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Opportunities to enhance collective activity to meet the demands of a task: A case of job rotation among port workers

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Abstract.
OBJECTIVE: This article aims to demonstrate the ways in which port workers collectively respond to task demands, work organization and functional turnover instituted in a Portuguese port.
METHODS: Based on both the theoretical debate on the cooperative aspects during the performance of the activity and the contextual research matrix of the activity ergonomics, the investigation conducted focused on the room for maneuvering that is assigned to the work teams and, more specifically, how collective action materializes more visibly in the elaboration of new rules of action with a view to the arbitration between the preservation of health, the guarantee of safety and the response to the required performance levels.
RESULTS: The results of the analysis of port activity make evident the development of a high degree of operational synchronization between the professional skills articulated in the team, specialized communication in certain work subprocesses, and strategies for collective surveillance of risks.

Keywords: Collective work, cooperation, safety, regulation, port activity

1. Introduction

From the end of the 1980s onwards, the collective aspects of activity consistently began to be inscribed in the research hypotheses about organization and work. Since then, the concepts that allude to this dimension of work have multiplied in terms of their relationship to teams, groups, or work collectives, but also in relation to the different aspects that collective action can take due to objects of action, expected results, tasks to be performed, or actors involved [1].

Despite the wide interest in the subject, a closer look at the organizational literature in this field revealed only general recommendations and guidelines on the cooperative aspects that the members of a team should apply. However, this view seems almost prescriptive, inasmuch as it may overlook the collaborative, cognitive and communicational elements shared by workers during the performance of a work activity in a given organizational context [2]. Therefore, in contrast to the lack of context that marked many conceptualizations in this field since the last decade of the 20th century [1, 3], the incorporation of ergonomic assumptions about the activity [4–7] allowed the development of more ambitious research projects. These studies sought to explore new approaches to work and its collective aspects,with regard to the context and constraints. Since then, these contextual elements have been part of the phenomenon under analysis, diverging from the path followed by restrictive perspectives that

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considered such variables only in reference to the prescription of the task.

2. Determinants, conditions, and characteristics of collective work

The interest in ergonomics as one of the collective aspects of an activity emerges as a consequence of the changes in production systems over the past decades, mainly due to the reconfiguration of the principles of a Taylorist-Fordist organization. The research questions framed in the scientific traditions of activity-centred ergonomics and work psychology have focused primarily on the cooperative and collective aspects of work in contexts under transformation due to the questioning of the limits of a 'supposedly perfect' rationality that once defined the work organization [8]. For this reconfiguration to take root, several changes in the workplace and in the organizational ecosystem had to develop between 1980 and 1990. Their implications produced important consequences in the collective dimension [9]:

- introduction of technological tools requiring greater levels of coordination and collaboration between individuals;
- development of vertical management models based on worker participation to encourage the emergence of collective regulations for the activity as a self-sufficient response to the increasing variability of the market [10];
- increase in temporary employment situations, which weakens group solidarity and durability;
- implementation of new forms of human resource management such as individualizing career paths and considering the team as an aggregation of individual competencies.

The background that prompted another look at problems of collective work is still contradictory in itself. On the one hand, this framework promoted cooperation, largely as the result of 'discretionary regulations' [11], which prescribe higher levels of coordination to the team to mediate between the organization and its environment [8]. On the other hand, there are the organizational choices regarding functional and temporal flexibility and human resources that often constrain and weaken the collective dimension of work. This makes it difficult to build collective competencies, to coordinate actions or to transmit information among the workers, such as in the work of magistrates in Brazil [7].

In such an ambivalent context, which intentionally provided margins for collective action while at the same time restricting it, the subsequent interest in collective work emerged as a necessity for the analysis of individual activity [4] and also to question the organizational framework in which this activity was performed [10]. This analysis reveals not only the discrepancies between the demands of the tasks, the level of experience, health and other characteristics of the individuals, but also the ways in which collective work becomes vital for the recognition of what each individual does as a professional [12]. Thus, the interpretive focus is oriented to the work of adjustment and reorganization of the work activity among the members of a team in order to elaborate new rules, to negotiate conflicts and professional contradictions, to establish commitments and adjustments in relation to the contextual singularity, to collectively manage the available individual resources or to delimit compensatory mechanisms [13, 14].

Bearing this is mind, the analyses carried out in the field have been supported by multiple typologies of collective activity; although, as Barthe and Quéinnec [1] acknowledged in their conceptual and theoretical clarification, the variability of the terms still reflects certain semantic and lexical equivalences. Cutting across the many definitions of collective work is the idea of sharing a common goal. However, as Caroly [15] pointed out,under certain conditions collective work should be analyzed not only as the sharing of specific goals, but also as the interaction of two additional elements. The first is the possibility presented to workers of responding jointly to task requirements; and the second is the sharing of spatial coordinates and the registration on a somewhat broader time scale (sharing of time coordinates), during which the activity is organized [16]. Collective work goes beyond the sum of individual activities to the accomplishment of independent tasks, in which individuals perform a task together in the same workspace or jointly in different places [1]. The boundaries of the individual specialties intersect,as the work begins to imply partnership relations with others to carry out the activity through the sharing of resources and the allocation and distribution of individual tasks. In general terms, this portrait of the collective dimension emphasizes two fundamental aspects: that workers involved in the same activity share the same goals and working conditions and that individual workers are mutually dependent on the results of each other's actions [15, 17].

As systematized by Caroly and Barcellini [14], collective work is always defined in relation to the task in which co-workers are involved and to the way in which their performance affects the actions of each one and the overall goal. In the organization of collective work, it is important to consider not only the sharing of goals, but also the degree of synchronization and coordination among workers [10, 14, 15]. Operative synchronization [14] is an essential element for cooperation and collaboration, since it makes it possible to confront, negotiate, and adjust points of view regarding the technical elements of work, issues related to the management of staff, breaks, or work times. Synchronization between workers is facilitated when they share a 'common operative referential' [18], that is, a reciprocal knowledge about the current state and progress of the work of all people involved in the activity. When present, operative synchronization will lead to the development of a 'shared situational awareness' [14, 19]. This requires careful coordination, planning and temporal organization of activities involving the coordination of behaviours, actions, decisions, and operations in terms of time units [10, 16]. There is always a question of compatibility in the durability and pace of the actions, which can still undergo adjustment during the activity, as shown in the research of De la Garza, Maggi, and Weill-Fassina [11].

In the scientific and epistemological delimitation of activity-centred ergonomics, other authors [14, 19, 20] looked at the opportunities for coordination as possibilities of operative and cognitive synchronization. In fact, coordination began to involve the synchronization of actions in time–starting and stopping points of action or periods of simultaneous action. Coordination is neither a verifiable aspect of absolute prescription, nor a product of an early and final construction in relation to the action. On the contrary, it is an element built up in the course of the activity involving verbal and non-verbal communication to make the necessary adjustments for effectiveness. The characteristics of collective work, such as the organization and how it unfolds into modalities, have been analyzed in several professional settings. From this analysis, we may highlight two crucial aspects: productivity and safety, and the demands of each work context, which inevitably impose permanent adjustments on collective work [9]. We also discuss how the collective aspect of work was often established as a way to ensure the performance and reliability of the sociotechnical system and for preserving safety and health [3, 14].

3. Collective work as a criterion of system reliability and preserver of health

3.1. When collective action is not foreseen by the organization of work

The ways in which individuals cooperate among themselves and the margins for the collective re-elaboration of the rules in the work environment have been investigated in a wide range of contexts. The research has taken place not only in high-risk areas, such as the nuclear [21], railway [10], medical and surgical [18, 22, 23], police [24] the driving of rescue vehicles [19], or jobs in the judiciary [7] but also in systems with particularly restrictive tasks [25] or in specific service professions [15, 26]. In all these cases, the research lens focused on distinguishing collective activity from individual activity,because of the critical need for employees to act together to preserve and maintain the reliability and security of the system. In this regard, De la Garza and Weill-Fassina [10] listed four ways of utilizing collective work so that maintenance personnel on railways could better manage risk and ensure safety. These strategies were: joint action, co-activity, collaboration and cooperation. Another study that stands out in this scenario was conducted by Re, Montagna and Ferrari [18]. The authors described the development of cooperative strategies to identify and minimize risks in the activity of a surgical team, and these strategies were strongly endowed with common codes and a shared language (verbal, nonverbal, and paralinguistic). They formeda resource for collective competency that was maintained regardless of shift changes or changes in the number of workers in the ward. In another situation, such as the work of magistrates, Giannini and colleagues [7] noted that although there were few possibilities for exchanges, informal networks of trust could be created that could reduce suffering and contribute to the establishment of defensive strategies.

In a study with a group of farmers, Landini and colleagues [27] concluded that among the factors that increase trust and cooperation are: interpersonal communication and mutual knowledge, sharing problems, values and objectives, and the existence of shared rules for group functioning, including sanctions for offenders.

In all of the aforementioned studies, the modalities of collective work were not pre-existing nor were they derived from prior rules in the organization. They were built after 'coordinated sequences

of work' [16] and after confrontations and strategy sessions within the group during the activity. This is why workers felt that it was essential to learn about the activities of each member of the group, creating common references for efficient cooperation and collective action that greatly enhanced the quality of the system's responsiveness. On the other hand, shared perceptions about the value and meaning of safety influence safety in various sectors that deal with individual and environmental risks [28].

3.2. When collective action is prescribed to workers

Previous investigations focused on activities in which the collective dimension was totally or partially prescribed, which meant that it existed prior to the group of workers that belong to the same level [19, 21, 25]. In such cases, the collective strategies were previously defined by the organization and simply imposed on the employees. It is also true, however, that while engaged in the activity, workers could develop new rules for regulating the workload, ensuring productivity, and preserving health. Thus, it is through cooperation and mutual help that workers in restrictive productive organizations can adopt other strategies for job rotation, allowance for breaks, or implementation of special needs depending on the condition of a given member [25]. The formal, explicit rules established by an organization provide a framework within which employees and managers can develop new rules for cooperative action. This may seem to go against functionalist concepts that individuals must adapt to the predefined conditions of the system, but cooperation among the members of the group for the adoption of shared rules for collective action enhances interactions of those involved in the production of goods and services [13].

3.3. Research objectives

In this study, we analyzed the situation of labourers in a Portuguese port. The work, both on land and on ship, is characterized by a high degree of interdependence between different occupational skills and by an almost daily reconstruction of work teams, due to job rotation, the characteristics of ships, and the types of cargo. Within this context, our research focused on how collective competencies were activated and reconstructed, and described how the boundaries of individual action were deliberately made malleable to ensure safety. The methods were based on previous contributions about the collective aspects, especially the elements of coordination, synchronization, sharing of a common language and criteria for ensuring effective job rotation.

4. Materials and methods

4.1. Work activity in the context of a port

This investigation took place in a port owned by a public company managing three ports in the northern region of Portugal. This port, which is the second largest in the country, handled over 18 million tons of goods in 2016, and led the country in roll-on/roll-off ('ro-ro') and containerized cargo for export. The port operates six cargo terminals for loading and unloading different types of goods. The present research focused on two of these terminals:

Terminal 1: for fractional general cargo and solid bulk goods, mostly wood, iron, steel rods, wind turbines, sheet metal rolls, granite, and bulk agri-food.
Terminal 2: for containerized cargo with a storage capacity of about 12,600 containers.

In addition to loading and unloading goods, these two terminals were involved in storage, parking, and stowage operations, reception, shipment, and verification work. The assignment of workers to different teams and the management of work schedules were carried out by a subcontracted company. At the time of this research, port workers at both terminals were hired by this company as permanent, fixed-term, or temporary[1]. Permanent workers worked solely at one of the two terminals, while fixed-term and temporary workers could be assigned to either Terminal 1 or Terminal 2. Thus, the composition of the work teams could be comprised of employees of all three types and each team could have a variable number of members. Though the number of members per team at both cargo terminals could change, there were six to seven professional functions that were required for each work team: coordinator, weighmaster, *portaló*[2], traffic controller, docker, and gantry/crane operator (Table 1). With the exception of the team coordinator, port workers could be called upon to perform any of the required professional functions–a kind of

Table 1
Tasks of port workers

Coordinator	Directs work teams and possesses skill in solving problems that may hinder the normal course of operations.
Weighmaster	Manages conference services and prepares the total load plan.
Portaló	Indicates by means of signals to the crane / gantry worker and the base workers the direction of movement of the load and operates the ship's load lift.
Docker	Moves cargo on board ships (deck or hold) or in the quay range. Generally works in pairs in the basements and on the ground in partnership with the traffic worker.
Traffic Controller	Performs functions exclusively on soil on the quay strip, including removing /replacing straps or other devices for transporting cargo.
Crane/Gantry Operator	Qualified to operate the crane or gantry in elevated cabins at varying distances from the ground.

'nomadic' style of work [29] that is not restricted to a designated workstation.[1]

4.2. Procedures

This research was conducted between January and September 2014, and involved 159 port workers: 89 permanent, 30 fixed-term, and 40 temporary. In line with the methodological framework of activity-centred ergonomics [30–32], three main sources of data were used: documentary analysis, open and systematic *in situ* observations (with questioning), and semi-structured interviews. By adopting these instruments, we attempted to design an inductive bottom-up investigation in order to conduct in-depth, detailed, local research about collective competence [33, 34]. Collective competence differs from traditional organizational competence by connecting individual and group experiences [31] in a contextualized and finalized way. Thus, given the contingencies of port activity, we aimed to understand the different ways in which the debate between safety and productivity established a set of compromises and adjustments of rules, built up over time among the employees. This included communication and the circulation of information, the standardization of representations, the articulation of know-how, and the development of common strategies [35]. In total, we conducted 30 interviews: 2 with the company's employees responsible for organizing and managing work schedules and 28 with port workers. In these interviews, we sought to describe the dynamics of daily operations in the port by focusing on the following elements:

(1) composition of the teams in terms of numbers of workers and their respective functions and adaptation to the needs of each terminal;
(2) integration of workers (whether or not they were always part of the same team);
(3) individual and collective leeway to designate work breaks;
(4) cooperation between team members as a requirement for completion of the job;
(5) degree of dependence on a colleague's work to perform one's own work;
(6) communication and circulation of information among team members.

The purpose of the observations, which totalled forty hours, was twofold: integrating the data from interviews and deepening the knowledge about the contextual, environmental, and organizational factors that affected both individual and collective performance. Based on this information about the activity at the port, we carried out two stages of restitution and feedback: an individual stage of four individual sessions with workers and a collective stage of one session with ten port workers and a second session with the board of the company responsible for the work schedules and the workers' management and staff allocated to work safety. In addition to validating the data gathered in the previous stages, these sessions allowed discussion with the various interlocutors about ways in which the collective dimension of safety/reliability was gaining emphasis in the global equation that attempts to match the port tasks to the characteristics of the work teams. These characteristics included the number of workers and their functions formally and informally represented on the teams, the level of job rotation, and the criteria for allocation of workers to each team. The collected data were organized and subjected to a thematic

[1]Contract workers were always present at the port, either in Terminal 1 or Terminal 2, but the requisition of temporary workers was conditioned by the volume of work. It should be noted that the temporary labourers had extensive experience in this work, although their employment relationship remained unchanged. The use of temporary workers allowed the adjustment of the number of working hours to be constant for contracted and permanent workers and the remainder to be managed by hiring a variable number of temporary workers.

content analysis [36], allowing the systematization of the results related to the composition of the work teams and the impacts of the rotation of functions in the terminals.

5. Results and discussion

5.1. Composition of work teams in the cargo terminals

The analysis of the composition of the teams at the two terminals revealed variability in the number of employees per team and the types of job each performed. This variability appeared to be directly related to the type of cargo handled (import or export) and the dimensions of the vessels (number of cargo holds) and their scheduled docking and departure times. Table 2 shows the generic composition of each work team for some of the types of goods handled in terminal 1 (steel rod, wind turbines, flour, and wood) and terminal 2 (containerized cargo). It is important to point out that, depending on the size of the ship, more than one team might be handling cargo on the same vessel.

From a functional point of view, the composition of the teams was mainly determined by the type of cargo to be handled, according to the examples of cargo destined for shipment shown in Table 2. In these cases, the functions of team coordinator, weighmaster, traffic controller and gantry/crane operator were required for all types of cargo. The companies operating at the two terminals decided the number of team members and their functions on a daily basis, considering both the type of cargo and the features of the ships that would dock or were scheduled to leave each day. The assignment of workers for each of the required functions, in turn, was the responsibility of the subcontractor, who organized the work schedules upon request from the two terminals. By comparing the data collected during the interviews with those from the analysis of the activity, we identified the following criteria as most commonly used for establishing the work schedule:

(1) the permanent workers operated exclusively at terminal 1 or terminal 2, and the fixed-term and temporary workers could be assigned to either terminal 1or 2; for that reason the latter do not belong to a fixed work team;
(2) except for the job of team coordinator, all functions could be performed by any of the port workers;
(3) the nearly daily job rotation was intended to promote multitasking ability and equalize monthly workload among all workers.

However, a more thorough analysis of the activity in the terminals identified another set of rules guiding the functional definition of the work teams. These criteria drew attention to specific requirements associated with certain port functions, as well as to the level of experience among workers.

5.2. Job rotation: work requirements vs work experience

On a formal level, the workers would rotate through all the port functions. In this way, they would take part in different work teams, become skilled in multitasking and attain a breadth of knowledge about managing the risks associated with each job such as falling due to lack of light, injury with metal bars, climbing up and down slippery steps, or working in hot and confined places [37, 38].

Table 2
Numerical and functional composition of the teams in relation to the type of cargo and size of the ship

Number of cargo holds	1 cargo hold	1 cargo hold	2 cargo holds	5 cargo holds	7 cargo holds
Type of cargo to be loaded	Steel rod (iron bales)[3]	Wind turbines	Flour	Wood (wood shavings)[4]	Containerized cargo
Composition of the work team	Coordinator (1) Coordinator (1) *Portaló* (1) Docker (2) Weighmaster (1) Traffic controller (2) Stacker operator (1) Crane operator (1)	Coordinator (1) Coordinator (1) Docker (2) Weighmaster (1) Traffic controller (2) Crane operator (2)	Coordinator (1) Coordinator (1) *Portaló* (1) Weighmaster (1) Traffic controller (2) Crane operator (3)	Coordinator (1) Coordinator (1) Docker (9) Weighmaster (1) Traffic controller (2) Excavator operator (2) Crane operator (6)	Coordinator (1) Coordinator (1) *Portaló* (1) Docker (2) Weighmaster (1) Traffic controller (2) Gantry crane operator (2)
Total number of workers	9	8	8	21	9

Moreover, according to international recommendations on safety and health of port workers [39], job rotation must be responsive to the individual group's activity needs. Thus, each team member must recognize that: (a) their actions may have a direct impact on other port workers, (b) safety and results of the team's work depend on the vigilance and knowledge of each member (c) and the safety of teammates may depend on individual safety assurance [39].

In the port analyzed, job rotation was regarded as a good thing, mainly because it allowed each worker to 'put themselves in their colleague's shoes'. A labourer who usually worked as a *portal*ó and crane operator reported:

'[Job rotation] is common, which is a positive thing, because it is important to know the work of others, the risks they are subject to..., because in this job we always depend on our colleagues'. The rotation of tasks every two hours was observed in the study by Queiróz and Lara [40] in some terminals in Lisbon.The rotation of workers among a set of different positions for loading and unloading cargo at a port is not new. In fact, this type of job allocation became more common during the last three decades of the twentieth century due to the desire to make the labour force more flexible [41]. As evidenced by other port activity researches, however [40, 42, 43], the functional mobility of port workers within teams did not completely dissolve the boundaries between different jobs, though it did enrich and broaden their know-how. Our analysis of the activity in the Portuguese port allowed us to determine that, in the nominal perspective, the functional composition of the teams was based on professional experience and, in certain cases, on the high degree of dependence and synchronization between certain functions within the teams, such as between the *portal*ó and the crane operator.

Although job rotation for all workers at the port was an established practice, the companies that operated at both terminals, in some cases requested workers according to their level of experience. The terminal companies along with the senior coordinator indicated to the company responsible for the work force management which workers they wanted to supervise a given loading/unloading job. This situation was even more evident in requests for workers for the functions of *portal*ó and crane operator for cargos of steel rods or granite pallets. In these cases, the companies named specific workers to be assigned to the tasks in consideration of their professional experience and familiarity with handling these types of cargo. This often interfered with the organization and management of human resources as carried out by the subcontracting company. A closer look at the loading of a cargo of steel rods allows us to understand the temporal, operative, and communicational synchronization that the task requires from the whole team, and particularly from the *portal*ó and the crane operator.

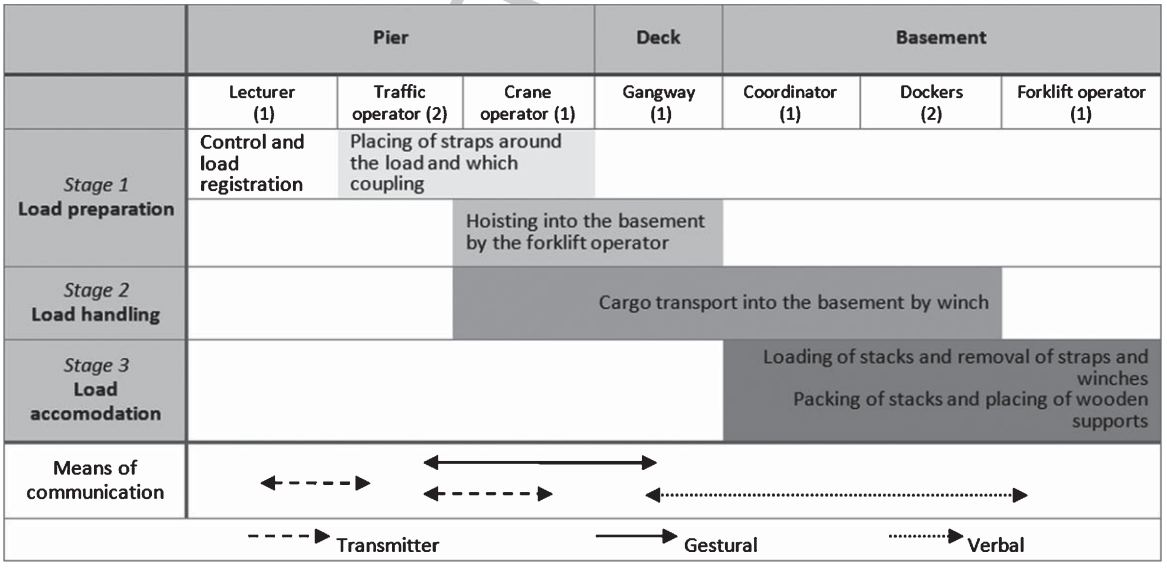

Fig. 1. Schematic representation of the steps for wrought iron loading (for boarding).

5.3. Example of loading a steel rod cargofor shipment

In order to illustrate how the task and its requirements affected the rotation of functions in a team, we chose to describe in detail the loading of a cargo of steel rods in stacks into the hold of a ship. In this case, the job required a 9-worker team and the loading operation was divided into three stages (Fig. 1).

On the harbour dock, the gate clerk was responsible for registering and controlling which stacks were loaded. Next, the traffic operators in cooperation with the crane operators placed the straps on the cargo stacks that would later be hooked to the winch for lifting the load. At the same time, the crane operator would be hoisting the forklift into the ship's hold with the help of the *portaló*. At this point we see one of the central examples of collective activity at the port. The crane operator works from a position onthe dock to move the winch for hoisting either the forklift or the steel rod stacks and lowering them into the hold; but without a line of sight to the ship's hold, he needs someone to guide the operation. The *portaló* is on the deck and serves as the 'eyes of the crane operator'. This operation is particularly hazardous since the coordinator and the docker are in the hold, and requires close coordination between the *portaló* and the crane operator to move the winch into the correct position and lower the load into the hold [16]. In this investigation, it was observed that the cooperation networks were not different between novice or former, temporary, contracted or permanent workers. This differed from the study of Giannini and colleagues [7] in which magistrates developed bonds of trust only with colleagues who entered the profession at the same time and passed the same competitions.[2]

As the steel rod stacks were raised and moved into the hold, the coordinator, docker and forklift operator inside the hold simultaneously performed the actions related to the accommodation of the load by placing wooden supports between the stacks. Thus, workers in different places, on the pier, on the deck and in the hold, used common spatial and temporal coordinates, to interdependently carry out stages 2 and 3 of the loading at the same time. The overall reliability of the process was largely assured by the use of both verbal and non-verbal instructions among the team members [18, 44]. This specialized language, in the context of cognitive representations shared by the team, became progressively more compatible with the requisite actions through repeated work experience [45]. According to Boreham [44], in epistemic terms, the use of this language requires the development of a collective knowledge beyond the individual knowledge of each team member. Thus, the use of such an operative language, whose capability is improved by repeatedly performing the activity and is focused in time and space by the task, continually maintains the efficiency of the process. This collective group knowledge may compensate for any insufficiencies in the work organization and for unforeseen events. Job rotation was not fully attained because the companies at the terminals indirectly restricted the rotation of crane operators and the *portaló* by appointing which professionals could operate with steel rod or granite. This meant that workers who operated the crane would more often take over *portaló* functions and vice versa. Because of this this, the work rotation among these professionals might be limited to these two positions. However, those in charge of organizing the work recognized that these very specialized jobs could best be served by the functional expertise and the 'know-how of caution' [46] developed by these specific workers.

Because the policy of work rotation was not totally rigid, the allocation of certain professional roles by terminal operators in a team was less variable. According to Leplat [3], the situation where teams have leeway to choose and develop their own action procedures [47] can increase system security and reliability. In the Portuguese port studied here, this freedom was expressed in the workers' initiatives in the negotiation of breaks for rest, meals or, in the absence of moored ships, leaving the port; and for 'relays' in which, for example, gantry operators could swap positions with a teammate every two hours in order to prevent fatigue. This creativity was also visible in the development of additional codes and communication methods such as gestures and audible gangway and forklift signals, to alert workers of potential hazards associated with the movement of loads, cranes or vehicles. Among some port workers, there was also a 'surveillance activity' [10], that was tailored to the specific work spaces, times and

[2]Despite the existence of radios, at certain moments of the operation sign language was most useful in the communication between these professionals. For cargo handling at a time when the crane operator has no view of the winch inside the hold, the shared codes were related to: (i) the spatial orientation (right / left), depending on the place of deposit inside the hold ;(ii) the interruption of the downward movement of the winch for the safety of workers inside the hold, as well as the oscillation of the goods; (iii) the speed of winch movement; and (iv) the exact moment when the winch deposits the load and opens the gripping mechanism .

circumstances of a job. In our port case, this was evident in the work of the *portaló*, which was not limited to signaling the directions that the winch should take, but also involved watching the movements of teammates in the hold and keeping an eye on the weather, especially the winds that could affect the loading or unloading operations.

Although the results were interesting, the limitations of the research must be mentioned. Even if the operational parameters were chosen to illustrate the collective work in the port context, however detailed the description may be, we still know that not everything that happens in reality has been reproduced. More empirical research is needed to validate and verify these perspectives and results during operations in real time. In addition, the fact that we operated in a real-life environment has a limitation in relation to the replication of the study. Each port, cargo and team composition is different, and an exact replication of this study would not necessarily produce similar results. It should be noted that replication literally has never been the main priority in this study. However, other researchers may use this study as a basis to develop their work.

6. Conclusions

The results of our analysis of the port activity showed that team members cooperated by sharing their knowledge about safe practices and ways to enhance productivity under the same temporal and spatial coordinates, with more or less specific tasks assigned to each team member depending on the type of job. The continuing interaction between port workers created dynamic professional boundaries in which exchanges of information about the current and future outcomes of individual actions and the ways individual competencies contributed to the group's productivity gave rise to common references and shared operative representations. In this sense, the analysis of the work in this port demonstrated that different activities could be simultaneously interdependent and coordinated among themselves. This process was clearly successful when enrolled in a collective work context, in which individuals coordinated their actions with those of their teammates [48].

Although not totally uniform, the changes that have taken place in the labour market in recent years have led to significant alterations in how work is organized: the decentralization of processes, the fragmentation and individualization of work objectives, or the establishment of procedures that allow for more flexible organizational structures, especially in the areas of competence or human resource management. In this study we showed how the current discourse on flexibility may be questioned on the face of the demands of a particular task, the characteristics of the environment or the potential hazards of the job. Regarding the selection of the members of each team, because of the variability in the ships and the types of loads, it was necessary to allocate some jobs according to the levels of experience of the workers rather than by a simple rotation scheme. However, in other situations, considering that the organization of work favoured a functional flexibility expressed in the daily rotation of workers among the different roles in the port, this management option, for certain types of cargo (Fig. 1) ended up having to focus primarily on professional specialization and high interdependence among workers at certain points in the work process. One distinguishing feature of this port was the stability of the workers in the teams. Although the work teams in this port were composed of members with long-standing employment bonds, even the temporary workers had considerable work experience, which contributed to the formation of a relatively solid and durable system. In spite of the presence of options related to the functional rotation and alternation of service in the two terminals, the workers had developed extensive knowledge about the individual competencies of each team member and how they could be applied to a particular job. This was seen most clearly in the contribution each worker gave to the system, in order to guarantee the collective safety at two levels. The first level referred to modifying the rules to reduce tiredness and fatigue through extra breaks, relay systems, mutual aid, or alternatively through the rotation of jobs. The second level referred to workers on the same vessel who could thus immediately see the consequences of their actions on others, and thus develop a common representation of the work situation, facilitating communication. These individual contributions could be used to enhance the general level of alertness of the team to risks [49] and, consequently, to increase the overall quality of the system's response. As in other contexts marked by cooperation among professionals, the collective activity in this port responded well to the problem of maintaining a high level of performance while preserving the health and safety of team workers. The solution lies in fostering continuing close relationships in which the safety of all is a

result of individual workers' choices regulating their own actions to ensure safer collective action.

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Conflict of interest

The authors declare no conflict of interest.

1. Requests for temporary workers were subject to workload while fixed-term employees were always in the port, in Terminal 1, or in Terminal 2.
2. Portuguese word to designate the person who guides the work of those who operate equipment that raise cargo. It can also be referred to as 'sinaleiro' (Portuguese for 'signalman').
3. Fine and extensive iron lintels, intended for the construction industry (e.g., to build interior reinforced concrete structures).
4. Sawdust/wood chips for the production of paper pulp or paperboard (furniture).
5. In spite of the existence of radio transmitters, in certain moments of the operation, gestural communication gained preponderance in the communication among these professionals. For load handling, when the crane operator has no line of sight of the winch inside the hold, the shared codes addressed: (1)the spatial orientation (right / left), depending on the storage location inside the hold; (2) the interruption of the winch's downward movement (both for the safety of the workers moving inside the hold and for the oscillation of the goods); (3) the winch's movement speed; (4) and the exact moment at which the winch can deposit the load (opening of the locking mechanism).

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