



University of Washington
Department of Environmental & Occupational Health Sciences
Field Research and Consultation Group

AN ERGONOMIC EVALUATION OF GROCERY CHECKERS

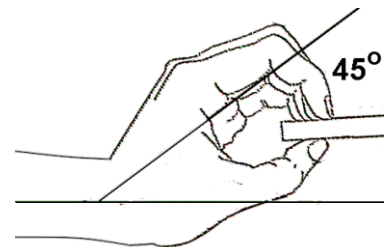
Introduction

Working in a grocery store can be hard and repetitious. Many grocery workers feel aches and pains that can eventually lead to injuries and lost work. Their stories are borne out by statistics. The rate of compensable soft tissue injuries (such as muscle strains, carpal tunnel syndrome, and tendonitis) for the grocery industry was found to be among the dozen highest in the state of Washington from 1994 through 1999.

The Field Research and Consultation Group, part of the Department of Environmental and Occupational Health Sciences at the University of Washington, chose one job within the grocery store – cashiers – to learn more about how we might reduce the stresses of the job. Specifically, we measured how the height of the checkstand affected back bending and how alternating the orientation and handedness of scanning could change how hard the shoulder and arm muscles had to work. We hope that what we learned can be put to good use in helping cashiers be healthier and more productive workers.

What causes injuries to the body?

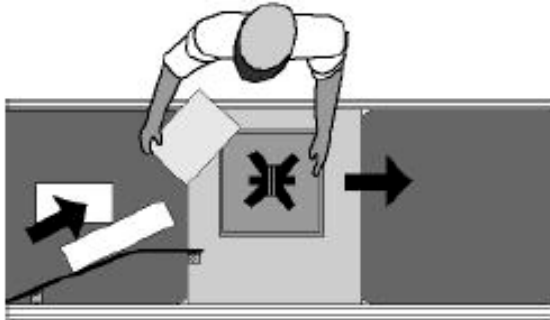
Sprains, strains, and nerve-related problems are some of the most common injuries to workers in the grocery industry. These conditions, which often develop over time, can happen at work, at home, or wherever you find your body overtaxed. Factors that can contribute to your chance of getting this type of injury are: using the same muscles too often, applying too much force with the body, and working (or playing) in awkward postures. These activities can be tiring to the muscles, stressful to the joints, and irritating to the nerves if done repeatedly or for long periods of time. The challenge for the field of ergonomics is to reduce these factors as much as possible.



Wrist extension

What is healthy movement?

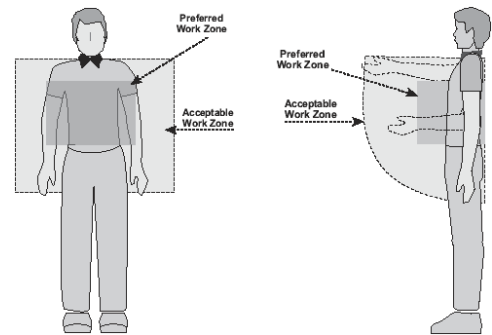
How much movement is too much or too little? People vary by fitness abilities, injury histories, levels of outside activity, genetics, age, and experience. Although research studies can provide some guidance for how to design work so that most people are not overtaxed, overlapping factors



Overhead view of checkstand

can complicate the task of estimating design parameters. For example, determining an individual's right amount of scanning is complicated by the workers' varied capabilities, described above, and also by the size, weight, and number of items to be scanned, the quality of the scanner, and its placement relative to the cashier. With so many factors to consider, there is no "one size fits all" workstation for cashiers.

Fortunately, some guidelines have been developed for predicting which movements will harm rather than help us. People are strongest when their joints are in the mid-range of movement or in a "neutral" posture. For example, shoulders will tire less quickly when stocking shelves at waist level with the arms close to the sides than when they are working overhead and outstretched. Similarly, keeping the back and neck upright and wrists straight is less fatiguing than bending them. We know that lifting, pushing, pulling, gripping, or pinching at a high percentage of a person's maximum strength capacity will tire the muscles sooner than if exerting a lighter force. We also know that people need enough rest between exertions to avoid straining muscles and joints, but the overlapping factors make it hard to determine how much rest is needed. Even with the guidelines, the answer to the question of "How much is too much?" is often still, "It depends."



Desired work zones

Why we chose to study cashiers at PCCCOMPANY X



PCCOMPANY X's Green

Cashiers can be some of the busiest workers in the grocery store and they often work under the scrutiny of the public. They can handle and scan thousands of items each day. Ideally, those items would all be within easy reach. However, the standard checkstands at many stores can be too short or too tall for the cashier, requiring more reaching, bending, and twisting than would be desirable. With such a high degree of exposure to repetitious movement and awkward posturing, the job of cashiering seemed well suited for further investigation into methods of quantifying and reducing these exposures.

PCCCOMPANY X Natural Markets are an ideal test site for several reasons. First, the company is committed to the health and well being of its employees. Secondly, it had installed U-shaped checkstands with alternate heights in many of its stores. The flexibility of these checkstands is unusual in the industry and allowed the UW to evaluate the physical impact of different workstations on the cashiers that use them. Thirdly, PCCCOMPANY X was more than willing to accommodate the inconveniences associated with a field study of this sort, such as employee schedule modifications and equipment setup time.

What we did

In the first phase of our study, we recruited six volunteer cashiers for a simulated work session. We asked them to wear instruments that measured muscular activity in their low backs and shoulders (electromyogram or EMG) and monitored the frequency and degree of wrist movements (electrogoniometers). The work that they performed while wearing these instruments was controlled by using a representative sample of grocery items recycled through the checkstand as the cashier scanned and bagged. We organized the work so that each cashier would perform this task for 15 minutes at each of the different checkstands (regular, tall, left side, and right side). The information from these instruments was fed into a computer and later analyzed to determine the effect of different checkstands on cashiers' posture and movement.



First phase instruments

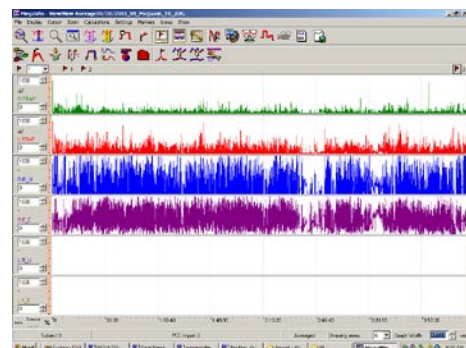


Second phase instruments

In the second phase of the study, we recruited three more cashiers (nine total) to perform their regular checking duties (with real customers) while being monitored with additional instruments. This time we collected data with the EMG (shoulders only), electrogoniometers (both wrists), Actigraphs (wristwatch-like devices that measured arm movements), and Virtual Corsets (pager-like devices clipped to a harness on the upper back and shoulders that measured the angles of movement). The cashiers worked for four-hour periods (on different days) at each of the checkstands as the instruments stored the data for later retrieval and analysis. The cashiers kept track of their level of discomfort every two hours.

Analyzing the data

We spent hours interpreting the massive amount of data collected with the instruments. While most of the devices worked as expected, the Virtual Corsets, which were to provide back-angle data, produced inconsistent and ultimately unusable data. The absence of this data limited our ability to draw conclusions about the effectiveness of tall checkstands.



EMG and electrogoniometry data

What we found

Somewhat surprisingly, we discovered that cashiering requires almost equal use of both hands and arms, regardless of whether the cashier worked at the right- or left-sided checkstand. The instruments did not differentiate between tasks (scanning, operating the cash register, and bagging), but observations showed the proportion of hand use varied for each activity, while the overall amount of arm and hand activity was similar. Variety could still be introduced into the job by alternating checkstands. The subjective discomfort data showed that those who switched sides after two hours reported less discomfort than those who worked the same side of the checkstand for four hours straight.

We found that the shoulder and neck muscles (the trapezius) consistently worked somewhat harder at the tall checkstand than at the regular checkstand. Six of the nine cashiers were of average or shorter height, and the mild increase in muscle activity is probably a result of the average or shorter cashiers having to reach a little higher to do the work. However, the discomfort data did not show that the higher reaching was in any way uncomfortable or problematic for the cashier's upper back or neck.

While the back-angle data to measure the effect of a taller checkstand was incomplete, there was some evidence that it benefited the cashiers. The data from the discomfort surveys suggested a trend toward less discomfort in the low back at the taller checkstand, but the small number of subjects limits our confidence in this finding. The discomfort data showed, as expected, that the cashier's overall discomfort increased as time progressed, although it was a small increase.

Finally, we found similar results when we compared the data from the first phase of our study, which was controlled, with that of the second phase, which monitored normal work activity. This finding suggests that future studies could be carried out in a controlled lab setting that simulated work conditions, without inconveniencing the company or workers in the store.

In the future, we think that it would be worthwhile to take another look at the impact of tall and regular checkstands on back angles, using a greater difference between checkstand heights (3-4"), after the Virtual Corset (or comparable instrument) has been validated as a useful measurement tool. We also think it would be useful to further differentiate and examine the muscular demands of the different cashier tasks.

Conclusion

The UW field research study of cashiers and their checkstands, which was carried out with the support and cooperation of [PCCCOMPANY X](#), proved to be a complex and rewarding project. The data showed trends that reinforce the efforts that [PCCCOMPANY X](#) has made to create a more varied and healthful work environment for its cashiers. Moreover, the results of this research point the way toward further studies that will help shape the policies and practices of the grocery industry as a whole. The UW would like to thank [PCCCOMPANY X](#), and in particular the Green Lake store personnel, for their support of this project.

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