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Procedia Manufacturing 3 (2015) 4756 – 4760

Procedia MANUFACTURING

6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015

A proposed methodology for task analysis in ergonomic evaluations

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Abstract

The aim of this job is to propose a procedure that helps ergonomists and engineers to develop task analysis and evaluations in workstations. In the ergonomics field, task analysis is a method to describe and analyze the task performance when users interact with complex systems, this is the first step to do an ergonomic evaluation. Most of the areas in ergonomics requires task analysis, literature contains clear descriptions for task analysis for cognitive tasks, and nevertheless there is a lack of information for biomechanics and design evaluations. In here, a procedure is proposed in order to offer tools to correctly conduct ergonomic assessments that help ergonomists to develop this evaluations and indicate the risk level of certain workstation. This research contains a proposedprocedure for task analysis and two case studies applying this procedure. The proposed procedure consists in five phases: recognition, video recording, subtasks separation, video analysis, and frame classification. The proposed procedure is applied in two case studies. The first case studyis in a workstation of an automobile parts industry.The second case study is in a shoe manufacturing workstation. Subtasks are identified and classified with frequencies in both jobs, indicating what subtasks are more repetitive, and thus need to be assessed.This work provides a procedure that allows to standardize the process of task analysis in biomechanics and design evaluations, this procedure allows to obtain the frequency of the subtasks that are part of the assessed workstation, and thus it is easier to identify which one of these need to be evaluated with ergonomic methods.

Peer-review under responsibility of AHFE Conference

Keywords: Task analysis; Methodology; Ergonomic evaluation

1. Introduction

Ergonomic analyses are always human-centered, focusing on human performance[1]. Evaluation of task performance when users interact with complex systems can be achieved by applying task analysisprocedures.When performing an ergonomic evaluation, partial success in determining stress, fatigue, and other concerns has been

Peer-review under responsibility of AHFE Conference
doi:10.1016/j.promfg.2015.07.573

brought by adopting the use of methods to describe an analyze individual performance in work environments[2]. Kirwan and Ainsoworth (1992) determined that task analysis is a process that identifies and examines the subtasks that must be performed by users that interact with systems. According to Stanton, (2006) most of all areas in ergonomics requires some form of subtasks representation. Among the benefits of Task Analysis, is that is highly recommended despite the subtasks descriptions facilitates the systematic identification of ergonomic problems [3]. Breaking down tasks into its components or subtasks[4], is also an important component in ergonomic design process performed to ensure that aforementioned objective is attained [5].

The proposedprocedurebenefits industry, by guaranteeing that evaluations are develop in a systematic way, rendering reliable results, that may help to standardize ergonomic assessments of workstations in order to determine postural risk level, and thus the results will contribute to preventing work related musculoskeletal disorders, in addition this contributes to enterprises reducing costs of accidents and occupational injuries, absenteeism, turnover, designing a more comfortable place to work that permits to increase productivity and quality on products.

2. Methodology

The procedure proposed in this case study consists in five phases: recognition, video recording, activity and subtasks separation, video analysis, and frame classification.

2.1. Phase 1: Recognition

The objective of this point is to be familiar with the job that is going to be assessed. During this phase, the ergonomist must define the task to be evaluated, carefully observe every detail that is part of the activity;tools, machinery, materials, equipmentuse, as well as measure cycle time.

2.2. Phase 2: Video recording

Once familiar with the activity to be evaluated, video recording of the activity must be completed; it is recommended that recording time contains sufficient work cycles to obtain a reliable analysis. As a minimum, ten work cycles for repetitive tasks, and 15 to 20 minutes for non-repetitive tasks must be recorded.Thevideoshouldinclude recording from both left andright view profiles of the worker, making sure the entire bodyis included and observable; recording must also be continuous, without interruptions. .

2.3. Phase 3: Subtasks separation

Once completed, recordingsmustbe viewed and analyzed, repeating as oftenas necessary, until the ergonomist canlist allsubtasksperformed by the observed worker. It is recommended to name the tasks and subtasks with short names or codes, whichwill allow for an easy identification of what the worker is performing.

2.4. Phase 4: Video analysis

The total time length of the recording must be converted into seconds; then, the number of seconds will be divided by 200; the result is the interval in seconds, then 200 frames are to be selected after each time interval. This can be easily completed by using GOMPLAYER® software, which will automatically select the frames by entering the time frame; afterwards, 100 frames must then be selected at random from the resulting 200. Random techniques should be employed to avoid selection bias.

2.5. Phase 5: Frame classification

Once frames are selected, the final phase consists in classifying each of the 100 frames; each frame must be observed in detail, classified and arranged within an identified subtask, and counted; once a count of frames per subtask is complete (totaling 100), frequency percentages for each should be estimated and added, this will allow the