



# MICRO-DESIGN AS DIY: DESIGNING FOR UNIQUENESS ON OFFSHORE PLATFORMS

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### Abstract

The text addresses the relationship between ergonomics, the singularity of action and the bricolage approach in contexts of great uncertainty. Initially, it discusses how operators deal with variability and diversity at work, highlighting the importance of considering the singularity of action. Based on case studies in complex work environments, such as an offshore platform, the strategies adopted by workers to deal with unpredictable situations are analyzed. The cases presented demonstrate the application of the concept of microproject and bricolage in the execution of tasks. Operators use available resources in a creative and adaptive way to solve emerging problems during the performance of activities. This approach reveals the construction of a rationality of action in the specific context, which is not based on prior theoretical knowledge, but rather on practical experiences and the manipulation of available tools. The analysis of the cases shows that operators act as bricoleurs, constantly adjusting and transforming work systems to adapt to specific demands. This approach is essential in situations of uncertainty, where adaptation and improvisation are fundamental to the success of operations. It is concluded that the proposal of resources for action must consider this way of thinking, providing flexible and adaptable tools that allow workers to build local solutions to complex problems..

Keywords: situated design; DIY; singularity.

## 1. INTRODUCTION

Most of the ideas that emerge from French ergonomics are based on the concepts of variability and diversity. According to Daniellou (2005), "*the situations that operators have to deal with are very variable (even in the case of repetitive work), just as the workers themselves can be characterized by their diversity and internal variability. Workers always try to take into account their internal state and variations of the task in the way they produce operational strategies.*"

Although such a perspective is consistent with their concepts, the ideas of variability and diversity can be limited, especially in situations of great uncertainty. This occurs due to a little-explored dimension of the activity: the singularity of the action. According to Vermersch

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(2000), activity is found in an experience and, by definition, an experience is singular, has a unique temporal place and belongs to one person and only one. Although action has invariants, lived experience gives every action a fluid and changeable dimension.

According to Quéré (2000), attention to the singularity of action involves observing it from a particular, non-reproducible point of view, seen in its unity, as an event. This perspective contrasts with the efforts to seek the regularity and recurrence of actions, relating them to stable structures or identifying invariants, which leads us to the search for anticipation. The perspective of singularity, according to the author, involves understanding its sources and its process of "singularization", that is, the way a subject represents a situation and acts according to his identity, values and competences.

Gotteland-Agostini (2013) and Gotteland-Agostini et al (2015) studied the activity of a supervisor in a horticultural production company. This is a typical scenario of situations of great uncertainty, as supervision is confronted with the dynamics of an open environment, highly dependent on the natural element. In this context, the work could not be completely planned in advance, given the constant demands for adaptations from a technical point of view, on the one hand, and according to the activity, on the other. Thus, a situated conception entered the scene. The author understands that this conception is carried out in the form of microprojects, whose duration is quite short. These microprojects were conducted by the supervisor, who developed framing actions for the design of the users' tasks.

Abraçado et al. (2021) observed a similar situation regarding the activity of operators on offshore platforms. In addition to identifying the realization of the microproject, the authors also identified two typical characteristics of this type of situated conception: (1)

it is a conception for use (FOLCHER, 2015) that mobilizes the constructive dimension of the activity (RABARDEL & BÉGUIN, 2005) and (2) it is an ephemeral conception, built for the solution of a specific problem, situated in time and space, and deeply linked to the context.

There is, however, a dimension of the microproject little explored in previous studies, related to the way of thinking of the subjects who carry out the microproject. Lévi-Strauss (1952; 1962) opposes two ways of thinking about the world: "modern thought" and "savage thinking". For the author, the engineer's thinking has the effect of modern science and seeks to impose forms on matter according to a project. The *bricoleur*, on the other hand, comes from a deviated and skewed look, seeking to combine parts of sensible matter.

In this sense, bricolage concretizes the wild thinking present in each subject, allowing the realization of diversified tasks with tools placed a priori, that is, without subordinating the action to the obtaining of raw materials and specific tools designed and acquired for that project. It rests on an empirical approach and is defined by a closed instrumental universe that has as its rule of the game always dealing with the "available means". Thus, *the bricoleur* has a finite and heterogeneous set of tools and materials at each moment, since the composition of this set was not developed for the current project. The *bricoleur* turns to this already constituted set, and interrogates its elements so that he can understand what each one of them "means", thus defining a set to be used, but which will ultimately differ from the instrumental set only by the internal arrangement of the parts. In Lévi-Strauss's view, the *bricoleur* is a designer, as he uses his inventory, establishing a set of relationships between the parts that compose him. He makes adaptations and combinations, rearranging and interchanging parts of sensible matter with a view to making them produce ever new arrangements. These actions allow you to define a project.

On the other hand, "modern thought", which is mobilized by the engineer, is essentially experimental, speculative and theoretical. He does not subordinate his tasks to pre-existing raw materials and tools, on the contrary, his repertoire is defined by his project. He proceeds by what could be called a "project approach", gathering knowledge, knowledge and materials, with a view to achieving the objectives he pursues, leaving the "contingent" aside to seek the "necessary". It is subordinated to immediate use and efficiency, with a sense of productivity, and requires specific and specialized tools designed for that project.

In this article, the objective is to highlight the relationship between microdesign and DIY. Then, the challenges that this approach poses to industrial projects from the point of view of the uniqueness of the actions will be presented. To this end, concrete cases of cargo handling activity on offshore platforms will be used.

## 2. METHODOLOGY

To achieve the objectives of this study, the six stages of the case studies proposed by Yin (1989) were used: planning, design, preparation, evidence collection, evidence analysis and reporting.

In the first stage, planning, the case study method was defined, considered appropriate to understand how users think when they act in situations of great uncertainty. As the dynamics of the microproject are based on the interactions of workers in the field, the combination of observation and other evidence becomes essential for the characteristics of this research (YIN, 1989).

The second stage, study design, includes the identification of theoretical references. The main concepts worked on in this research are bricolage (LÉVI-STRAUSS, 1952) and microdesign (GOTTELAND-AGOSTINI, 2013; EMBRADO, 2021). Such concepts will be discussed from the perspective of the singularity of actions (VERMERSCH, 2000).

The third stage, preparation, consisted of detailing a research protocol. The collection of evidence followed the method of ergonomic analysis of the work, which uses direct observations of the real work (GUERIN et al, 2001) and self-confrontations (MOLLO & FALZON, 2004). The objective of the direct observations was to identify, analyze and discuss typical real work situations and how field workers dealt with operational uncertainty and project solutions. Among the situations observed, two were selected that could represent the work of the cargo handling team.

The fourth stage, the collection of evidence, considered eight shipments on oil platforms, for a total of 32 days on board. In these shipments, 18 real situations were considered to understand how the microproject is carried out in cargo handling. Among them, the current research presents two typical work situations.

The fifth step of the case study presents the analysis of the evidence. These analyses were carried out according to the research demand in the different phases of data analysis. The discussion elements are based on the pattern matching technique. According to Yin (1989), this is a technique based on a comparison between an empirically observed pattern and a pattern predicted before data collection. This technique consists of the development of different theoretical propositions articulated in operational terms and the identification of independent variables. The study analyzes the behavior of these variables in empirical cases.

In this study, the idea is to observe in concrete situations, how the microproject relates to wild thinking and modern thinking, according to three central variables: (1) theoretical or constructed knowledge in the field, (2) tools selected or put a priori, (3) specific/specialized or adapted tools, with the construction of arrangements in the field.

#### 3. FINDINGS

In this item, the two cases of cargo handling will be presented. Then, the analysis of the cases will be carried out, showing the behavior of the selected variables. The idea is to highlight the relationship between micro-design and DIY.

### 3.1. CASE A – MOVING A FLANGE TO THE WORKSHOP

This movement concerns a flange (40 kg) located in a module of the process plant and should be moved to the boiler shop for maintenance. The supervisor acted to define how to make the route. The main challenge would be to move the equipment to the central track of the process plant, located on the first floor. In view of the lack of resources for movement in the place, improvised means were used. The supervisor observed a pillar adjacent to a sailor's ladder and realized that he could use them as a resource for the execution of the maneuver:

We used this sailor's ladder as if it were a hole in the floor to get to the first floor and [used] the pillar to screw the cable and generate friction. So the weight to lower the load is much lower. We call this maneuver 'going down on a lap' or 'paying cable on a lap'. It helps a lot at times like these.

The supervisor and the assistant dragged the flange together to the sailor's ladder while the assistants brought the necessary equipment to perform the maneuver: a resistant cable, a guide cable and a platform cart. Then, the supervisor and the assistant tied the guide cable to holes in the flange and screwed the cable to the pillar. Finally, they tested the consistency of the system: "*The [assistant] put the load into action to test if it would* 

*function. We confirm that the cable can handle it and that, if necessary, I will hold the load*" (Supervisor).

The team was divided into two: (1) the supervisor and an assistant on the 2nd floor and (2) two assistants on the first floor. In the team on the second floor, an important regulation was observed during the action: while the supervisor "paid the cable on the way back", dictating the pace of the maneuver, the assistant was responsible for directing the flange, for maintaining communication with the assistants who were on the lower floor and for supporting part of the weight of the piece, when necessary (Figure 1). The supervisor maintained communication with the assistant, as he could not see the movement of the flange. If the flange was heavier, it is possible that the assistant was more focused on carrying weight and communication was impaired, for example: "*It ended up being like this, with it there [at the interface] because I could handle the weight*".

On the first floor, one of the assistants manipulated the flange with a guide cable, also to avoid pendulum movement and direct the piece to the cart. The second assistant received the flange, positioned it on top of the cart and untied the cables. The organization of actions among these assistants was also carried out during the action. The plan only provided for the lowering of the load, the receipt by the assistants and the allocation in the cart. However, the organization to perform the task was defined in use, depending on the situation. At the end of the maneuver, the assistants moved the cart along the central road of the process plant, towards the workshop. In parallel, the supervisor dismantled the system designed for that maneuver and stored the materials.



Figure 1 – Dynamics and representation of the Maneuver

# 3.2. CASE B – MOVING A PUMP IN THE ENGINE ROOM

The mechanical maintenance team demanded the removal of the hot water pump (600 kg), located in the engine room. The equipment stopped operating and would be disembarked for corrective maintenance on land. As soon as he received the demand, the supervisor went to the site to check the situation. He searched for and found the bomb in a cradle, but realized that the maneuver would not be trivial:

We have to take the pump to that hatch, but I'm thinking about how we will get the equipment there.

The hatch to which the supervisor refers performs the interface between the engine room and the main deck of the ship, through a hatch. Above this hatch there is an automated hoist capable of moving between the two levels. However, to get there, it would be necessary to remove the equipment from the cradle and move it to an access point of this hoist.

The room had a mezzanine, exactly where the pump was located. To get to the hatch, the supervisor would need to go down with a pump to the main floor. Seeing the initial difficulty of the maneuver, the supervisor summoned the team to discuss the movement plan:

We are going to use hoists to get [the pump] out of here [from the mezzanine], but we are seeing where we are going to install it. There is a monorail, but it does not pass over the pump. Then we will have to go down with the piece to the main floor.

During the discussion, the users installed the hoist on the monorail, in order to facilitate the visualization of the best place to install the other hoists. Thus, the assistants were able to simulate and define which position of the auxiliary hoists could give greater stability to the maneuver:

"They saw that there was the monorail, but as it was not aligned and it was going to sway, right? This work with more than one hoist to stabilize the load happens, because things are not always where we need them. You need to find a way." (TLT)

Finally, two beams were improvised as a carving point, with the use of straps. As the monorail was not aligned with the cradle, the other hoists were used to make a heavy play with the cables to remove the pump without generating pendulum movement. With the execution form defined and the hoists installed, users started the process by tying the pump with straps. While the supervisor and two assistants were lifting the pump, the others were trying to detach the pump from the support:

# We will go up with just the pump. The support is [on site].

When raising the equipment, the operators tried to swing the pump to release the support, but realized that it was still attached and that they would need to lower the equipment to release it. Unable to release the bomb, the users decided to return with the equipment to the crib:

We didn't see this support stuck and we couldn't release it with it in the air. Then we came back with the pump [to the crib] to release it before doing it again.

With the pump parked on the floor, the operators were able to release the support and were finally able to lift the load, manipulating it with their hands to avoid sudden movements. Once it was already high enough to be removed from the cradle, the operators gradually loosened the cable of the hoists installed in the structures in order to align the pump with the monorail, thus preventing pendulum movement (Figure 2).



Figure 2 - Removing the Bracket and Removing the Pump from the Cradle

At this point, the operators started moving the pump through the monorail to access the main floor of the engine room. However, the space below the monorail was taken up by equipment, which made it impossible for the pump to descend directly to the main floor. Thus, the users opted, during the action, to install a tirfor to pull the pump (Figure 3) and avoid the equipment that was located below it.



Figure 3 - Users pull the pump with the tirfor to pass through the interferences

The operators tried to place the pump on the pallet directly, but were unable to do so due to the weight of the pump. Thus, to allocate the pump on the pallet truck, it was necessary to make a new lift. The operators mounted a hoist on a beam located on top of the pallet and, to avoid pendulum movement, two operators used the 'cable over loop' feature to generate friction between the cable and a structure in the room. This allowed the reduction of the effort to contain the movement of the pump, which was carried out gradually (Figure 4).



Figure 4 - Users assemble a system with hoists and cables to allocate the pump to the pallet truck

With the pump placed on top of the pallet truck, the operators moved it to the hatch. They then used the hatch hoist to move the equipment to the main deck of the unit and then took the equipment to the reach of a crane to access the cargo deck.

# **3.3. ANALYSIS OF THE CASES**

The cases allowed us to observe that, when operators act in situations of great uncertainty, the rationality of the action is not given a priori. On the contrary, it is constructed by the subjects according to local conditions. The construction of this rationality is nothing more than a conception for use (FOLCHER, 2015) but it is driven by wild thinking, that is, it does not follow the traditional logic of engineering projects.

When carrying out the microproject, **the operators use the available resources**, which are at hand. In Case A, the supervisor combined a sailor's ladder, a pillar and a cable to constitute a movement system, which allowed him to lower the flange to the first floor of the process plant. In Case B, the supervisor and the operators used monorails and structures of the engine room to install cables, hoists and tirfores, all available on board in order to make the execution feasible.

They also **built arrangements in the field, adapting the available tools to the** circumstances of the action. They make these resources interact, select a set of coherent tools that, combined and reorganized, can solve your problem. In Case A, the tools were combined to construct an arrangement they called "cable over turn", combined with the use of the ladder as a route, which allowed for an integrated operation between the two floors to descend the flange. In Case B, arrangements of hoists, wires and ropes were observed at different times, mounted in different structures of the engine room to perform the necessary movements.

It was also possible to observe, from the verbalizations, that the operators used **knowledge built from previous experiences**, that is, practical knowledge. At no point in the action was theoretical knowledge used, but intuitive solutions, which were brought from applications in other contexts.

In this sense, the operator-designer is nothing more than a bricoleur using available resources to solve the organizational demands that are requested of him. He uses his skills built in the field to select, organize, combine and transform available resources and, thus, build a rationality of action, the microproject.

However, as we have shown, the microproject will allow the construction of a framework that frames the action, but it is not the action itself. After building this rationality and constituting the handling system with the available resources, the operator performs the action. This is the moment of conception in use, in which the system developed by the *bricoleur* is put to the test of reality, that is, the operator appropriates the artifact, begins to deal with unforeseen situations and, therefore, adapts it to the circumstances in use. In this second moment, the operator is also acting as *a bricoleur*, as he is using the available resources

(including the system that he himself designed for the action) and the knowledge built in the action to adapt the system and solve the problem. Even in use, the bricoleur continues to transform and reorganize the system to achieve its objectives, in the process we call conception in use.

### 4. CONCLUSIONS

We conclude that, in situations of great uncertainty, we observe two bricolages. The first aims to build the rationality of action, that is, it is a conception for use. The second aims to correct, adjust and transform the system in use, according to the demands that emerge in the course of the activity.

The uniqueness led to the need for operators to finalize the design in the field. Since the situations are unique, it is impossible for any project to predict how the activity will be carried out. This led us to the idea that the operator needs to build the rationality of the action when the demand emerges, through the microproject.

Naturally, the way teams organize, interact, and build solutions will vary in each field. Similarly, the features to be offered will differ according to these factors. However, the way in which operators think and construct this rationality of action is identifiable: it is the savage thought, typical of the *bricoleur*, as proposed by Lévi-Strauss (1962).

The operator, like the *bricoleur*, starts from a finite set of resources given a priori to constitute his project. To build his solutions, he transforms, adapts, combines and rearranges the elements available for building local solutions. With this, he invents new arrangements, enriches his resources and, thus, builds skills that allow him to solve more problems in time. In this way, to deal with uniqueness, the operator will always be a *bricoleur* who is constantly transforming the work systems to adapt them to the different contexts that the unit lives in order to achieve its objectives.

In this sense, the proposition of resources for action must be in accordance with this way of thinking. The immaterial resources to be offered, for example, should be less focused on concepts and theories and more grounded in the field, so that they can be applied in concrete situations based on this thought. Material resources, on the other hand, need to be flexible, adaptable and known from the concrete use in reference situations, which stops focusing on typical situations and starts to be guided by the process of building rationality.

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