AUDIO-VISUAL PRESENTATION OF FOUR MOTION ECONOMY PRINCIPLES FOR FOOD SERVICE WORKERS

by

ELIZABETH ANN SWIGERT

B. S., University of Colorado, 1954

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Institutional Management

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1966

Approved by:

Grace O. R. Shugart
Major Professor

TABLE OF CONTENTS

INTRODUCTION

Skilled and unskilled positions in the food service industry require a work force of three million with at least 150,000 new employees needed each year to fill vacancies caused by retirement, disability, and transfer (Greenaway, 1964). Such a turnover adds to the rapidly accelerating cost of labor in the food service industry and has forced management to investigate ways of controlling this expenditure. Cost analysis studies have revealed that low productivity also contributes to high labor cost.

Reducing the rate of employee turnover is a direct money saver for most companies. The experienced worker's salary is less than the combined cost of recruiting, interviewing, training, and initial low productivity of the new employee. Archibold (1964) estimated that $400 per employee is the national average cost of labor turnover.

The food service worker has been credited by Fairbrook (1964) with 50 per cent efficiency as compared to the factory worker's 75 per cent. Reasons stated for such low productivity by the food service employee were: (1) poor training, (2) lack of supervision, (3) frequent distractions, and (4) poor layout of equipment. Management may not be able to remove existing equipment or to alleviate all distractions, but they can improve training programs and supervisory skills.

Surveys reported by Moore (1964) indicate a lack of well-organized training programs for dietary employees. Food service management generally finds it difficult to maintain adequate

personnel training. A department may lack a capable person to direct the program or the administrator may be unaware of the trainer's qualifications, the trainee's needs, and/or the learning process.

Many basic fundamental processes developed and utilized by industry are applicable to certain phases of food service production (Bruce, 1964). The concept of assembly line efficiency, long accepted by industry, has in the past few years been adapted to food service. Closely related is body motion proficiency, attained in many cases through a study of time and motion and made effective through training programs.

Creation of a spirit of teamwork is necessary for the development of a worker's potential abilities. This is the supervisor's domain and can be attained more easily when he explains and demonstrates the essential elements of operation in terms understood by employees.

Carter et al. (1964) pointed out that lack of time to prepare training materials is one cause of poor training. Food supervisors, according to Armstrong (1960), are interested in visual aids that might be made available for use in a training program. Prepared materials, basic in content, could reduce preparation time needed to implement training.

The purpose of this study was to develop educational material related to motion economy for food service workers and to evaluate visual presentation of the material.

REVIEW OF LITERATURE

Training Programs

Management has not always comprehended the needs of an effective training program and as a result has been susceptible to "fads" (Cooper, 1942; McGehee and Thayer, 1961). Thus, specific objectives in a particular program should be stated. Such goals, as advocated by Lundberg and Armatas (1964), can be set for the overall organization as well as for each task.

Davis (1962) included profit and satisfaction of consumers' needs in the objectives and responsibilities of management. Earnings are insured by increasing the number of sales or by lowering production costs of an item or service. Efficient employee production is an important factor in decreasing expenditures. Since neither time nor business can wait for more efficient workers, Brunson (1961) advocated development of present personnel into a more productive work force. Greenly (1941), Lawshe (1944), and Lindahl (1945) agreed that training programs increase employee productivity, thus lending emphasis to the statement made by Peter Drucker (1959): "... a developed society and economy are less than fully effective if anyone is educated to less than the limit of his potential."

McGehee and Thayer (1961) defined training programs as procedures that modify or change skills, knowledge, and attitudes. Agreeing with this definition are Davis (1962) and Lundberg and Armatas (1964).

According to George and Heckler (1960), the ultimate training program objective is to raise the level of ability of the individual. West and Wood (1955) explained that the aim of training programs is to produce more efficient workers as quickly as possible. They further stressed the importance of increasing employee interest in the job by giving reasons for procedures. Creating work patterns of relationships that are both technologically productive and humanly satisfying was proposed by Dinkin (1963).

To achieve specific goals, Brunson (1961) stated that a training program must be continuous to be effective. Warner (1963) added the qualities of simplicity, practicality, and good design to produce results in a reasonable time and within cost limits.

A formula developed by Sandell (1964) stated that total requirements of the job, minus what the employee already knows about the work, equals what he needs to be taught. Following this plan could reduce training time, eliminate unnecessary instruction, and emphasize points and areas where training needs to be accomplished.

Cooper (1942) commented that training will be needed as long as there exists experienced supervisors and inexperienced workers. Organized training is superior to permitting the operator to learn the job the best way he can. An individual who can perform effectively even the simplest tasks in business or industry without further training is the exception rather than the rule (McGehee and Thayer, 1961).

The prospective trainee, according to Mitchell (1955), includes not only the new worker, but experienced employees changing positions and those engaging in a new product or a new method of production. Cronan (1962) called attention to the fact that supervision and training of employees will take considerable time and effort, but in no other way can efficiency be strengthened and high morale developed. Training is believed by Lundberg and Armatas (1964) to result in at least a 25 per cent increase in efficiency.

Controversy exists among leaders in industry about who is to conduct training programs. In small businesses, immediate supervisors usually are responsible for training. Large companies may be able to establish a special department to handle this assignment. Lundberg and Armatas (1964) pointed out, however, that final responsibility rests with the supervisor who is in a position to reward or punish the employee. The efficacy of training, pointed out by Cooper (1942), depends upon the ability of individual supervisors to impart knowledge quickly and accurately. The caliber and experience of the trainer and degree of difficulty of the first job assignment are considered by Hedrick (1957) to be other factors influencing the effectiveness of training.

Training and development of employees, according to Miller (1964), is an important function of the supervisor. Carter et al. (1964) maintained that in the past, training of employees has depended to a large extent on availability of qualified

supervisory personnel with the necessary time for training. Friction and personal differences among employees arise from lack of understanding of what is expected of them. Basis of training should be understanding between management and workers, concluded Mitchell (1955).

Training programs, according to Smith (1964), offer to employees and to management economic and personal benefits. For the employee, such a program may aid in developing skill and knowledge for a particular job and enhance his chance for advancement (McGehee and Thayer, 1961). Another advantage stated by Dinkin (1963) was the opportunity for employees to learn duties and responsibilities with minimum frustration. George and Heckler (1960) agreed that successful training increases job satisfaction and decreases waste of time and energy. Wynn (1956) discussed the fact that attention given to an employee in training reaffirms his worth as an individual.

Training, as cited by McGehee and Thayer (1961), is important to management in that methods are improved and talent is discovered. McDermott (1964) added to this list the decrease of errors, increased learning rate, higher quality of performance, and reduction of accidents. He further stated that training prepares personnel for change in work methods. Lundberg and Armatas (1964) and Archibold (1964) acknowledged that training reduces labor turnover. The method of teaching a new employee may be an effective means of reducing the high cost of labor turnover. Robinson (1952) stated that the first days on a job,

like all first impressions, are remembered; therefore, if a new employee is adequately instructed in every phase of the job, he is more apt to accomplish better work because of the acquired skill.

Many methods and techniques are used in training. Some represent broad approaches to meeting instructional requirements; others are narrower in scope to meet a special training need or to improve present skills.

Selection of techniques used, according to Smith (1964), may depend upon: (1) the kinds of behavior to be acquired; (2) the number of employees to be trained; (3) the ability level of trainees; (4) individual differences among trainees; (5) cost in relation to various factors; and (6) the incorporation of learning principles such as motivation, opportunity for practice, reinforcement, knowledge of results, and meaningfulness.

On-the-job training is the usual method of instructing production employees. In addition to this a few institutions may offer further instruction through separate classes, which McGehee and Thayer (1961) labeled formal training.

On-the-job training enables an employee to learn in the physical environment in which he will be required to perform the task. In the opinion of McGehee and Thayer (1961), a new employee may be assigned to an experienced worker for instruction or guided by trained instructors who also evaluate their learning efforts.

Advantages of on-the-job training, pointed out by Smith (1964), are that it is low in cost and carries less lost motion between learning and application of newly acquired knowledge. McGehee and Thayer (1961) mentioned that the learner, in part, is paying his way by what he does in the process of learning the job. Maier (1955) commented that on-the-job instruction is training through doing, which incorporates a fundamental principle of learning.

Disadvantages also were pointed out by McGehee and Thayer (1961) who cited the fact that whether training takes place in a shop or on a production line, the primary function is production and not training. Because of the individual nature of the instruction, Maier (1962) recognized on-the-job training as somewhat costly and should be reserved for those aspects of training that require a high degree of skill and a personal touch. Smith (1964) commented that the trainer may be a good worker but a poor teacher. In addition, the trainer may be antagonized by the extra assignment. Through poor instruction the trainee may fail to learn the best production techniques and, by haste to gain immediate production, be inefficient.

Formal training usually is supplementary and has a value when the purpose is to develop knowledge concerning processes, procedures, or attitudes (McGehee and Thayer, 1961).

Class lectures, used when groups of employees are given instructions or explanations, generally consist of an oral presentation of information by an instructor. Economy is listed by

Smith (1964) as the major advantage of the lecture. According to West and Wood (1955), group training saves instructors' and workers' time and provides stimulation from group participation.

Disadvantages of formal training cited by McGehee and Thayer (1961) are: little interaction between the trainer and trainee; limitation of behavior to be acquired; ignoring of individual differences of trainees; and little opportunity for practice, reinforcement, and knowledge of results.

Lundberg and Armatas (1964) called attention to the fact that on-the-job training has been patterned after the "Training Within Industry Program" which was developed by the War Manpower Commission and was widely used by industry during World War II. Advantages of this program listed by Archibold (1964) were brevity and adpatability to virtually all types of jobs. He outlined steps used in the development of this training program:

PREPARATION

1. Prepare a training plan.
2. Prepare a job breakdown.
3. Have everything ready.

PRESENTATION

1. Prepare the employee for instruction.
    a. Put him at ease.
    b. Explain the job and its importance.
    c. Create interest.
2. Present the job to the employee.
    a. Follow the job breakdown.

b. Explain and demonstrate one step at a time.

c. Stress key points.

d. Don't tell too much at one time.

e. Use simple language.

f. Don't do all the talking.

g. Set a high standard.

h. Give reasons for methods or procedures.

i. Show one thing at a time.

j. Give everything to the trainee you will want back.

3. Provide for the employee to give a demonstration.

a. Have him do the job.

b. Have him tell you the why and the how. Make sure he stresses the key points.

c. Correct errors and omissions as he makes them.

d. Encourage him.

e. Get back everything given in Step 2.

f. Continue until "you" know "he" knows.

4. Follow through.

a. Put him on his own to do the job.

b. Encourage questions.

c. Check frequently.

d. Let the trainee know how he is doing.

Adult Education

Davis (1962) considers motivation the most important factor in learning. People learn what they want to learn. An adult

wants to know what is expected of him, why it is necessary to learn each point, and what is the ultimate goal.

The fundamental approach to adult education, according to Gibb (1958), is to produce behavioral changes that would help the individual acquire growth in attitudes, ideas, and skills. Wagner (1964) defined adult education as "all activities with an educational purpose that are carried on by people in the ordinary business of life."

Verhaalen (1964) believes the adult, because of his wide background of experience, can relate present learning to past experiences and make it more meaningful. Schrendler (1960) added that the adult would rather modify than start from "scratch." Past experiences, according to Morton (1963), will enable him to perceive and grasp many concepts and goals involved in learning a new subject.

Many institutions face the problem of training workers with a minimum education and with varying abilities (Phillips, 1959). Training that emphasizes learning by doing is effective in increasing employee efficiency.

Knowles (1950) stressed the fact that the best way to learn is by doing. Study has shown that adults will forget within a year at least 50 per cent of what they learn passively. Within two years they will forget 70 per cent. Retention of knowledge or skills is much higher, however, if the adult has immediate and repeated opportunities to practice what he has learned. Kidd (1961) ascribed the effectiveness of on-the-job training to this theory.

The adult, according to Verhaalen (1964), must have an ability similar to that of the young student if he is to learn. Martin (1963) stated that the learning rate of adults declines about 1 per cent a year from ages 45 to 70. However, Wagner (1963) pointed out that adults learn with an ability corresponding to earlier school years when there are no stringent time limits.

Kidd (1961) emphasized the fact that a variety of methods should be used in teaching adults. Education research has demonstrated that learning proceeds most quickly when information reaches the learner through more than one sensory channel.

Knowledge of success and failure, Verhaalen (1964) contended, generally will improve learning. Flanagan (1963) indicated that within a group the ability to learn, motivational needs, receptiveness of attitudes, and level of skills exist in varying degrees. Martin (1963) suggested that attitudes, interest, and motivation are better sustained as age advances. A training program would need to be flexible in order to reach every trainee.

In planning training programs, Martin (1963) considers these physiological and psychological changes in adults important:

1. There is a slight but steady decrease in the ability to see and hear.
2. Speed, intensity, and endurance of muscular reactions are decreased.
3. More time and understanding are needed to coordinate and relate learning to daily life.

Work simplification was considered by Martin (1963) as an essential part of food service employee training. She emphasized techniques to reduce reaching, pulling, and straining the back, and reasons for specific methods used.

Concept Teaching

The concept approach to knowledge, as discussed by Bruner (1961), may result in learning of knowledge that will not be easily forgotten. Detail is placed into a pattern, and relationships among ideas are shown.

Many definitions of concepts are found in the literature. The instructor should accept a definition that is feasible or understandable in terms of what he is to accomplish. Burton et al. (1960) listed these definitions:

> A concept is a defined idea or meaning, fixed by and as extensive as the term used to designate it ...
>
> A concept is the amount of meaning a person has for a thing, person or process ...
>
> A concept is the suggested meaning which has been detached from many specific situations, giving rise to it and provided with a name ...
>
> A concept is a word or symbol, which stands for the common property of a number of objects or situations.

Phenix (1956) stated that the use of key ideas greatly increases the depth of comprehension. Concepts enable an individual to have a relatively stable and permanent system of knowledge subject to change as new facts are discovered. Generalizations, according to Dalrymple (1964), are the meanings of a concept. They enable an individual to carry understanding

adeptly from one area to another, to identify specifics, and to supplement knowledge of a particular thing through drawing upon the total concept.

Teaching and learning of structure, rather than simply facts and techniques, is regarded by Bruner (1961) as the center of the classic problem of transfer. Verhaalen (1964) stated that transfer depends upon the mastery of general principles developed by emphasizing meaning, by studying and organizing experiences, and by looking for interrelationships among ideas and techniques.

Haselrud and Meyers (1958) pointed out evidence that indicates transfer can be enhanced if concepts and principles, their application and discovery, are emphasized in training.

Audio-Visual Aids

Lundberg and Armatas (1964) emphasized the importance of audio-visual materials in training. Carefully used, they add the extra interest necessary to hold attention and stress important points to the trainee and/or the experienced employee.

Real experiences were cited by Wendt (1961) as bases of understanding, thinking, and attitude formation. Since actual situations are not always possible, pictures and graphs with an oral presentation may be substituted. Wendt further stated that the primary function of audio-visual materials is to provide experience whereby the trainee can build up his storehouse of knowledge. In contrast to the symbolic nature of words, Hasting and Schultz (1963) consider audio-visual materials more like real

life situations. Their meaning is more accessible, more understandable, and therefore more easily and correctly absorbed. Their direct appeal, by producing strong interest and clear meaning, increases retention of what has been learned. Thus, when the locale and terms are familiar to employees, instructions are more readily understood.

Calhoun (1963) reported that words alone had a 62 per cent retention at the time of the lecture and only 20 per cent by the end of the third week. Retention was doubled by showing printed works along with the oral presentation.

As a person becomes expert in his area of work, some of the knowledge or habits he first learned become automatic or merge with other facts. Brown (1964) warned that the teacher may omit fundamental information and important connecting links which he assumes a learner knows. By failing to explain the reason, he can make the job seem uninteresting, which, in turn, decreases motivation and slows up the learning process.

Yoder et al. (1958) emphasized that care must be taken to use visual aids as part of, not as a substitute for, the training program.

Advantages listed by Hasting and Schultz (1963), in projecting a picture, are: (1) a large group can see the same picture at the same time, (2) details of the large picture can be readily studied, and (3) it is relatively inexpensive.

An overhead projector for showing transparencies was advocated by Brown (1964) as a training aid. Placed at the front of

the room, this equipment allows the trainer to face the audience and talk, draw, write, or point to the illustrations. Transparencies may be shown at any desired pace, enabling discussion at any point in the presentation.

Motion Economy

A trend toward increasing work efficiency has brought about a widespread interest in motion and time study. Wherever manual work is performed, a problem of finding the most economical way of doing the task and then of determining the amount of work that should be done in a given period of time exists. A study of body movements has been found by Close (1960) to be a valuable approach to the problem of finding better ways of doing work.

Barnes (1963) reported that time study, originated by Taylor, was used mainly for rate setting; motion study, developed by the Gilbreths, was employed largely for improving methods. Objectives of the Gilbreths' were:

> ... accurate determination of causes of fatigue for various types of work, elimination of all unnecessary fatigue where possible, provision of means for overcoming fatigue, and presentation of data obtained from the studies in easily used form.

Motion study was described by Close (1960) as the analysis of various body movements used in performing a job for the purpose of eliminating or reducing motions. Reinhalter (1960) defined motion study as the planned procedure for elimination of all non-essential details, the combination of steps in an operation to reduce handling, the rearrangement of sequence of

operations to reduce back tracking, and the improvement of ways to perform this.

Nadler (1955) pointed out that motion study was applicable to past, present, and future work, any industry, or any type of operation. The use of motion study in planning new jobs was advocated by Sampter (1941) and Niebal (1962). Work improvement methods, based on motion study, were proposed by Lehrer (1957) and Spiegal (1961).

Although Barnes (1963) discussed principles under the heading "principles of motion economy," he believed a more accurate designation to be "some rules for motion economy and fatigue reduction." After summarizing available material, he selected 22 rules which he classified according to their relationship to the use of the human body, the arrangement of the work place, and the design of tools and equipment. Eight rules related to the use of the human body as developed by Barnes.

1. The two hands should begin as well as complete their motions at the same time.
2. The two hands should not be idle at the same time except during rest periods.
3. Motions of the arms should be made in opposite and symmetrical directions and should be made simultaneously.
4. Hand motions should be confined to the lowest classification with which it is possible to perform the work satisfactorily.
5. Momentum should be employed to assist the worker wherever possible, and it should be reduced to a minimum if it must be overcome by muscular effort.
6. Smooth continuous motions of the hands are preferable to zigzag motions and sharp changes in direction.

7. Ballistic movements are faster, easier, and more accurate than restricted (fixed) or "controlled" movements.

8. Rhythm is essential to the smooth and automatic performance of an operation, and the work should be arranged to permit an easy and natural rhythm wherever possible.

Close (1960) emphasized the distinction between fatigue caused by useful application of human energy and that caused by needless activity. The objectives of motion study are to eliminate waste caused by unnecessary human fatigue, to devise methods that will increase productivity, and at the same time decrease the demands on human energy. He commented further that if it is possible to begin a new job with the proper motion pattern, the problem of habit change is greatly reduced. Motion study was given credit by Kotschevar (1961) for showing how to work with less fatigue and more satisfaction.

Because of a tremendous amount of wasted effort in the average food preparation center, Hartman (1963) believes that Industrial Engineering techniques can aid food production by reducing employee fatigue, increasing efficiency, and improving the job for dietary department personnel. She stated further that employee fatigue is expensive when measured in terms of resulting poor quality food. Pope (1962) commented that labor-saving methods usually are more important than machinery or work arrangements.

PROCEDURE

In developing visual training materials for food service employees, these factors were considered: (1) motion economy principles that could be adapted from industrial research, (2) a food service suitable for the study, (3) method of evaluating application of principles by employees, and (4) evaluation of the method of presenting materials.

Selection of Motion Economy Principles

Principles of motion have been formulated from work by Barnes (1963) and others for use in industry, but food service employees often have difficulty adapting these principles to food production procedures. Workers may use them but without comprehension.

Motion economy principles developed by Barnes (1963) relate to use of the human body, the work place, and design of tools and equipment. This study was limited to the use of the human body, and four principles, identified by Barnes, involving the hands and arms were selected:

1. Motions of the arms should be made in opposite and symmetrical direction and should be made simultaneously.
2. Hand motions should be confined to the lowest classification with which it is possible to perform the work satisfactorily.
3. The two hands should begin as well as complete their motion at the same time.
4. Smooth continuous motions of the hands are preferable to zigzag motions or straight line motions involving sudden and sharp change.

For this study, the principles were modified and all were restated in words familiar to food production employees. The adapted principles were:

1. The reach of the arm determines the best work area.
2. Using two hands results in balanced easy motions.
3. Continuous motions are easy, efficient and energy-saving.

Throughout this discussion, the adapted principles will be referred to as the Reach Principle, the Two Hands Principle, and the Continuous Motion Principle.

Selection of Food Service

The junior high school in Manhattan, Kansas was selected for this study because of interest of the administration in employee training and because of the organization of personnel. Of the 12 units in the system, this school had the largest number of employees working without continuous direction of a professional supervisor.

Kitchen Layout. In the two-year-old kitchen, new multi-purpose equipment, as well as pieces from the former cafeteria, were used in preparing 1150 type A lunches daily. Nine hundred fifty students were served at the junior high school. Food for 200 grade school students was prepared in this kitchen and sent in bulk form to two elementary schools.

Specific preparation areas divided the kitchen, with dish-washing activities in a separate room. Comfortable working heights, adequate lighting, and good ventilation helped produce

a pleasant working atmosphere. Mobile storage cabinets, small carts, and a double entrance to the storeroom facilitated a smooth flow of production toward the serving counter.

Small utensils, hanging from bars over work areas, were within reach of the employees. Work space was doubled and steps saved in the bake area by using carts and tops of portable bins when filling roll pans. Utensils stored on portable racks were brought to the point of use when needed. Hot carts and under-counter refrigerators were filled and located near the serving counter to speed up replenishing of food items.

Organization of School Lunch Personnel. The school lunch program director is in charge of all cafeteria employees in the Manhattan school system. In turn, each cafeteria has a cook manager directing daily activities. Employees are women hired as helpers, with the possibility of advancement to a cook's position. Capabilities of the worker and her willingness to accept responsibility are determining factors in advancement.

Students are given an opportunity to work during the serving period and are paid twenty cents a day plus their meals.

Junior High School Personnel. Twelve women regularly employed at the junior high school are: cook manager and her assistant, head baker and assistant, head salad maker and assistant, dishwashing supervisor, head cashier and assistant, and three helpers. Homemakers from the Manhattan area working to supplement the family income during the school hours of their children fill these positions. Ages of the women at the time of

this study ranged from 36 to 65 years. All had completed a high school education and had worked in the school lunch program from one to twelve years. Only two women had previous experience in quantity food production, one in a fraternity, the other in a university residence hall.

In addition to food preparation, serving line duties also were included in the day's routine. Six women, assisted by four students, served 950 lunches in 75 minutes. Two workers were responsible for replenishing food on the serving counter when necessary. The cook manager supervised the entire production and handled any problems that arose.

Student employees, averaging 21 a day, helped serve food on the tray line, sorted meal tickets for the cashiers, and scraped trays returned to the dish room. Boys, under supervision of a full-time employee, operated the dishwasher and transported clean trays and silver to the kitchen.

Employee Training Program. School lunch workers in the Manhattan system normally receive instructions from various sources. At the start of employment, the program director explains policies, describes duties, and stresses the importance of cooperation. Each employee is expected to learn duties of three positions. On-the-job training is conducted by the director and by the cook manager, each unit of training being varied to fit needs of the individuals. Although formal instruction in work simplification is not included in the training, use of carts for transporting items and cooperation among workers in lifting

heavy pans are emphasized. School lunch personnel attend four workshops each year. Topics often discussed are sanitation, meat cookery, baking, steam cookery, and work simplification. Speakers may be food representatives, equipment specialists, or dietitians.

Observations of Motion Economy Application

Twelve junior high school employees cooperating in this study were observed at work to determine their use of motion economy principles. Observations were made every day at different times for two and one-half weeks. Although an attempt was made to observe each employee daily, this was not always possible due to complexity of menus and variations in production timing.

In order to maintain natural work habits, employees were not told they were participating in a study. The purpose of the observations, as explained to them, was to collect information on work methods. Questions, notes, and daily visits were needed to develop examples of actual situations. Employees were asked to view and appraise the work when completed.

Observations were recorded on a check list, based on adapted principles (Appendix A). Criteria used in evaluating motions were measured subjectively. For example, a noticeable delay in the flow of production might indicate improper use of two hands. Reach was judged by the position of the arms in relation to the body and arrangement of equipment and materials. When checking for continuous motion, a zigzag or straight line movement was

an obvious misuse of this principle.

Each worker was assigned a letter from A to K. Use of the three principles in accomplishing daily tasks was noted and work area symbols were made on the check list with the letter of the corresponding employee.

Because the head cashier and assistant were observed only occasionally in food preparation duties, they were not included in this study.

Development of Educational Material

Educational material using the three adapted principles of motion economy was based on information reviewed in the literature and on observations at the junior high school.

Generalizations were developed, explained, and illustrated with work situations (Appendix B). Transparencies for an overhead projector were made.

Evaluation of Presentation Method

Transparencies were shown to employees during the last hour of a working day. Visual illustrations were accompanied by an oral presentation. Typewritten words on the transparencies were read for the purpose of emphasis through use of as many of the senses as possible.

Following the presentation, each person was asked to complete an opinionnaire (Appendix A).

An informal conference was held the following morning with each employee as she worked in her particular area. In this way verbal comments on the presented material could be assessed. Employees were questioned as to whether motions explained in the material could be applied to daily activities at home.

Observations were continued for three days after presentation of the visual material to evaluate any observable changes in work habits.

RESULTS AND DISCUSSION

Presentation of Visual Material

Instructional material developed for this study (Appendix B) was presented to ten cafeteria employees in the junior high school. The meeting was scheduled through the school lunch program director and cook manager for the last hour of a work day.

Timing, an important factor in arranging employee meetings, presented some problems in this study. The session was scheduled within working hours, but the women were apprehensive that the presentation might interfere with unfinished duties and that it might not terminate at the end of the normal day. One employee expressed concern about missing her car pool ride and another about a dental appointment.

Transparencies were projected on the wall of the lunchroom by an overhead projector. In this type of presentation, lights are left on and participants or trainees face the instructor, making it possible to note reactions. Employee D was observed

twisting her body when one of the motions was presented, and employee A practiced making square corners with her finger. Such reactions were in accordance with a theory expressed by Knowles (1950) that because learning is a dynamic active process, the trainee learns best by doing. Self-consciousness in performing an isolated motion might have inhibited some of the women. Smiles and head noddings at the weight moving transparency (No. 8), and laughs at the proverb (No. 31) were observed. Those illustrations were deliberate inclusions to maintain interest of the participants.

An attempt to develop discussion after the program met with little success. Eagerness to leave, the fact the meeting was not concerned with an obligatory function of the department, and possibly the presence of the school lunch program director were contributing factors.

Opinionnaire Results

Prior to leaving the meeting each woman was given an opinionnaire (Appendix A) to complete.

Questions in the opinnionaire were formulated so the employees would feel that effectiveness of the program rather than their knowledge was being tested.

The purpose of the opinionnaire was to obtain candid comments and reactions to the material and its presentation. Questions were constructed for recognition or recall of the motions illustrated in work situations and understanding of the selected principles of motion economy.

The entire group responded affirmatively to the first two questions (Table 1). One employee added an additional comment, listing the examples of the motion she recognized and the principle it illustrated.

Table 1. Summary of responses to opinionnaire by junior high school food service employees.

Question	Number of employees responding: Yes	No	Other	Blank
Did you recognize these motions as motions you have been using?	10	0	0	0
Were the main points explained clearly to your satisfaction?	10	0	0	0
Did the drawings help explain the ideas?	9	0	1[a]	0
Do you think the material would be of help to a new employee?	10	0	0	0
Do you think the students who help you serve on the line might learn something from seeing the illustrations?	8	0	2[b]	0
Would you suggest other examples I can use in the program?	0	0	1[c]	9

[a] Some

[b] Possibly

[c] Complete serving line filling trays

Only one person stated that the drawings did not fully explain the idea. Another added that illustrations were interesting and clever. Two respondents believed the visual material might help students, and all agreed it would be helpful to a new employee.

Only one suggestion was given in response to the last question, which was included to indicate understanding of the material and ability to apply it. Factors other than lack of understanding may have caused the small number of replies, however.

Individual Conferences

The morning following presentation of the transparencies, individual conferences were held. To supplement information from the opinionnaire, employees were asked whether the principles could be applied to home use and were requested to cite examples. Additional responses indicated that workers had some knowledge of the principles.

Employees were pleased to be asked for suggestions and ideas, and often related "tricks of the trade" they felt might be useful. Some of these examples were applications of motion economy principles.

As a group, the women enjoyed the transparencies and found them interesting. The motion familiar to the largest number of workers was shaping rolls. Three employees mentioned that equipment arrangement in the lettuce cleaning example was the same as in the school kitchen. This may have indicated either that workers were aware only of the similarity of the kitchen arrangement, or that recognition of the locale helped them to understand the principle illustrated. Six employees gave as further suggestions for illustrating motions, mixing salad,

stirring gelatin, washing pans, and sorting utensils.

Employee H, who admitted that worry over a dental appointment prevented her from listening closely, was able to relate an illustrated motion to her own work area. She recognized why the arrangement of equipment and food on the serving line caused her to twist her body when passing trays to the students. In addition, she offered a possible solution.

Employee F suggested that the transparencies would be more interesting to younger people and to employees new to quantity food production and not familiar with generalizations presented.

In answer to the question of applying motion principles to home activities, workers responded in various ways. The two women in the bake area used the institutional method of shaping rolls at home. Better organization of her time, according to employee C, resulted from her experiences at the junior high school kitchen. Employee G stated that the Reach Principle would not apply at home because of having to keep objects away from her children. Kitchen arrangement of her home, according to employee F, prevented use of this principle.

Workers suggested that more needed to be written about the proper way to lift heavy items, as this was one motion they used frequently.

Observations

Employees were observed both before (Table 2) and after (Table 3) presentation of the visual materials. Design of the

Table 2. Utilization of motion economy principles: Observation and evaluation before audiovisual presentation.

Employee	Two hands	Reach	Continuous motion
A	M - 4	M - 3	M - 4
B	M - 4	M - 4	M - 4
C	B - 4	B - 3	B - 4
D	C - 2	B - 3	B - 4
E	C - 2	D - 4	D - 4
F	S - 3	S - 4	S - 4
G	S - 4	S - 2	S - 4
H	C - 3	M - 2	C - 4
J	B - 3	M - 2	C - 4
K	D - 4	C - 4	D - 4

Bake area	B	Almost always	4
Counter serving	C	Frequently	3
Dish washing	D	Sometimes	2
Meat area	M	Hardly ever	1
Salad area	S		

kitchen enabled observations to be made while the women were working and without interrupting production.

The principle used most efficiently before and after showing of the transparencies was the Continuous Motion Principle. An increased use of the Reach and Two Hands principles was noted during the second observation period (Table 3), though the increase may not have been a direct result of the visual materials.

Continuous Motion Principle. Continuous motions were used by all workers during both periods of observations. Employee A

Table 3. Utilization of motion economy principles: Observation and evaluation after audiovisual presentation.

Employee	Two hands	Reach	Continuous motion
A	M - 4	M - 3	M - 4
B	M - 3	M - 3	M - 4
C	B - 4	B - 4	B - 4
D	B - 3	B - 4	B - 4
E	D - 4	C - 4	C - 4
F	S - 4	S - 4	S - 4
G	S - 4	S - 4	S - 4
H	S - 3	C - 4	C - 4
J	C - 3	C - 4	C - 4
K	D - 4	D - 4	D - 4

Bake area	B	Almost always	4
Counter serving	C	Frequently	3
Dish washing	D	Sometimes	2
Meat area	M	Hardly ever	1
Salad area	S		

demonstrated this motion to butter vegetables. Cakes were iced with continuous motions by employees C and D, and crumb toppings were sprinkled on quick bread batters in the same manner.

Employee B adapted different circular motions to fit the situation. Barnes (1963) stated that a person naturally works in areas bounded by lines which are arcs of circles. Employee B stirred stew in a large steam-jacketed kettle in a rowing motion with a stirring paddle. After further observation, it was noted that the motion was continuous, although oval in shape, and was

suitable for the quantity and density of the product. With smaller quantities of food cooked on the range, employee B used a circular motion.

Reach Principle. Employees misused the Reach Principle most often (Table 2). However, on the day when workers were observed to overreach, a new item (turnovers) appeared on the menu. Employees were unfamiliar with production procedures and were apprehensive about the turnover's appearance. Preparation involved rolling out pastry, portioning filling, shaping, sealing edges, and placing in pans. Employee H reached over a cart to place a scoop of filling on pastry squares rather than moving the cart aside. Stretching beyond her maximum reach span was, with this employee, a breach of her usual good work habits.

Working in an awkward position, employees A and J made turnovers at the top of their reach span. Employee B moved the product to the assembly area in front of her to shape it easily.

Correct use of the Reach Principle was demonstrated in most cases by workers at the cafeteria. Only when flustered and under time pressure did a lack of thorough understanding of the principle become visible.

When cleaning lettuce, employee G used the sink furthest from the garbage disposal, but she was able to place lettuce heads easily on the counter to drain. Whether she was using extra motion and energy at one particular step of production or attempting to save motion and energy at the next phase was uncertain. Questioning her at the time of the motion might have

revealed reasons for her procedure and indicated knowledge of motion economy principles. Constant awareness and observation by the supervisor are essential to on-the-job training.

The Use of Two Hands Principle. A good example observed early in the study demonstrated balanced motions of two hands. Employee E used one hand to portion a serving of salad while the other hand held a squeezable bottle to dispense dressing on the salad after it was placed on the tray.

Applications of this principle prior to and after the visual presentation included: sorting silver, shaping rolls as illustrated in the transparency, serving chili, placing fruit segments on trays, mixing salad ingredients, and picking up a serving utensil in one hand simultaneously as the other hand picked up a tray.

Only when employee D worked in an unfamiliar position, and consequently with less skill, was it noticeable that she used only one hand and extra motions. When she served bread and butter on the cafeteria line, she reached for the bread with her right hand and placed it on the tray; with her right hand, picked up the butter and set it by the bread while the left hand rested on the edge of the tray. The serving line obviously was slowed down and students waited for their trays.

Other instances when employees did not use both hands advantageously were: placing meat slices in a pan and putting celery stalks into a container. Employee J dropped cheese into the grinder with one hand while the other hand rested on the bowl.

CONCLUSIONS AND RECOMMENDATIONS

During observations, it was apparent that employees had some knowledge and training in motion economy principles but did not apply them consistently. When rushed or confronted with a new situation, workers were observed to use poor work habits. It is possible this apparent lack of carry-over could be changed or modified with continuous training.

Initially, food service employees are instructed in techniques necessary to performance of a job. Routine must be emphasized in this phase of training. Improved work habits and increased employee efficiency result from continuous training. It is at this point that many managers fail because of pressures of production problems, inability to teach, or lack of educational materials.

If motion economy principles are not introduced shortly after initial training, poor work habits may be formed. Although improved methods may be taught as the supervisor works with individual employees, it appeared from this study that class instruction in principles of motion economy could be a time-saving device for the instructor. Follow-up by individual supervision would be necessary to increase understanding of the principles and insure their application to food production.

Material developed for this study could be used for an introduction to motion economy, although similar presentations could be helpful as a refresher to demonstrate new points and reemphasize forgotten facts. Use of prepared transparencies

based on carefully developed teaching points insures presentation of the same facts to each new worker.

Although an attempt to discuss principles after showing of the transparencies met with little success, conferences with employees indicated their interest in this method of presenting information. If the material had been presented to these workers at the beginning of the school year or if it had been shown to a group of new employees, greater improvement in work habits might have been noticed during observation periods. All personnel cooperating in the study had been on the job for eight months and some for as long as 12 years. The school lunch program director recognizes the importance of improved work methods and stresses this phase of employee training, although she is not able to continuously supervise employees in all units of the school system. For this reason, the women cooperating in the study were aware of usage of motion economy principles.

Additional motion economy principles, adapted in a similar manner, would increase the value and scope of the present material. An accompanying script that prepares viewers for the material, adds explanations, and summarizes key points for emphasis would improve delivery.

As suggested by the school lunch program director, demonstrations of the motions with equipment would point up the principles and relate them to the work situation.

SUMMARY

Educational material related to motion economy for food service workers was developed and presented to employees at the junior high school in Manhattan, Kansas.

From industrial motion economy principles involving use of the hands and arms, these three were selected and adapted for this study: (1) the reach of the arm determines the best work area, (2) using two hands results in balanced easy motions, and (3) continuous motions are easy, efficient, and energy saving. Generalizations were developed and explained in terms and work situations familiar to food production employees. Illustrations were recorded on transparencies.

Prior to presentation of the educational material, ten junior high school employees were observed to determine use of motion economy principles. Observations were made daily at different times for two and one-half weeks. Use of the various principles in accomplishing duties was noted on a check list.

Transparencies were shown to employees who then were asked to complete an opinionnaire. Questions were constructed for recognition and recall of the motions illustrated and understanding of the selected principles of motion economy.

Informal employee conferences were held the following morning to supplement information from the opinionnaire. Observations were continued for three days to evaluate observable changes in work habits. Opinionnaire and conference responses indicated understanding and knowledge of the adapted principles.

Employees expressed interest in this method of presenting information.

The principle used most efficiently before and after showing of the transparencies was the Continuous Motion Principle. An increased use of the Reach and Two Hands principles was noted during the second observation period, though this may not have been a direct result of the presentation.

Employees cooperating in this study had the advantage of the director's interest in improved work methods and were aware of usage of motion economy principles.

Although improved work methods may be taught as the supervisor works with individual employees, it appeared from this study that class instruction in principles of motion economy could be a time-saving device for the instructor. Material developed could be used for an introduction to motion economy with follow-up by individual supervision.

ACKNOWLEDGMENT

Appreciation is expressed to Mrs. Grace M. Shugart, Head, Department of Institutional Management, for her assistance as major instructor and in the preparation of this manuscript; to Dr. Bernadine H. Peterson, Department of Home Economics Education, for her guidance and constructive criticism; to the committee; to Mrs. Ray D. Caughron, School Lunch Program Director, for her enthusiasm and interest in the study; and to the employees of the junior high school for their cooperation.

LITERATURE CITED

Archibold, C. W. 1964. Job turnover. Volume Feeding Mgt. 22, 36.

Armstrong, P. R. 1960. A training program in work simplification. Unpublished M.S. thesis, Kansas State University, Manhattan, Kansas.

Barnes, R. M. 1963. Motion and time study: Design and measurement of work. 5th ed. New York: John Wiley and Sons, Inc.

Bloom, B. S. 1964. Taxonomy of educational objectives: Handbook I: Cognitive domain. New York: David McKay Co., Inc.

Brown, J. I. 1964. The overhead projector - prime aid for programmed instruction. Education Age 1, 30.

Bruce, K. 1964. New education bells to help train workers. The Cornell Hotel and Restaurant Admin. Quarterly 5, 14.

Bruner, J. S. 1961. The process of education. Cambridge: Harvard University Press.

Brunson, W. E. 1961. Insight on training. Institutions 48, 97.

Burton, W. H., R. B. Kimbal, and R. L. Wing. 1960. Education for effective teaching. New York: Appleton-Century-Crofts, Inc.

Calhoun, R. P. 1963. Managing personnel. 1st ed. New York: Harpers and Row Publishers, Inc.

Carter, E. F., A. N. Moore, and C. L. Gregory. 1964. Can teaching machines help in training employees. J. Am. Dietet. Assoc. 44, 27.

Close, G. C. 1960. Work improvement. New York: John Wiley and Sons, Inc.

Cooper, A. M. 1942. Employee training. New York: McGraw-Hill Book Co., Inc.

Cronan, M. 1962. The school lunch. Peoria, Illinois: Chas. A. Bennet, Inc.

Dalrymple, J. I. 1964. Teaching for concept development. J. Am. Dietet. Assoc. 45, 22.

Davis, K. 1962. Human relations at work. New York: McGraw-Hill Book Co., Inc.

Dinkin, R. 1963. How important is training. Personnel J. 42, 35.

Drucker, P. F. 1959. Landmarks of tomorrow. New York: Harper and Bros.

Fairbrook, P. 1964. What you must know about labor cost. Food Service Magazine 26, 31.

Flanagan, T. G. 1963. It's easy to teach an old dog new tricks. J. Home Econ. 52, 111.

Gibb, J. R. 1958. Planning with principles. Adult Educ. 9, 19.

George, N. L., and R. D. Heckler. 1960. School food centers. New York: Ronald Press Co.

Greenaway, D. 1964. An overview of the food service industry. The Cornell Hotel and Restaurant Admin. Quarterly 5, 10.

Greenly, R. J. 1941. Job training NAM labor relation bulletin No. 35. National Assoc. of Manufacturers.

Hartman, J. 1963. How to do the best job in the least time. Modern Hospital 100, 122.

Haselrud, G. M., and S. Meyers. 1958. The transfer value of given and individually derived principles. J. Educ. Psychology 49, 293.

Hasting, G., and A. Schultz. 1963. Techniques for effective teaching. Dept. of Home Econ. NEA.

Hedrick, C. B. 1957. Feedback: A method of evaluating and improving training personnel. Personnel J. 32, 16.

Kidd, J. R. 1961. How adults learn. From article prepared by State 4-H Club Staff, Kansas State University, Manhattan, Kansas.

Knowles, M. S. 1950. Informal adult education. New York: Association Press.

Kotschevar, L. H. 1958. How to use work simplification in food service. Reprinted from Institutions Magazine. Domestic Engineering Co., Chicago.

Kotschevar, L. H., and M. E. Terrell. 1961. Food service planning: Layout and equipment. New York: John Wiley and Sons, Inc.

Lawshe, C. H. 1944. The training of operative personnel. J. Consulting Psychology 8, 54.

Lehrer, R. 1957. Work simplification. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Lindahl, L. G. 1945. Movement analysis as an industrial training method. J. Applied Psych. 29, 420.

Lundberg, D., and J. P. Armatas. 1964. The management of people in hotels, restaurants and clubs. Dubuque, Iowa: Wm. C. Brown Company Publishers.

Maier, N. R. F. 1955. Psychology in industry. Boston: Houghton Mifflin Co.

Martin, J. 1963. Changes in adults which affect teaching. J. Am. Dietet. Assoc. 43, 439.

McDermott, F. A. 1964. Office training returns more than cost. Admin. Mgt. 25, 52.

McGehee, W. E., and P. W. Thayer. 1961. Training in business and industry. New York: John Wiley and Sons, Inc.

Miller, E. J. 1964. Quality: A magic formula. J. Am. Dietet. Assoc. 45, 347.

Mitchell, M. L. 1955. Management and organization in quantity food production. J. Am. Dietet. Assoc. 37, 680.

Moore, A. N. 1964. Teaching machines: A new training aid for the dietitians. Hospitals 38, 64.

Morton, R. K. 1963. Teaching mature students. Improving College and University Teaching XI, 84.

Nadler, G. 1955. Motion and time study. New York: McGraw-Hill Book Co.

Niebal, B. W. 1962. Motion and time study. 3rd ed. Homewood, Illinois: Richard D. Irwin, Inc.

Phenix, P. H. 1956. Key concepts and the crisis in learning. Teachers College Record 58, 137.

Phillips, K. T. 1959. A training school for food service personnel. In Personnel Management in Institutions, reprinted from Institutions Magazine. Domestic Engineering Co., Chicago.

Pope, H. H. 1962. Work measurement standards. Restaurant Mgt. 91, 51.

Reinhalter, G. A. 1960. Work simplification: Its application and principle. School Lunch J. 14, 40.

Robinson, W. F. 1952. A program for training dietary employees in small hospitals. In: Readings in Hospital Dietary Administration, Publication No. M17-52 Am. Hospital Assoc., Chicago.

Sampter, H. C. 1941. Motion study. New York: Pilman Publishing Co.

Sandell, R. E. 1964. Making job training effective. Personnel J. 43, 571.

Schrendler, R. E. 1960. Telling is not teaching. J. Am. Dietet. Assoc. 37, 118.

Smith, H. C. 1964. Psychology of industrial behavior. 2nd ed. New York: McGraw-Hill Book Co.

Spiegal, Inc. 1961. Methods improvement and work simplification. Am. Mgt. Assoc. Encyclopedia of Supervisory Training, 381.

Wagner, F. W. 1963. Teaching adults in hospitals and school. Hospital and School Feeding 1, 153.

_____. 1964. Some principles of adult education. J. Am. Dietet. Assoc. 44, 64.

Warner, M. 1963. Training simplified: the seven basic steps. Implant Food Mgt. 11, 36.

Wendt, P. R. 1961. Audio-visual instruction. Department classroom teachers. Am. Educational Research Assoc. NEA.

West, B. B., and L. Wood. 1955. Food service in institutions. 3rd ed. New York: John Wiley and Sons, Inc.

Wynn, R. 1956. How to improve personnel relations. Institutions 39, 58.

Verhaalen, R. 1964. Principles of adult learning. Speech presented to Educ. 837, Seminar in home economic educ., Kansas State University, Manhattan, Kansas. (ditto.)

Yoder, D., H. G. Hineman, J. S. Turnbull, and C. H. Stone. 1958. Handbook of personnel management and labor relation. New York: McGraw-Hill Book Co.

APPENDIX A

Table 4. Junior high school cafeteria employees cooperating in study.

Employee	Age (years)	Length of service (years)	Work area
A	42	7	Meat
B	49	7	Meat
C	50	5	Bake
D	59	6	Bake
E	60	8	General
F	45	1	Salad
G	41	1	Salad
H	36	3	General
J	59	12	General
K	65	12	Dishroom

Observation Check List

Employee	Principle		
	Two hands	Reach	Continuous motion
A			
B			
C			
D			
E			
F			
G			
H			
J			
K			

Code for work areas:

Bake area	B
Counter serving	C
Dish washing	D
Meat area	M
Salad area	S

OPINIONNAIRE

1. Did you recognize these motions as motions you have been using?

2. Were the main points explained clearly to your satisfaction?

3. Did the drawings help explain the ideas?

4. Do you think the material would be of help to a new employee?

5. Do you think the students who help you serve on the line might learn something from seeing the illustrations?

6. Would you suggest other examples I can use in the program?

APPENDIX B

SIMPLE

MOTIONS

ACCOMPLISH

ROUTINE

TASKS

Being smart is using simple motions to accomplish routine tasks.

Being smart saves energy.

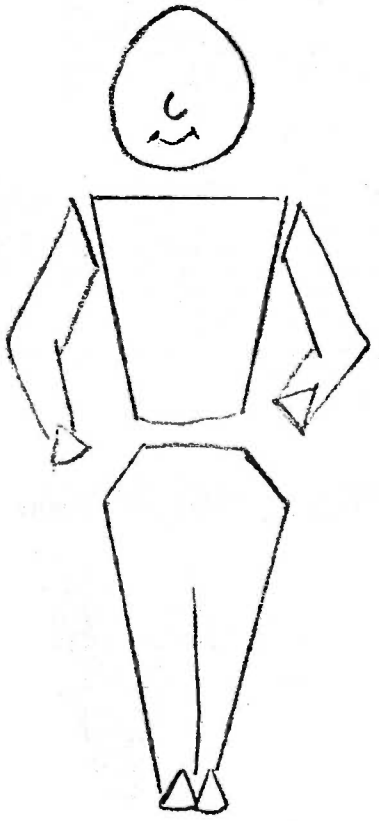
BEING SMART IS

WORKING

SMARTER

NOT

HARDER.



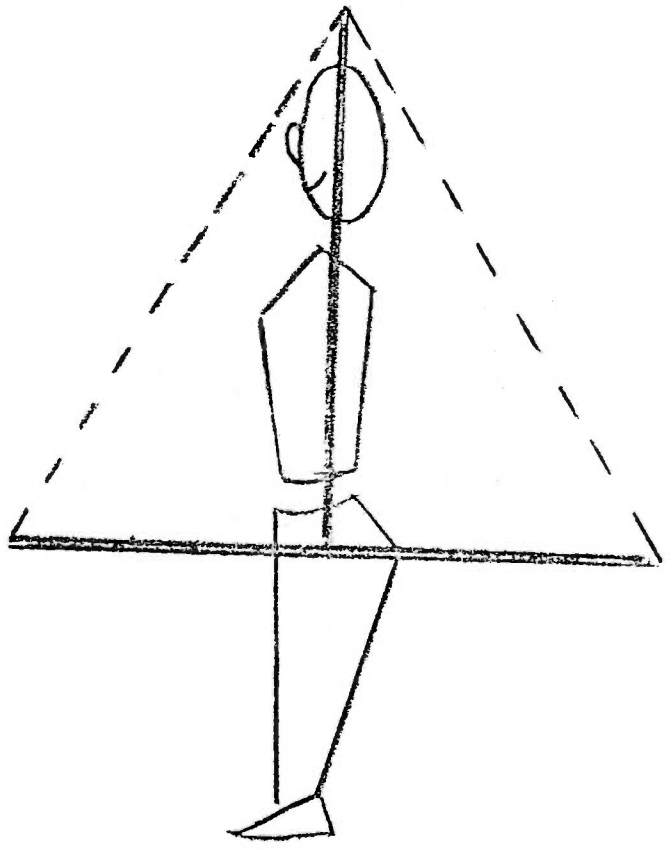
The most important tool you use at work is your body.

Your body uses energy to move your muscles. And your muscles do your work.

Work produces some fatigue in parts of the body

- your legs when you walk
- your back when you stoop
- your arms when you reach

Unnecessary work and useless motion waste your energy.

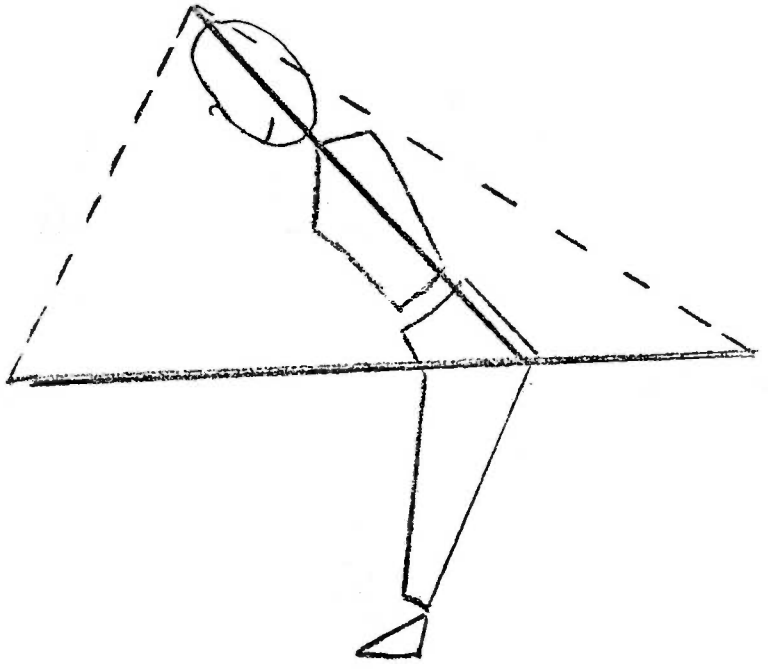


Look at the body as an upside down T.

The weight of the body rests on the spine, the hips and the legs.

Your weight is evenly balanced only when your body has good posture.

Then no single muscle group is overworked.



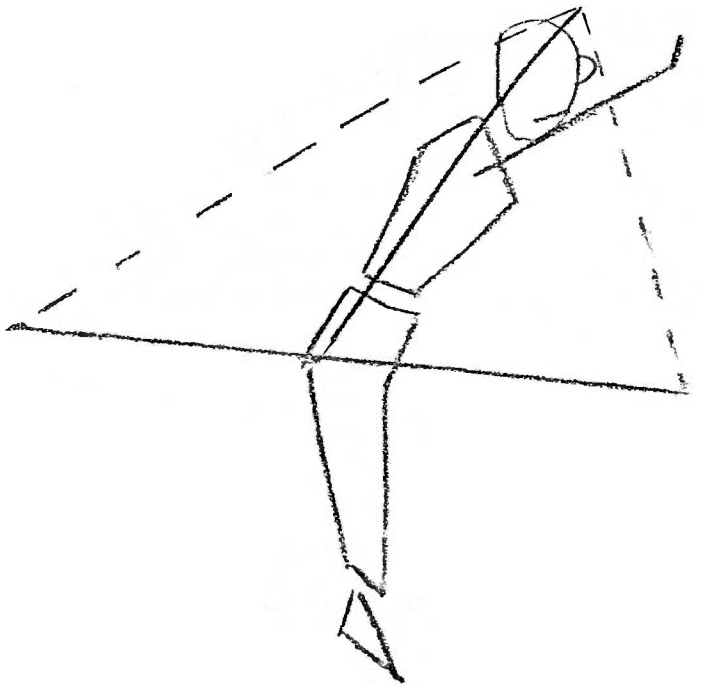
The weight of the body is unevenly distributed when the body is out of line.

You are off balance.

To keep you balanced, muscles on the stretched side use more energy than dancing all night.

When you are off balance, you increase the chance of sprains and strains.

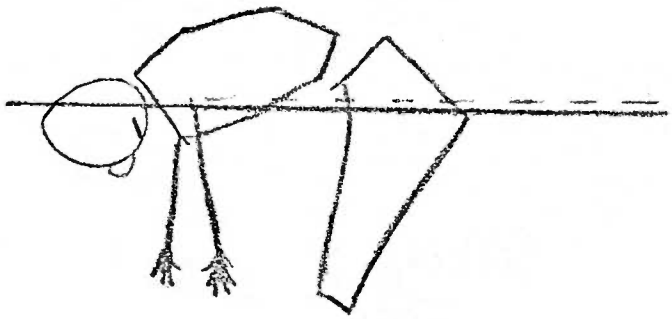
You become tired faster.



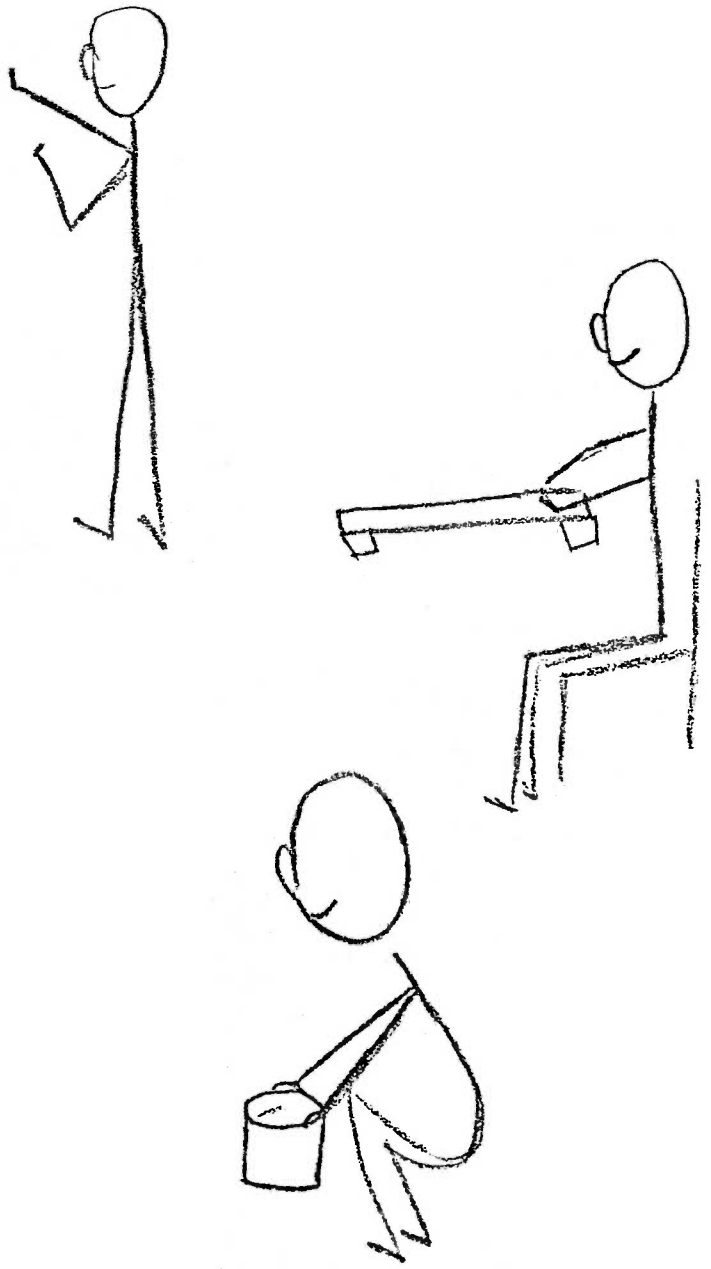
Reaching and bending throw the body out of line.

Unnecessary reaching and bending are a waste of your energy.

Smart workers use their bodies correctly.



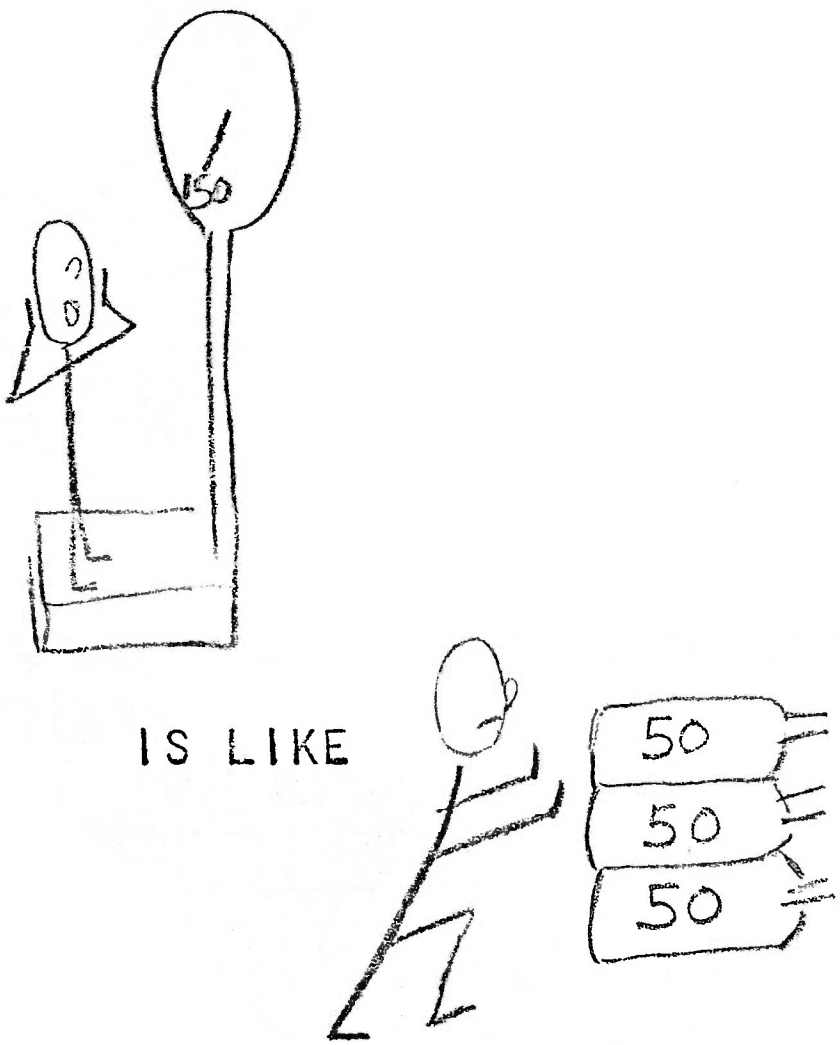
They use simple motions to accomplish routine tasks.



Good posture reduces fatigue and saves energy for other activities.

Simple motions help maintain good posture.

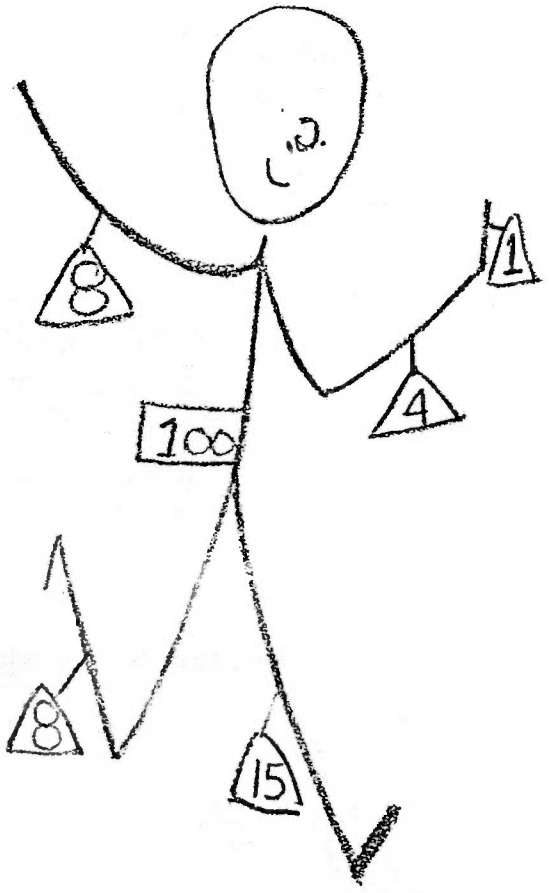
They let you do routine tasks easily.



The more parts of the body that you move, the more energy you use.

When a 150 pound person changes position, it is like moving three 50 pound sacks of flour or three bags of potatoes.

That's hard work and lots of energy, isn't it?



Moving a hand is like lifting one pound.

Moving a lower arm is moving four pounds.

Moving the entire arm or lower leg is moving eight pounds.

When it is the entire leg, fifteen pounds are moved.

Moving the body trunk is moving a hundred pounds.

Smart workers cut down the number of pounds that are moved.

They use simple motions to accomplish routine tasks.

PRINCIPLE

THE REACH OF THE ARMS

DETERMINES

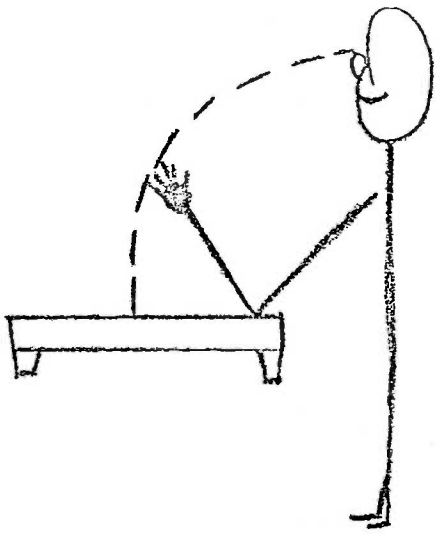
THE

BEST WORK AREA.

Arranging work around the reach span is a good idea,

This will save many back aches and maybe prevent strained muscles.

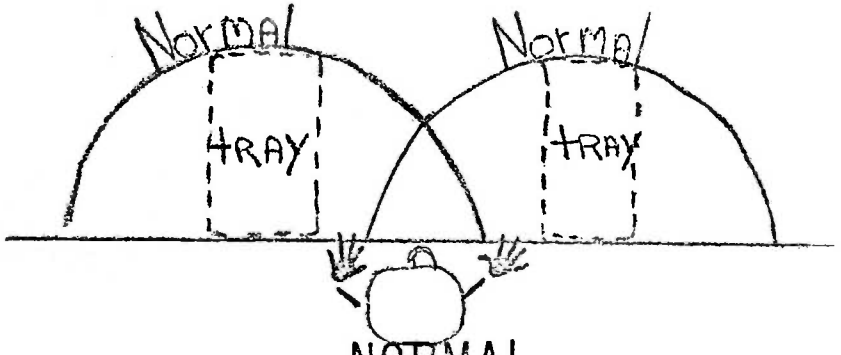
Energy can be saved for other activities



NORMAL
VERTICAL REACH SPAN

Moving the lower arm in a half circle - table top to nose - is your normal vertical reach span.

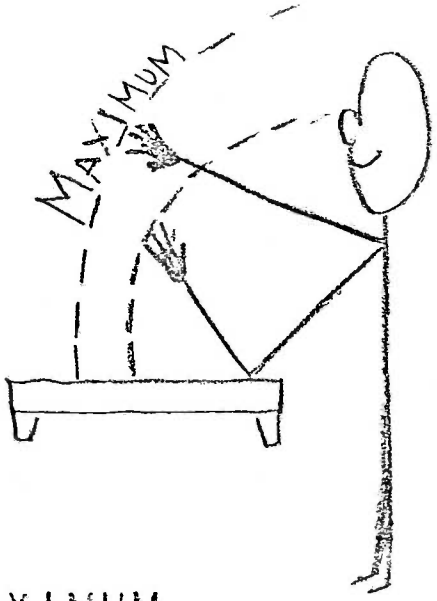
Moving the lower arm in a half circle - front to side is your normal horizontal reach span.



NORMAL
HORIZONTAL REACH SPAN

The normal span is the distance you can reach easily when the arm is bent.

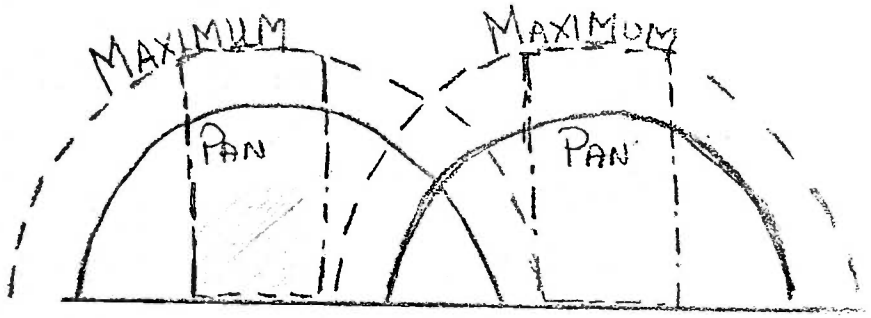
These areas are about the length of a cafeteria tray.



MAXIMUM
VERTICAL REACH SPAN

Moving the entire arm in a half circle - table top on up - is the maximum vertical reach span.

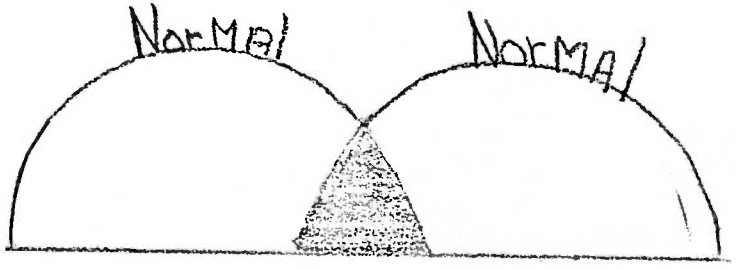
Moving the entire arm in a half circle - front to side- is the maximum horizontal reach span.



MAXIMUM
HORIZONTAL REACH SPAN

The maximum span is the farthest you can reach easily when the arm is straight.

These distances are about the length of a bun pan.



CONVENIENT PREPARATION AREA

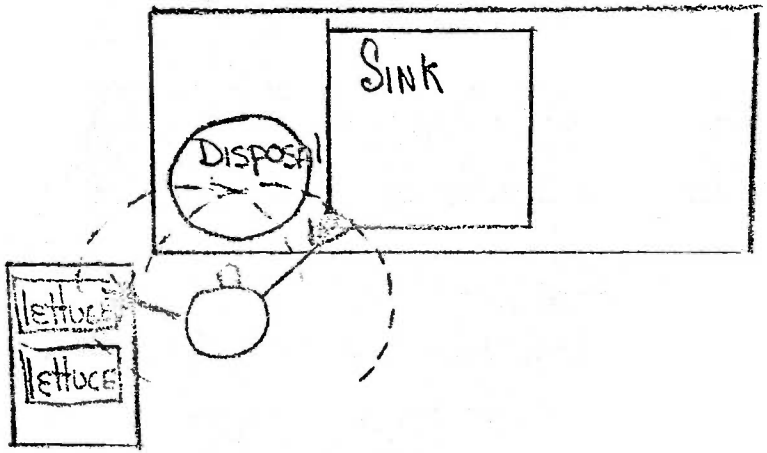
The darkened area in the middle of the illustration is the best space for putting things together.

Making a crumb topping for bread or mixing up a sandwich filling in this area is smart.

This area is convenient for both hands and arms.

The work is done in a comfortable position.

Reaching and stretching is kept to a minimum.



PLAN WORK AREA
AROUND
THE REACH SPAN

Using a cart to hold boxes of lettuce is smart.

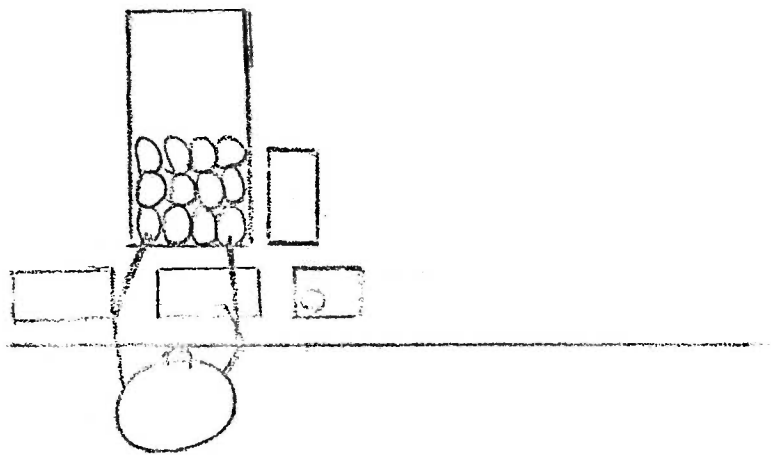
Many heads of lettuce are within reach. Steps are saved.

Reaching is reduced.

Both hands can easily strip the outer leaves directly in front of you.

Disposing of the waste does not call for extra motion.

The sink is within reach so the lettuce can be dropped in and rinsed.

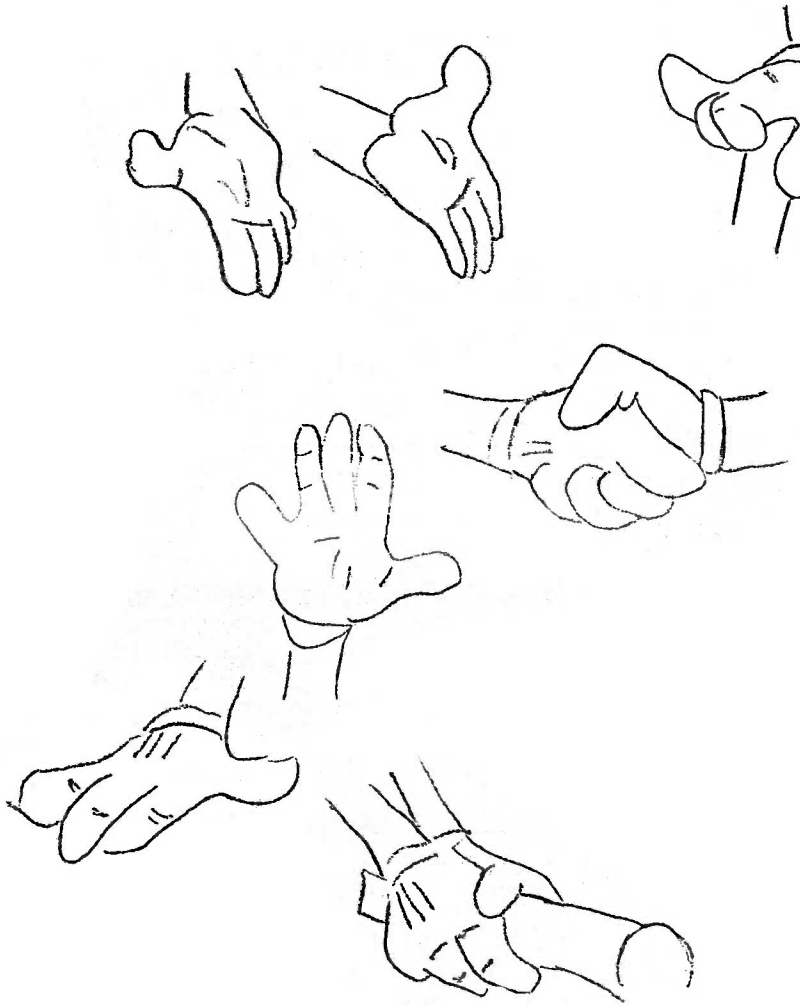


When you serve on the line you use many reaching motions.

Reaching for 450 buns takes a lot of motion. It is like lifting 56 pounds.

It is important to work inside of the reaching span to save energy.

You may need it when you reach for bun number 451.



HANDS DO THINGS

Hands are efficient tools

There are jobs when one hand is enough:

- -shaking hands
- -picking up a small sauce pan
- -reaching for a spoon

At other times two hands work together naturally.

Two hands quarter an orange
- -one hand to hold
- -one hand to slice

Two hands push a cart.

Two hands pick up a pan of stew.

PRINCIPLE

USING BOTH HANDS

RESULTS IN

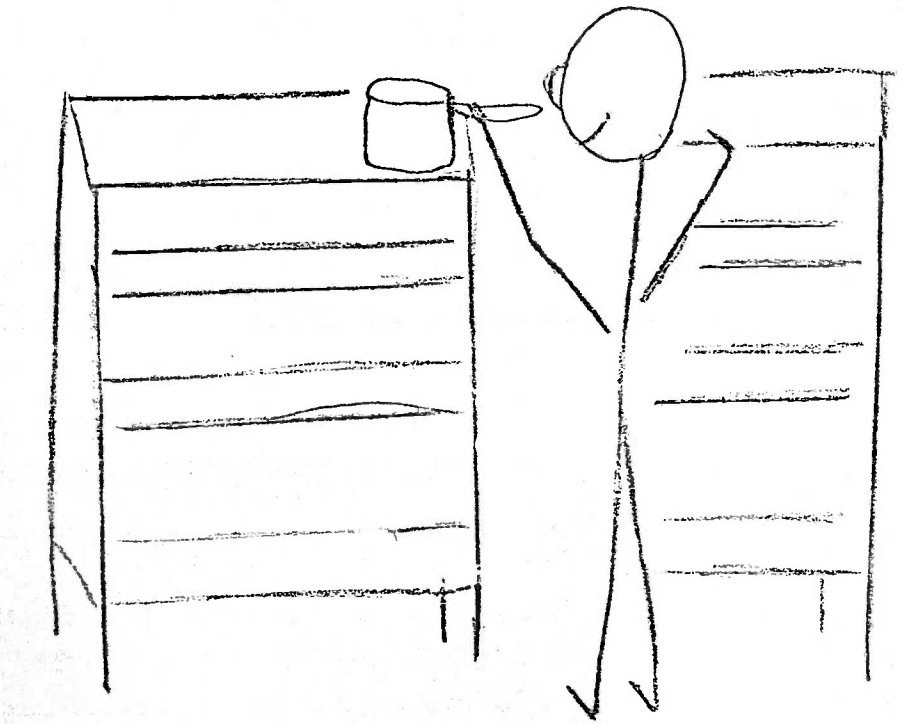
BALANCED

EASY MOTIONS

Even when a task appears to be one handed, using two hands may make the job easier and quicker.

-shaping rolls
-serving bread & butter
-stripping trays

Using both hands saves motion and energy.



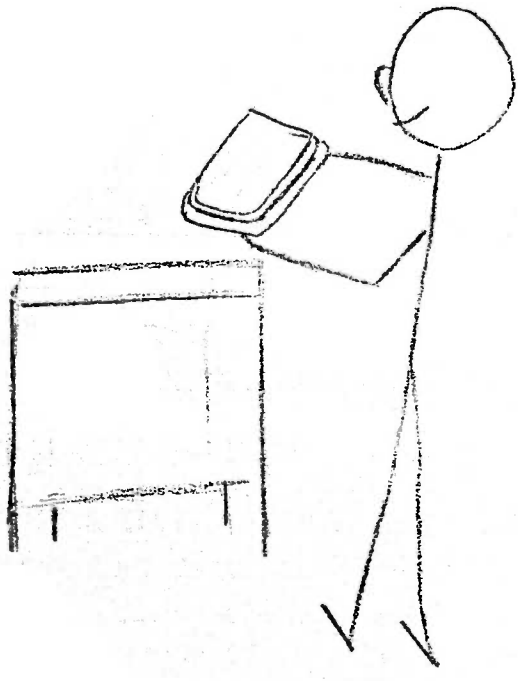
Picking up trays or pans may be easy.

Doing it many times is still easy, but tiring.

Using one hand works the muscles on only one side of the body.

These muscles work harder and longer than those on the other side.

Besides doing work, the muscles strain to keep the body in balance.

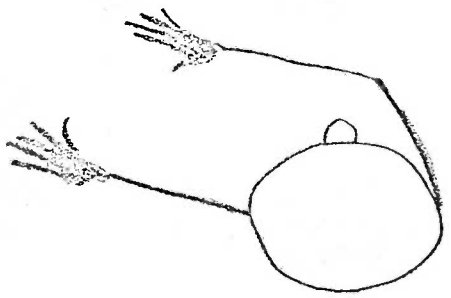


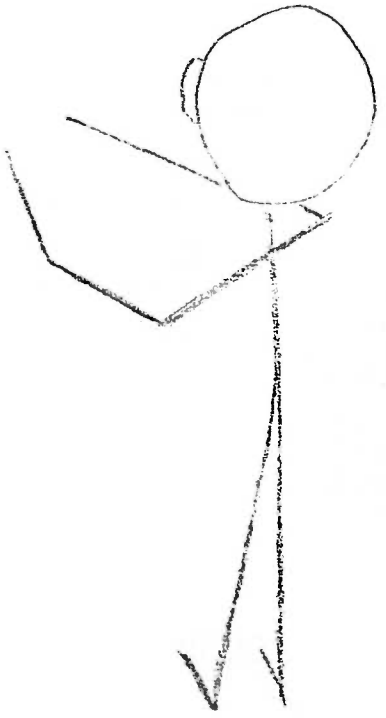
When you pick up trays or pans with both hands, your muscles and hands share the work.

Hands working together build balance.

Balanced motions make the work easier and faster.

You save energy and time,



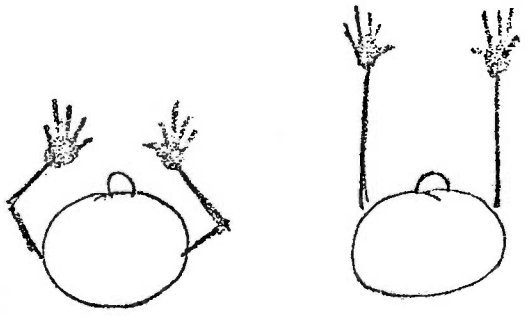


Some movements use more energy than others.

When you move both arms to one side, the body and shoulders have to twist.

It takes energy to move the body.

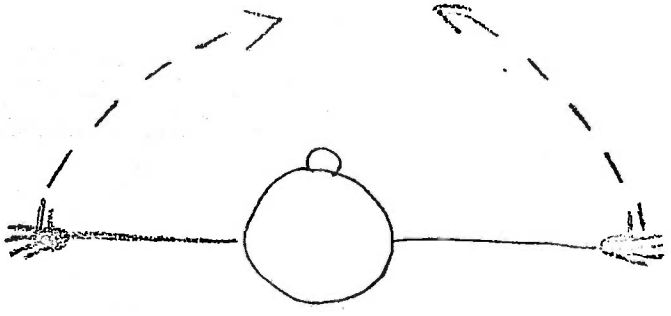
It takes more energy to twist the body.



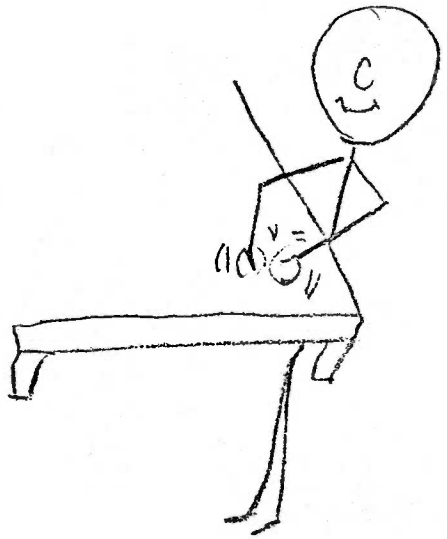
When each arm moves from side to front, the body stays in a straight position.

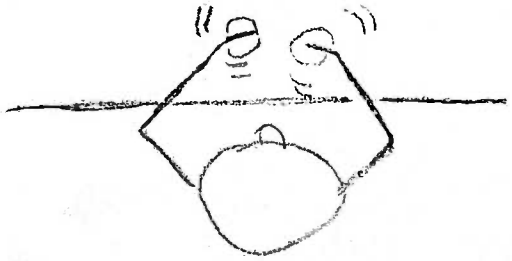
The body is balanced.

Motions are easy.



Energy is saved for your own activities.



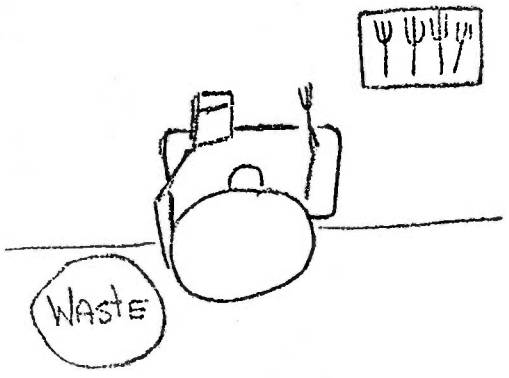


It is natural to shape rolls with the hands - both hands forming one roll.

It takes a little practice to shape rolls two at a time -one with each hand.

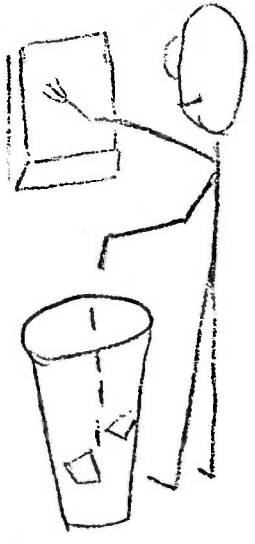
But when you consider the counter top as the partner for each hand and roll the dough against the counter, it is like using four hands.

Using both hands in quantity food production reduces your work fatigue.



Clearing trays is a time consuming job.

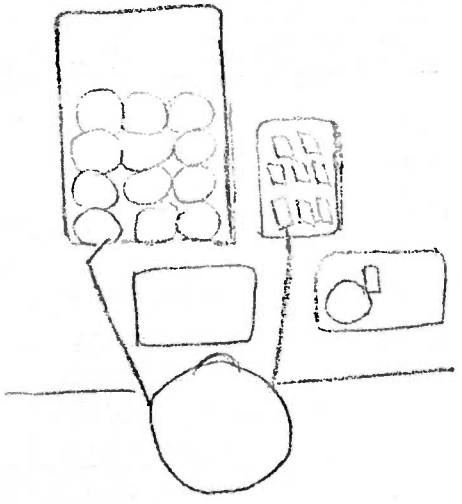
When you use both hands to strip the trays, the work load is reduced.



Two items can be removed from the tray at the same time.

The tray line moves smoothly and quickly

Energy is saved for your own activities.



Twelve o'clock is Zero hour for serving lunch.

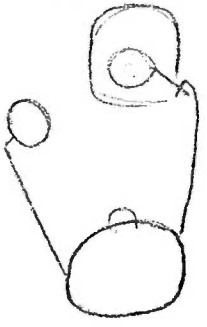
When you run a smooth assembly line, the trays move along continuously,

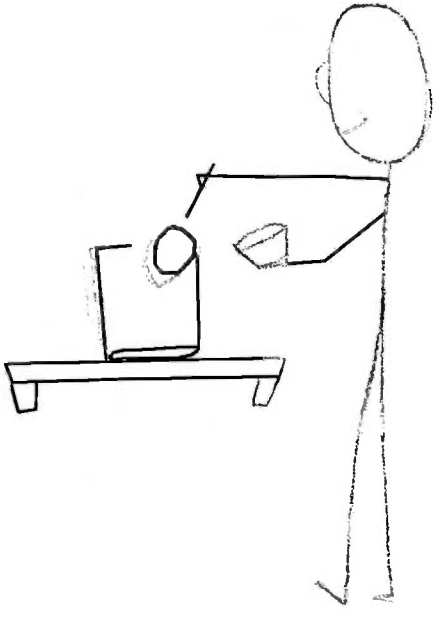
When each hand does a specific job, you have a fast smooth operation.

Using both hands to pick up and place bread and butter on the trays keeps the line moving.

The motion becomes automatic.

Rhythm develops and the job is done in a relaxed manner.





Serving soup on the line is not difficult.

Picking up the cup with one hand while the other hand dips the soup is the smart thing to do.

The body is balanced.

PRINCIPLE

CONTINUOUS MOTIONS

OF THE ARMS

ARE EASY, EFFICIENT, AND

ENERGY-SAVING.

A motion is like a rolling ball.

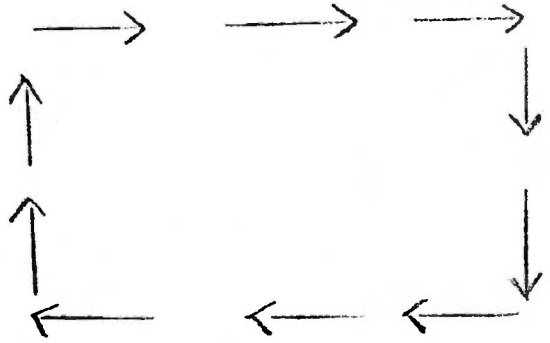
Once it starts, it is easier to keep it going than to stop it.

Moving an arm in a square pattern is not hard,

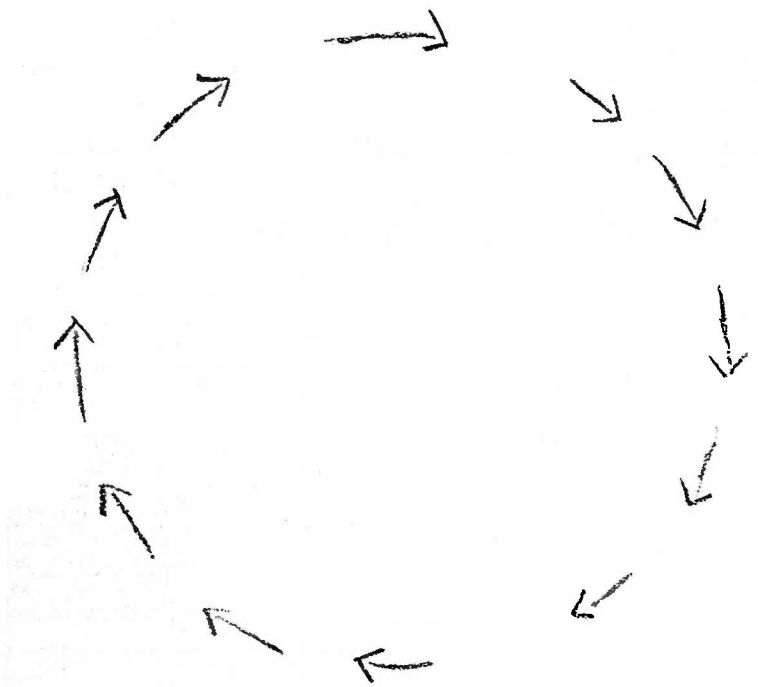
But you had to think about turning the corners, didn't you?

This concentration on corners takes energy.

It takes even more energy to stop and start this kind of motion.



SHARP TURNS DEMAND
THOUGHT AND CONCENTRATION

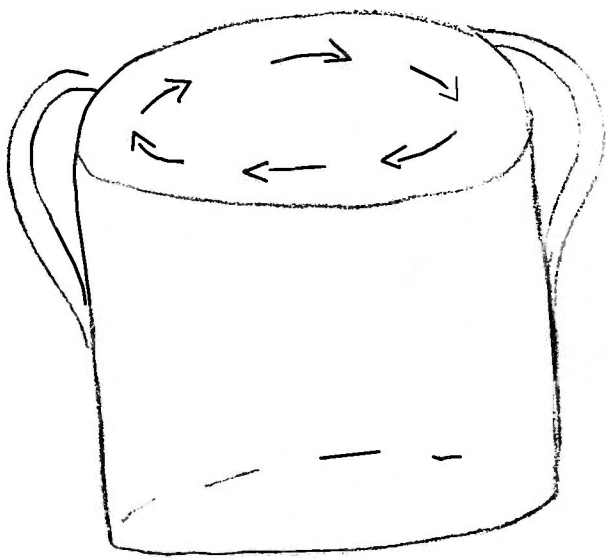


Moving the arms in a circular pattern is easier.

It is also quicker.

Circular motions are natural.

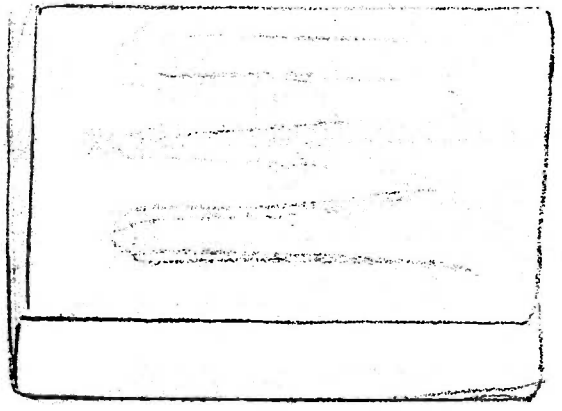
Natural, smooth continuous motions save energy.



It is natural to stir a pot of soup with circular motions.

It is smart because you lessen the chance of splashing and perhaps scalding yourself.

The soup continues to move and to help you.



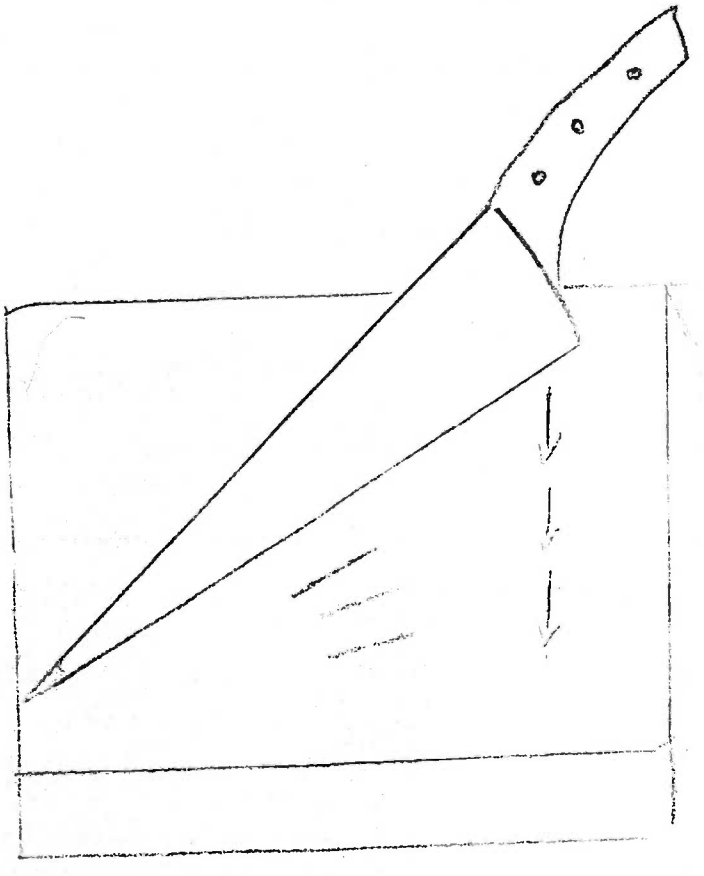
It is natural to ice a cake with continuous motions.

The icing spreads easier.

Fewer crumbs get into the icing.

The job looks professional.

Smart people are professional people.



Chopping vegetables with continuous motions help save energy and time.

Downward strokes save energy because you use the natural power in your arm.

Downward strokes are easy to repeat.

Continuous downward motions make the work go faster.

Continuous motions make simple work of a routine task.

WISE PROVERB

HE WHO POINTS KNIFE

AT SELF

IS LIKE BOLOGNA

READY FOR SLICING

Downward strokes aim the blade away from the body.

This is smart because it reduces the number of cuts.

SIMPLE

Smart workers use smooth continuous motions.

MOTIONS

The motions are comfortable.

ACCOMPLISH

They prevent fatigue.

ROUTINE

They increase your high quality work.

TASKS

Your high quality work is easier to do.

AUDIO-VISUAL PRESENTATION OF FOUR MOTION ECONOMY PRINCIPLES FOR FOOD SERVICE WORKERS

by

ELIZABETH ANN SWIGERT

B. S., University of Colorado, 1954

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Institutional Management

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1966

One hundred fifty thousand new employees are needed each year to fill vacancies in the three million personnel work force of the food service industry. This turnover and low productivity of new workers add to the rapidly accelerating cost of labor and have forced management to investigate ways of controlling this expenditure.

Training in use of motion economy principles has been effective in reducing these problems in industry. The objective of this study was to develop educational material related to motion economy for food service workers and to evaluate visual presentation of the material.

These motion economy principles involving use of the hands and arms were adapted for this study from previous work by Barnes (1963): (1) the reach of the arms determines the best work area, (2) using two hands results in balanced easy motions, and (3) continuous motions are easy, efficient, and energy saving. Generalizations were developed and explained in terms and work situations familiar to food production employees. Drawings were made on transparencies accompanied by typewritten instruction.

Prior to presentation of the educational materials, ten junior high school employees were observed to determine use of motion economy principles. Observations were made daily at different times for two and one-half weeks. Use of the various principles in accomplishing duties was noted on a check list.

Transparencies were shown to employees in the last hour of a working day and time was given to complete an opinionnaire.

Questions were constructed for recognition and recall of the motions illustrated and understanding of the selected principles of motion economy.

Informal conferences were held the following morning with employees to supplement information from the opinionnaire. Observations were continued for three days to evaluate any observable changes in work habits. Opinionnaire and conference responses indicated understanding and knowledge of the adapted principles. Employees expressed interest in this method of presenting information.

The principle used most efficiently before and after showing of the transparencies was the Continuous Motion Principle. An increased use of the Reach and Two Hands principles was noted during the second observation period, though this may not have been a direct result of the presentation.

Employees cooperating in this study had the advantage of the director's interest in improved work methods and were aware of usage of motion economy principles.

Although improved work methods may be taught as the supervisor works with individual employees, it appeared from this study that class instruction in principles of motion economy could be a time-saving device for the instructor. Material developed could be used for an introduction to motion economy with follow-up by individual supervision.