HOUSEHOLD EQUIPMENT FOR LEFTHANDERS:

AMBIDEXTROUS DESIGN

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PREFACE

This study came about as the result of many years of observing the world "through the looking-glass." It is hoped that this study will spark new ideas for the betterment of design. It is also hoped that this study will be a comfort and encouragement to lefthanders.

I wish to express my most sincere appreciation to the students, faculty, and staff of Oklahoma State University who so eagerly participated in this study. Special thanks goes to Dr. Kay Stewart, my advisor, for her assistance and guidance in the development and execution of this problem. I am grateful to Dr. Florence McKinney for serving as a knowledgeable member of my advisory committee and to Mrs. Christine Salmon for her support as a committee member and for her hospitality in her home to the participants in the experiment. I would like to thank Mr. Neal Willison for his inventive spirit in helping with the can opener design. I wish to thank Mrs. Carolyn Hansen for her typing excellence and Mr. Kenneth Hutchison, my brother, for his patent research.

Gratitude goes to all my friends for their prayers and encouragement. A special thanks is due my parents, Mr. and Mrs. C. Bryce Hutchison, who taught me that to be lefthanded is to be special.

This work is dedicated to the Lord Jesus Christ, who started it, sustained me in joy throughout it, and accomplished it.

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CHAPTER I

INTRODUCTION

Statement of the Problem

The tools and utensils which we use everyday in the home are a constant part of our lives. The design of the physical form of household equipment is a controlling factor in its ease of use. Tools used in the hand need special care in their design if they are to be effective in everyday use. The well known phrase, "form follows function," has been a basic principle for twentieth century product design. Designers in many fields, furniture design, machinery design, and industrial design concur that the function of the product is uppermost in the designer's thoughts when a design is conceived (Dreyfuss, 1967; Pye, 1964; Thiberg, 1975; Wallance, 1956).

Finding out exactly what makes up the "function" of a piece of equipment is not always an easy task (Pye, 1964). Home Economists, in the study of work simplification, have developed questions concerning the function of a piece of household equipment related to selection of equipment for the handicapped (May, Waggoner, and Boettke, 1966). Among these are questions related to the person doing the job and the standard to which the job should be done. Industrial designers have developed many ways to observe and measure the human body working with tools of all types. Included in these observation techniques are time lapse photography and the ergometer, a device for measuring work

(Diffrient, 1975).

Industrial designers have given much time and consideration to the problem of fitting hand held or operated equipment to the hands that do the work. Most equipment is designed with the idea that all or at least the major part of the work will be done by the right hand (Damon et al., 1966). Problems in ease of use arise when the user of the equipment does not conform to the standard for which the tool is designed, as in the case of the sinistral.

There are four major reasons why one would be using his left hand for operating household equipment. First there are those who find the dominant use of the left hand more natural, or use either hand equally well. A second group of persons using the left hand are those whose right hand or arm has been impaired due to injury or disease. Third there are those with the right hand or arm paralyzed. The fourth group of persons are those whose right hands have been amputated because of injury or disease. Other problems often accompany impairment or loss of the use of one hand, but the problems related to the design of tools adaptable to the left hand are important for the people in any of these groups.

Research into problems of lefthanded usage of equipment has been primarily limited to the study of persons who are severely handicapped. The problems of everyday annoyances caused by equipment that is designed "backward," in the eyes of the sinistral, had not, to this researcher's knowledge, been scientifically researched to the present time. The purpose of this study was to be a pilot study into the investigation of problems which may be encountered by sinistrals in using household equipment and to make suggestions for solutions to these

problems. Any one of these objectives could be completed as a study of ambidextrous design but as no studies have been done in this area it was felt that the utilization of these many types of research would bring to light problems which could be studied in depth by future researchers.

Objectives

The objectives of this study were:

1. to identify pieces of household equipment which present problems to lefthanded homemakers because of the design of the physical form of the equipment.

2. to locate sources of products designed for use with either hand, as well as products and helps specifically for the left hand.

3. to test the adaptability of lefthand users to selected utensils.

4. to suggest possible solutions to design problems experienced by the lefthanded, including adaptations of design of household hand held utensils, when ambidextrous utensils are not available.

General Procedure

For the fulfillment of the objectives of the study, many varied activities were necessary. Each had its own procedure, which will be explained in detail in Chapter III. The general procedure for the fulfillment of the study involved five steps.

To fulfill objective one, interviews of four lefthanded persons were made. These were natural sinistrals and handicapped stroke victims. The responses to general questions concerning equipment and lefthandedness contributed to the development of a list of equipment. An examination of equipment available in hardware, variety, and gift stores in

Stillwater suggested other items of equipment which might present problems. At the same time some "ambidextrous" equipment was located. This activity related to objective two. An investigation of catalogues of stores specializing in lefthanded equipment completed the list of problem equipment and added to the sources of ambidextrous utensils.

In order to test the adaptability of equipment to lefthanders, an experimental situation was designed so that observations could be made while participants used selected pieces of equipment and kitchen utensils. Six lefthanded and two righthanded subjects were video-taped, and the tapes were analyzed to identify general patterns of usage. These were designed as in depth case studies of equipment usage, rather than comparisons between right and lefthanders.

From the data that was gathered, many problem areas were identified and possible solutions were derived. One of these problems, the usage of the righthanded can opener, prompted a search for a can opener which could be used easily by a stroke victim who could use only the left hand. No suitable design was found, so the author, with the help of a mechanical design enthusiast, designed such a can opener. Design solutions to other problem equipment were also thought through.

Definition of Terms

The following words need definitions to be meaningful within the context of this study.

Dextral - 1) Righthanded. (This may refer to a person or object, and has nothing to do with ability to do fine motor tasks with the hands). 2) Designed for use with the right hand.

Sinistral - 1) Lefthanded or with a leaning to the left. (Although

this word has the same root as the word sinister, they should not be confused or linked in any way). 2) Designed for use with the left hand.

Ambidextrous - 1) Able to use both hands with equal ease (Webster's New World Dictionary, p. 46), or easily used with either hand.

Utensil - 1) Hand held and operated piece of kitchen equipment.

Lefthanded - 1) Primarily using the left hand as the preferred hand for performing most commonplace activities. This may or may not include writing, or any other skill in which the participant may have been forced or trained to use the right hand. 2) Designed for use with the left hand.

Hindrance - 1) Anything which makes an activity more difficult to perform.

Handicap - 1) "Any chronic ailment or condition that reduces a person's capabilities below those used as a basis for current design specification" (Industrial Design, 1974, p. 25).

Limitations of the Study

The limitations of the study are as follows:

1. The size and composition of the sample interviewed and the sample observed in the experiment put limitations on the study. Because the observations of the subjects were case studies no statistical tests were used, but rather, general patterns were identified.

2. The household equipment used in the experiment was limited for coherence in the meal preparation.

3. The search for ambidextrous, "lefthanded", and "righthanded" equipment was limited to the immediate shopping area of Stillwater, Oklahoma, population 34,000.

CHAPTER II

REVIEW OF LITERATURE

Equipment Design and Functions

"The ultimate object of design is form" (Alexander, 1964, p. 15). In order to understand why household equipment is given a certain form, it is necessary to study the people and processes behind the equipment design. The person most responsible for the physical form of household equipment is the industrial designer. Designers have definite opinions about their role in shaping the equipment homemakers use. Designers are problem solvers.

> It is the prime function of the designer to solve problems. My own view is that this means that the designer must also be more sensitive in realizing what problems exist. Frequently, a designer will 'discover' the existance of a problem that no one had suspected before, will define that problem and then attempt to solve it (Papanek, 1972, p. 270).

Design is a service to the public to make life a little easier, but is not a cure-all for life's problems (Nelson, 1965). Designers also get personal satisfaction from designing or redesigning an everyday piece of equipment. As Swedish designers Ahlstrom and Ehrich have commented on whether a new dish brush was needed, "No, but we got to re-do a bad brush and develop one that would be better" (Brown, 1975, p. 8). The continual betterment of the product is the designer's goal.

Designers have set criteria for the form of the equipment designed. These relate not only to aesthetics and function, but to many other

factors as well. Wallance felt that the fusion of visual design, functional excellence, and technical quality made up a useful object (Wallance, 1956, p. 4). Another designer gave performance, simplicity, jointing, and economy as the four factors by which he measured for excellence of design (Alexander, 1964). Henry Dreyfuss listed five criteria for excellence in design to be achieved in work by his firm. These were convenience of use, including utility and safety; ease of maintenance; cost; sales; and appearance (Dreyfuss, 1967). Niels Diffrient of Henry Dreyfuss Associates added the emotional aspect to the criteria for products. He felt that individuals should feel good about using their equipment and machinery (Diffrient, 1973). Thiberg included psychological factors in her criteria of good design. She felt that equipment should have simplicity and economy in use of resources. Also it should be recognized that there is a possibility that the product will affect people, and the user has the right to form his own environment (Thiberg, 1975, p. 8).

The designer's products must be produced by a manufacturer. The manufacturer's demands also affect the form to be taken by the equipment. "Almost all products are produced, distributed, and bought within the framework of the market economy" (Thiberg, 1975, p. 8). Sales appeal, versatility in use, and economy of materials are all important to the manufacturer (Brown, 1975). Fashion is another factor which affects the form a product will take. The fashion at the time may or may not bring about a workable design for a product.

Designers agree that the function of a tool is a very important factor in determining form. "The designer has great possibilities of affecting the final product . . . it is almost entirely up to him if

the form is to give a good function or not" (Brown, 1975, p. 8). Functionality implied convenience of use to Dreyfuss, who felt this was his primary criterion for design. "If the point of contact between the product and the people becomes a point of friction, then the industrial designer has failed" (Dreyfuss, 1967, p. E). To determine the function of a tool is not always easy. Functions change as technology eliminates some jobs and creates others. Tools should be designed to be flexible. "The purposes of things are the purposes of men and change according to who entertains them" (Pye, 1964, p. 12).

Man adapts well to his environment, but adaptation on the part of the user of equipment is not always a good solution to a design problem. Adaptation to design has been termed "degrading" (Diffrient, 1973, p. 55). While the experience to adapting may or may not be degrading, it seems much easier and healthier to adapt tools rather than people. Adaptive design costs money, however, it takes time and effort to consider people's needs, desires, and security. Mass manufacture cannot create "product individuals," but only product stereotypes. The consumer can only be offered compromises (Mono, 1975, p. 13). These compromises can be good design if used in the proper way. Kettunen found that common tools used in a different way could allow a handicapped homemaker to perform homemaking activities (Kettunen, 1963). The problem in equipment design may not be so much one of compromise, but rather one of specialization for a non-existant "average man". The average man is the basis for the size and form of hand held objects and the form is made to work ideally for him.

The specific function of hand operation is a problem which the designer tries to solve in the best way possible, so that the hand is

comfortable and the best strength and control are achieved. The preferred hand should be used if possible, but designers plan for righthanded usage (Damon et al., 1966). The design of the equipment causes a hindrance or a handicap to those who find it hard to adapt to the equipment. Usually, the term "handicap" has been limited to those who are severely disabled, but according to participants in the Armco Student Design Program, very few people do not have a handicap of some type.

> We're using a broad definition of the word 'handicap' to include any chronic ailment or condition that reduces a person's capabilities below those used as a basis for current design specifications. Within this definition fall not only such well-known ailments as paraplegia, arthritis, and blindness, but also such everyday conditions as obesity, underweight, old age, and youth (Industrial Design, 1974, p. 25).

Lefthandedness could easily fit into such a definition.

Handedness

Before the 1950's, and in some places even today, natural lefthandedness has been thwarted. The non-conformity of sinistrals plus leftovers of superstition have led parents to force dextrality (righthandedness) on their children. In a syndicated newspaper column "The Worry Clinic," the doctor recommended that since most musical instruments, tools, and one handed objects were dextral, children should be trained to be dextral (Crane, 1975). Researchers have found that forcing handedness on a child creates emotional problems and stuttering (Blau, 1946).

It is rather common in the United States to allow lefthanded children to follow their natural tendencies. Estimates of what percentage of the population is lefthanded vary because of the social stigma

against lefthandedness. The United States Army found 8.6 percent of its registrants considered themselves lefthanded (Karpinos and Grossman, 1953). In a study of nursery school children, none of whom had been forced to use one hand or the other, 11.1 percent were found to be lefthanded (Hildreth, 1948). The question of what exactly constitutes sinistrality is made more difficult by the varying degrees of lefthandedness exhibited. Many people write with their right hands, but do nearly everything else lefthanded. However, because of our culture's dextral orientation, sinistrals tend to be more ambidextrous than dextrals (Humphrey, 1951). The determination of which hand is really dominant in questionable cases has been researched by several physicians. These tests include many seemingly unscientific methods for determining handedness. One test requires that the subject examine his thumbnails, and whichever is wider and more squared off at the base is the thumb of the dominant hand (Block, 1974). Another test for handedness is for the subject to hold both arms behind his back, and whichever arm reaches up farther on his back, that is his non-dominant side (Crone, 1974). A third test requires that the subject form pairs with the fingers of one hand. The index and middle finger are held tightly together and the ring and little finger are held together, with space in between the two pairs. This hand position is done with both hands and the hand with the larger span between the pairs of fingers is the non-dominant hand (Syed, 1973). These tests have been refuted by other physicians, and the most reliable definition of sinistrality remains the individual's choice of preferred hand for most activities.

Those persons whose right hands or arms have been impaired through injury or disease are decidedly lefthanded. In 1971, there were 1,699

persons who lost partial use of an upper extremity permanently (National Center for Health Statistics, 1971, p. 16). This figure does not include the many people who lose use of a hand temporarily, as in the case of a broken arm or finger. In 1972, there were 1,543 persons in the U. S. who suffered a stroke which impaired or paralyzed one side of their bodies (NCHS, 1972, p. 2). Stroke or cerevascular disease, affects one side of the brain causing the opposite side of the body to be affected. In addition to stroke victims, there are other hemiplegics who have brain disorders, congenital or otherwise, forcing them to rely on the left hand.

The fourth group of sinistrals is made up of amputees. In 1969, persons reported as having an artificial arm or hand numbered 46,000 (NCHS, 1969, p. 19). The Federal-State Vocational Rehabilitation Program reported that in 1970, 1,764 persons who had lost an upper extremity and were rehabilitated, and in 1971 the figure was 1,456 (USSRS, 1971, p. 20). Injury or disease would put many people in the position of adapting to lefthandedness after having been naturally righthanded. Research into sources for locating utensils that can be utilized by these groups would be beneficial to increasing their independence.

Design Process

Equipment and the person to use it are studied carefully in order to determine the best design for a tool. Industrial designers must use a scientific design process to arrive at the best solution to the design problem.

> Today more and more design problems are reaching insoluble levels of complexity. In spite of their superficial simplicity

> even these problems have a background of needs and activities which is becoming too complex to grasp intuitively (Alexander, 1964 p. 3).

A methodology for design has been developed to carry out the process in an orderly way. Three basic steps are included. The analysis of the present design is the first step. The correction of problems in the original design is second, and development of a drawing, then a prototype of the new design is the third (Allen, 1974). The analysis of the present design is a highly complex operation, including two major areas. These are the parts of the object to the whole, and the analysis of the relationship of the object to the person who performs the task (Allen, 1974).

The analysis of the relationships within the tool requires the designer to have some knowledge of physics, engineering, and physiology principles. These areas are well established and many principles have long been set forth in these fields. The analysis of the relationship of the worker to his tool is a new area of interest and is developing quickly. Among the first to study how motions are carried out in a job was Gilbreth, in the early 1900's. His development of motion study was an attempt to improve the efficiency of workers in the home and industry (Gilbreth, 1911). The science of motion study has become highly advanced. Gilbreth's principles included reducing present practice to writing (Gilbreth, 1911). Many new methods for observing and charting of present practice have been developed. The filming of workers and homemakers performing their tasks is a useful technique for recording observations. Memomotion, the use of motion pictures, is a superior way to study long and complex cycles (Mundel, 1960). The film provides for greater detailing than eye observation, and greater accuracy than pencil

and paper recording of data (Mundel, 1960). Memomotion includes three steps - filming, film analysis, and graphic presentation. During filming, all concentration is on recording the motions on film. Categorization of motions and charting on a process chart take place during viewing of the films (Mundel, 1960). The types of filming may include time lapse photography, 16mm filming, or video-tape, recently added to the available types of film for designers.

> Video-tape systems which allow easy sight and sound recordings, on videotape with instant playback through television receivers promise great and as yet untapped potential for designers. Uncomplicated equipment and light-weight cameras open up a whole realm of human experience to instant study and analysis (Diffrient, 1975, p. 32).

In addition to observation of the actual process, questions are asked of those who work with the tool. Home Economists have developed work simplification questions for use of handicapped homemakers to aid in the selection of equipment. Included in the list are the following questions (May, Waggoner, and Boettke, 1966, p. 9):

> What is the job to be done?
> Could another member of the family do it?
> How should it be done?
> Must there be some adaptation of household equipment?
> Is there need for new tools or appliances?

Other questions include how the person feels about working with the equipment (Diffrient, 1975, p. 33).

Not only must the work be studied, but also the body performing the activity. Human engineering includes many fields. Anthropometrics, the comparative study of bodies related to race; ergonomics, the quantitative study of work; and biomechanics, the study of the mechanical operation of the body, are included. Body metrics utilizes various

devices for measuring endurance, strength of joints, and muscle movements (Diffrient, 1975). All these factors are combined in analysis for the best design solution possible with present knowledge.

CHAPTER III

DATA COLLECTION AND ANALYSIS

Introduction

The data were collected in four phases, in order to fulfill the objectives of the study and to get an overview of the problems of lefthanders related to household equipment design. First, interviews were made with four lefthanders in order to determine general design problem areas. Secondly, utensils available in local shops were analyzed as to the ease of operation with either hand. Thirdly, catalogues of equipment for the lefthanded were examined, and a list of equipment designated as "problem equipment" was compiled by the researcher. The fourth phase was the experimental situation involving case study observations of eight subjects using selected equipment.

Interviews With Lefthanded Subjects

In order to identify major equipment related problems experienced by lefthanded homemakers, interviews were conducted with four lefthanded homemakers. These interviews were informal with open-end questions concerning origins of lefthandedness and equipment problems experienced. The questions were formulated from the researcher's personal experiences as a sinistral, and from information from the literature. (See Appendix A.)

Sample Selection

The four subjects interviewed included two natural lefthanders, Mrs. B. and Miss L., and two righthanded women, Mrs. S. and Mrs. J., who had suffered strokes to the left side of the brain, thus impeding or paralyzing their right sides. The natural lefthanders were selected from graduate classes in Housing, Design and Consumer Resources. It was thought that these Home Economics majors might have taken special notice of equipment design and other areas of design which were bothersome to them as lefthanders. The two handicapped women were contacted through physical therapists and medical doctors in the Payne County, Oklahoma, area. It was thought that these stroke victims, having had to recently make adjustments to being lefthanded, might have been especially conscious of problems involved in lefthand usage of items that they had previously been used to operating easily with their right hands.

Findings

The first lefthander interviewed was Mrs. B., a graduate student in her mid-twenties. She had been lefthanded all her life, and had not been forced in any way to be righthanded. She did not, however, consider herself completely lefthanded. She reported doing several tasks righthanded, including cutting meat when eating, opening jars, and opening doors. She carried things on her left side, leaving her right hand free. She did not remember having trouble writing her name as a young child, as do many lefthanded children. She did not set the table backwards as a child either, since it was logical to her for the fork to be on the left.

Mrs. B. expressed having experienced problems with several items

designed for righthanders. One armed school desks presented the largest problem, as she could not rest her arm on the desk to write. Butter knives and one spout punch ladles had also caused her some confusion in the past. She felt that she had adapted well, and did not meet daily frustration.

Mrs. B. owned several pieces of equipment designed for lefthanders. She had lefthanded sewing shears, and her iron had a cord which was wired to come out the left side of the handle. Her dishwasher had a combination switch-on button, lock which eliminated having to pull a lock handle to the left. She also owned an ambidextrous butter knife.

The second interview was with Miss L., also lefthanded all her life. Miss L. was in her twenties and lived in an apartment. She was decidedly lefthanded in her own opinion. As a child, she had trouble learning to tell time, and set the table backwards. Her teacher in elementary school tied her left hand behind her back to force her to be righthanded, but Miss L.'s mother stopped the teacher. She felt that she had adapted very well to righthanded design and did many activities with her right hand without much trouble. She opened doors and pared carrots righthanded. She cut righthanded, because she never had a pair of lefthand scissors, and she batted in softball with either hand dominating. Righthanded writing desks and screws presented problems to her. She noticed that whenever she wanted water from the faucet she always turned on the hot water since it was located on the left.

Miss L. owned lefthanded sports equipment, golf clubs and softball glove. She put most of her dishes on the left side of the cabinets, and had an iron with the cord coming from the left.

The third person interviewed was Mrs. S., who was sixty-one years

old. Nine months prior to the interview, Mrs. S. suffered a stroke, which left her right side very weak. Mrs. S. exercised everyday with weights in her right hand, and had partial use of her hand and arm. She could steady things with her right hand and work with her left to cut, write, and eat. She hoped to regain enough use of her right hand to be considered righthanded again. She still tried first to perform activities righthanded, but most often could not, and so used her left. She was not having too much trouble performing tasks with her left hand, since as a child she was rather ambidextrous, and had her left hand tied behind her back in grade school to teach her to be righthanded.

Mrs. S. had not been doing much cooking since her stroke, as her husband prepared most of the meals. Mrs. S.'s sister lived nearby and helped with major housekeeping such as vacuuming, while Mrs. S. performed minor tasks such as dusting, laundry, and straightening up the seven room house. She had not purchased any special equipment to aid her in becoming more independent, but rather relied on her family to perform most tasks. Mrs. S. was rather quiet and withdrawn, and seemed disheartened by her disability.

The fourth interviewee was Mrs. J., a sixty year old stroke victim. Mrs. J. had her stroke four months prior to the interview. Her right arm and leg were paralyzed and she walked with a leg brace and cane. Mrs. J. was lively and talkative and was adapting to being lefthanded. She was learning to write and do other fine motor skills with her left hand. She used a cobbler's apron for carrying around household cleaning items, and did most of the cleaning of her five room house herself. She would also have liked to do the cooking, but her husband did most of it. She embroidered by using a hoop which attaches to the knee, and she also

enjoyed fishing with her husband although her activity was limited. She usually did not do the grocery shopping, but occasionally did it, sitting in a wheelchair and holding the groceries on her lap. Mrs. J.'s family was a great help to her, and her daughter-in-law was lefthanded and had been helpful to her adaptation.

Conclusions

The natural lefthanders identified a few problem areas of design, such as the butter knife, the desk, and the ladle. On the whole, however, they were well adapted to righthanded design. Neither of these lefthanders was nearly so left oriented as this researcher, who does nearly everything lefthanded, and is constantly aware of the "backwards" design of most buildings and gadgets.

The two stroke victims were quite different in their personalities and desire to become independent. Their families did most of their homemaking tasks for them, since they had recently had their strokes. As they become more used to limited mobility, they will probably attempt to do more things for themselves, especially Mrs. J. If a stroke victim did not have such cooperative families as these two have, it would become more necessary for them to have equipment that would help them to become independent more quickly.

Analysis of Available Equipment

To add to the growing list of equipment which contained design features favoring dextrals, it was necessary to investigate the equipment market for the average homemaker. Several stores in Stillwater, Oklahoma, all carrying or specializing in kitchen utensils were visited.

All possible pieces were examined and analyzed as to their ease of operation with either hand. The stores visited included variety stores, hardware stores, gourmet and gift shops, and grocery stores.

In addition to visiting stores available to the local shopper, catalogues from stores specializing in lefthand equipment were examined. These catalogues were helpful in showing what areas of design were being promoted by these manufacturers as solutions to design problems of lefthanders.

Personal experience was a third contributor to the list of problem equipment. The researcher had noticed many areas of design over the years which had caused her difficulties.

From the previously described activities, a list of equipment, thought to be problematic to lefthanders, was developed. Although the list was not long, it represented items which are widely used in homemaking on a regular basis. Many other items, mentioned by those involved in the research, were not household equipment so they were not included in this list. The list included:

Potato parer (one blade)	Electric on-off switches
Manual can opener	Faucet handles
Spouted ladle	Screw lids
Spouted pans	Iron cord
Ice cream scoop with release	Electric mixer cord
Butter knife	Handle-lock on dishwasher
Liquid measure	Refrigerator door
Scissors	Telephone dial

Observation of Use of Equipment

While opinions of what constitutes a problem piece of equipment are valid for identifying these problem pieces of equipment, more valid support of the need for ambidextrous equipment may be obtained through actual observations of the problems encountered by lefthanders in the

use of this equipment. In order to examine problems in usage of equipment by the lefthanded, an experimental situation was set up in which the use of the equipment could be studied. It was decided that a meal preparation would be a good activity to observe since it would utilize many of the pieces of problem equipment. The menu was a stew luncheon which was simple to prepare and could be done in a short time.

Sample Selection

The sample selection was purposive involving the selection of six lefthanded subjects and two righthanded subjects for case studies. The sample was selected from students either previously or currently enrolled in Housing and Interior Design or Home Management courses. Instructors were asked to watch for sinistrals and report to the researcher. The researcher also observed students in her classes for right or left-handedness. Twenty possible participants were located, and contact was made to invite them to participate in the study. When asked to participate, the students were told about the time schedule for each observation. Since the observations were to be video-taped, the number of observations possible was determined by the amount of video tape which could be purchased and borrowed by the researcher. The two righthanded subjects were selected from students who had expressed interest in the project. They were included so that comparisons could be made of how righthanded and lefthanded persons performed the same tasks with the same equipment.

Characteristics of the Sample

The sample population consisted of eight persons, six lefthanded

and two righthanded. Seven were female and one male. All were university students, ranging from 19 to 21 years of age - Sophomores and Juniors. All were students in the Division of Home Economics. Four were Housing and Interior Design majors, two were Food, Nutrition, and Institution Administration majors, and two were Family Relations and Child Development majors. Two had had a food preparation course at the university level. Five had had home economics in high school. Six had had a basic Home Management course in which equipment design was briefly mentioned. Four were living in sororities, two in residence halls, and two in apartments at the time of the experiment. Of the two apartment dwellers, one was male, and rarely cooked. The other was a female who had recently married. All of the subjects had done some cooking at home, but none considered himself experienced in food preparation.

Procedure for Observations

Twelve kitchen utensils were chosen for study of their usage by left and righthanded subjects. These twelve utensils were:

two potato parers (See Figure 1.)
one paring knife (See Figure 2.)
two liquid measuring cups (See Figure 3.)
one manual can opener (See Figure 2.)
two ice cream scoops (See Figure 4.)
two soup ladles (See Figure 5.)
one butter knife (See Figure 6.)
one dinner knife (See Figure 6.)

Six of these utensils were designated by the researcher as utensils designed for use by dextrals. In this study, these will be referred to as "righthanded." These were:

one blade potato parer
two cup transparent plastic liquid measure
manual can opener
ice cream scoop with release on the left side of the handle
butter knife with hump in the handle
ladle with pouring spout on the left side

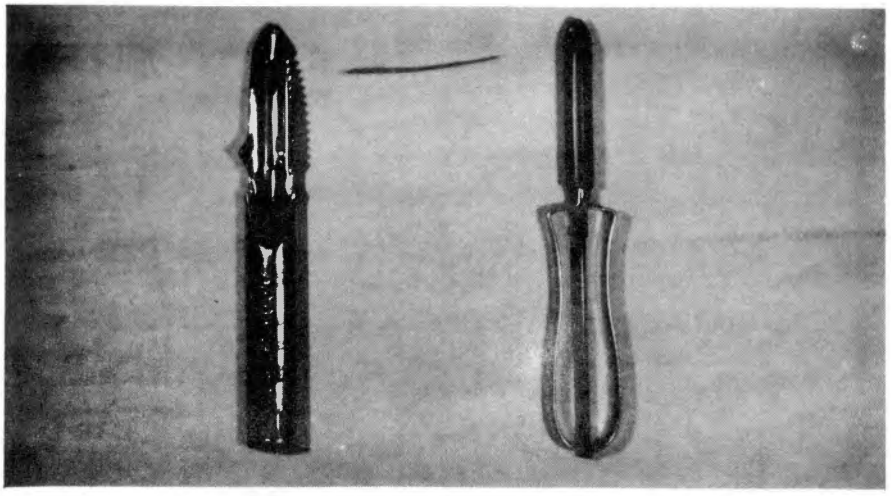

Figure 1. "Righthanded" and "Ambidextrous" Potato Parers

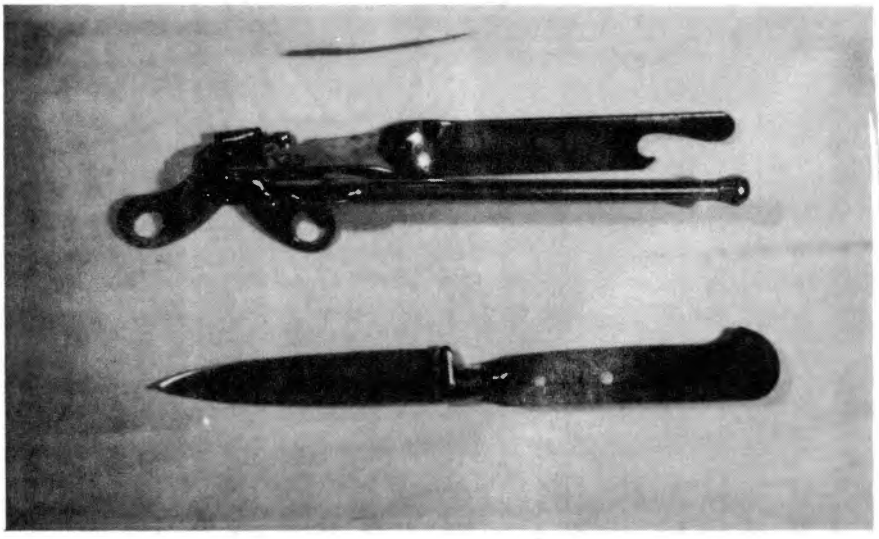

Figure 2. "Righthanded" Can Opener and "Ambidextrous" Paring Knife

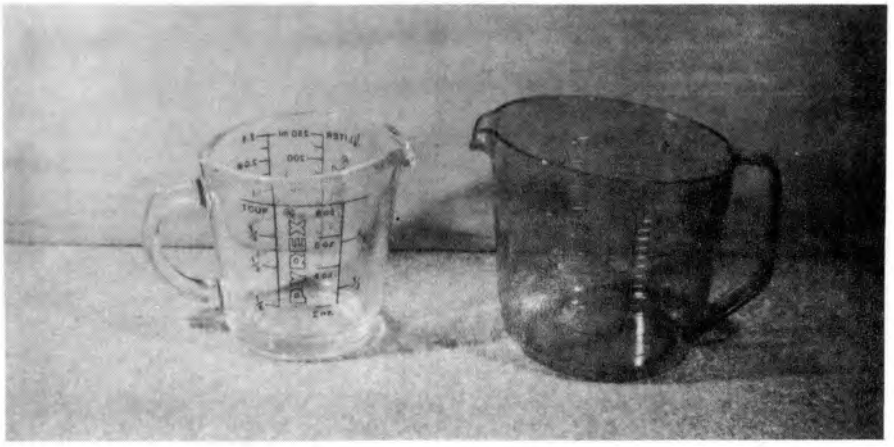

Figure 3. "Lefthanded" Measure and "Righthanded" Measure

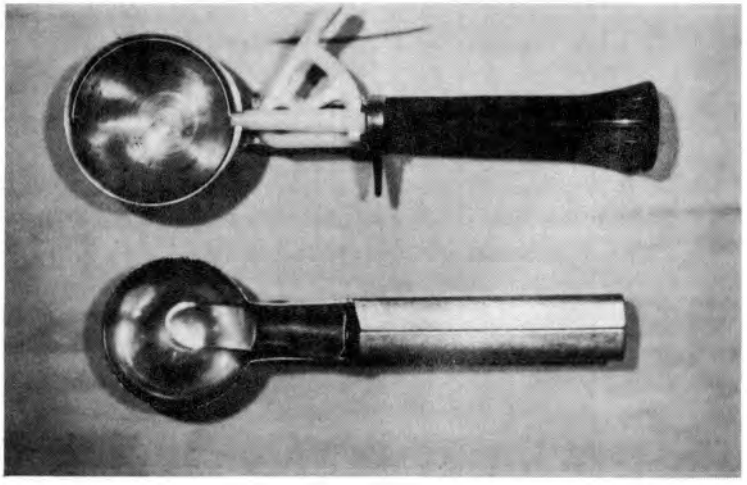

Figure 4. "Righthanded" Ice Cream Scoop and "Ambidextrous" Ice Cream Scoop

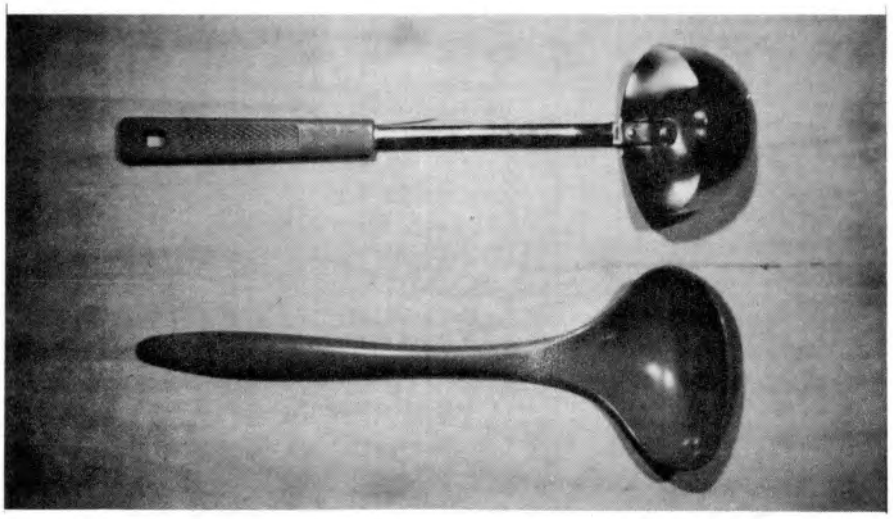

Figure 5. "Righthanded" and "Ambidextrous" Soup Ladles

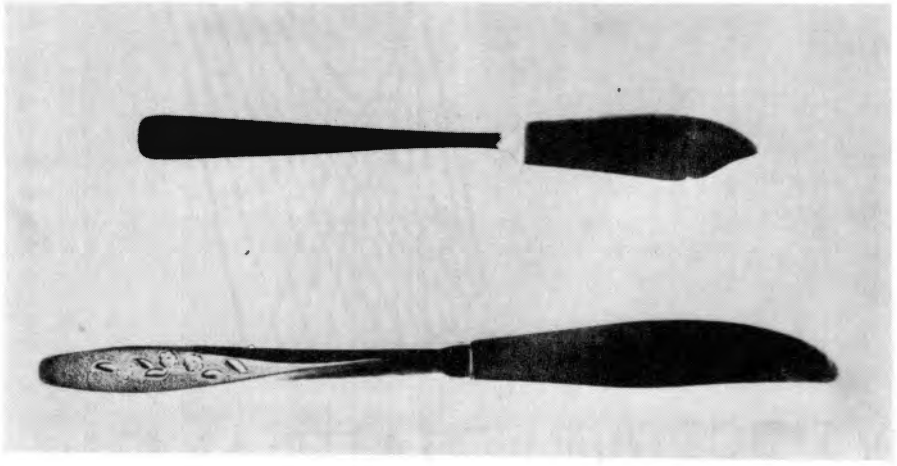

Figure 6. "Righthanded" Butter Knife and Dinner Knife

Five other utensils were designated as being adaptable to use with either hand. In this study, they will be referred to as "ambidextrous." These were:

two blade potato parer
paring knife
ice cream scoop with release centered on the handle
dinner knife
ladle with no pouring spout

One additional utensil completed the set of twelve utensils. This was a liquid measure with cup divisions visible when the cup was held in the left hand. This will be referred to as the "lefthanded" measure.

The eight subjects were divided into two groups. Three lefthanders and a righthander, Group A, were given the "righthanded" utensils to use, and three lefthanders and an righthander, Group B, were given the "ambidextrous" utensils to use, plus the "lefthanded" one cup measure. All subjects used the "ambidextrous" paring knife and the "righthanded" can opener.

Meal preparation was broken into eight activities. In order of accomplishment, these were:

1. Paring Carrots
2. Paring Potatoes
3. Cutting Vegetables
4. Opening Can
5. Measuring Liquid
6. Buttering Crackers
7. Scooping Ice Cream
8. Ladling Stew

The subjects were asked to follow a schedule of instructions specifying which utensils were to be used for each activity. (See Appendix C.) A meal preparation was chosen as the way to utilize the twelve pieces of equipment. A stew was chosen, because of its simplicity of preparation, and because of the short amount of time needed by a subject to demonstrate use of a hand tool. A previously prepared stew was available for

serving so that the meal could progress and use of additional tools could be analyzed. After the first observation, the meat preparation step was completed by the researcher since it did not involve the use of "problematic" equipment, and took time that was needed for observation of other activities.

The subjects prepared the meal individually in the kitchen of a private home, under natural conditions such as interruptions and informal conversation. The time period of each individual experiment was approximately twenty minutes, between the hours of 11:30 a.m. and 1:30 p.m. This time period was the most convenient for the subjects and the researcher, and the subjects could eat a previously prepared stew for lunch as a small compensation for participation in the study. Two subjects were filmed each day on four successive days.

During the food preparation activities the subjects were filmed with a Sony AV3600 video-tape recorder. The filming provided an accurate record of the activities which could be examined several times in order to record details and analyze activity patterns carefully. During the filming, the researcher talked with participants about their usual food preparation procedures. The subjects offered comments about the equipment they were using, other problem equipment, and topics related to lefthandedness. Any questions the subjects had concerning how to perform an activity were answered by the researcher unless the questions related to the use of the equipment. The subjects were told to do the best they could with the equipment provided, and were told to perform the activity as they would in their home situation.

Analysis of Data

For the analysis of the data, the eight video tapes of the experiment were viewed and studied in their entirety two times. Some tapes were viewed a third and fourth time to verify specific details in the performance of an activity. During the filming, patterns of usage were observed by the researcher, and then were written down in detail during the first viewing of the first film. The films were then viewed once, and the activities were charted in their categories. Comments made by the subjects were recorded in written form. The films were then viewed again to pick up details missed during the previous viewings and to reaffirm the categorizations. (See Appendix B.)

Findings and Explanations

The subjects proceeded through the activities in the order of a regular meal preparation. The performance of each subject in each activity is represented in the tables. These tables included are in order to clarify the explanations. For each table, these symbols apply:

S - used utensil successfully
C - changed to another utensil
LD - had a little difficulty using utensil
MD - had much difficulty using utensil
Ex D - expressed difficulty
A - made a successful adaptation
DA - made a difficult adaptation

The first activity was paring the carrots. (See Table I.) The four subjects in Group A were assigned to the potato parer with one blade. Of these subjects, three were lefthanded and one was righthanded. It was expected that three lefthanded subjects might have difficulty with a parer supposedly designed for dextrals. The opposite result was true, however, the only subject to have difficulty was the righthander

in the group. The preferred method by which the subjects pared the carrots was to cut away from themselves. This was easily done by the sinistrals, but was impossible for the dextral since the blade was positioned for paring toward oneself. The dextral changed to the two blade parer to complete the activity. All four of the subjects in Group B using the potato parer with two blades had little or no difficulty paring away from themselves with light, quick strokes.

TABLE I

PERFORMANCE OF SUBJECTS PARING CARROTS

	Left Handed	Left Handed	Left Handed	Right Handed
Group A	S	S	S	C
Group B	S	S	S	S

In the second activity, the potato parer was used again, only in many different ways. Individual preference affected usage of the parer as much as did handedness. Of the four subjects using the one blade parer, Group A, three showed or expressed difficulty with its use. (See Table II.) One sinistral subject quit using the one blade parer and used a paring knife instead. The parer forced the subject to pare away from herself, while she could pare toward herself with a knife. Another subject had a little difficulty and indicated that she would rather pare

in both directions, depending on the shape of the potato. The dextral of Group A could not use the one blade parer. She kept trying to cut away from herself and found that she could not. Among those subjects using the two blade parer, Group B, two had trouble and two did not. Two subjects used short, swift strokes away from themselves and found that the blade was not always sharp enough. One of these subjects switched to a paring knife, cutting with slow, controlled strokes toward himself. The other subject was given the one blade parer, which proved easy to use. The righthanded subject in Group B pared with the two blade parer both toward and away from herself.

TABLE II

PERFORMANCE OF SUBJECTS PARING POTATOES

	Left Handed	Left Handed	Left Handed	Right Handed
Group A	LD Ex D	S	C Ex D	C Ex D
Group B	C	S	C	S

The third activity, cutting the potatoes and carrots into pieces was an activity in which handedness had no effect on the ease of usage of the equipment. The paring knife was used as easily by lefthanders as by righthanders.

In the fourth activity, opening the can of beans, a "righthand" can opener was used by all subjects, because it was the only type readily available in local shops. The subjects had to perform four tasks to open the can:

1. position the opener
2. squeeze the handle to punch a hole in the can
3. hold the opener in place
4. turn the key handle to rotate the can

It was expected that the lefthanders might have difficulty turning the turnkey which makes the can turn and the blade cut. The observations showed that strength of both hands was important in ease of opening the can. The lefthanded male subject had the least amount of trouble squeezing the handles together and turning the turnkey. (See Table III.) The most difficulty was had by a righthanded female subject. Her left hand was not strong enough to hold the squeeze handle together to keep the opener blade down in the can. She twisted the turnkey easily, but the opener would not move and cut. Two lefthanders had some trouble turning the key handle, a result which was anticipated.

TABLE III

PERFORMANCE OF SUBJECTS OPENING CAN

	Left Handed	Left Handed	Left Handed	Right Handed
Group A	LD	S	S	MD
Group B	S	S	LD	S

The fifth activity was measuring of the liquid. The liquid was poured from the beans into the liquid measure, and water from the faucet was added for a total amount of 1½ cups. The two liquid measures were different. One had the divisions marked so that they were visible when the cup was held in the right hand, and the other measure had to be held in the left hand for the divisions to be visible. Four parts were identified in this activity:

1. picking up the measure
2. holding the measure
3. measuring the liquid from the can and from the faucet
4. pouring the liquid from the measure into the stew

Of those using the "righthanded" measure, a righthander and a lefthander picked it up with the right hand. The other two lefthanders picked it up with the right hand after measuring the liquid. Of those who used the "lefthanded" measure, the three sinistrals picked up the measure in their right hands and the dextral picked it up in her left hand. Three possible explanations might be given for the varied ways which the subjects picked up the liquid measure. First, they might have just picked up the cup with the closest and most convenient hand, depending on which way the handle of the measure was turned. Secondly, one might pick up the measure in his non-dominant hand so that he could pour from the can with his dominant hand. A third explanation might be habit. Since most measures have the divisions printed for right hand usage, it might just be habit for most people to pick up a measure in the right hand.

The act of measuring with the two different cups gave some interesting results. (See Table IV.) Of those who used the "righthanded" measure, Group A, one lefthanded subject picked up the cup twice with

her left hand and had to turn it around both times in order to measure. Another lefthanded subject did not bother to turn the cup around. She estimated the measure. The other two subjects, sinistral and dextral, both picked the cup up with the right hand and measured with no difficulty. In Group B, those who used the liquid measure designed for left hand use, two sinistral subjects picked it up with their right hands, and had to turn the measure around to read the divisions. Two other subjects, one lefthanded and one righthanded, did not turn the measure around, but estimated instead. The "lefthand" measure was not any easier for the lefthanders to use than a "righthanded" measure.

TABLE IV

PERFORMANCE OF SUBJECTS MEASURING LIQUID

	Left Handed	Left Handed	Left Handed	Right Handed
Group A	S	S	DA	A
Group B	A	A	A	A

After preparing the stew, the subjects were to butter crackers as an accompaniment to the meal. It was anticipated that the sinistral subjects might have difficulty with the "righthand" butter knife. Although there was no real difficulty experienced by the participants, two subjects commented on the awkwardness of its use. (See Table V.) The

lefthanded subjects used the back of the knife for spreading and propped their index fingers on the hump in the handle much as one puts one's index finger on top of a pencil. None attempted to use the knife upside-down and none cut from the far end of the stick of butter. There was no trouble experienced or commented on by any of those in Group B, using the dinner knife.

TABLE V

PERFORMANCE OF SUBJECTS BUTTERING CRACKERS

	Left Handed	Left Handed	Left Handed	Right Handed
Group A	A Ex D	A Ex D	A	S
Group B	S	S	S	S

Ice cream was to be the dessert for the meal since scooping involved handed utensils. Difficulty was encountered by subjects using both the "righthanded" and "ambidextrous" scoops. (See Table VI.) In Group A, one sinistral subject had a hard time removing ice cream from the box. The small metal projection on the right side of the handle kept her from getting a good grasp on the handle. In releasing the ice cream into the bowl, the lefthanded subjects were forced to use their index and middle fingers instead of their thumbs to push the release.

The angle of the release was awkward and caused some problems. Using their two strongest fingers to push the release for the scoop left them with a rather unsure grip on the handle. In Group B, the ice cream scoop with the centered handle did not cause any problems related to handedness, but three of the four subjects using it had trouble releasing the ice cream into the dish. The release lever pushed the ice cream straight forward instead of scraping behind it to free it from the scoop, as in the "righthanded" scoop. The ice cream often stuck to the release lever in the "ambidextrous" scoop.

TABLE VI

PERFORMANCE OF SUBJECTS SCOOPING ICE CREAM

	Left Handed	Left Handed	Left Handed	Right Handed
Group A	DA	DA	DA	S
Group B	S	LD	LD	MD

The final activity was to ladle the stew into bowls for serving. The two ladles used were so similar in design that no difficulties related to handedness resulted. A subject in Group A mentioned that pouring punch from a "righthanded" ladle is very awkward. The accuracy needed in pouring punch into a small cup would accentuate the problem more so than did stew which was received in a large bowl rather than a

small cup. In viewing the films of the subjects ladling the stew, it was observed that one half of the participants turned the ladle to the center to pour the contents and the other half poured from the side of the ladle. This again seemed to be a matter of personal preference rather than of handedness, and did not depend on which ladle was used.

On the whole, more difficulty was experienced by Group A, using the "righthanded" utensils. However, the sinistrals adapted very well to the "righthanded" equipment, even though many expressed that they found the utensils to be a problem. Apparently, through years of adaptation, great difficulties have been overcome and are not noticed anymore or are easily adapted to despite awkward design. The righthanders had some problems with "righthanded" and "ambidextrous" equipment, especially the measuring cup and the can opener. This seemed to indicate household utensils are not designed perfectly, even when designed with use of a specific hand in mind.

CHAPTER IV

DESIGN RECOMMENDATIONS AND SUMMARY

Design Recommendations

The findings of the experiment and the interviews indicate that all those who use equipment, use it in their own individual ways. Because of this indication, it is once again suggested by this researcher that equipment design needs to be flexible and adaptable.

Design Selection

It is suggested that the homemaker, whether he or she be lefthanded, handicapped, or righthanded, should take notice of the design of the equipment at the time of purchase. When buying equipment for one's own use or for the use of others, thought should be given to the ease of use for all persons. Adaptive ambidextrous design is readily available in many kitchen utensils. In order to determine the availability of items adapted to the lefthander, a list of solutions to some problem equipment was drawn up during the visits to the Stillwater stores. It was observed that for most kitchen and home use equipment, ambidextrous pieces can be found. The only ambidextrous utensil that could not be found was a manual can opener.

Some manufacturers seem to have given some thought to the ambidexterity of the users of their products, and these are mentioned below.

The Ekco Company, maker of kitchen utensils, has ambidexterity in

several lines of utensils. The soup ladles have two pouring spouts. The potato parer states on the packaging that it may be used with either hand.

Pyrex has a new clear glass, one cup liquid measure with liter measures on the left and cup divisions on the right side. While this is still a basically righthanded design with the measure intended to be used more frequently with right hand, it is a benefit to sinistrals using the cup divisions.

The Corningware ten inch skillet has two pouring spouts, very convenient for pouring off grease or sauce.

Dansk Gourmet Cookware has double spouts on its pots and pans having spouts.

Le Creuset Cookware does not always provide two spouts on spouted pans, but the larger skillets have two spouts.

Iona Levermatic electric can opener and Rival electric can opener both provide push bars which may be easily pushed with either hand to start the cutting motion.

Two brands of "lefthanded" sewing shears are available at almost all quality fabric and sewing supply stores, Fiskars by Normark of Finland and Wiss knife edge and pinking shears.

While this list is not complete for all lines of cookware and hand kitchen tools, it represents the availability of such items in shopping facilities. In addition, there are available to lefthanded homemakers several sources of entirely lefthanded equipment. Three stores in the United States specialize in "lefthanded" equipment and have catalogues available for orders. These are listed in Appendix D.

Design Alternatives

During the observations of the subjects using the equipment, two problems arose for which the researcher saw the need for new pieces of equipment. These involved the ice cream scoop and the can opener. The ice cream scoops used in the experiment had both good and bad features. The "righthanded" scoop had a scraper which swept along the back of the scoop, freeing the ice cream. However, the handle was righthanded. The ambidextrous scoop had a handle easily operated by either hand. It presented a problem in that the ice cream stuck to the release. It seemed reasonable that the good features of each scoop could be combined into one better design. The scoop would have a central release connected to a scraper. Progressis Italie made a scoop similar to this type several years ago, but it is no longer available on the market.

Development of Can Opener Design

From the interviews with two stroke victims and the observations of six lefthanded subjects in the kitchen, it was concluded that these people experience some difficulty or awkwardness with the conventional manual can opener.

The lefthanders often find it awkward to turn the key handle because their stronger hand is not used. A stroke victim or weak person cannot hold onto the opener and turn the key.

The problem became one of finding a manual can opener which could be used equally well with only one hand, be it the right or left hand. A search was made through a United States Patent Officer for an "ambidextrous" can opener. Three models have been developed since 1920. (See Figures 7, 8, and 9.) There are difficulties involved in all three of

Sept. 18, 1928. 1,684,829

J. J. HOELLE

DOMESTIC HAND TOOL

Filed Oct. 9, 1923

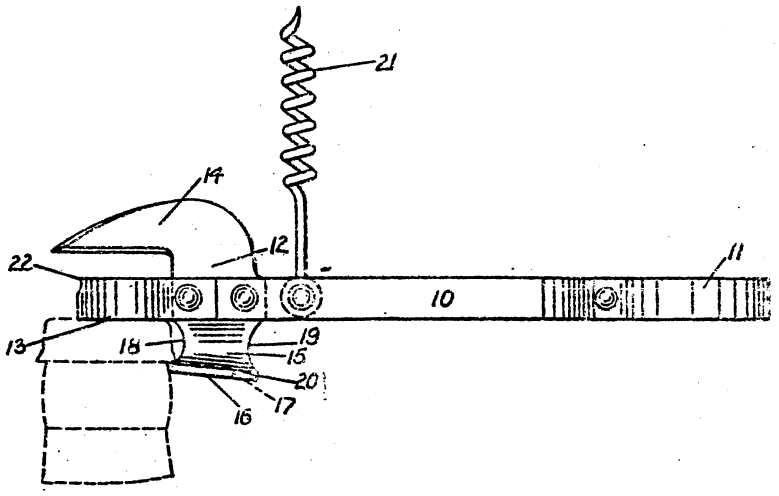

Figure 7. Domestic Hand Tool, 1928
Source: United States Patent Office

June 24, 1930. 1,767,489

J. T. SWEENEY

COMBINATION TOOL

Filed Aug. 4, 1922

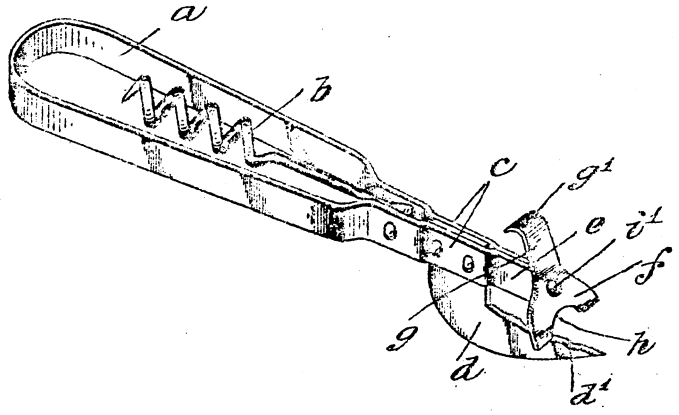

Figure 8. Combination Tool, 1930
Source: United States Patent Office

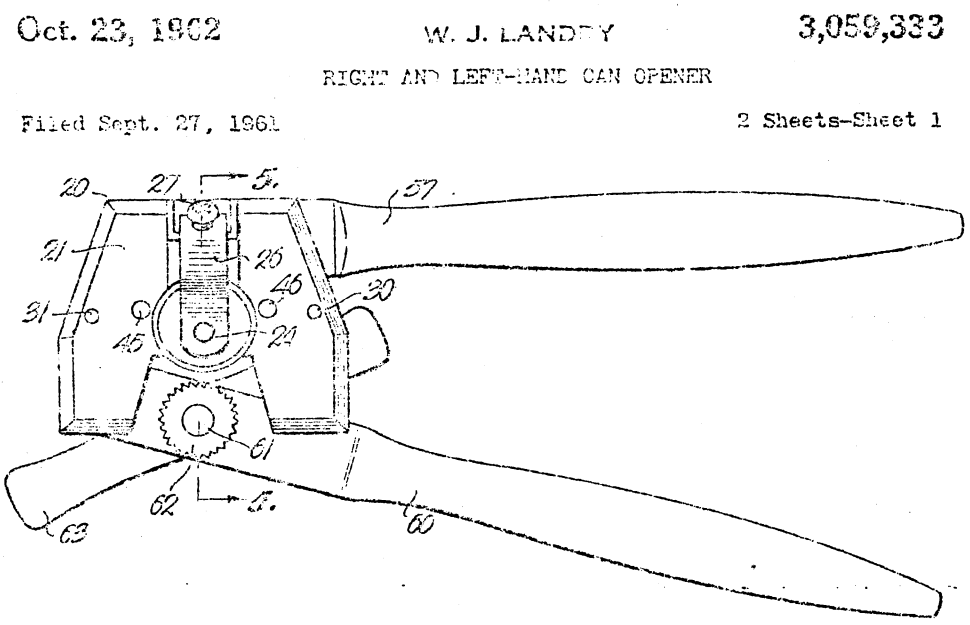

Figure 9. Right and Left-Hand Can Opener, 1962
Source: United States Patent Office

these designs. For the lefthanded person, the first designs, (Figures 7 and 8) require much effort and strength to operate, and the third design (Figure 9) must be manipulated to the proper orientation before being used. In addition to this, the opener in Figure 9 requires two hands to operate. Therefore, the researcher believed a new design solution was necessary to solve this problem.

In analyzing the functions of a can opener, three main activities were noted as being performed in the act of opening a can:

1. Punching the hole initially in the top of the can.
2. Holding the cutting surface down into the can.
3. Rotating the can or the opener so that the cutting surface moves along the edge of the can.

In the conventional manual righthanded can opener these functions are performed in this way: 1) the hole is punched in the lid by the cutting wheel when pressure is applied by the left hand to squeeze the handles of the can opener together; 2) the cutting surface is held down in the can by continuous pressure of the left hand on the handles; and 3) the cutting surface moves around the can when the turnkey handle is rotated. A second hand is needed for this turning operation. A person using one hand cannot continue to grasp the handles once the hole is punched, and turn the key handle as well. The right hand location of the turnkey is very awkward for lefthand use.

There are many possible design solutions to this problem. Desiring to fulfill all the functional design requirements, as well as keeping the design simple and inexpensive, the researcher with the aid of a mechanical design enthusiast invented the can opener design shown in Figure 10. This can opener has been sent to a patent examiner in

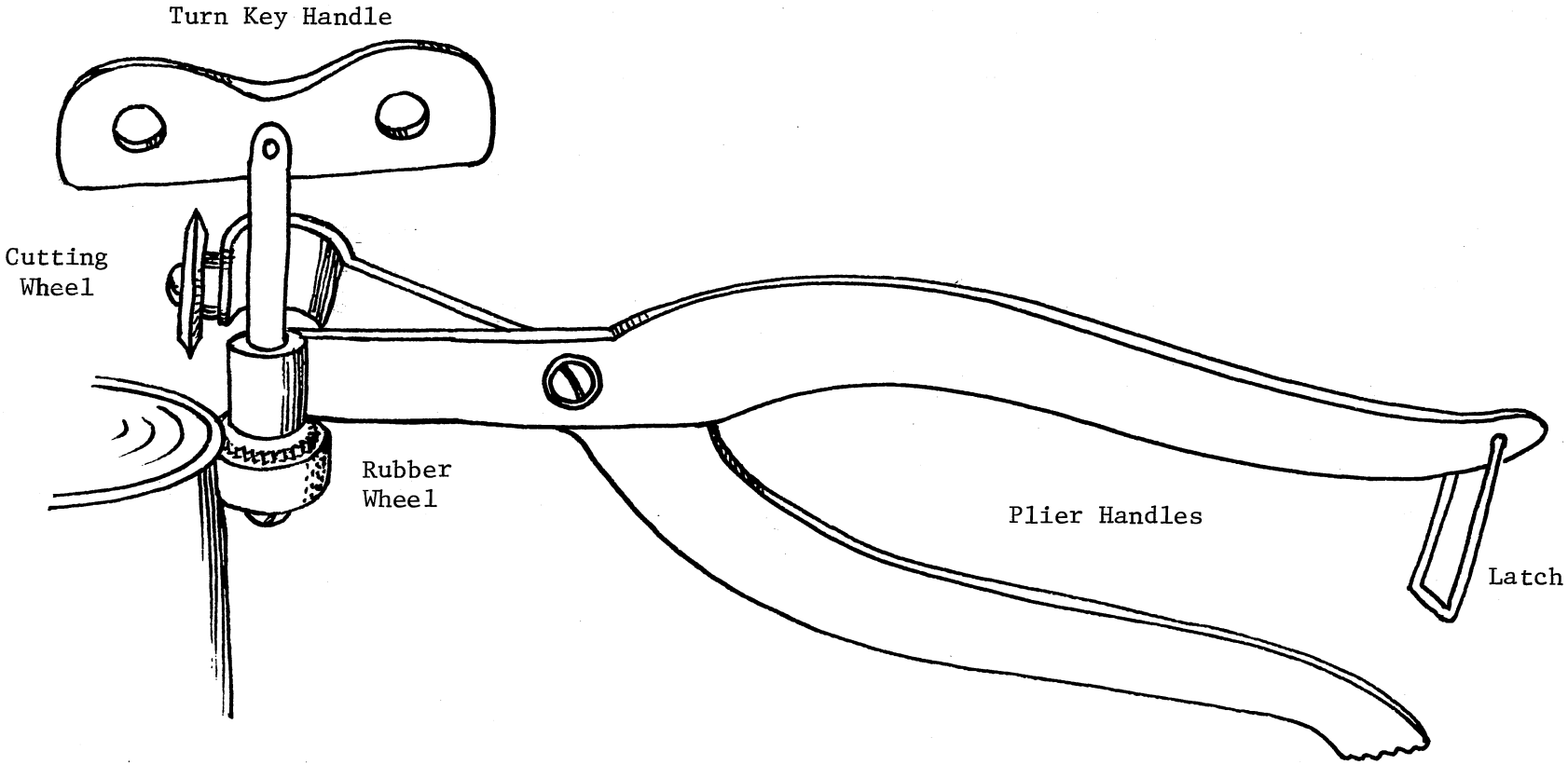

Figure 10. Ambidextrous One Hand Can Opener

preparation for patent. The handles for punching the initial hole in the can are of the plier type and extend perpendicular from the can rather than lining up tangent to it. This allows either hand to be used to punch the hole.

To hold the cutting edge in place, a small latch can be engaged when the handles are squeezed together. This latch allows a one-handed person to punch the hole in the can, let go of the handles, and then grasp the turnkey. The turnkey is located on top of the can opener in a horizontal position and is connected to a metal cog and rubber wheel. The wheel and cog make contact with the side of the can and underneath the metal rim. The metal cog surface will create enough friction to keep the rubber wheel from slipping. The stress between the rubber wheel and the cutting edge will produce the turning motion. The handle may be turned either to the left or to the right, thus turning the cutting wheel, for usage with either hand. In order for the can opener to turn around the can, the can must be held stationary. A one-handed person may hold the can between his knees or use a suction holder to hold the can steady while clamping the handles then turning the key.

Summary

The purpose of the study was to examine hand tool equipment problems of lefthanders, and to recommend solutions to these problems. In order to complete this purpose four research methods were utilized. These four methods of research were used rather than one method in depth. This was in order to investigate the breadth of the subject of household equipment for lefthanders. Each of these steps had a procedure and findings. The first step was the interview of four lefthanders. It

was found that several pieces of equipment presented problems to these lefthanders. Among these were a number of kitchen utensils. The second step was to add to the list of problem equipment with observations. This was done by an analysis of the equipment available in the immediate shopping area. The third method used for identifying problem equipment was a search through catalogues.

The verification of the problems and adaptability of equipment, the fourth step, was accomplished through eight brief case studies which involved filmed observation of eight subjects using given equipment. It was found that much of the equipment did cause problems, not only to lefthanders, but to dextrals as well. Not only the dextral equipment, but also ambidextrous equipment caused problems on occasions.

The fifth step was to make design recommendations to remedy the identified problems. This was done through location of sources of ambidextrous and lefthanded design when they were available. No suitable design was located for the can opener, so a can opener was designed by the researcher.

Implications for Further Study

The motion study method of research has the great advantage of being very thorough and detailed, especially when filming observations. The filming makes possible close viewing of an activity and much reviewing of the same data are possible. Unfortunately, filming is expensive, both in time and money.

The study of design problems of lefthanders does not end with kitchen utensils or household equipment. Discussions with lefthanders who are interested in engineering, architecture, and other fields have

resulted in a list of other items which cause design problems to lefthanders:

Pencil sharpener
Watch and clock winding mechanism
Location of wall switches and plugs
Screws, nuts, and bolts
School chairs with arm desks
Ignition and shift on automobile
Most industrial machinery and equipment
Cameras
Many musical instruments
Drinking fountain buttons
Drafting tools
Subway token slot
Telephone booth
Adding machine
Microscope
Fishing reel
Lighting installations

The needs of a sizeable minority of the population have been ignored. Further study into handedness and its many implications is greatly needed. In depth use of any of the four research methods used in this study could be used in subsequent research. The most successful method in this study was that of the case study observations. The filmed observations yielded the most informative data. A large study comparing use of household equipment by sinistrals and dextrals would point out the difficulties had by sinistrals using equipment. The betterment of design depends on research into the needs of all users, and the betterment of the adaptation of this minority will be aided by research into its problems. These problems include not only awkwardness in performing tasks, but also the psychological effects of being "different."

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APPENDIX A

INTERVIEW GUIDE QUESTIONS

INTERVIEW GUIDE QUESTIONS

How long have you been lefthanded?

Do you own any special equipment or lefthanded equipment?

What problems have you noticed with using equipment because you are lefthanded?

Do you feel that you are adapting well (to being lefthanded) or (to righthanded design)?

Natural lefthanders -

Did you have any problems as a child because you were lefthanded - such as learning to write?

Do you do most things lefthanded or do you do things righthanded too?

Stroke victims -

Do you do the housekeeping or does someone else do it for you?

Do you have a husband or children living with you?

Can you use your right hand at all?

Do you anticipate recovering full use of your right hand?

How large is your house? Can you do things for yourself in this size house, or do others help you a lot?

Have you noticed any problems with equipment since you have become lefthanded?

When did you have your stroke?

Age

Marital Status

APPENDIX B

OBSERVATION CHART

This is an example of the charts made for viewing the films of the experiment.

Paring Carrots

Subject	1 Blade parer	2 Blade parer	away	toward	Comments
1	x		x		
2		x	x		
3		x	x		
4	x		x		
5	x first	x	x		Tried 1 blade first and wouldn't work
6		x	x		
7		x	x		
8	x		x		

APPENDIX C

STEW LUNCHEON PREPARATION PROCEDURE

STEW LUNCHEON PREPARATION PROCEDURE

This experiment is to test the ease of the use of basic kitchen utensils. Just prepare the meal as directed, being sure to use the correct equipment.

1. Roll 4 pieces of meat in flour mixture.
2. Using the large saucepan, brown the meat in a small amount of butter, turning with a fork.
3. Using the potato parer, pare 2 carrots and 3 potatoes.
4. Using the paring knife, cut potatoes and carrots into bite size pieces.
5. Using the can opener, open the can of beans.
6. Pour the water off the beans into the liquid measure. Add water from the faucet to make 1½ cups.
7. Pour water into the pan with the stew meat and turn to simmer.
8. Add the vegetables to the meat, and cover.
9. Using the butter knife, butter 4 crackers and place on 2 napkins.
10. Using the ice cream scoop, scoop 1 scoop of ice cream into each bowl.
11. Take the cooked stew off the burner, and using the ladle, ladle it into two bowls.
12. Pour the lemonade into the glasses and set the table.
13. Set the stew, crackers, and ice cream on the table.
14. Eat if you want to and have time!

APPENDIX D

SOURCES OF EQUIPMENT DESIGNED ESPECIALLY FOR LEFTHANDERS

The Aristera Organization

9 Rice's Lane

Westport, Connecticut 06880

The Left Hand

140 West 22nd Street

10th Floor

New York, New York 10011

The Left-handed Complement

1430 South Village Way, Suite M

Santa Ana, California 92702

APPENDIX E

ORGANIZATIONS FOR LEFTHANDERS

International Society of Lefthanders

Adolph G. Miller, President

837 North Monroe

Rockford, Illinois 61103

Lefthanders International

Dean Campbell, Founder

Manhattan, Kansas 66502

VITA

Sharon Jill Hutchison

Candidate for the Degree of

Master of Science

Thesis: HOUSEHOLD EQUIPMENT FOR LEFTHANDERS: AMBIDEXTROUS DESIGN

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Professional Organizations: Phi Kappa Phi; Omicron Nu; Phi Upsilon Omicron.