

Organizational simulation: issues for ergonomics and for teaching of ergonomics' action

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Abstract. Activity-centered ergonomics has developed an approach to provide support for design projects which incorporates ergonomics work analysis, participatory design and simulation of work. As the approach has been initially developed and used in relation to technical and industrial design, there is nowadays an ongoing interest to apply it specifically to organizational design. In this communication, we examine the requirements for participating to organizational design settings and consequently the issues regarding the methods to be developed by ergonomics to support effectively organizational design project.

Keywords. Simulation, organizational design, teaching, ergonomics.

1. Introduction

It is a common idea to consider that ergonomics is mature enough to address organizational design issues (Carayon & Smith, 2000), i.e. that the “organization” has to be considered as an “object” of design, just as technical artifacts or products. This focus is becoming even more important in a context in which various alternative models of work organization are emerging (Lean management, telework...) and in which organizations are frequently moving (Carayon & Smith 2000). Consequently, ergonomics practitioners (academics, counseling, company ergonomics...) have to take responsibility for addressing these strategic issues for companies and institutions, as well as for the development of our discipline (Dul & Neuman, 2009). This implies “*considerable changes*” in ergonomics research, education and practices (Dul & Neuman, 2009). Our communication takes place in this perspective as we propose to relate a three years’ experience of teaching organizational design to students and practitioners engaged in a master thesis program in ergonomics.

Teaching organizational design imposes to make clear the specifics contributions of ergonomics to organization design (compared to organizational and management science for instance) and what specific methodologies (technical and social) have to be developed to investigate among various organizational choices. Relating this experience imposes to precise the various models we are referring to, and that will be described in the following: (1) the Activity-Centered Ergonomics approach and its related design project management approach (Daniellou; 2007; Daniellou, 2005; Daniellou & Rabardel, 2005; Garriguou et al., 1995) that grounded our training program; (2) the model of work organization we refer to, in relation to Social Regulation Theory (SRT) (e.g. de Terssac, 2003); and (3) the

theory of action (Schön, 1983) that strongly influence our teaching settings. Combining this theoretical ground with a 3 years experience in training organizational design, we point out requirements to teach organizational simulation to ergonomics' practitioners.

2. Theoretical framework to approach organizational design

2.1 Approach of ergonomics and design project management

Our approach and the teaching program in which we are involved are strongly grounded in Activity-Centered Ergonomics (ACE), which puts an emphasis on regulation of a goal-oriented activity effectively performed by operators in a work situation (Daniellou, 2005; Daniellou & Rabardel, 2005) that is socially determined (by decision makers, designers, prescribers of work in general...) and in which the activity takes place within an area defined by a set of prescriptions (tasks to be carried out, organizational structure (staff allocation, contracts, timetables, rules ...) (Guerin et al., 2006).

In this perspective, ergonomics' academics and practitioners have developed, for thirty years, a specific approach to provide support for design projects. This approach incorporates ergonomics work analysis (based on activity and work situation analysis), participatory design and simulation of work (e.g. Garriguou et al., 1995; Daniellou, 2007; Barcellini et al., 2014). This approach is intended to cope with perils of a poor integration of real-world work in design project (delays, overspending, difficulties encountered by operators, difficulties in reaching targets...) (e.g. Barcellini et al., 2014 for a synthesis). For ACE, the finality of design projects has less to do with the characteristics of the artifacts involved (products, tools, working spaces, workstations, organization etc.) as with the *work situations* in which these artifacts are present.

Three main iterative phases structure the approach of design project management developed by ACE : analyze, simulate and support (Figure 2). The *analyze phase* is intended to construct knowledge about the project and work in the real world in order to: (1) enrich project decision making process by means of trade-offs between the different dimensions of performance (human, technical, organizational, economics...), the connection between them, and health issues; and (2) elaborated models of situations to support the simulation of what could be a future activity given the "new" work situation being elaborated. The *simulating phase* is intended both to assess and enrich the proposals of designers and to develop the activities of stakeholders involved in a constructive way (Barcellini et al., 2014). This phase supposes a careful design of the situation of simulation, in terms of participation of actors and resources supporting the projection of a potential activity in a new work situation (scenarios of actions, scenario of prescription, material support, avatar for incarnation of future activity (Van Belleghem, 2012) (see section 3). Finally, the *supporting phase* aims at "converting the try" of simulations and at following the progress of the project (by proposing other simulations following the evolution of the designed artifacts for instance).

As the approach has been initially developed and used in relation to technical and industrial design, there is nowadays an ongoing interest to apply it specifically to organizational design.

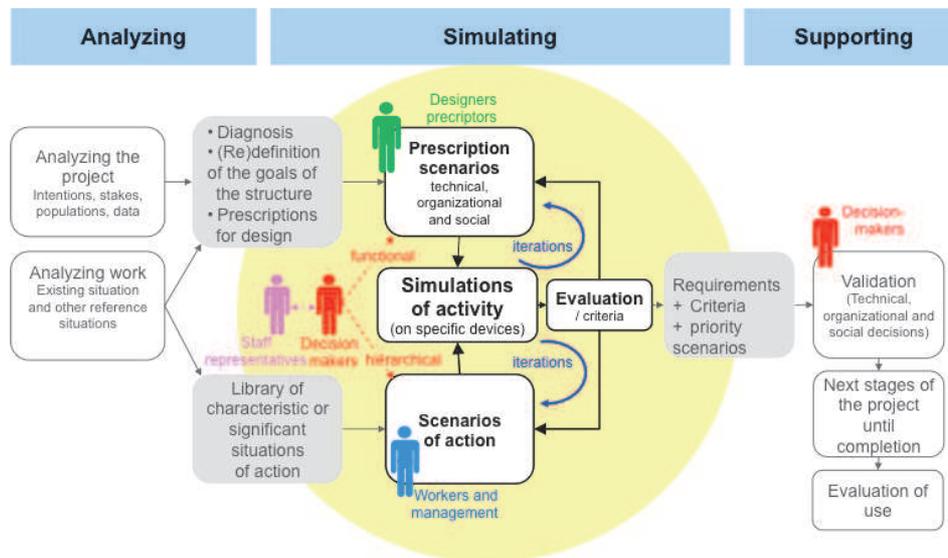


Figure 2. (Updated) approach to project management, as proposed by activity ergonomics (from Barcellini, Van Belleghem & Daniellou, 2014)

2.2 Regulation, “organization of work” and “organization work”

Classically, organization is thought in terms of: (1) hierarchical structure and rules to be followed in order to reach objectives defined by the company (Arnoud & Falzon, 2014); (2) strict separation of design functions (planning work) and operational functions (executing work). Beside this view, ACE frequently refers to Social Regulation Theory (de Terssac, 2003), to help in understand combination between activity and organization.

This theory stresses gaps existing between (Figure 3): (1) *control rules*, i.e. a set of formal rules aiming at controlling actors (schedule, hierarchical structure, coordination rules, performance criteria...) which refer to a prescribed –theoretical *organization of work*; and (2) “*autonomous*” rules, i.e. informal rules that are elaborated in actions through social interactions in order for actors to cope with control rules often incomplete, inconsistent and implicit (Moison, 1994). Real-world work is seen as an *organization work* (“*Off the cuff*” regulation) to answer to managerial short-comings. *Actual rules* that are mobilized in action are thus resulting from a compromise between control and autonomous rules. Those actual rules may enriched control ones, by a mechanism called “*Cold state*” regulation, i.e. an elaboration of rules mechanisms performed “outside” and after the actions, but only under some circumstances, in particular if some spaces of debate about organization are allowed by organization of work (Petit & Coutarel, to appear).

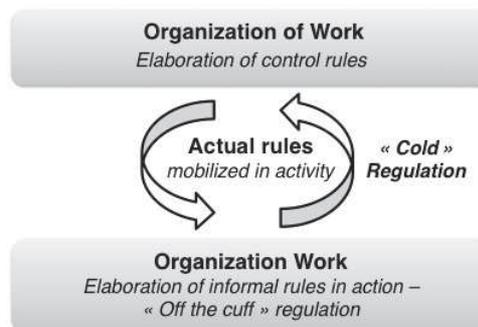


Figure 3 Combination of organization of work and organizing in activity

Transformation of an organization cannot just be seen as actions on control rules, but implies to address the process leading to elaboration of actual rules (Coutarel & Petit, 2009;

Van Belleghem, 2012). Thus, a stake for organizational design is to propose spaces of debate and of design of rules in order to help companies to combine organization of work (“Cold” regulation) and organization work (“off the cuff” regulation). We assume that situation of simulation used in ACE design project management is a good candidate as a space of discussion and elaboration of rules because (1) it puts together prescribers/organizers and executing actors; (2) given the settings that simulation proposes it could make visible managerial gaps; (3) simulation situation supports the design of new and negotiated rules. Putting in the terms of Social Regulation Theory, situations of simulation appears to be “cold” regulation spaces supporting simulation “off the cuff” regulation and revealing what could be actual rules in the futures. The arising question at this point is the type of didactical situation to set up in order to train to organizational design and in particular simulation of organizational design.

2.3 Chosen approach of teaching ergonomics

In reference to Harmonizing European Training Programs for the Ergonomics Profession (HETPEP) (CREE, 2007) requirements, most training programs in ergonomics in France combined: (1) transmission of both theoretical (e.g. human characteristics, relation between people, technology and organization...) and methodological knowledge (work analysis, measurements...), and (2) construction of pragmatic skills in order to help trainees in the deployment of actual practices regarding transformation actions (Gadbois et Leplat, 2004). Indeed, theory of action (Schön, 1983) stresses that practitioners cannot just apply pre-defined plans of actions while facing a given situation. Consequently, training programs should support the construction of competences to select and to adapt knowledge to the diversity of contexts of actions (Gadbois et Leplat, 2004). A requirement is thus to create situations of “learning through action” and to bring back context in these situations. In this sense, a modality is to set up practical workshops in which trainees could actually performed methods in ecological situations, i.e. situations in which context of a real transformation action is transposed (Rogalsky, 1995) and for which real materials is available (e.g. videos, interviews etc...).

We choose this approach to train practitioners to ACE design project management, in particular in the context of organizational design. Organizational design training session we propose concerns a didactical transposition of real ergonomics transformation actions (reorganization of a human resources service employing 250 persons in a French ministry; and re-organisation night schedules in an agro-alimentary line of production involving permanent and temporary employees), in which practitioners have to effectively deal with issues regarding setting up and managing organizational simulations.

3. Organizational design training sessions

ACE design project management training sessions are composed of: theoretical knowledge transmission regarding ACE approach, and various objects of design (space, computer-supported tools, organization...); and practical workshops regarding these objects, with a strong emphasis on the construction of the situation of simulation. In the following, we focus on requirements to set up a situation of simulation. One can note that those requirements are both partly inherited of those regarding real-world simulations and that are not specific to organizational design.

Two issues regarding setting up simulation for organizational design are discussed: dimensions of activity to be transposed (scenario of actions and avatar to embody activity) and requirements regarding resources supporting organizational simulation (scenario of prescription, simulation support).

3.1 Dimension of activity to be transposed in organizational design simulation

The work analysis conducts in the analyzing phase of ACE design project management is intended to characterize activity related to the project and to define scenarios of actions to be played by participants in simulation workshops. In the case of organizational design, these scenarios should help in combining control and informal rules by framing discussions around principles of interaction between actors (communication, coordination, cooperation). For instance, in the design of a Human Resources service, Van Belleghem (2012) reveals 3 actual “management loops” structuring decisions, transfers and following of some mail demands. Those loops are supported by color of the files in which demands was stored. A goal of the simulation was then to transpose those management loops in the new scenario of organization, by making participants manage mail demands.

3.2 Requirements regarding resources supporting simulations

We define three general requirements for supporting simulations (Van Belleghem, 2012). For each of them, we illustrate specificities of organizational design situations. The first requirement deals with characteristics of the support of simulation. It needs to support *representation and modification of scenarios of prescription*. While designing spaces of work, those supports can be volumetric mock-ups of space. For organizational design, this requirement must be fulfilled by a representation of control rules structuring the work, which are the object of design (for instance representations of a hierarchical structure, schedules of tasks, allocation of tasks...). A particular attention is needed on rules that are modifiable and those that are not (by analogy in architectural design a bearing wall should be a “non modifiable” rule). The second requirement deals with the *possibility to modify collectively scenarios of prescription*: each actor whatever his/her position in the project (e.g. designers vs. “users”) and hierarchical (management vs. operators) has to be in position to propose and to embody future activities. In organizational design, the size and the manipulation conditions of the supports have to be carefully thought. For instance, in our training workshop dealing with design of a schedule for an agro-alimentary production line, practitioners used a woolen thread tacked on a paperboard to negotiate collectively various potential schedules. Finally, the third requirement deals with the *support for embodiment of activity*. In spatial design, the choice of an avatar that participants can mobilize is quite intuitive (for instance Playmobil© characters), as the entities that are evolving are humans or objects that can be materialized easily. In organizational design, avatars may be more symbolic (a file, rules of interactions with hierarchy, a woolen line to represent schedule...). In the case of organizational design of the Human Resource service, the chosen avatar was the representation of a file (with adequate color referring the identified management loops). Avatar files were moved on the support (representing management loop) according to decisions that were negotiated, expressing this way actual rules that were mobilized by participants.

4. Discussion and Conclusion

This communication presents a proposition for contributions of ergonomics to organizational design and for learning of organizational design. However, in a constructive ergonomics perspective, a stake for the discipline is to be able to act on rules framing governance structure of a given company or institution, even when ergonomists are gone from the company, in order to design “enabling organizations”, i.e. organizations that are able to transform itself in a sustainable way and that take into account real world work (Petit & Coutarel, 2014; Arnould & Falzon, 2014). These organizations require at least spaces of discussions of rules, we assume that organizational simulations is a good

candidate for being these types of spaces.

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