the weak party (cf. e. g. [6], p. 147, 149, 151).[8] In texts of the Collective Resource Approach, the different interest groups are usually presented in the form of polarities, capital vs. labor, the management vs. the immediate executing workers, the designers vs. the users/workers. Conflicts and power differences between different groups of workers are also sometimes mentioned - e. g. "between skilled and unskilled workers, between men and women, between workers organized in different trade unions" ([11], p. 46). A problematic variety of dealing with differences in interest, and specifically with relations of power, though, is to just assume that particular groups of actors exist and act in a certain way, instead of exploring, who specifically acts and shapes things locally and societally mediated according to which specific interest.[9][10]

In any case, dealing with local/societal relations of power means acting within delicate constellations when proposing, preparing, playing and post-processing a design game. An *interested* variety includes developing a "view from somewhere" ([17,25]), a conscious and partial (partisan) attitude toward constellations of power, their history, their future potentials for change, one's own possibilities and limits in possible change processes, maybe together with allies. In the students' design games, for example, the *surgery mask group* became very much aware of the power difference between the senior physician and the developer-physician on the one hand, and the nurses and assistant nurses on the other. The group had the actors first play the design game individually and then in a group, supported by rules that assigned equal influence on the development of the game to each player. In the group playing situation, the senior physician mentioned his possibility to overrule any nurse's decision after a nurse had expressed disagreement with one of his statements. The *first aid training dummy group* could see implications of the competition of dummy manufacturers for the working conditions of first aid trainers. The *scaffolding work group* explored the constellations of power and competition in their dialogue with work security consultants, union representatives and a variety of members of several scaffolding firms.

A variety of *taking for granted* here would mean accepting and affirming the existing relations of power by declaring them as natural or neutral, or not taking them into account, assigning them the status of "marginal conditions" etc. In the students' design games, for example, the meaning of automated solutions with regard to power of workers was not addressed in the *pharmaceutical production unit group* and the *package sorting and transportation group*; the *supermarket group* developed their solution in tight collaboration with a group manager without reflecting the implications of this tight collaboration and other potential options. The danger is that such use of the design game helps cement power relations even if they are dysfunctional, and hence that beneficial changes cannot happen within the restrictions of the existing power structure.

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[7] The game was one element in each group's larger approach. Sometimes, the comments necessarily refer to the larger approach of the respective group in which the use of the design game was embedded.

[8] Separating interest groups would also relieve the game facilitator from having to immediately deal with issues of interest and power.

[9] For the problems of identifying and determining interest groups, and the dangers of perpetuating inappropriate notions regarding interests and interest groups cf. [26,27,28].

[10] Further conceptualizations of interest, power and conflict exist but are not addressed here.

3.2 Dealing with socio-technical textures

Work largely takes place within socio-technical textures consisting of artifacts, meanings and references; examples are transport systems and networked computers together with programs and additional devices, within concrete organizational structures and handled by concrete humans for concrete tasks. (This has been captured by concepts such as "infrastructures", cf. [19,24].) The socio-technical textures, as well as the artifacts within them, often provide particular main use possibilities along with specific, local, maybe individual use possibilities and interpretive space. Artifacts and socio-technical textures can also serve to enforce far-reaching exclusion of individuals or societal groups. Trips out of New York City or to the shore are difficult for the poorer class New Yorkers. On the one hand, they often can not afford cars. On the other hand, mass transportation was not helpful because the busses were too big for the bridges out of the city. This has been a classic example (cf. [29]). One feature of many pervasive socio-technical textures is that they are virtually black boxes most of the time for most of the people who use them: the concrete mode of functioning is largely not known to the bulk of users; understanding the way of functioning is not trivial; they are too intricate to easily be understood; and to utilize them it is not important to know how they actually work. In this way, most users of the web have at best a very rudimentary understanding of the underlying client-server structure; most drivers know little about how a car or a traffic system works; and the bulk of the population, even in western countries, does not really know what electricity is. The very presence of socio-technical textures is not something people usually are aware of, at least as long as the textures function as expected. If they suddenly stop to function orderly, they can be appreciated as crucial, but in the negative sense of as problematic in their deficiency; often, only then they actually become noticed. A power blackout makes the people affected aware of their dependency on electricity and when the public transportation system or the backbones of computer networks collapse, threatening situations can result. A bank, for example, would be considered as reaching a dysfunctional state when its central data system is disrupted and data exchange with other banks is not possible for more than three days. In such a case, state authorities would intervene to protect the state's finance system.

If one attempts to add or change elements or functionality, for example in the form of a new computer application, the existing socio-technical textures can appear to provide insurmountable barriers. A new element can initially cause intense friction, maybe even breakdown. In such typical situations, new elements must be adjusted and integrated, maybe the whole arrangement needs to be modified, minimally or far-reaching, when the new element is introduced or in the course of its attempted use.

Typically, important socio-technical textures were developed by humans over longer historical periods; sediments evolve and overlay each other. The older sediments are, on the one hand, contained in the present texture and can, on the other hand, have become modified in their meaning and functionality with new constituents. Bank mainframe computers, for example, used to be the only bank computers. Today, these computers, along with an extended operating system, sometimes assume the role of the core of the bank's IT system complying to the highest security standards required for the administration of the bank accounts. Hospital equipment may be complemented by additional devices over time, hence, be complemented, extended and/or fundamentally modified in their very functionality, as the *anesthesia nurse group* reports.

Larger socio-technical textures contain a multiplicity of constituents and meanings, multiply interlinked. The constituents and meanings can be disparate, are not necessarily entirely compatible mutually; and the concrete textures with their interlinked structures are not only somehow conglomerates of heterogeneous constituents but may »contain«, or objectify, disparities, even in the form of contradictions. The resulting functionality is hence often heterogeneous, full of disparity and contradiction, and provides degrees of freedom for integrating, further developing and harnessing it. Contradictions can, particularly, »invite« attempts of re-design. The relations of degrees of freedom and restrictions regarding re-design and re-organization are always specific for the respective socio-material textures.

It is important to take into account the comprehensiveness, pervasiveness, historicity and multiply interlinked structure, the always specific relations of degrees of freedom and restrictions - in an *interested* way. This means, for example, being curious, sensitive, inquiring and experimenting with regard to the specific functionality of socio-technical textures, their inherent tendency to include or exclude societal groups or groups of workers, their specific heterogeneous constituents, their specifically interlinked artifacts and meanings, their specific history, their specific potential for further development. The role of an interested change agent includes an appreciation of how delicate the conditions regarding one's own influence on existing and partially well-functioning socio-technical textures can be. In this way, the *pharmaceutical production unit group* engaged in cycles of expanding, differentiating and delimiting their problem space in dialogues with several groups and individuals with different perspectives, representing diverse units, functions and objectives. It became obvious for the group that textures and their interlinking structures were differentiated and that the descriptions and actual phenomena, as perceived by the group members, contained contradictions. Additionally, the group members experienced that in the course of their project work the textures and the related problems developed further, partly independent of the students' activities, partly impacted by the students, utilizing and partially integrating their preliminary insights and ideas.

The group did not only elicit problematic aspects of the work environment but also well-functioning aspects - in order to not suggest solution directions where functioning aspects were replaced by aspects whose functioning would have to be shown. The *first aid training dummy group* realized that different suppliers' disparate views had to somehow be integrated; that the experiences reported by the first aid course provider umbrella organization representatives and the first aid trainers, again, required new ways of conceptualizing the relevant problems; and that the same shift in perception, conceptualization and design directions was required when first aid course participants became visible in the process. The *surgery mask group* asked game players to give reasons for their prioritization of objectives. This way, they did not take one way of interpreting the lists for granted but were aware of the multiplicity of meaning, signification and interpretation around the mask, working with the mask and the conditions in which the work occurred. Similarly, the *anesthesia nurse group* encouraged the nurses to describe and hence contextualize the contents of the photos they had taken, and hence were open and inquiring regarding the meaning of the captured incidents in relation to the constituents of the nurses' work environment in which the recorded incidents had occurred.

One variety of *taking for granted* socio-technical textures can be characterized as permanent black-boxing. All specific qualities then appear normal, natural or to emerge out of an immanent dynamic that does not need special attention. A new element appears to either fit or not fit; the interpretation of the role of a change agent is the role of one who simply replaces and/or adds elements and functionality. The *package sorting and transportation group*, for example, only looked at the work in the unit, black-boxing everything else as »context« that did not need to be regarded. In fact, we and they cannot know whether the selected unit and problems provided the appropriate focus for improvement.[11] The members of the *anesthesia nurse group*, even though they provided possibilities of (re-) constructing context and meaning around the incidents captured on the nurses' photos were not aware of the fact that incidents could maybe not immediately be captured on photographs. The group invited the nurses to take photos of positive and problematic incidents. But an event that is relevant could already be over before a photo is taken. If the event was unique, it then can no longer be captured; events only have a good chance to be captured on a photo, if they recur. And in the case of a recurring relevant event, the nurse would have to be ready to take a photo - which would not necessarily fit into the textures of nurses' work, where e. g. everybody is physically and psychologically absorbed handling patients, devices, medication etc.

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[11] We will always have a rest of uncertainty, and it may turn out to be decisive - or not.

3.3 Dealing with concrete forms of work and organization

In the past years, new approaches to work and organization have been enforced in many of the so-called western societies (e. g. [2,21]). This has been related to processes of globalization and deregulation. Formerly present extensive systems of societal protection and support of workforce members have increasingly been disestablished. Enterprises have used strategies to minimize their entrepreneurial risk, for example by shifting it via outsourcing to self-contained units or by making internal groups or individuals accountable. »Normal« workers increasingly find themselves in a situation where they have to directly take on responsibilities formerly done by the top management and/or owners of enterprises and/or state agencies. In many cases, the accordingly changed approaches to work and organization take the form of newly established organizations. In other cases, already existing organizations are re-structured and their approaches to work changed. In any case, the concrete forms of work and organization have been diverse. Under the current developments, it is well possible that they become even further differentiated and that it, hence, increasingly becomes necessary to really look at the concrete work and the concrete organizations in which it is done. Dimensions, along which concrete work and organization can differ, are, for example:

- the size of the organization: from small to large,
- the employment status: from short-term freelance work to long-term contracts,
- the extent to which a horizontal division of labor is present: from clear and stable organizational units to diversity and change in groupings,
- the extent to which a vertical division of labor is present: from clear and stable hierarchies to diversity and change in roles,
- the degree to which the organization serves as a buffer between individual workers and the market: from strong to weak or even enforcing market forces within the organization,
- the role unions play: from unionized to not unionized or a situation where unions are inappropriate and
- the degree to which interest groups can be represented and their issues negotiated: from structures of representation in formalized bodies to transient negotiation constellations.

Taking into account the diversity and local specificity of forms of work and organization for the design game in an *interested way* includes inquiring into the actual features of the work and organization at hand. The *scaffolding work group*, for example, carefully scrutinized the phenomenon of the piece-rate system in the scaffolding branch, also in its local historical dimension and its interplay with other topics, mainly related to the ergonomy of working practices. Moreover, the possible impact and role of the inquiries and design attempts have to be contextualized in the concrete kinds of work and organization. The *surgery mask group*, for example, was very conscious of the

importance of how far-reaching and delicate a change in work and organization after a possible introduction of their mask dispenser solution in the operating theater could be.

The variety of dealing with concrete forms of work and organization of *taking for granted* when using the design game can take the forms of mistakenly assuming certain features of work and organization that are not present or seemingly neutrally notice the existing form of work or organization, without taking into account possible meanings, implications, historical changes and development potentials. The *supermarket group* was not sensitive to the differences between full-time permanent and part-time temporary staff when trying to activate staff involving them into conceptualizing service improvement programs. The *first aid training dummy group* neither inquired into nor challenged the broader working conditions of first-aid course trainers: these were self-employed, and the work organization included that they individually had to pick up and return the dummies. The *anesthesia nurse group* had not expected that the concrete work of the nurses included that their time and space was so limited that the disposable camera and description sheets could not be put visibly on a table or shelf, but was instead locked in a cabinet hence out of sight and not used. The variety of *taking for granted* can also mean not being aware of the meaning and potential impact of one's own change impulses. The groups that suggested automated solutions, i. e. the *pharmaceutical production unit group* and the *package sorting and transportation group* did not explore possible local consequences of automation, re-organization and rationalization.

4. DISCUSSION, CONCLUSIONS, OUTLOOK

In this contribution, in a form very open towards taking many individual shapes, corresponding with the conditions at hand, and in a form where end-users can easily be involved, the design game has been treated. This corresponds with the kind of design game frame students in the "Workspace Design" course were provided with. Even in this form, the design game is not a PD procedure that is automatically beneficial or appropriate. Instead, risks are present. One of them is that *relations of power* are not adequately taken into account, so that the design game either becomes a catalyst of such power relations or that it does not bring about any effect because it misses the conditions at hand. Another danger is to focus on aspects of the present *socio-technical textures* that are not relevant. And a third danger is to miss the realities of the *concrete kind of work and organization* at hand.

Certainly, the issues addressed in this contribution are not the only relevant issues to be dealt with when using the design game - or other procedures - in a PD process. Further concerns that have not been treated here also need to be dealt with appropriately and beneficially. One important example is dealing with the *power of defining exerted in parallel to formalizing* when preparing, playing and post-processing a design game. The power attached to

knowledge and possibilities of using formal notations can be related to presenting statements or proposing solutions - but also to conceptualizing a design game: On the one hand, in the references to the organizational design game the game is proposed as alternative to formal notations. But, on the other hand, the design game is usually itself a highly formalized objectification of, possibly debatable, assumptions regarding technology, work and organization.[12] Another important example of an issue to be dealt with when using the design game is the concrete *interplay of practices of research and design, and further work practices*. Such design or research specialists, for example, who are used to presenting the first version of a possible solution or to prepare games, exert far-reaching power in the participant group, with the danger that they largely define the course of the project and the shape of its results without giving all group members a chance to contribute with their experiences, categorizations and problem formulations.

In some cases, whether the design game as procedure itself actually fits needs to be decided. The *scaffolding work group*, for example, chose not to use the design game they actually had prepared after having explored the possibilities of involving scaffolding workers under piece-work conditions and after having learned that it would not be possible to have members of other relevant groups play the game together.

One complication related to the examples elaborated here is that there is an important addition to design, research and other kinds of work: the activities and relations of institutionalized learning and teaching. An important example of the implications is that the instructors and students act in a space where the instructors can grant or restrict chances, e. g. via student evaluations, while students are trying to succeed in a competitive institutional system as preparation for a competitive labor market. This is, of course, also related to the issue of dealing with relations of power.

Part of the chances of using design games in design education as referred to in this paper lie in their potentials to demonstrate chances and risks of using gaming and other PD techniques. What in relatively small education projects can be experienced on a small-scale level could become substantial factors of success or drawback if practiced on a larger scale in professional design projects.

For the description, assessment and critique of procedures, methods and approaches in PD, such as the design game, it is essential that one is explicit about the specific approach, method, procedure, measure and objective addressed. This provides the chance that assumptions, for example pertaining to the target groups, target use environments or

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[12] Here, the insights presented in [3] are, again, highly relevant.

target use situations can be identified and, building on this, the specific qualities can be assessed. As a consequence, well-founded decisions can be taken what kind of measure is to be utilized in the specific situation at hand, how the degrees of freedom granted can be used, whether or which modifications need to be made etc. (For this way of inquiring cf. [26,27,28].)

This contribution has been doubly exemplifying: on the one hand, the design game is treated as one kind of procedure within PD; on the other hand, the described concrete design games carried out in the "Workspace Design" project course are exemplars of the design game. It can be expected that the issues, chances and challenges can similarly be formulated and are similarly relevant for other design game exemplars and for other PD procedures. Concrete statements and examples of this kind remain to be prepared as part of future practice and research. Solutions might not always be easy to find - the reflections in this paper are thought to contribute to good PD practice.

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