

CASE STUDY

Ergonomics assessment in a retail store

Context

Large-scale distribution is a sector that includes many work situations, with multiple handling and load carrying activities.

These tasks expose employees to the risk of developing Musculoskeletal Disorders (MSDs). A project to improve working conditions was launched by a major retail company, based on an objective and **quantifiable multifactorial mapping**, followed by a diagnosis.

The aim of this ergonomic study is to identify both biomechanical and physiological risks together with the activities likely to cause them, in order to make recommendations for improvement.

Methodology

The observed work cycle consists of three main tasks: pallet handling, product stocking and pallet reconditioning (including stretch wrapping the remaining products).

The following measurements are performed using sensors and software developed by T.E.A. Ergo :

- **Postural constraints** on all joints with 15 Motion Capture sensors (IMU).
- Amplitude of the **muscular efforts** on the lumbar muscles with 2 EMG sensors.
- **Heart rate** for estimating the **task intensity** with an ECG sensor.

To supplement the analysis, a video of the work situation is automatically synchronized with the measurements in the CAPTIV software.

Data analysis

Global posture analysis

By means of Motion Capture, **postural solicitations** of the upper limbs (figure 1) are **mapped in a precise and objective manner** according to three **CAPTIV reference thresholds**¹: green (comfort zone), orange (non-recommended zone) and red (risk zone).

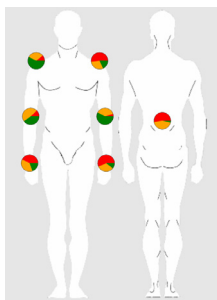
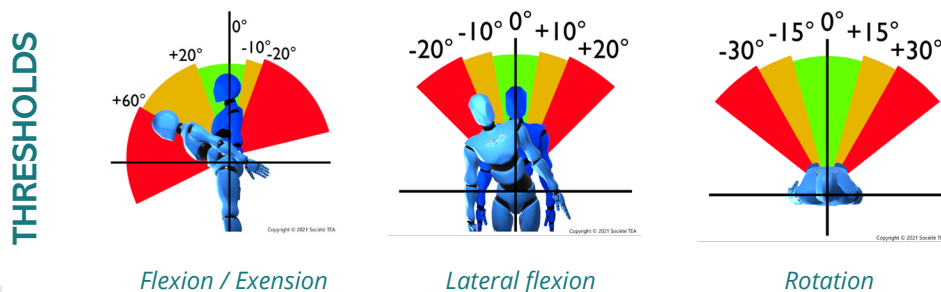


Figure 1

This analysis does highlight **significant load** on the **lumbar** region (rotation), on **left shoulder** (rotation) and for both **wrists** (extension).

The **task analysis timeline** created from the video of the workstation shows that the activities at the origin of these hazardous gestures are **pallet reconditioning** and **product stocking**.

¹ : Dr. Kapitaniak Thresholds

Task-specific analysis: pallet reconditioning



Pallet reconditioning task

During this task, measurements show that the rotation of **back** and **left shoulders**, as well as the **right wrist** extension, are mostly (if not exclusively) in the risk zone (figure 2).

It can thus be observed that hazardous postures represent:

- 68,5% risk exposure time for back rotation
- 64% risk exposure time for left shoulder rotation
- 45% risk exposure time for right wrist extension

During this activity, the lumbar muscles are significantly solicited (beyond the non-recommended threshold) for 22% of the stretch wrapping time.

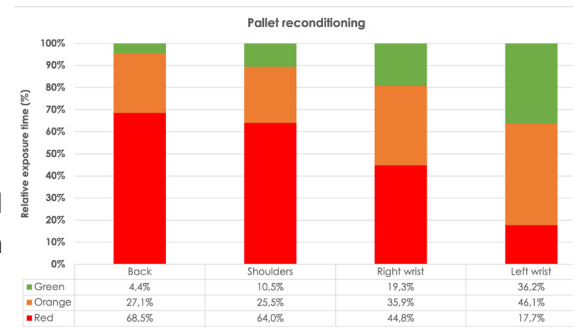


Figure 2

Task-specific analysis: product stocking

The stockpiling task entails four subtasks: **pulling**, **lifting**, **carrying** and **pushing** parcels on shelves.

Measurements show that (Figure 3):

- **Back and shoulders rotations** are under **significant constraint** when a parcel is **lifted**,
- **Wrists extension** and **left shoulder rotation** are **very solicited** when a parcel is **pushed**,
- The tasks of **pulling** and **carrying** a parcel cause **moderate strain** on **upper limbs' joints**.

Heart rate analysis shows **elevated cardiac stress** if the work intensity is **maintained over an extended period**.

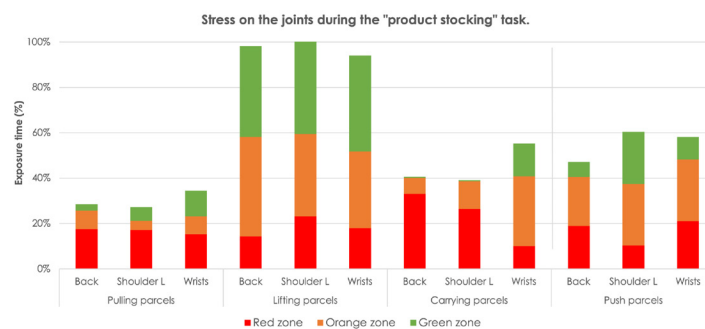


Figure 3

Conclusion

Based on **objective metrics** obtained using the **CAPTIV solution**, experts can formulate **operational recommendations** and **implement preventive measures** aimed at **improving the working conditions** of employees.

To fight against musculoskeletal disorders (MSDs), the CAPTIV tool enables to combine several types of physiological data and **automatically correlate them** with information from **workstation mapping**. This approach is as innovative as it is effective. In addition to its **ease of deployment and versatility**, CAPTIV also offers unparalleled possibilities of **risks visualizations** (3D avatar, diagrams, etc.) while significantly **reducing data processing time**.