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CONTRIBUTIONS OF ORGANIZATIONAL SIMULATIONS TO PROJECTS OF COLLABORATIVE ENVIRONMENTS IN THE OIL AND GAS INDUSTRY

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Summary
This article shows that simulations for the layout design of a collaborative environment highlight issues relating to the future organization of work. Several collaborative environments are being created in well-known projects in the offshore industry, such as Integrated Operations. The participatory dynamics and the use of the layouts proposed for the new space were the main characteristics of the simulation process used in this research. More than discussions about furniture and the physical arrangement of rooms, the simulation meetings turned into discussions about the number of operators needed and the future work process

Keywords. Project, Collaborative Environment, Simulation, Ergonomic Work Analysis.

1. Introduction

The search for cost reduction and production performance improvements has led oil companies to implement several operational integration (IO) projects (AbdulKarim et al., 2010).

IO projects are considered to be those that aim to integrate onshore and offshore operations, through real-time data transmission and management resources and technologies. These projects are characterized by the transfer of activities carried out on platforms to land; by connecting distant work locations or teams and by increasing integration in multidisciplinary work. In the area of oil exploration and production, this process has been going through different phases. Initially, focusing on information technology and the construction of multidisciplinary work environments. Currently, it points to the need to create a structure for operating a global business, in real time (Edward et al., 2010).

In this context, an ergonomic study was carried out for the design of a collaborative environment, where different activities related to submarine operations will take place. It is an oil company and the objective of this integration is to share available resources between different sectors and be more efficient in meeting requests from different platforms.

2. Simulation and design

Simulation is one of the methods used by activity ergonomics to overcome the paradox of design ergonomics. According to Theureau and Pinsky (1984), the paradox of ergonomics

is related to the fact that activities carried out in similar situations are used as a reference for projects, which will certainly be different from the future activity. What to transfer from the current situation to the future? How to anticipate the consequences of design decisions on future activities? These are the questions posed by this paradigm that relates to anticipation, which approaches what is probable or possible and not legitimacy. Ergonomics simulation does not aim to simulate the functioning of the artifact (Leplat, 2000) nor does it prescribe the best way to perform tasks. It is mainly concerned with evaluating what the possible forms of future activity are and whether or not they are acceptable. During the design process, they also serve as 'reflective support' for future users and designers to analyze and evaluate the proposed solutions based on their experiences (Daniellou, 2007).

The design process is a complex social activity that involves numerous forms of interactions between actors with different ways of thinking (Martin, 2000). The meeting of operators, designers, actors with political functions and representative bodies contributes to the construction of project solutions. Furthermore, this meeting also contributes to the development of activities and the capacity of actors to deal with changes in the work situation. Therefore, these conditions perceived in the design process characterize a constructive dimension (Barcellini et al., 2013).

Designing is a dialogical process of mutual learning. In this process, a designer's hypotheses will be confronted, tested, and generally set into motion, in the world of other actors in the design process. The exchange between actors is carried out through the mediation of temporary results. The use of these results in the design action remodels, enriches and modifies the characteristics of the object to be designed. In this sense, the use of the term “exchange of activities” can be used to emphasize the dialogical process, during which the result of the designer's activity is rescued in the activity of another actor through intermediary objects. (Béguin, 2003 and 2007).

It becomes difficult to establish a dialogue between actors and negotiate each other's interests when there is no shared knowledge and the information is unknown among those involved. Therefore, it is important to bring the real work to the heart of discussions between actors so that decisions are not made based on prescriptions, without considering situations of variability. Otherwise, there will be a risk of not anticipating constraints and margins for maneuver relating to the work activity, as well as the consequences caused to the worker's health and the quality of production (Barcellini et al., 2013).

3. The project of a collaborative work center for the underwater area

The ergonomic study in question was developed in the initial phases of the layout project for the collaborative environment. The initial period of three months was extended to seven months, due to the various organizational aspects involved. The study was organized in three stages: (a) analysis of reference situations; (b) simulation; (c) validation and elaboration of ergonomic recommendations for the architectural project.

The initial demand for the ergonomic study arose from the need for project managers to evaluate layout studies developed by the company's own team. The studies presented predicted the allocation of around 90 jobs in a single environment. A support structure was also foreseen with: pantry, cafeteria, restrooms, shared services, meetings and contingency support room.

The space provided for carrying out the ergonomic study was 900 m² of the roof floor of a building at the end of construction. The total roof area was 1,500 m², distributed on the main floor (900 m²) and the jirau (600 m²). The area designated for the collaborative environment could only be occupied on the main floor or both. The remaining area would later be occupied by two other management areas of the company.

Currently, the activities to be integrated into the collaborative environment are carried out in five different sectors of the company. The objective of the new integrated sector is to share the main resource (available vessels) of submarine operations between the groups involved. The hourly cost of vessels is high. A diagnosis carried out by the company showed that the idle time of the vessels was often higher than desirable and that the scheduled schedule for servicing the platforms was no longer met for various reasons. It was expected that the integration of these sectors into a single environment would allow a greater degree of

efficiency in the use of resources and in meeting requests from different platforms.

The main activities involved in the subsea installations process are: (a) monitoring, control and technical support (seek to optimize the use of equipment over a period of up to three days); (b) planning and scheduling (aim to optimally schedule the use of equipment over periods longer than three days); (c) logistics planning and due diligence (act on the mobilization of materials); and (d) supervision and operational performance (acting in the management of teams and the process).

When contracting the ergonomic study, the integration project was already underway and the company had already carried out some initiatives: (a) structuring hierarchical groups for project management (operational, executive and management committees); (b) process mapping, carried out by third parties, based on the Business Process Management - BPM methodology; (c) redesign of work processes, defining positions and functions using the "as is" x "to be" model; (d) definition of staff, based on the estimated time to carry out a task; (e) forecast for the development of an integrated data and process management system, based on the Enterprise Resource Planning - ERP system; (f) pilot room with monitoring, control and technical support activities; (g) layout studies, carried out by a company technical team.

4. Methodology

The methodology adopted by the ergonomics team was based on the Ergonomic Work Analysis – AET (Guérin et al., 2001), based on observations and individual and collective interviews with workers. The following reference situations were adopted: existing pilot projects in the operational unit studied; a collaborative environment implemented by another management and a contingency response complex. Monitoring of activities was carried out in these locations. However, it must be considered that it is not possible to completely transfer the information collected to the future situation. According to Béguin (2007), certain elements are pertinent, while others will be modified by the act of conception"

For the analysis and validation of ergonomic layout studies, simulations were carried out involving: representatives of the operations of the different sectors, representatives of the committees (operational and executive) and the project leader. PowerPoint presentations were used in the simulations. The criteria adopted to prepare the layouts, the floor plan arrangements with the location of each function and the main scenarios that characterized the activity of each nucleus were presented. These scenarios were constructed based on monitoring activities.

Collective meetings were held, involving the operators and supervisors of each cell/nucleus and those responsible for the unit's integration project. In addition to the notes taken by the ergonomics team, all meetings were audio recorded. The aim was to have a detailed memory of the numerous issues discussed with the various groups gathered.

5. Results: the space project is crossed by the organization's project

The simulation meetings made it clear that the project of the collaborative environment is permeated by the organization's project and, therefore, cannot be conducted just as a space project: it is the project of a work system.

Meetings were held that initially aimed to present layout proposals for the future collaborative environment. However, in the first meetings it was possible to realize that future users did not have sufficient knowledge regarding the organizational changes to be implemented in the new work environment. In this way, these meetings began to play a fundamental role in the new organization.

The layouts were used as a basis for exhibitions of future work scenarios that supported discussions about the needs related to equipment, furniture and planned changes in the organization of work. These layouts evolved through discussions and new studies emerged from the new information obtained.

The discussions allowed for a greater understanding of the main types of interactions between the actors of each operational nucleus and the main interdependent relationships of

their actions, culminating in a collective reflection on how the new organizational process would materialize in that new space. This reflection led to a redefinition of the future work organization and the definition of the space for the new work environment.

To operate in the new environment, four nuclei (teams) of previously mentioned activities were defined: (a) monitoring, control and technical support (monitoring and controlling compliance with scheduled services, in addition to acting in resolving unforeseen situations and responding to emergencies - period of up to three days); (b) planning and scheduling (planning services and materials and optimizing the use of resources - deadlines greater than three days); (c) planning, programming and logistical due diligence (act on the mobilization of materials and people); and (d) supervision and operational performance (acting in the management of teams and the process).

The number of jobs and the division into centers was the result of work carried out by a company hired to map and redesign processes. This quantity was initially passed on to a team of architects from the plaintiff company so that the layouts could be proposed. As the team did not have information regarding the work to be developed, the layouts were designed only based on the available area and the number of jobs provided. However, the layout proposals (Figure 1) generated were not approved by the committees and, as mentioned, this was the reason for carrying out the ergonomics study.

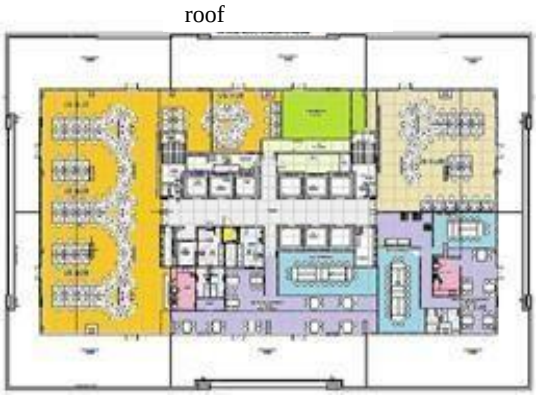


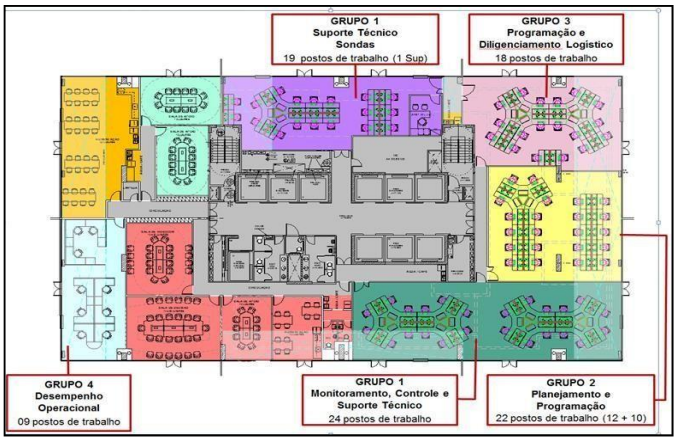
Figure 1 – Initial layout proposal

When the ergonomic project was contracted, pilot projects were underway and changes related to the occupation of jobs were happening dynamically. Changes in team formation and role definitions were

constant and aimed at improving ongoing processes. New work processes were being thought of, redesigned and tested in reality. Thus, this simultaneity of design and execution. Typical of pilot projects, it contributed to changes in data relating to the number of jobs.

Based on observations of the activities in reference situations, some layouts were proposed that served as a starting point for meetings with the teams. The dynamics adopted by the ergonomics team involved meetings with members of the project team and with representatives from each operational core, chosen by the operational integration project team itself. The meetings promoted brought the real work and its variability to the heart of discussions between project actors.

Questions from operational teams regarding the future work organization did not allow discussions to focus solely on layout proposals. Many of the operators did not know how they



would operate in the new work environment. It was necessary to discuss what this new work organization would be like based on the scenarios proposed by the ergonomics team. Depending on the needs of work activities, issues related to: (i) interactions between people and teams were discussed; (ii) definitions of functions not foreseen in the quantities provided and additions to existing functions; (iii) definitions of furniture and communication and visualization technologies; (iv) management of work processes, among others. Discussions with representatives of the operational teams were supported by layout proposals (Figure 2).

Figure 2 – Examples of layout proposals

Some meetings were held with all representatives and others were specific, by groups. The purpose of the latter was to discuss the interactions between the different actors of each team based on scenarios proposed by the ergonomics team.

The layout proposals served as an instrument to promote discussions about the different points of view, limits and needs of each team. In these discussions, it was possible to discuss and understand, using examples of operational situations, how each team needs to act and what their limitations are within each context, allowing each team to understand the different interfaces necessary to carry out operations in an integrated manner.

At the end of the ergonomic study, nine layout proposals were made. As the proposals evolved, based on contributions from the teams involved, the number of jobs was changed.

Based on the results, it is concluded that to define the numbers it is necessary to go beyond a tool that predicts the number of employees, strongly based on prescribed procedures or interviews, which reproduce in some way the responsibilities of each function. To design an organization, it is essential that we seek to build future work.

Operator participation is not an option. It is a condition for the coherence of the future work system.

The results presented show us that the space project is permeated by the organizational project. The meetings that, initially, were supposed to support future layouts became forums for debates and reflections on the future organization. These debates should be the basis for designing the work organization of future collaborative environments.

6. Final considerations

The possibilities for the contribution of activity ergonomics to the design of new work situations occur in several areas: layout and environments; equipment and furniture; software and screens; support for training and work organization. When it comes to designing the organization of future work, some difficulties are encountered.

At first, companies have difficulty defining and understanding what work organization is and which bodies should be involved in the organizational project. In addition to the strategic dimension of the organization, work is generally seen as the object of a roadmap. The work is completely conscious, explicit and structured, and can be learned through training. Under this logic, problems would be known in advance by those who represent the organization (Lima, 2000). These representatives would probably be responsible for redesigning it.

Thus, it can be observed that in these views of work the following strongly predominate: the classical approach, based on the Taylorist model of the Scientific Organization of Work (OCT); and the functionalist view, of the socio-technical system. According to Terssac & Maggi (2004), both have a positivist nature. In the classic model, the prescription must be followed without question. In the functionalist model, the prescription can be questioned and/or disrespected when it is necessary to solve a problem.

The ergonomics of the activity has a strong constructivist influence. In an organization there are different logics, often conflicting, that will constantly articulate themselves during the performance of the work. To achieve this, it is necessary for workers to create strategies to deal with these different logics, as they arise in their daily lives. The strategies are not part of a script and are not learned only in formal training. They are at the same time collective and individual (Simões et al., 2012); they are not always explicit and conscious; and are always related to the context (Guérin et al., 2001). Therefore, it is necessary not only to understand the worker's work, but also to have a global strategic vision. This way, problems and possible

solutions can be socially constructed. In an ergonomics project "providing a solution" is less important than "allowing different solutions". The flexibility of the solution built and adopted will allow for future adjustments, which will certainly occur.

In the case studied, the organizational redesign proposed for the submarine operations sector was developed based on the existing organization. The aim was to solve problems related to the lack of integration between operations. The company was structured into committees to conduct participatory management of the project. However, the understanding of what work is and what its organization is remained restricted to the positivist view and new prescriptions. The analysis of the activities of these operations was fundamental to understanding the existing problems and how the space had an impact, positively or negatively, on the activities. From this understanding, it was possible for the ergonomics team to prepare layout studies for the future built environment. The studies were validated by operators and committees.

On the other hand, the members of the project management committees now have a clearer vision of what they could anticipate for the new work situation. In the search for

a more flexible solution, they changed the scripts and prescriptions considered in the process mapping.

Another aspect to be highlighted is that in the design of work spaces, there are artifacts that materialize the proposals and restrictions of the various actors involved: sketches, schemes, plans, models and others. These artifacts function as facilitators for exchange between actors. Ideas are disseminated, confronted and transformed, often without the use of words, based on these intermediary objects.

The organization's project lacks intermediary objects that facilitate and promote dialogue between the different actors. In the case studied, there was a first attempt to develop process mapping ("as is" x "to be" schemes). But the model adopted and the lack of greater involvement of workers resulted in insufficient instruments to encompass the operating logic involved in the sector's processes.

These difficulties came to light during the design of the workspace, as the layout is ultimately a portrait of the organization of work (Goldenstein, 1997). The layout proposal simulation meetings turned into a forum for discussions about the space and the organization. The intermediate objects built for the layout simulation were used to intermediate communication between the different interlocutors. The organizational project advanced and included specific demands of the work activity. The discussions resulted in practical changes in the number of expected operators, planned functions, communication relationships between cells and available equipment. All of this had a direct impact on the arrangement of jobs. The support created by the participatory dynamics, established in the simulations, raised questions regarding the integration of operations that were still dissociated from the unit. It was necessary to negotiate the expansion of the building area that was assigned to the submarine operations unit.

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