



COGNITIVE JOB EVALUATION: APPLYING THE COGNITIVE JOB ANALYSIS TECHNIQUE

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Summary: Ergonomic Work Analysis (AET) is a methodology that aims to evaluate jobs to identify risks and propose improvements. It covers physical, cognitive and organizational aspects, being regulated by NR-17 in Brazil. AET comprises structured analyses, including analysis of demand, task, activity, diagnosis and ergonomic recommendations.

Cognitive work analysis, part of AET, was defined with different methods by Carvalho and Vidal (2008), aiming to understand and transform work activity to promote worker well-being and improvements in the company. The Cognitive Work Analysis Technique (TACT) is applied in nine stages, including collection of spontaneous reports, observation of activities, preparation of knowledge process maps, guided interviews and final diagnosis.

A case study applied TACT in an insurance brokerage, highlighting differences in cognitive load between employees. The results highlighted issues such as manipulation of digital platforms, the need for multiple information devices and the overload of online services. Based on this, interventions have been proposed to improve working conditions and reduce cognitive risks.

It is concluded that ergonomic assessment must encompass physical, cognitive and organizational analyses, and the application of TACT can contribute to a complete AET, enabling the identification and control of risks in different work domains.

Keywords: Cognitive ergonomics; Ergonomic Work Assessment; Occupational risks; Cognitive load at Work; Cognitive Work Analysis Technique.

Introduction

Ergonomic Work Analysis (AET) defined by Santos and Fialho (1997) is a methodology carried out to evaluate the workplace and its surroundings, to identify risks, observe work situations, propose changes for improvements, etc. This analysis must be carried out holistically, including both the physical aspects of the activity and the cognitive and organizational aspects, all of which generate occupational risks. AET is divided into analysis of demand, task, activity, diagnosis and ergonomic recommendations (BRAATZ et al., 2021), corresponding to a set of structured analyses, applied according to the risks and type of occupational activity. It is used to understand and transform the activity of individuals in an organization, generating well-being for the worker and improvement for the company (GUÉRIN et al., 2001). AET can often lead to transformations in technical systems, in the organization of work, as well as in the organization and management of the company (WISNER, 2004). This method is regulated by NR-17, a standard that aims to ensure employer compliance with practices and rules that adapt work, making it safe for the worker's mind and body, covering the entire work space and all activities carried out by employees. collaborators (BRAZIL, 2021).

A part of AET corresponds to cognitive work analysis. This cognitive analysis was defined by Carvalho and Vidal (2008) with several methods, techniques and instruments that aim to elucidate the way in which specialists, experts and other professionals perform it, based on the generic ergonomic analysis model of Marmaras and Pavard (1999). According to Carvalho and Vidal (2008), there was a change of paradigms and it was concurrently appropriated by several disciplines, such as information technology, psychology, anthropology, ergonomics and engineering, and led to the introduction of new methodologies, concepts, models and terminologies. Based on this, the authors state that there is no exact rule that is said to be correct for the analysis of complex skills or cognitive capabilities, which sounds coherent, as changes in work environments have been increasingly rapid, as has the development of new methodologies from the most diverse fields of knowledge and studies.

The aim of this research was to evaluate the cognitive load of the workplace using the Cognitive Work Analysis Technique.

Method

This study is applied in nature, as it provides information that can help optimize the analyzed work environment. Regarding its objective, this is an exploratory-descriptive study,

as it aims to explain and describe the cognitive assessment of the workload. Finally, in terms of technical procedures, it was framed as a case study carried out in a company that sells insurance applying the Cognitive Work Analysis Technique to two office assistants. The case study was based on bibliographical research (GIL, 2008).

The Cognitive Work Analysis Technique (TACT), applied in this research, consists of 9 steps: Collect spontaneous reports; Systematically observe individuals at work; Prepare the knowledge process map (inputs, cognitive process, results); Carry out preliminary diagnosis; Structure the guided interview (mental load, decision making, cooperation and communication); Apply the directed interview; Tabulate the directed interview; Carry out the final diagnosis; Define the intervention proposal (PERFETTO- DEMARCHI, 2021).

When collecting spontaneous reports, workers explain how they understand the work they do. Systematic observation allows you to identify how activities are carried out, the risks to which they are exposed, which work tools they use, as well as the time dedicated to each part of the activity. With this information collected, we proceed to perform a visual representation of the activities with the Knowledge Process Map. On the map it is possible to record the order in which each worker performs the activities, the inputs used, the interaction with the work environment, as well as the worker's resources (characteristics of the person) and external resources (characteristics of the system project) that may be

influencing the process to obtain the results of the activity. Which allows preliminary diagnosis to be made.

Then, it is possible to structure the guided interview. TACT has a Guide for the guided interview of cognitive work factors. It consists of questions that will allow you to identify the factors of mental load, decision making and communication and cooperation. The questions are adjusted according to the job to be analyzed. Once the interview has been carried out, the answers are tabulated. Then carry out the final diagnosis. Finally, define the intervention proposal.

Development

Cognitive Ergonomics focuses on individuals' ability to memorize, attention, perception and other cognitive processes. Refers to mental processes such as perception, memory, reasoning, and motor response as they affect interactions between human beings and other elements of a system. Relevant topics include the study of mental workload, decision making, expert performance, human-computer interaction, stress, and training as they relate to projects involving humans and systems (IEA, 2019).

According to Richard (1990), mental activities can be inferred from behaviors and verbalizations, and can be simulated by information processing models. Mental activities can be defined by the nature of the information from which they work and the decisions they produce. The information they come from are the result of sensory treatments, the identification of objects and their position, movements, changes and their succession, which are the basis of the perception of events, identification of lexical elements and syntactic marks and , one can also add the identification of propositional meanings.

With the purpose of evaluating the cognitive risk present in occupational activities, the Cognitive Work Analysis Technique was used. TACT is structured into 9 steps, described in the method section, of which we present the highlighted parts below. Those that make the difference in the cognitive assessment process.

First, the collection of spontaneous reports, in which the worker provides a verbal explanation of the work they perform, what inputs and resources they use, how to perform the activities, and how they perceive the work they perform with the aim of making an initial identification of the perception of the worker about their work activities. The worker presents the activities with a particular chronology, emphasizing the degree of importance of the stages of his work, according to his perception, emphasizing what he considers most relevant and most exhausting for him.

Secondly, the creation of the knowledge process map, which graphically represents how the worker carries out the activities, the order in which they are carried out, when they use resources and inputs and how they obtained the results of the work performed.

And thirdly, the questionnaire to assess the characteristics of Mental Load: reference to intra-individual management - level of knowledge. Decision Making: the interest is knowledge management in the individual's relationship with labor elements. And finally, Cooperation and Communication: if the objective is schematized, how several people share and communicate their knowledge.

The other steps are similar to other AET processes: observation of the activities carried out, diagnosis and identification of risks and definition of improvement proposals.

Results and discussions

The case study company is an insurance broker that provides insurance intermediation services for damage and theft of vehicles, life, business, home, cell phone-notebook, travel and civil liability. It sells insurance from 15 insurance companies and has 6 employees.

In the initial part of data collection, each employee was asked to make a spontaneous report, explaining what the activity they carried out consisted of. Each employee explained their roles

and activities, starting with those that they consider most important, those that generate some type of discomfort, and those that are least important. Among the reports we highlight:

Employee 1: “My routine consists of telephone calls, WhatsApp messages with clients, control of client payments, emails, and closing insurance contracts on the computer. And in addition, assistance to collaborator 2.” Conclusion: it is noted that employee 1 is uncomfortable helping employee 2, in addition to carrying out her daily duties.

Employee 2: “In my daily life I provide customer service, close insurance protocols, monitor claims by phone and emails.” Conclusion: it is noted that employee 2 has a restrictive view of her role, and therefore does not fully address what she really has to do.

Afterwards, the collaborators' routine was observed and knowledge process maps were created, presented in Fig. 1 for collaborator 1 and in Fig. 2 for

of collaborator 2. The Map is a visual tool that presents the sequence of activities carried out by each collaborator, the interaction with materials and resources to obtain the results.

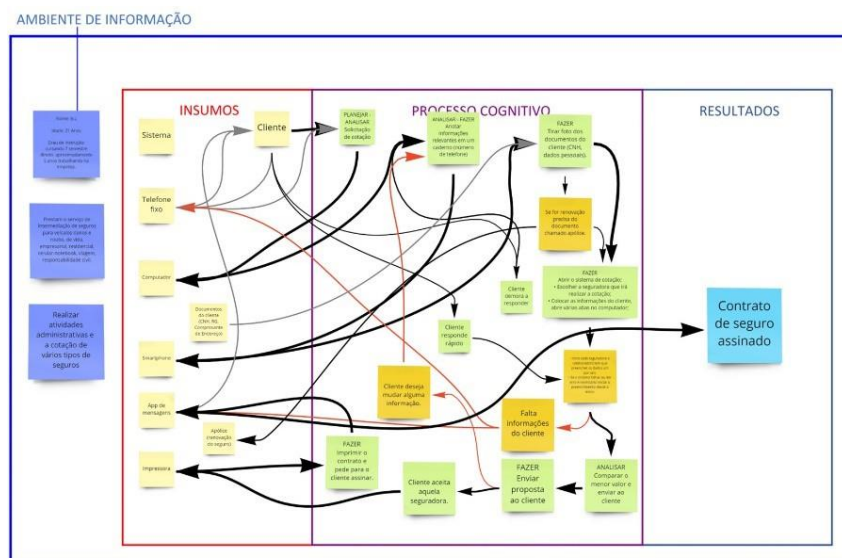


Figure 1. Knowledge process map of Contributor 1 (Authors)

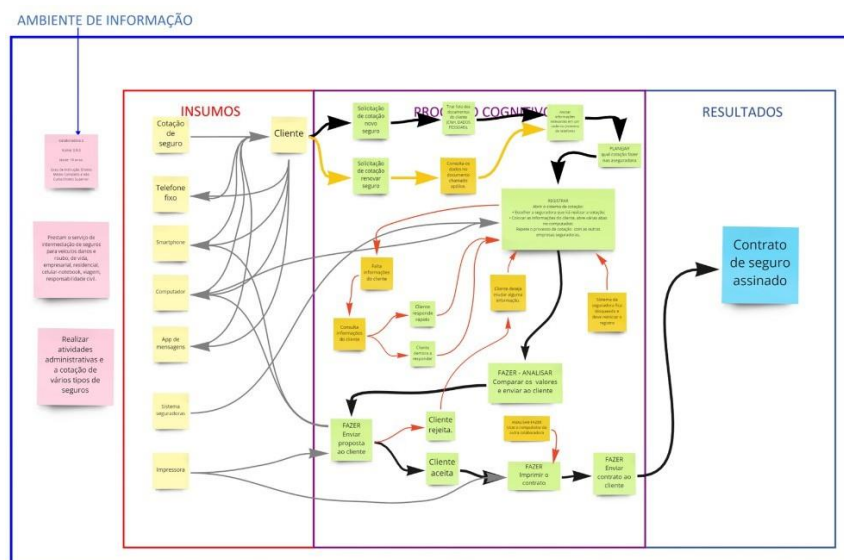


Figure 2. Knowledge process map of Collaborator 2 (Authors)

It was possible to visualize differences in the process carried out by each employee to perform the same activity. The inputs were used at different times, as was the sequence to carry out the process.

Analyzing the spontaneous reports, observations of the activities and preparing the knowledge maps, we proceeded with the preliminary diagnosis, identifying: The activity demands a lot of attention, since the result is a contract proposal for the client;

Manipulation of the platform throughout the work period; Need to manipulate more than one Informational Device at the same time; Employee 1's discomfort due to helping employee 2; Printing system only for one computer, interrupting the concentration and performance of employee 1. Employee 2 has a restrictive view of her role, so she does not broadly address the different activities she performs; The system expires and the employee starts the whole process again; Increased mental load due to the number of online services (An average of 30 different customers respond at the same time on WhatsApp); It takes time to get a quote from all insurance companies.

Afterwards, the occupational risks were identified, as follows: Employee 1 - Discomfort due to carrying out support activities for the other employee, Mental processes, Mental workload, Decision making, Human-computer interaction, Stress, Reasoning and motor response and Monotony ; Collaborator 2 - Mental processes, Mental workload, Decision making, Human-computer interaction, Stress, Reasoning and motor response and Monotony.

The guided interview was then organized with 8 questions related to mental load factors, 7 on decision making and 4 on communication and cooperation. For each question, the employee had to select between levels: total, high, medium, low or not applicable. Each employee has a different perception of the work performed, generating a different cognitive risk. In Figure 3 it is shown that Employee 1 has a greater mental load than Employee 2, confirming what was expressed in the spontaneous report of Employee 1.

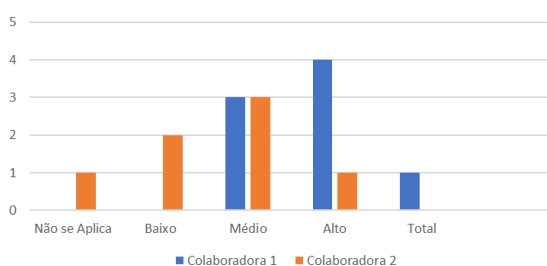


Figure 3. Cognitive mental load requirement

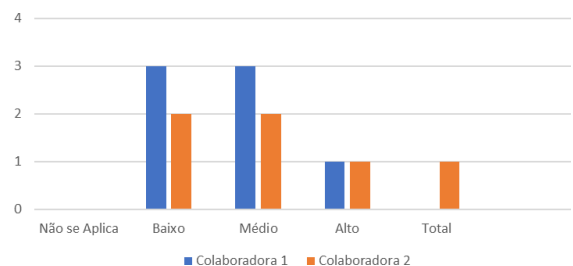


Figure 4. Cognitive requirement for decision making (Authors)

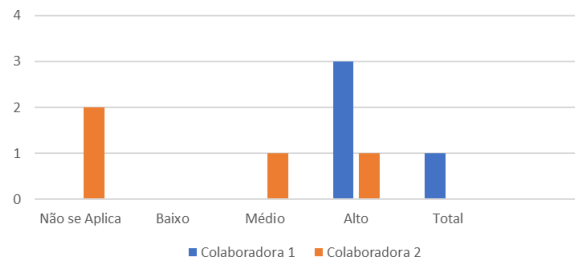


Figure 5. Cognitive requirement for Communication and cooperation (Authors)

In Figure 4, it is observed that employee 1 has decision-making at all levels. And finally, Figure 5 presents the cognitive requirement of communication and cooperation where Employee 1 presents the load at high and total levels. While Collaborator 2 qualified that some cognitive requirements in this section do not apply to her.

In the penultimate stage, the Final Diagnosis of the mental load of the workplace was carried out: Activity demands a lot of attention, since the result is a contract proposal for the client; Manipulation of the digital platform throughout the work period; Need to manipulate more than one Informational Device at the same time; Discomfort due to helping collaborator 2; Printing system only for one computer, interrupting employee 1's concentration and performance. Collaborator 2 has a restrictive view of her role, so she does not fully address what she really has to do; Registration of the same information as customer data on each insurance company website; Reprocessing customer information in the system, when the usage time expires, the employee must start the whole process again; Increased mental load due to the number of online services; (Responds to an average of 30 different customers at the same time on WhatsApp); It takes time to get a quote from all insurance companies.

As an intervention proposal, 6 activities were defined to be carried out to improve workplace conditions in an attempt to reduce the cognitive risk of the evaluated employees. Figure 6 presents the proposed schedule for the company.



Conclusions

Analyzing the cognitive risks of the workplace allows us to have a global view of the occupational risks to which employees are exposed while carrying out the activities performed. The applied Cognitive Work Analysis Technique allowed generating the

Map of each employee's knowledge process graphically showing which inputs are involved and the sequence of the cognitive process to obtain the result of the analyzed activity. Likewise, the guided interview has an important and fundamental contribution to identifying the components of the mental load factors, decision making, and cooperation and communication of each employee, making it possible to make a specific intervention proposal to reduce cognitive risk of employees during the execution of activities.

The Ergonomic Work Assessment must include analyzes of the physical, cognitive and organizational ergonomics of all activities performed by workers. The application of TACT made it possible to carry out the Cognitive Work Assessment and define risk control activities in this field of ergonomics specialization, making it a tool for carrying out AET. Other tools must be applied to assess the risks of the physical and organizational domains of the workplace for the purpose of designing a complete AET.

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