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TECNOLÓGICO NACIONAL DE MÉXICO
Instituto Tecnológico de Tijuana

DEPARTAMENTO DE INGENIERÍA INDUSTRIAL

COGNITIVE ERGONOMICS IN THE PRACTICE

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AGENDA

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The research Practice
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Background

Cognitive ergonomics is concerned with mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system (IEA, 2016)

Relevant topics include mental workload, decision-making, skilled performance, human-computer interaction, human reliability, work stress and training as these may relate to human-system design.

Aims:

- user-centered design of human-machine interaction and human-computer interaction (HCI)
- design of information technology systems that support cognitive tasks (e.g., cognitive artifacts)
- development of training programs
- work redesign to manage
- cognitive workload and increase human reliability

Areas of application:

- Psychology
- Physiology
- Health and safety
- Sociology
- Economy

The research practice

MUNICIPAL WORKSHOPS

The aim of the project was to investigate the human reliability by evaluating the individual and collaborative performance from the viewpoints of the operational and administrative personnel.

An intervention should be planned and implemented in the near future.

Note: Intervention was seen as a change to increase efficiency in the routine operation at the municipal workshops.

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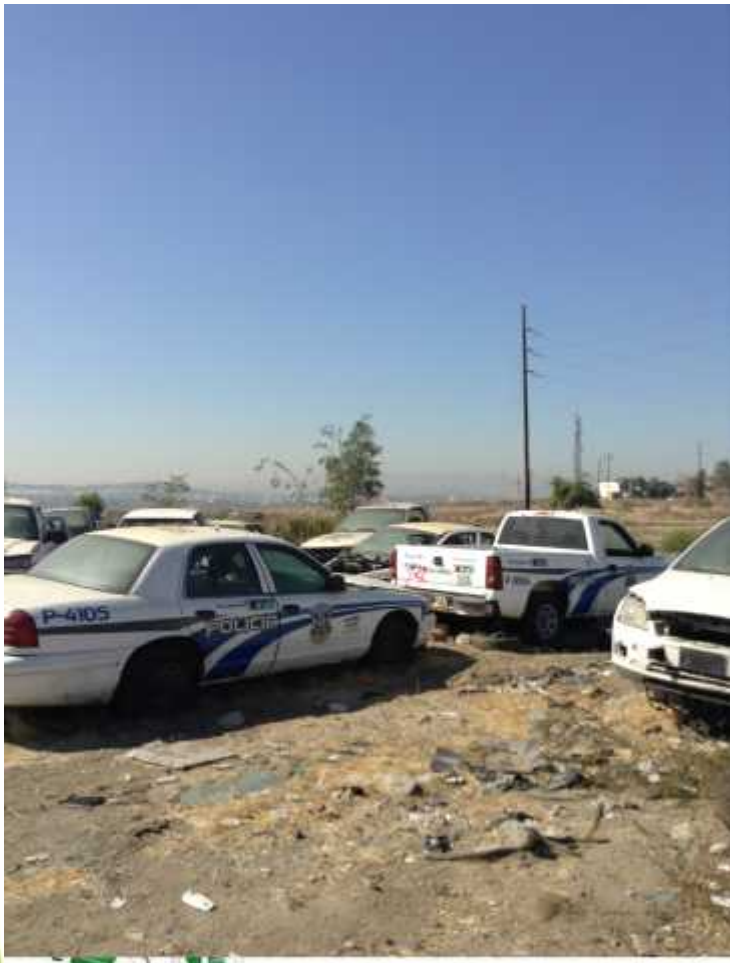


This study was solicited by a department of the municipal government.

This department solicited specific attention to the routine operation at municipal workshops.

The workshops give preventive and corrective maintenance to the municipal government vehicule fleet.

METHODOLOGY

An interpretive paradigm was choosen:

1. To gain in-depth understanding of phenomena.
2. To gain in-depth understandings of reality created, maintained and employed by individuals.

Case study strategy was adopted for involving a naturalistic context and enabling better understandings of phenomena in context.

We use a cualitative approach. It involved to recognize that knowledge exist in context despite participants do not know about it.

It gave the opportunity to gain in-depth insights of the routine operation.

Three methods were used to gather data: interviews, observation of routine operation and revision of organizational documentation

Before starting to gather data, ethical issues were considered:

- The participants agreed to participate in the investigation.
- Collected data was codified.
- Results were presented to the participants and gave feedback about them.

The workshops are considered complex, dynamic, time-constrained and naturalistic contexts.

Ambulances, patrols, garbage trucks, trucks, armoured vehicles, motorcycles, among others are part of the municipal vehicle fleet (nearly 1,100 units).

155 individuals work in three big and nine small workshops

Example of big workshop.
Preventive and corrective maintenance services are provided

Example of small workshop.

Preventive maintenances are provided.

Interviews

25 interviews were done involving operational and administrative personnel. The critical incident technique was employed

The personnel came from all areas of the workshops touching seven administrative levels.

Revision of organizational documentation

The revision permitted the access to the norms and rules related to the routine operation (legislation).

Examples: instructives, flowcharts, maps, reports, incident reports, invoices, service budgets, procedures, etc.

125 documents were collected.

Observations

The observation of the routine operation was limited to certain hours for ethical reasons. Nearly of 250 hours of observations in one year.

They made many questions to the investigators about the study. Gaining trust was suggested.

The word “investigation” have other meaning in this context. So, we change it for doing “an academical study”.

Additional Observations

The preliminar analysis of collected data suggested that additional information from the administrative personnel should be collected.

So, three sessions making beaded collars and bracelets. Different scenarios of production.

Three sessions assembling Lego vehicles. Different groups in each session, same individuals.

Making beaded collars and bracelets

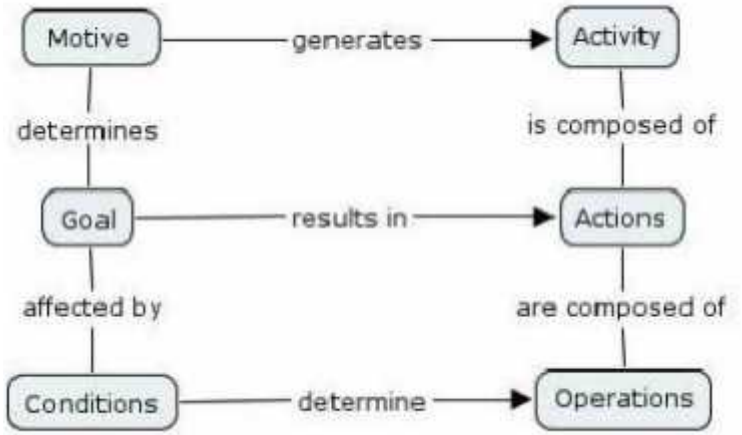
Assembling Lego vehicles


24-7 SERVICE

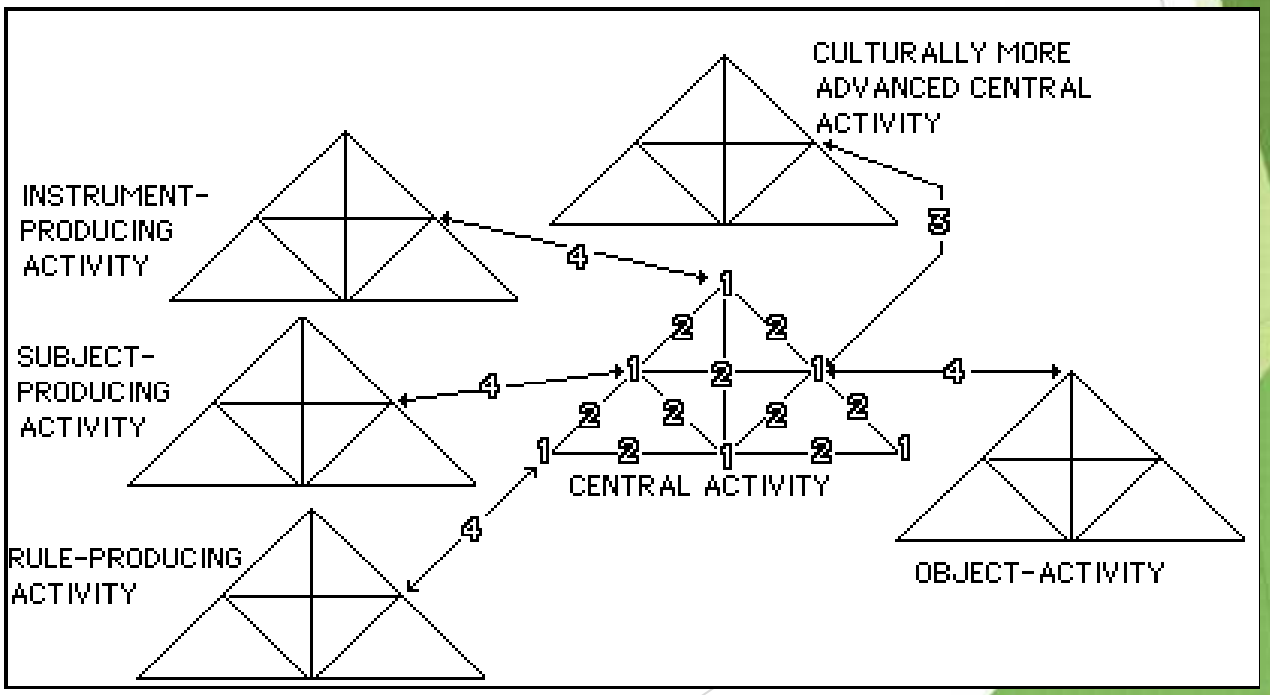
Analysis of collected data

Activity theory was employed as conceptual framework and analytical tool.

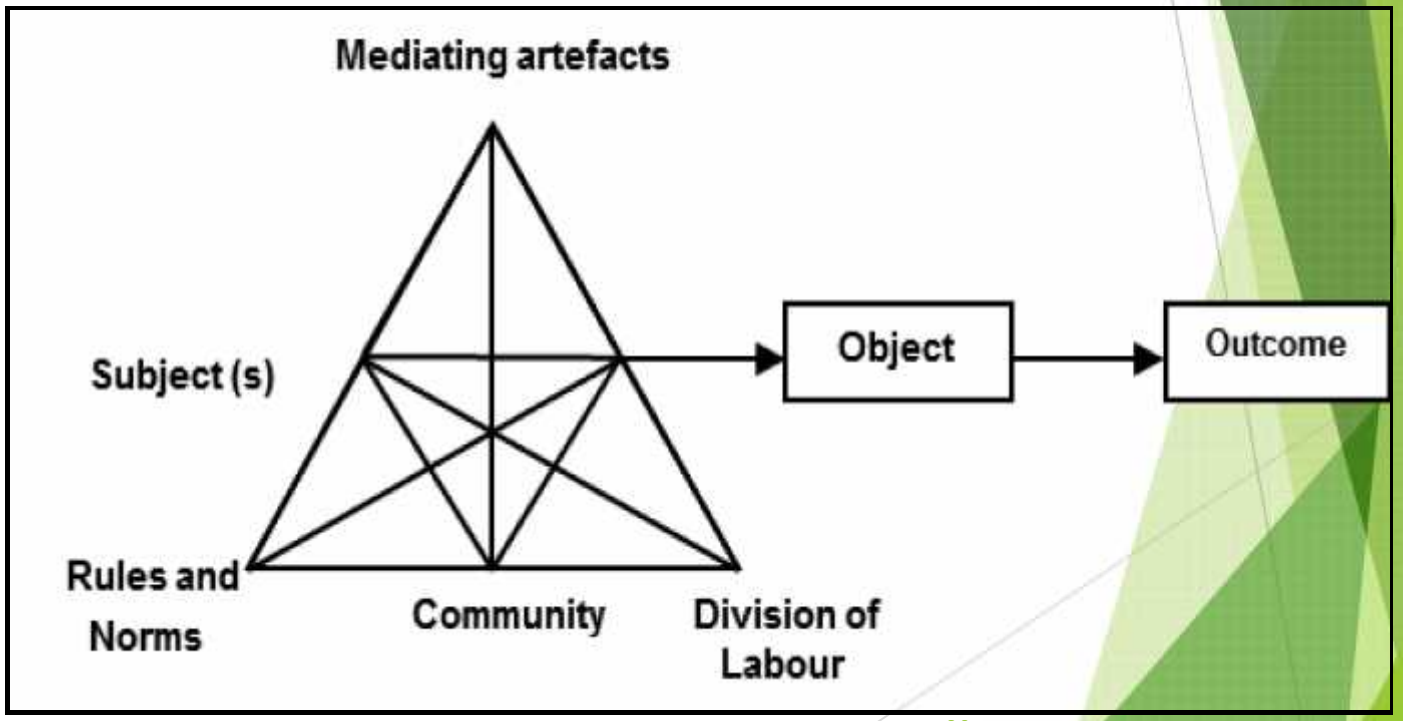
It would be required to discover the motivations of the activity in study; the goals of actions, and the conditions of the routine operations.



In addition, it would be neccesary to find the tensions and contradictions –generate innovation- of the activity in study at four levels (primary, secondary, tertiaty and cuaternary):



Similarly, the elements of the activity in study (conceptual framework).



Subject (s): in relation with the context

Mediating artefacts: abstract and material
Rules and norms: formal and informal
Division of labour: organization
Community: group or teams

Motivations of individuals: internal and external
Object (ive) of the activity in study
Outcome: expected result

Additionally, an inductive approach was followed.

The aims were:

to discover the significant themes inherent in raw data without restrictions,

to link concepts and themes facilitating subsequent analysis.

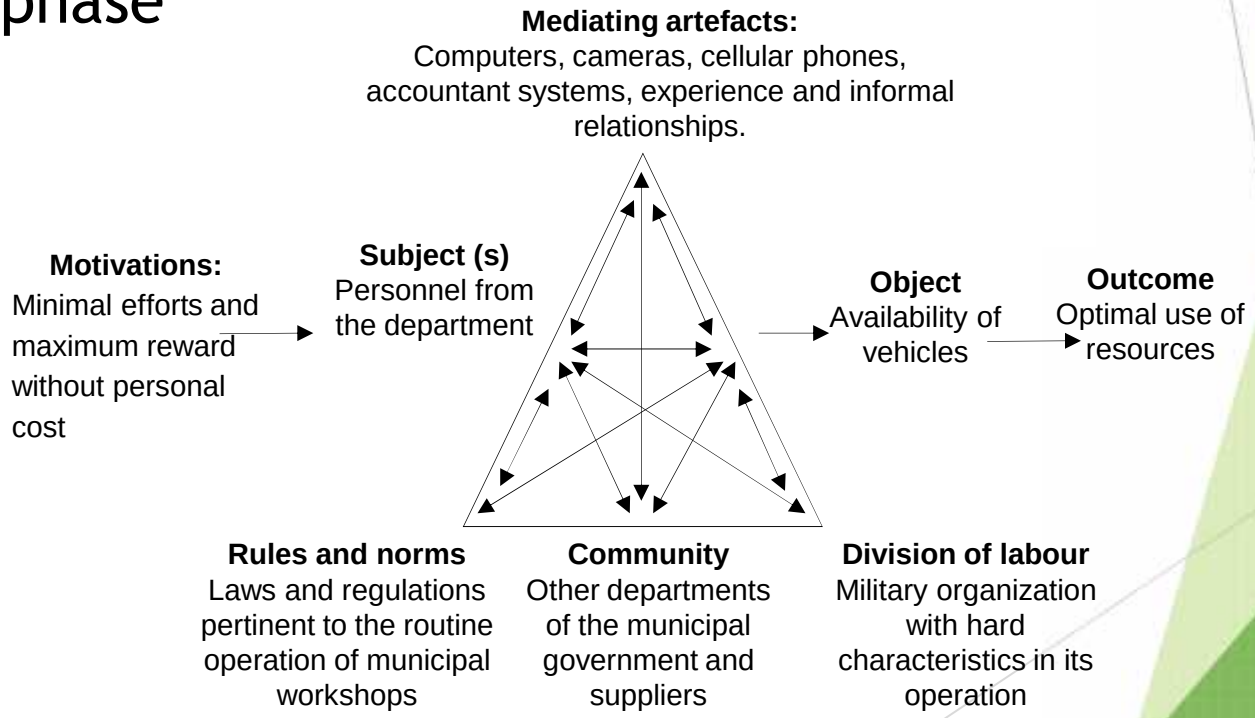
The coding process employed the constant comparative method:

Open coding –small pieces of information to be categorised-,

Axial coding –link categories in themes-.

RESULTS

The next figure presents the activity system in the diagnosis phase



Examples of tensions and contradictions

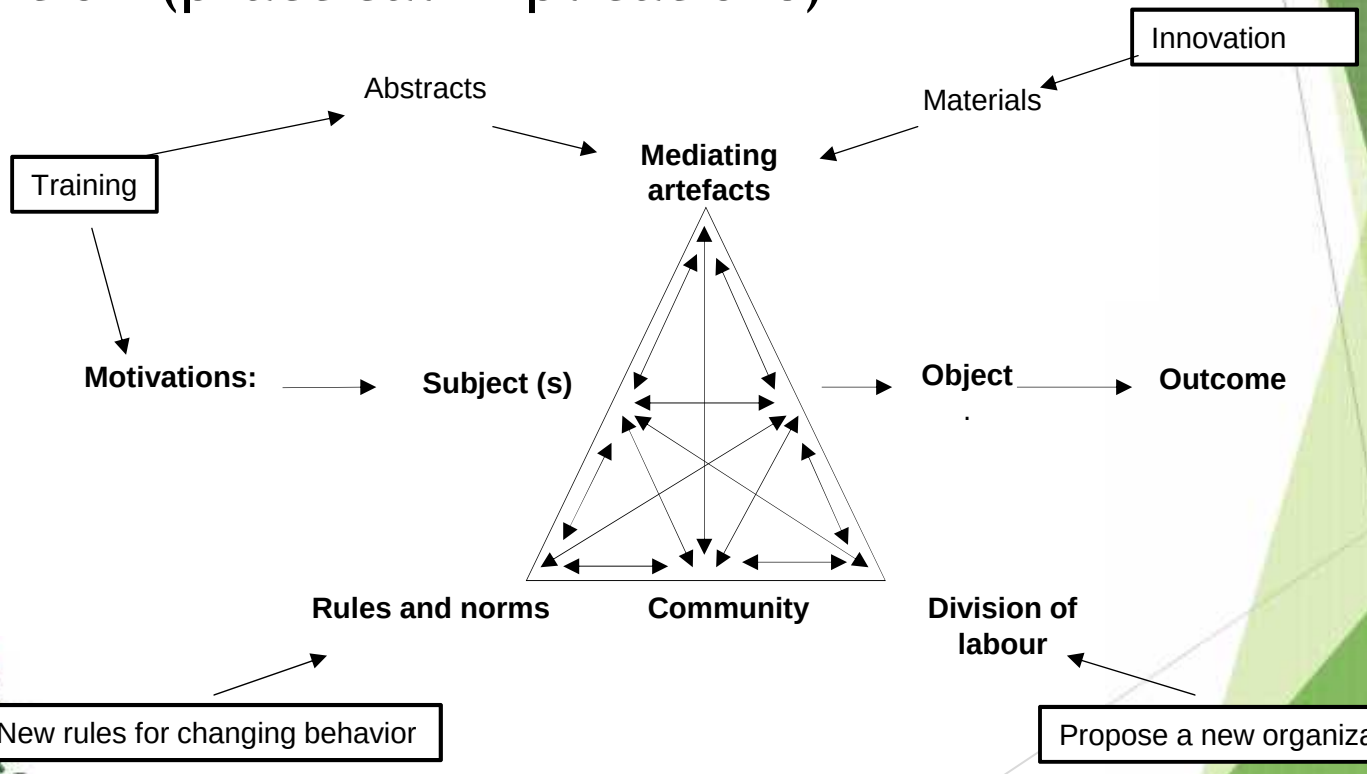
Primary. 11 authorizations per corrective maintenances.

Secondary. Lack of training to perform the preventive and corrective maintenances.

Tertiary. Changes in the maintenance programs.

Cuaternary. Lack of information sharing between departments involved.

Interpreting the activity system for doing the intervention (practical implications)



Training. To increase abilities.

Innovation. To develop technology user-friendly and to facilitate collaboration.

New rules. To facilitate the collaborative work.

A new organization. To redefine authority and responsibility

Conclusions

The interpretive paradigm was a feasible paradigm to study human reliability in context.

There were in-depth understandings of human reliability in terms of participants.

In-depth understandings of the conditions of the context were obtained.

The collection of data was a challeging activity.

The analysis of data was time-demanding and challenging.

The discovery of the activity elements and the tensions and contradictions oppened the opportunity to ask additional questions.

Recomendations

The cualitative approach is time demanding, so you would consider to present partial results.

It gives a holistic view of the phenomena in study, because you gain additional insights of it.

It uncovers other areas of research that you would consider in the near future.

You would develop additional research questions for studying unexplored contexts.

The research products decrease in number by investing additional time for gathering and anlysing data. So, you would be considered unproductive ☺!

You would know the possible meanings of usual words in context.

Thanks for your attention

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