Correcting working postures in industry: A practical method for analysis

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A practical method for identifying and evaluating poor working postures, i.e., the Ovako Working Posture Analysing System (OWAS), is presented. The method consists of two parts. The first is an observational technique for evaluating working postures. It can be used by work-study engineers in their daily routine and it gives reliable results after a short training period. The second part of the method is a set of criteria for the redesign of working methods and places. The criteria are based on evaluations made by experienced workers and ergonomics experts. They take into consideration factors such as health and safety, but the main emphasis is placed on the discomfort caused by the working postures. The method has been extensively used in the steel company which participated in its development. Complete production lines have already been redesigned on the basis of information gathered from OWAS, the result being more comfortable workplaces as well as a positive effect on production quality.

Introduction

When the problems of working postures in industry are considered, the following two questions are important. What is the most feasible way of analysing postures? How does one know which postures are the poor ones, i.e., how can the postures be evaluated according to a chosen criterion?

The first question seems fairly easy to answer. The features of a working situation can be observed (e.g., Tippet, 1967) or photographed (Muybridge, 1887), or chronocyclography, etc., can be used. The newest methods available are automated, computer-based posture and movement analysing systems. The posture analyser can choose the method to be used according to his needs and economical resources.

The problem of identifying and classifying poor working postures seems more complicated. Scientific literature on the ill effects of working postures is scant; well-controlled epidemiological studies are few; and present knowledge is mainly based on case reports and common sense. In the earlier literature poor postures were connected with physically heavy jobs, in which diseases of the musculoskeletal system were over-represented (Schröter, 1961). Poor postures and the physical demands of the job were regarded as the causes of the injuries. The relation between ergonomic deficiencies in the workplace and diseases of the musculoskeletal system has been demonstrated by van Wely (1970), and illustrative case reports have been published by Perrot (1961).

An analytical method for industry must meet the following criteria: (a) it must be simple enough to be used by ergonomically untrained personnel, (b) it must provide unambiguous answers even if it results in over-simplification, (c) it must also offer possibilities for correcting the over-simplified ergonomic approach. Continuity is gained if the method can be incorporated into existing routine tasks.

The Ovako Working Posture Analysing System (OWAS) has been planned to meet the preceding criteria for use by work-study engineers. The engineers may use it as part of their daily routine or as a separate analytical tool. The method is based on work sampling (variable or constant interval sampling), which provides the frequency of, and time spent in, each posture. The postures are classified and their discomfort assessed so that a systematic guide to corrective action can be constructed. Occupational health personnel participate in the use of OWAS and this procedure helps to solve problems arising from a too rigid application of the system.

<table>
<thead>
<tr>
<th>Table 1: Scheme of the reliability evaluation of posture x</th>
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<tbody>
<tr>
<td>Workers</td>
</tr>
<tr>
<td>Work-study engineers</td>
</tr>
<tr>
<td>No 1</td>
</tr>
<tr>
<td>No 2</td>
</tr>
</tbody>
</table>
Classification of postures

The working postures were collected from photographic material taken in several divisions of one steel factory. The material covered most of the working postures typical for a branch of heavy industry. The material was sorted to form a classified system. The classification was based on the subjective evaluation of discomfort and the health effect of each posture, as well as the practicability of observational analysis. The classification yielded 72 postures (for some examples, see Fig. 1), the main grouping being based on the general features (sitting, standing, etc.) and the position of the back and arms. The classification itself implied the existence of some postures which did not appear in the original photographic material.

During a pilot study the practicability of the method was tested. Twelve work-study engineers spent one week learning the system. After this training they analysed 28 tasks in the steel plant. The results were encouraging, and we proceeded to the next phase of evaluating the reliability of the method. During the pilot phase training material was also developed for later teaching programmes.

During the reliability evaluation, 52 tasks were analysed and a total of 36,240 observations were made (for the statistical method used, see Ferguson, 1959). The scheme and results of the reliability check are presented in Tables 1 and 2 respectively. The percentages in Table 2 describe the inter-worker and inter-observer agreement as well as the agreement between the morning and afternoon observations. In general the reliability of the observations was fairly good between the two work-study engineers. The figures indicate, however, that the two workers who were observed doing the same job used different postures on a large percentage of occasions. From a theoretical point of view the concept of reliability may need more clarification, but for practical purposes the information presented here seems sufficient to justify OWAS. The reliability of the work sampling method has been discussed in other literature (eg, Ferguson, 1959).

Evaluation of the classified postures

In order to evaluate each posture from the point of view of the discomfort caused and the effect on health, we established a rating system with which 32 experienced steel workers evaluated each position twice during the same session. For each posture the workers were shown a manikin properly positioned as well as a schematic drawing. The four-point rating scale which was employed had the following extremes: "normal posture with no discomfort and no effect on health" and "extremely bad posture, short exposure leads to discomfort, ill effect on health possible". From the workers' ratings a mean rating was calculated for each posture and a rank order was established. In general the distributions of the workers' ratings were coherent. In some cases, however, a scattering of ratings occurred. In order to provide these postures with a firm rating, a small group of international ergonomists also rated them. The final rating of each posture was formed from the workers' ratings weighted by the evaluation of the specialists.

OWAS as a tool for work-study engineers

After each of the postures had been rated, they were re-classified into four categories according to the results. The first category contained the normal postures, the fourth included those which were rated as the most uncomfortable, and the other two were made up of the postures with intermediate ratings. These categories, which have an operative character, were named operative classes. Each class has an implication for the work-study engineer, i.e:

Class 1 = normal postures which do not need any special attention, except in some special cases.

Table 2: The medians and ranges of the percentage agreement between the two workers, the two work-study engineers, and the morning/afternoon observations

<table>
<thead>
<tr>
<th>Item</th>
<th>Median %</th>
<th>Range %</th>
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<tbody>
<tr>
<td>Workers A and B</td>
<td>69</td>
<td>23–88</td>
</tr>
<tr>
<td>Work-study engineers 1</td>
<td>93</td>
<td>74–99</td>
</tr>
<tr>
<td>and 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning/afternoon</td>
<td>86</td>
<td>70–100</td>
</tr>
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</table>
Class 2 = postures must be considered during the next regular check of working methods
Class 3 = postures need consideration in the near future
Class 4 = postures need immediate consideration

In practice the work-study engineer uses OWAS during his daily routine. If postures are regarded as a special problem, the method can of course be used separately. It can also be applied by other personnel such as safety engineers, health officers, etc, after they have been appropriately trained.

Before OWAS can be useful as a tool for improving working conditions, company policy towards working conditions must be decided. Otherwise the work-study engineer's use of OWAS has no meaning.

Experience with OWAS

OWAS has been used for two years in the steel company which developed it. The work-study engineers make their analyses either during their daily routine or at the request of production departments, health personnel or workers. The results have led to improvements in comfort in individual jobs and have greatly contributed to the reconstruction of some production lines. For one difficult task, bricklaying the deck of an electric arc oven, a satisfactory solution was found with OWAS*. Trials to solve the problem had earlier been made for many years in vain. The effects of OWAS in improving health and safety are currently being evaluated.

With OWAS a rapid registration and check of working postures can be made with the use of a special formula and decoding transparency. OWAS has proved to be handy and easy to use. Observations can be made rapidly on postures so that they can be classified into various groups and then evaluated in terms of their desirability and need of attention, by reference to the special formula and decoding transparency. One by-product of OWAS has been a growing interest in working conditions in the firm in which it has been applied. The training material developed at the beginning of the project has not only greatly added to the work-study personnel's knowledge of working postures but also to that of production engineers.

References

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van Wely, P.

* Case-study material on this exercise, illustrating the use of OWAS, will be published in a future issue of *Applied Ergonomics*.