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ERGONOMIC WORK ANALYSIS IN INTERMEDIATION OF DIFFERENT PROJECT LOGICS: STUDY OF A SEDIMENTOLOGY LABORATORY

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Abstract: This article presents an ergonomic action developed in a Sedimentology Laboratory of Operation Unit in Bahia, evidencing the importance of the intermediation of different professional logics for the elaboration of a layout that contemplates the needs of the work activity. In order to achieve excellence in built environments it is essential to align th ese languages and technical knowledge, mixing the logics and prioritizing relevant technical aspects, reformulating the problems of layout and furniture in the environment.

Keywords: Ergonomics, Laboratory, Sedimentology, Ergonomic Analysis.

1. INTRODUCTION

This article presents an ergonomic action developed in a Sedimentology Laboratory at an Operation Unit in Bahia, highlighting the importance of intermediating different professional logics for creating a layout that takes into account the needs of the work activity. To achieve excellence in built environments, it is essential to align these languages and technical knowledge, merging logic and prioritizing relevant technical aspects, reformulating the layout and furniture problems of that environment.
In this way, the work on the project aimed to provide input to the designers through understanding the activity, its dynamics and the census of characteristic action situations. The scope of work also included providing assistance to the project coordinator, equalizing different expectations and needs.

2. METHODOLOGY

2.1 Theoretical Framework

The ergonomist, among other roles, must act as a design actor, advising the entrepreneur, equating the elaboration of the problem and what is desirable from the point of view of technical solutions, with the activity of the project coordinator, who seeks the real possibilities for the artifact or designed environment, in an integrative character (Béguin, 2012).

For the ergonomist to exercise his role as mediator between the different actors of the design, it is imperative to outline what is called “social construction”. This occurs through interaction with designers and other professionals involved in the process, defining their objectives, financing, evaluation of solutions, coordination, construction and occupation and use of the system (Daniellou, 2012), that is, maintaining the coherence of

different technical “knowledge” and also taking into account the participation of users, through knowledge of the activity that is carried out (Béguin, 2012). The ergonomist, among other roles, must act as a design actor, advising the entrepreneur, equating the elaboration of the problem and what is desirable from the point of view of technical solutions, with the activity of the project coordinator, who seeks the real possibilities for the artifact or designed environment, in an integrative character (Béguin, 2012).

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3. METHODOLOGY

The most critical activities of the aforementioned Laboratory were mapped, and, from there, the Ergonomic Work Analysis of the Sequential Analysis of Testimonies activity was carried out. This was the work process chosen due to the centrality of the activity in that environment, both in terms of relevance in the portfolio of services offered and the interconnection with other activities performed.
As part of the methodology of this study, monitoring of the activity and preparation of flows of materials and people were carried out. In this way, the movement in the sector and the dynamics of work organization were understood. From then on, self-confrontations and interviews were conducted, consolidating the knowledge built about the exercise of activities and their variability. “Verbal” simulations, use of an intermediate board-type object and 3D drawings were also used as a way of expanding the understanding of the activities carried out, validating proposals and aligning information collected with workers, contributing to the structuring of a project, in fact, participative. Discussion meetings were organized with geologists involved in the

sequential analysis of cores and architects, allowing validation of proposals for the benches. Likewise, there was participation in internal meetings of the Infrastructure team, with the designers and project leader, providing input for the construction of the layout and aligning expectations and needs for using the environments.

4. RESULTS

Core Sequential Analysis (AnaSeTe) consists of analyzing the petrographic, granulometric and lithofaciological characteristics of cores, integrating them with petrophysical and profile data, to characterize the depositional environment, the stratigraphic framework and the quality of the reservoir rocks, describing them. to the. The rock boxes are organized on benches, organized in the "Testimonial Hall" environment.

During the analysis of the activities, the following Characteristic Action Situations were identified:

- Qualitative Rock Analysis
- Technical Meetings

4.1. Qualitative Rock Analysis

Visual analysis of the rocks is carried out, with the naked eye and with the aid of magnifying glasses and a fluoroscope, and classification according to technical criteria, entering the data into the AnaSeTe computerized system. In figure 1, boxes of testimonies to be analyzed can be seen.

Figure 1: Testimony Boxes for analysis

To build reasoning, on the part of the geologist, it is important that, firstly, observation of all the well boxes is carried out, from this moment on, the individual categorization of the boxes can begin.

Throughout the rock classification process, the need to maintain visualization of adjacent boxes for comparison was highlighted. To visually approach the rocks, professionals move the boxes, bringing them closer to the body, and leaving them partially unsupported from the bench.

The analysis is carried out with the naked eye and later using a magnifying glass and fluoroscope. The objective of the analysis using the magnifying glass is to visualize the way grains are aggregated, quantity and distribution of cement in the rock. The fluoroscope, in turn, looks for fluorescent points in the rock, which indicate the presence of oil.

On average, 5 to 10 meters of cores are analyzed per day, but productivity varies according to the geologist's experience, the complexity of specifying the analysis required, the heterogeneity of the rock sample interval and the number of different structures .

The activity on the bench ends with the completion of recording the description of the testimonies in the Anasete editor. The activity includes consulting analyzes of similar testimonies and technical bibliography and discussions with colleagues.

It is observed that, currently, there are periods in which new analysis demands arise and the benches are completely occupied by cashiers. In this way, the start of new analyzes is delayed, making it necessary to wait for the ongoing analyzes to be completed.

"What makes it very difficult currently is the number of benches. We have to wait for our colleague to vacate the bench so we can start the analysis."

Therefore, there may be a need to overlap boxes in order to accommodate a greater number of cores and avoid delaying the start of geologists' work. Placing one box on top of another makes it difficult to analyze the cores from the lower boxes, as it is necessary to constantly rearrange the bench to visualize the rocks in the boxes.

As for the layout of the "Testimony Hall", one of the benches is against the laboratory wall, causing impacts as it makes access to both ends of the boxes impossible.

"That bench in the corner is unusable. We can't reach the more distant rocks and the wall creates a 'shadow game' that confuses the visualization of the rocks' depositional models."

The benches are fixed, and each of them supports a rolling table located 20cm above its surface, powered by an electrical bus, as shown in figures 2 and 3. This table accommodates CPU, monitor, keyboard, mouse and microscope, and can move from one end of the bench to the other. This furniture, bench and table, has a sharp corner and does not allow for adjustment of its height. Between the benches there are tall model chairs, without armrests, but with footrests and adjustable seat height and lumbar support.

Figure 2: View of the current testimonial analysis bench

Figure 3: Bottom view of bench and associated electrical bus

It is noted, therefore, that due to the difference in level existing between the surfaces of the benches and rolling tables, the fit of the lower limbs under the benches is conditioned by the adjustment of the height of the seat of the chair intended for carrying out activities on its surface. surface, but hindering the proper positioning of the arms, if you need to use the computer keyboard. On the contrary, if the activity is with the computer, located on the rolling table, the chair must have a different seat adjustment, accommodating the upper limbs at the expense of the lower limbs. Furthermore, there is no arm support when using the mouse and keyboard.

"Sometimes I prefer to enter the data into the system standing up; the legs don't fit well under the bench."

4.2. Technical Meetings

Technical meetings, generally with up to 6 participants, are held in this space with the help of a microscope, computer and television. The images generated on the screen

on TV facilitate exposure and exchange of knowledge between technicians, contributing to a more accurate analysis of rock analysis parameters.

The arrangement of the furniture does not favor this practice, considering that these technical meetings have to be held standing up or with benches placed improvisedly between the benches. In the sector, about once a month, larger volume categorizations are carried out, in which up to 500 boxes are moved and visiting geologists hold discussions with professionals in the sector. These meetings last an entire day, and global and less specific opinions are issued about the well studied.

Based on systematic observations of the activity, interviews and self-confrontations and the dynamics of using an intermediate "board" type object, it was identified that the adaptations made in the space to carry out the activities cause discomfort in workers, in addition to "bottlenecks" in production flows.

Due to the discomfort caused to workers when carrying out their activities, the strategy of alternating tasks in the sector's portfolio was adopted (microscopy, issuing reports). As a result, the boxes of cores from the analyzed wells are organized on the benches and remain in place for long periods, until the analysis of the well as a whole is completed. It is essential, for categorization, that all boxes of the well under analysis are exposed for the construction of rock sedimentation reasoning.

Due to the way work is organized, associated with flexible deadlines for delivery of analyzes and autonomy in prioritizing demands, the benches are completely occupied full-time and even so, during peak periods, professionals are reported to have to wait for bench occupation and analysis of testimonies.

With this verification, associated with the analysis of the Laboratory's total production volume, the hypothesis of insufficient bench space to accommodate the test boxes was discarded and reformulated for the existence

of production "bottleneck" associated with the way in which bench occupation is organized.

In this way, with information on the flow of processes and their respective materials, it was possible to discuss with the Infrastructure team so that the preparation of the new layout proposal reflected the exercise of activities, the global dynamics of the sector and, to the extent of possible, the desires of workers.

Due to budget restrictions associated with the company's economic context and, specifically, the Operational Unit where this work was carried out, it was decided by the leadership that the laboratory area in question should be reduced by 100m2. It was then possible, seeking to equalize the spatial reduction and the needs considered most critical and relevant arising from the analysis of work activities, to jointly construct a new space proposal. Therefore, the space between benches was proposed to be adjusted to at least 1.20, in order to allow the rock transport cart to pass between them, favoring the replacement of rocks; provision that all benches are not placed against walls, to avoid shading, which makes it difficult to categorize the rocks, and access to the boxes; provision of an environment for small technical meetings, with chairs arranged close to the TV and magnifying glass, favoring discussion and categorization of rocks; positioning the fluoroscope in a more central position in relation to the benches so that displacements are minimized when analyzing the rocks.

As a central management process, the Testimony Hall was maintained in its original size, but the number of benches needed to be reduced by prioritizing the adequacy of the spacing between benches and their remodeling, providing more comfort to workers.

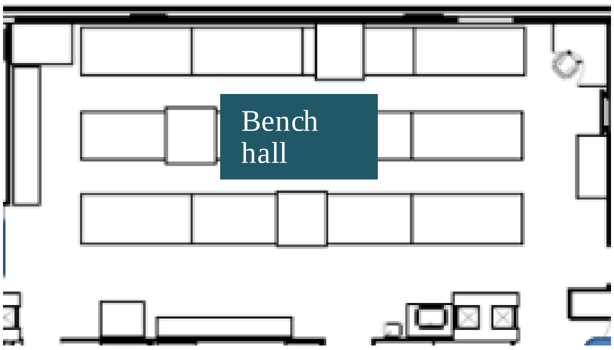

Figure 4: Current layout of the Sedimentology and Stratigraphy Sector

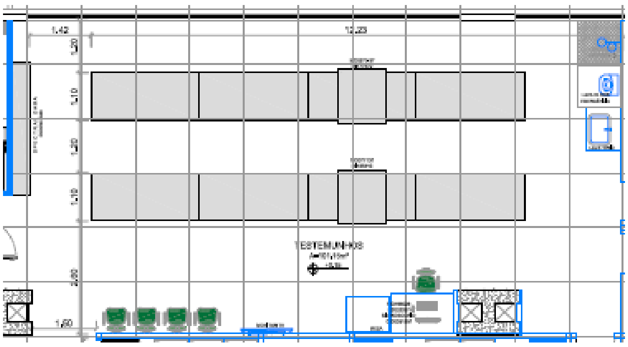

Figure 5: Final layout proposal for the Testimony Hall of the Sedimentology and Stratigraphy sector

The idealization of the bench design came from the need for direct observation of the rocks chosen as representative in the sample for analysis, the possibility of viewing through a magnifying glass, as well as the insertion of data into the System, promoting comfort for workers.

With the reduction in the number of benches available, which is imperative when remodeling the Laboratory layout, it became necessary to optimize their usage time and occupancy. A new bench layout ultimately seeks to deliver analysis results in a shorter space of time, due to less need to alternate tasks due to the potential comfort provided by the furniture when carrying out the activity, and a greater rotation of boxes of testimonies arranged on it, in order to avoid loss of productivity and the aforementioned production "bottlenecks".

The main features of the proposal are the extension of the table top, as seen in the simulations in figures 1 and 2, allowing better accommodation of the lower limbs and maintaining a full view of the rock boxes.

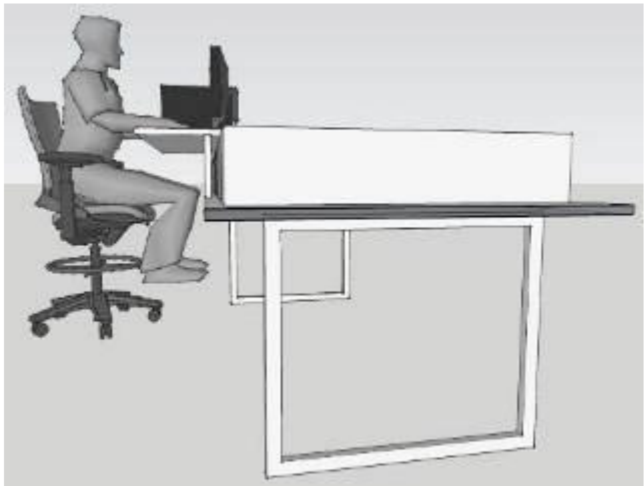

Figure 6: Simulation of bench proposal for testimonial analysis (side view

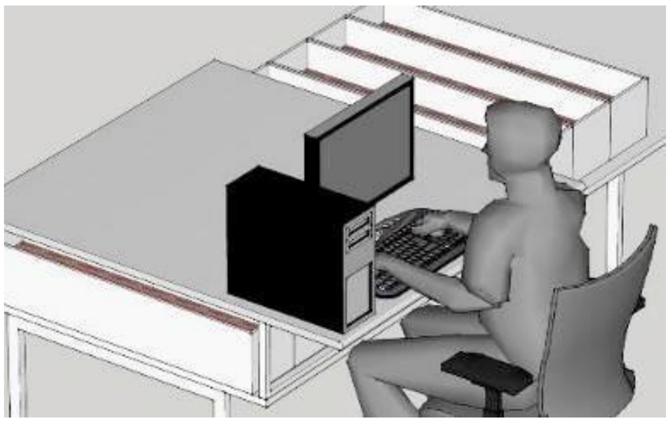

Figure 7: Simulation of bench proposal for testimonial analysis (top view)

Due to the transport of testimonial boxes to the bench hall, the ideal would be for this environment to be close to the temporary storage area and, consequently, the material entry and exit area. Throughout the ergonomic analysis carried out in the Sedimentology Laboratory, the gradual construction of the problems in design and the importance of ergonomics in the bring activity inputs for the progressive construction of an environment that actually meets the needs of the different project actors, including end users. In the intervention carried out, to understand and restructure the problems, the analysis of real situations and the participation of operators, as described by Duarte et al, 2008, proved to be essential. However, it is demonstrated once again that ergonomics can contribute effectively to reduce this distance that exists between the real demands of users and the designers' responses to these demands. Through the study of reference situations, in this specific case the Sedimentology and Stratigraphy Laboratory, it was possible to perceive a clear rapprochement between these two sides, the users' demand and the project response, its associated viability (Martin, 2007).

Throughout the process, the demands of technical specialties were confronted and the implicit needs of users were clarified, making it not possible to fully comply with the guidelines proposed by the architects. Thus, the basic needs of each 'actor' involved in the process were hierarchized and prioritized, ensuring the good result of the project. Therefore, the model described by Daniellou, 1994, was evident, in which the project is unfolded based on technical and political choices.

The ergonomist is therefore constituted as an 'actor' of the design through the mobilization of knowledge of the discipline and the analysis of reference situations, contributing with inputs for designers and for the idealization of innovative solutions for built environments, highlighting the character integrator of the profession (Duarte et al, 2008).

Through ergonomic analysis, the need to increase the number of benches available was validated, taking into account the major categorizations carried out monthly, with the participation of visiting geologists. However, due to the company's situation and the consequent need to reduce funds and associated area, the need to consider the tasks carried out on a daily basis and the benefits of adapting the
spacing and remodeling of the bench layout, these being prioritized.

The result achieved in this process of structured social construction with the architects, technicians and workers of the Laboratory, ergonomists and bringing together knowledge in a participatory and organized space for discussion to reduce the perspectives of power, as proposed by Daniellou, 1994.

In addition, throughout the analysis process and, especially, in issuing recommendations, the user played a 'key' role, as cited by Darses and Reuzeau, 2007. Even after an extended period of open observations of the activities, only through self-confrontations it was possible to elucidate flows, ways of dealing with variability, and peculiarities of operators' tacit knowledge.

3. CONCLUSION

The ergonomist, as a project actor, contributes to the development of layouts through the developments and characteristics of activities, variability and strategies used to address them. In addition, he participates as an advisor to the project leader and architects, articulating the logic and needs of the different technical specialties.

In the project in question, with the emergence of new contexts and project guidelines, the ergonomist's role was important in prioritizing priorities, elucidating and mediating work organization issues.

In addition to adapting to regulatory requirements, improvements were potentially provided in the layout that favor workflows, accessibility to facilities, reduction of unnecessary journeys to the process, greater exchange of information, comfort and reduction of risks for workers. In this way, even with the reduction in the total area of the Laboratory, it is expected that there will be no reductions in productivity and quality of petrographic analyses, also favoring the maintenance of the health condition of workers.

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