TELESENSORY SYSTEMS, INC.

OPTACON TRAINING

Teaching Guidelines

FORWARD

One of the most important factors in a blind person achieving mastery of Optacon reading skills is the effectiveness of the training received. A variety of research programs and practical applications over the past several years have produced a body of knowledge useful in the entire process from candidate assessment, class administration, teaching methods, and equipment factors. This manual has been compiled in an attempt to make this information available in a convenient and organized form.

The need for dissemination of the material has become increasingly urgent with the growing number of Optacon training centers. Because of this urgency and the rapidly expanding body of relevant information, we have emphasized completeness and a timely publication date in this first attempt at compilation, perhaps sometimes at the expense of professional style and format. However, this looseleaf format provides a convenient mechanism for updating and addition, which is planned as the field develops.

The editor bears the responsibility for the overall organization, the accuracy, and the completeness of the material presented. However, many of the ideas, teaching techniques, and actual writings are the contributions of the TSI teaching staff of 1972 - 1973. The following members of this staff deserve special acknowledgement for their contributions: Joan Bliss, Gayle Brugler, Joan Harrison, Ellen MacNeale, Linda Wagner, Kay Miller, and Carolyn Weihl. In addition, comments and suggestions on the manuscript from Prof. Mary W. Moore of the Department of Special Education, University of Pittsburgh, were very much appreciated and highly valued.

James C. Bliss
President

September 1973

R17454-A

TABLE OF CONTENTS

SECTION		PAGE
	1. INTRODUCTION TO TEACHING OPTACON READING	
1.1	The Optacon: Its Function and Role	1
1.2	Extensions of the Optacin Concept	3
1.3	The Learning Process	3
1.4	Purpose of this Manual	5
1.5	An Example Teacher Training Program	8
	References	9
	2. STUDENT FACTORS	
2.1	Capabilities Important in Optacon Reading	10
	2.11 Field Experience	10
	2.12 Basic Components of the Optacon Reading Task	12
	2.13 An Experimental Assessment Test Battery	15
	2.131 Experimental Interview Form and Test Instrument	16
2.2	Optacon Performance Evaluation	22
	2.21 Letter Recognition	22
	2.22 Reading Rate Measurements	23
	2.23 An Example of a Letter Recognition and Reading Rate Test	24
	References	25
	3. EQUIPMENT FACTORS	
3.1	Principles of Operation for the Major Optacon Subsystems	26
	3.11 The Camera	27
	3.12 The Electronics Section	27
	3.13 The Tactile Array	30
3.2	Modes of Operation for the Optacon	30
	3.21 "Normal" and "Invert" Modes	30
	3.22 "Master" and "Slave" Modes	31
3.3	Teaching Aids	31
	3.31 Master/Slave Cable	31
	3.32 Visual Display	31
	3.33 Tracking Aids	33
	3.331 Tracking Aid, Model T-1B	34
	3.332 Tracking Aid, Models T-2A and T-2B	34

SECTION PAGE

3.4 The Controls - 34
3.41 On/Off Switch - 36
3.42 Tactile Array Intensity Control - - - - - - - - - - - - - - - - - 36
3.43 Threshold Level Control - 38
3.44 Magnification Control - 40
3.45 Charger Jack - 41
3.46 Battery Check - 41
3.47 Circuit Breaker - 41
3.5 Method for Checking for Proper Functioning of the Equipment - - - - 43
3.51 Row and Column Check - 43
3.52 Trouble Shooting - 44
3.6 Equipment Arrangement for Training - - - - - - - - - - - - - - - - - 44
3.7 Introduction to the Student - 46
3.71 Step-by-Step Procedure (Teacher's Directions) - - - - - - - - - 46
3.72 Special Precautions and Hints - - - - - - - - - - - - - - - - - - 50
3.8 Special Optacons and Training Devices - - - - - - - - - - - - - - - 52
3.81 The Left-Handed Optacon - 52
3.82 The Model R-1C Optacon - 52
3.83 Fixed-Rate Presentation Systems - - - - - - - - - - - - - - - - - 54
3.831 Optacon Cassette Trainer - - - - - - - - - - - - - - - - - - 54
3.832 Automatic Page Scanner - - - - - - - - - - - - - - - - - - - 56

4. TEACHING TECHNIQUES AND MATERIALS

4.1 General Considerations - 57
4.11 Student Involvement - 57
4.12 Stage 1 - Emphasizing Feedback and Success - - - - - - - - - - - 58
4.13 Stage 2 - Emphasizing Individualized Materials - - - - - - - - - 59
4.2 Manual Skills - 60
4.21 Finger Position Considerations - - - - - - - - - - - - - - - - - - 60
4.22 Problems of Finger Positioning and Possible Solutions - - - - - 62
4.221 Heavy Finger Pressure on Array - - - - - - - - - - - - - - 62
4.222 Excessive Finger Movement on Array - - - - - - - - - - - - 64
4.223 Finger In or Out Too Far - - - - - - - - - - - - - - - - - - 64
4.224 Finger Lifted From Array - - - - - - - - - - - - - - - - - - 64

SECTION PAGE

4.225 Diffusion of Sensitivity in Early Stages - - - - - - - - - 65
4.226 "Dead" Spots - 65
4.23 Tracking Considerations - - - - - - - - - - - - - - - - - - - 65
4.24 Goals of Tracking Instruction - - - - - - - - - - - - - - - - 68
4.25 Instructional Techniques for Tracking - - - - - - - - - - - - - 68
4.251 Use of Tracking Aid - 68
4.252 Sitting Position and Camera Grip - - - - - - - - - - - - - 69
4.253 Spatial Relations - 71
4.254 Building Rapid Smooth Tracking - - - - - - - - - - - - - - 71
4.255 Making Line Changes - 71
4.256 Orientation to a Page - - - - - - - - - - - - - - - - - - - 72
4.26 Problems of Tracking and Possible Solutions - - - - - - - - - - 73
4.261 Pivoting - 73
4.262 Skewing - 73
4.263 Tense, Jerky Movements - - - - - - - - - - - - - - - - - - 73
4.264 Sitting on Letters - 74
4.265 Backtracking - 74
4.266 Cutting Off Tops or Bottoms of Letters - - - - - - - - - - 74
4.267 Excessive Up and Down Camera Movements - - - - - - - - - 74
4.3 Grapheme Recognition - 75
4.31 Grapheme Recognition Considerations - - - - - - - - - - - - - 75
4.32 Goals of Grapheme Recognition Instruction - - - - - - - - - - 76
4.33 Instructional Techniques for Grapheme Recognition - - - - - - - 76
4.331 Initial Instruction - - - - - - - - - - - - - - - - - - - 77
4.332 Catalog of Critical Features - - - - - - - - - - - - - - 79
4.34 Problems of Grapheme Recognition and Possible Solutions - - - - 82
4.341 Periods of Poor Letter Recognition Ability - - - - - - - 82
4.342 Letters are Commonly Confused - - - - - - - - - - - - - - 82
4.343 Concentrating on Only Part of Letter, Neglecting Rest - 82
4.4 Word Recognition - 83
4.41 Word Recognition Considerations - - - - - - - - - - - - - - - 83
4.411 Learning Sequence - 83
4.42 Goal of Word Recognition Instruction - - - - - - - - - - - - - 84
4.43 Instructional Techniques for Word Recognition - - - - - - - - - 84

SECTION PAGE

4.44 Problems of Word Recognition and Possible Solutions - - - - - - 85
4.441 Poor Letter Recognition - - - - - - - - - - - - - - - - - - 85
4.442 Difficulty - 85
4.443 Failure to Get the First Letter of Word - - - - - - - - - 85
4.444 Fixation on Reading Letter by Letter - - - - - - - - - - - 86
4.445 Weaknesses in Sounding Out Words - - - - - - - - - - - - - 86
4.5 Initial Text Reading - 86
4.51 Some Reading Considerations - - - - - - - - - - - - - - - - - 86
4.52 Goal of Text Reading Instruction - - - - - - - - - - - - - - 89
4.53 Instructional Techniques for Text Reading - - - - - - - - - - 89
4.54 Problems of Text Reading and Possible Solutions - - - - - - - 91
4.6 Type Style and Format - 91
4.7 Examples of Student Logs - - - - - - - - - - - - - - - - - - - 93
References - 106

5. CLASS ORGANIZATION AND ADMINISTRATION

5.1 Before the Class Starts - 107
5.11 Decide on a Training Model - - - - - - - - - - - - - - - - - 107
5.12 Arrange for a Teaching Area - - - - - - - - - - - - - - - - - 107
5.13 Arrange for Equipment - 108
5.131 Optacon Arrangements - - - - - - - - - - - - - - - - - - - 108
5.14 Gather Teaching Materials - - - - - - - - - - - - - - - - - - 109
5.15 Arrange for Students - 110
5.16 Arrange for Teachers - 111
5.2 Notes on Teacher/Student Scheduling - - - - - - - - - - - - - - 111
5.3 Class Supervision - 113
5.4 Forms Used in Training - 114

6. FOLLOW-UP TRAINING

6.1 General Considerations - 122
6.2 Bibliography for Optacon Readers and Teachers - - - - - - - - - 124

LIST OF FIGURES

NUMBER		PAGE
1.1	Reading With and Optacon	2
1.2	Using an Optacon to Read a Video Terminal Display	2
1.3	Teaching Manuals	5
2.1	Profiles of Top 10 and Bottom 10 Optacon Readers	12
3.1	Major Optacon Parts	26
3.2	Master/Slave Cable	32
3.3	Visual Display	32
3.4	Tracking Aid, Model T-1B	35
3.5	Tracking Aid, Model T-2A	35a
3.6a	On/Off Switch (front panel)	37
3.6b	Back Panel	37
3.7	Threshold Adjustment	39
3.8	Magnification Settings	42
3.9	Student and Teacher	45
3.10	Arrangement for Operation of Two Optacons	47
3.11	Wooden Case	48
3.12	The Left-Handed Optacon	53
3.13	Left-Handed Use of Right-Handed Optacon	53
3.14	Optacon Cassette Trainer	55
3.15	Automatic Page Scanner	55
4.1	Finger Position on Tactile Array	61
4.2	Reading Times	67
4.3	Camera Grips	70
4.4	Tracking Method	72
4.5	Fixation Points	87

LIST OF TABLES

2.1	Assessment Test Results	16
4.1	Relation Between Handedness and Optacon Reading	62

SECTION 1 INTRODUCTION TO TEACHING OPTACON READING

1.1 THE OPTACON: ITS FUNCTION AND ROLE

A major handicap resulting from blindness is the lack of direct access to printed material. The concept of the Optacon (for OPtical-to-TActile-CONverter) is to produce a dynamic tactile image of an area from the printed page with a small, portable, electronic system, thereby enabling a blind person to read using the sense of touch. Figure 1.1 shows a person reading with an Optacon. Thus, the Optacon is a kind of closed-circuit tactual television system in which the blind reader senses images with his finger produced on a rectangular array of vibrating pins. These images are acquired by a small hand-held camera, about the size of a pocket-knife, which the blind reader moves across the printed page. In the normal reading situation, the Optacon displays tactile images with a resolution roughly equivalent to 20/50 vision with a $\frac{1}{2}$ degree field of view. The performance of some trained Optacon users indicates that this level of tactile "vision" can be actually achieved in this task. However, our tests with greater numbers of image points displayed tactually have failed to show a corresponding increase in performance, as is found in vision [1/2/*]. Therefore, development of tactile systems with a greater number of image points does not appear to be warranted.

Alternative methods of access to printed documents available to blind people are braille, disc and magnetic recordings, and a sighted reader. These methods all require the interposition of another person to provide the necessary transcription. This requirement limits the convenience, acceptability, and usefulness of these methods. The primary advantage of the Optacon is that this intermediate transcription process is eliminated, making the blind person more independent, enabling him to keep certain documents private, and avoiding the hassle frequently involved in obtaining transcriptions.

The primary disadvantage of the Optacon is that reading is usually slower than the other methods. Because of the relative advantages and disadvantages, neither the Optacon nor any of these other reading methods

---

* References are located at the end of the section in which they occur.

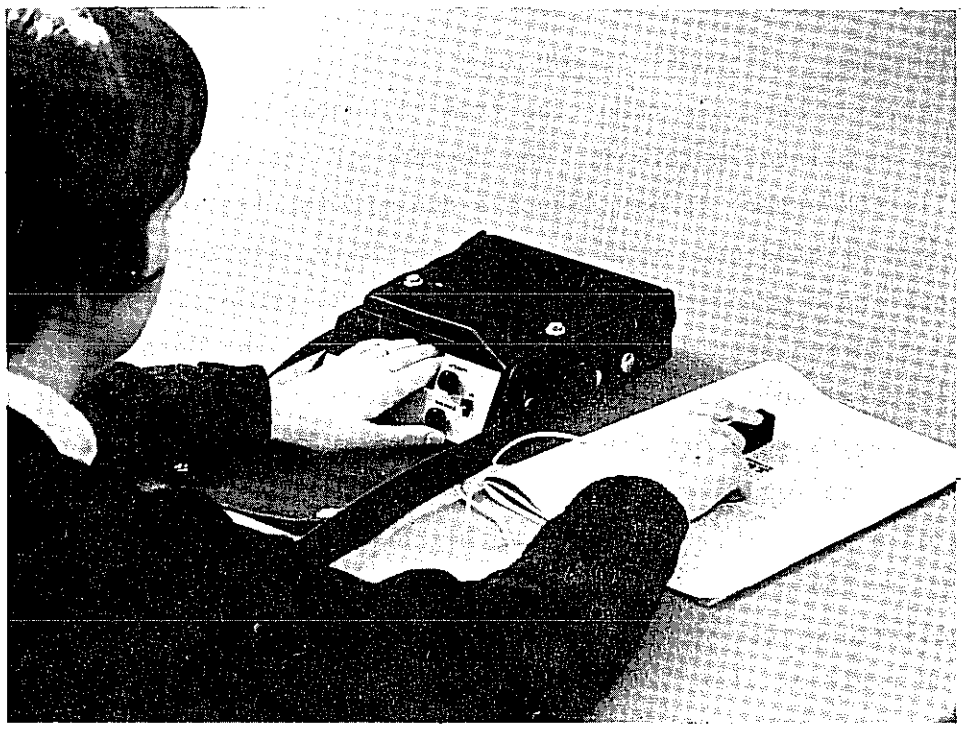


FIGURE 1.1
READING WITH AN OPTACON

FIGURE 1.2
USING AN OPTACON TO READ A VIDEO TERMINAL DISPLAY

are likely to supplant one another. The method a blind person elects to use usually depends on the particular situation at hand. Many blind people use more than one of these reading methods.

The Optacon was developed at Stanford University and Stanford Research Institute, primarily under United States Government support over an eight year period. The research prototype of the presently available model was completed in early 1971. Telesensory Systems, Inc. was established to manufacture Optacons with the first units becoming commerically available in September of 1971.

1.2 EXTENSIONS OF THE OPTACON CONCEPT

The basic Optacon instrument, with slight modifications, can be used for reading tasks other than normal reading. These other applications have proven to significantly extend the capabilities of a blind person and to open up new educational and vocational opportunities.

For example, an Optacon accessory lens is available which enables the visual display on many electronic calculators to be read. The importance of this accessory is that it enables a blind person to make computations to 10-place accuracy involving nonlinear functions -- a capability that is virtually impossible by any other portable means without sighted help.

In addition, another modification is possible which enables many video terminals to be read with the Optacon. The cathode ray tube, or television tube, is becoming an increasingly popular information display device, and is employed in airline reservation offices, customer service centers, as well as computation centers. The capability of a blind person to read such terminals not only expands opportunity but protects against obsolesence for computer programmers. Figure 1.2 shows how the Optacon is used in this situation. Optacon accessories are also planned which will aid a blind person in typing and handwriting.

1.3 THE LEARNING PROCESS

Initially, the beginning student needs to become familiar with the equipment, learn to recognize letters, and develop skill in the two-hand coordination task of manipulating the camera and perceiving the

corresponding images. Depending on their previous education, blind people with no previous visual experience may not know the detailed features of all upper case and lower case letters. Thus, the first few days of training are devoted to these tasks.

The most difficult task, which is usually only initiated in a training course, is to develop sufficient reading speed so that the Optacon is useful to the individual and can be integrated into his normal functioning. Developing reading speed takes time because Optacon reading is a different mode of reading than most people are accustomed to. Since letters are only seen one at a time, the individual must extensively exercise his immediate memory in order to perceive words and phrases as a whole. In addition, inkprint documents are much more variable in terms of style and format than braille, which is standardized. The variety found in the "world of print" can be a surprise to a blind person and training is useful in helping him to cope with this.

Given normal capabilities and a strong desire for independent access to printed information, a blind adult can expect to be able to read from 5 to 20 words per minute at the end of about 50 hours of private instruction. This 50 hours of training could be an intensive course over nine days or it could be spread over several months. After this, the student should be able to practice independently from a teacher, with the speed of reading and the range of documents with which he can handle with confidence gradually increasing. Over a period of six months to a year, some blind people have been able to achieve reading rates from 40 to 60 words per minute, while others have not. The maximum reading rate achieved after several years of Optacon experience has been about 80 words per minute.

Most blind people who have undergone this process emphasize that reading rate is not the all important measure of usefulness. The value of independent reading with a minimum of hassle, and any desired degree of privacy, is that it can create an image of self worth which can lead a person to develop his educational and vocational potential.

1.4 PURPOSE OF THIS MANUAL

This Teaching Guidelines Manual is intended to provide the theoretical framework for a training course, a curriculum for teacher training, and suggested teaching methods which use the other manuals in the set. The complete set of teaching manuals (shown in Figure 1.3) are as follows:

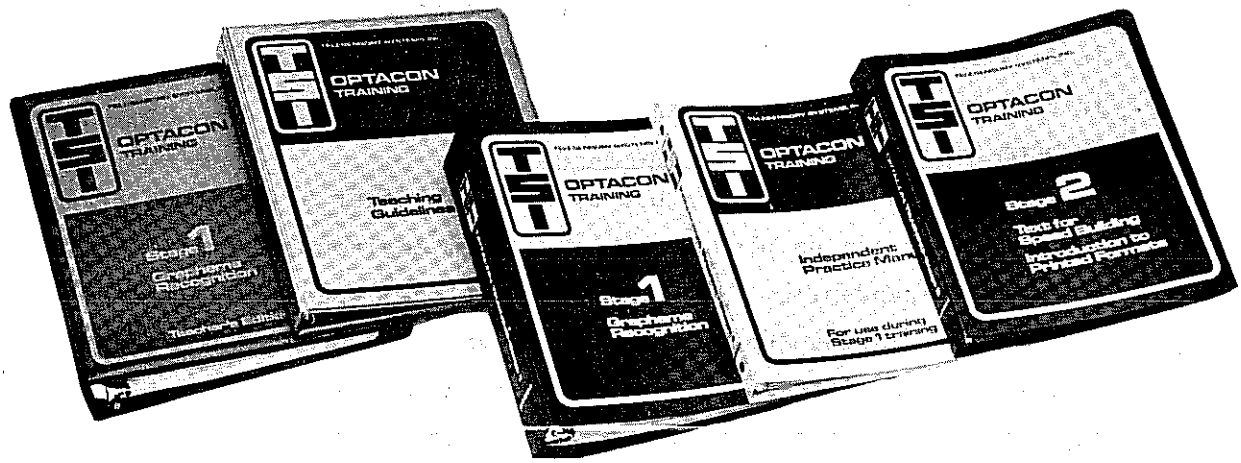


FIGURE 1.3
TEACHING MANUALS

Optacon Training Manual, Stage 1, Grapheme Recognition, R17450-A
This "Grapheme Recognition" manual is the basic training manual used by all beginning students. It consists of lessons for Upper Case letters, Lower Case letters, and Numbers, and can also be used to record the student's progress. One of these manuals is shipped with each Optacon at no charge.

Optacon Training Manual, Stage 1, Teacher's Edition, R17451-A
This is the teacher's edition of the above manual. It contains lesson pages identical to the student's manual, with a set of

teacher's instructions added at the beginning of each lesson. This teacher's manual is required for each person teaching Optacon reading. A braille version, R17457-A, is available for use by a blind Optacon instructor.

Independent Practice Manual, Stage 1, R17452-A

This manual is intended for independent reading by a student to provide additional practice outside the classroom. The material is designed for use without teacher feedback, and provides reinforcement exercises as well as easy reading material.

Optacon Training Manual, Stage 2, R17453-A

This manual is intended for use by students after Stage 1 has been completed and can be used in the classroom environment or by the student independently. It provides additional speed-building material and also introduces the student to the various formats of printed documents. Reprints of commonly read materials such as the Bible, magazines, newspapers, charts, and mathematic symbols are included.

Optacon Teaching Guidelines, R17454-A

This teacher's manual summarizes the techniques and theory of the Optacon training program. It is essential for those interested in establishing an Optacon training center, and for each Optacon teacher.

Two fixed rate presentation systems are used in teaching and are described in Section 3.83. The cassette tape lessons, listed by title on the following page, are available for use with the Optacon Cassette Trainer (OCT). Some of these lessons consist of letter and word drill and are meant to be coordinated with the lessons in the manuals described above. Stories of various vocabulary levels are also available for speed building. Special lessons on numbers and computer language are especially useful with students who are also computer programmers.

Lessons are now being developed for the Automatic Page Scanner (APS) that will correspond to the OCT taped lessons. Greater emphasis will be placed on various type styles in the APS lessons and some lessons will be especially for particular professions, e.g., lawyers, computer programmers, steno-typists, etc.

TITLES OF OCT TAPE LESSONS	TYPE FONT	RECORD SPEED (wpm)
Reader Evaluation Tapes		
1. Test Tape (upper & lower case)	Block	10
2. Position Tape	"	10
3. Additional Tape Exercises (lower case)	"	10
4. Limited Alphabet Speed Building (lower case)	"	10
Word Recognition Skills - Letter Drill		
1. Alphabet and Number Warm-up	"	15
2. Confused Upper Case Letters	"	10
3. Confused Lower Case Letters h,n,b and l,f,t,r	"	10
4. Confused Lower Case Letters a,e,o,s and r,i	"	10
5. Confused Lower Case Letters m,n,w and g,p,y	"	10
6. Confused Lower Case Letters p,d,b,q and c,o	"	10
Word Recognition Skills - Word Drill		
1. Common Words -- Short Words	"	5
2. Compound Words	"	15
3. Suffixes	"	15
4. Common Words -- Short Words	"	15
Speed Building - Level One (spaced stories)		
1. Paul Bunyan	"	10/15
2. Napoleon	"	10
3. Four Short Stories	"	10
Speed Building - Level Two (4th grade)		
1. Ants	"	10
2. Chanticleer and the Fox	Pica	10
3. Pecos Bill	Block	15
4. Charles Goodyear	Pica	15
5. Indian Joe - The Great Air Race	Block	40
Speed Building - Level Three (6th grade)		
1. Limericks -- Four Short Stories	Block	15
2. Morse Code -- Eskimo	Block & Pica	15/40
3. Casey Jones	Block	15
4. A Most Unusual Father	"	18/40
Speed Building - Level Four (8th grade)		
1. Wild Ride	"	15/40
2. Surrender at Appomatox	"	18/40
3. The Last Pioneers	"	18/40
4. The Great Molasses Flood	"	18/40
Vocational - Math		
1. Random Single Digit Numbers -- Number Practice	"	15
2. Newspaper Articles with Numbers	"	15
Vocational - Computer		
1. COBOL Vocabulary	EZ Pica	15
2. COBOL Text and Error Code	"	15
3. Assembler Operation Code	"	15
4. Assembler Text	"	10/15/40
Vocational Language		
1. German "Erlkonig" -- Vocabulary and Story	Block	10

1.5 AN EXAMPLE TEACHER TRAINING PROGRAM

Almost all Optacon instructors have completed a formal course in teaching Optacon reading. This manual is intended to provide the basic theory and methods to be covered in such a course. In addition, the course should also provide "hands-on" experience in operation of the equipment, use of the teaching manuals and related materials, and student teaching experience.

An example of a nine-day teacher training course is given below:

Monday	. Observe experienced teacher introduce the Optacon to a new blind student . Receive Optacon equipment training (Section 3 of this manual)
Tuesday	. Observe and discuss an actual training situation . Cover Sections 4.1 - 4.3 . Practice with equipment
Wednesday	. Observe and discuss an actual training situation . Study and operate fixed-rate display devices (Sections 3.83, 4.2, 4.7) . Begin short periods of practice teaching
Thursday	. Discuss Section 5, class organization and administration . Observe and teach with experienced supervision . Write mock log and discuss logging procedures
Friday	. Discuss Section 4.4 - 4.7, teaching techniques . Observe and teach with experienced supervision . Hands-on practice with fixed-rate presentation devices
Saturday	. Discuss student progress and logs . Blindfolded practice with teacher trainee in the blind student's role . Equipment practice
Monday	. Discuss Section 5, esp. how to set up a training center . Practice teaching . Practice Equipment check-out procedures
Tuesday	. Discuss student progress . Practice teaching . Equipment troubleshooting procedures (Section 3.5) . Student evaluation procedures (Section 2.2)
Wednesday	. Practice teaching . Discuss student factors (Section 2.1) . Observe and teach . Participate in evaluation . Final summary

REFERENCES

1. Bliss, J. C., and Hill, J. W., "Optical-to-Tactile Image Conversion for the Blind." Stanford Research Institute Interim Report to Social and Rehabilitiaton Service on Contract SRS 70-42, December 1970.

2. Taenzer, J. C., "An Information Processing Model for Visual and Tactile Reading," Perception, 1972, Vol. 1, pp. 147 - 160.

2.1 CAPABILITIES IMPORTANT IN OPTACON READING

The situation often arises in which an assessment of a candidate for Optacon reading is desired, either by a counselor or the candidate himself. Such an assessment is useful in formulating realistic expectations, in making the decision to undertake Optacon training or not, and in planning an individual's instructional program. Unfortunately, techniques for performing such an evaluation are not well developed, and therefore are not entirely accurate. However, a number of good indicators can be easily obtained. These indicators are based on current field experience which is briefly summarized below.

2.11 Field Experience

At this writing over 400 Optacons have been disseminated around the world. One of the earliest field Optacon programs was initiated in the San Diego Unified School District in October, 1971[1*]. Five blind students participated in this program, which were all the high school students in the metropolitan San Diego area who appeared to be able to participate in the program for at least two years. Thus, participants were not selected according to intelligence or proficiency in reading braille; however, all were braille readers.

All the normal alternatives to access to printed information (i.e., braille, tapes sighted readers, etc.) were available to these participants through their school program. They all received, or were eligible to receive, talking book records through the Department of Welfare. The Optacon program was an after hours extracurricular activity.

All participants, with the exception of one, achieved the project objective of thirty words per minute in ornate type style by July, 1972, and the remaining student eventually achieved this objective. The mean speed attained was 39 wpm with a standard deviation of about 13 wpm.

During this project the Optacon proved to be a relatively durable device; the average down time for the instrument was six hours over five months. Most of the problems were easily remedied. Now, two years later, all five original Optacons are still in use by the original participants. This use is on a sustained basis, meaning that Optacon reading has become a normal part of their functioning.

*References are located at the end of the section for which they occur.

A second experience with a group of Optacon users began in April of 1972 in a class of 15 blind computer programmers at the Berufsfoerderungswerk, Heidelberg, Germany. An intensive training period was instituted with 13 of these students (two are partially sighted and use a closed-circuit television system to read). This German rehabilitation institute had originally intended to provide its trainees with braille computer listings and manuals. One manual was being transcribed and the first few programs had been listed in braille when the Optacons were delivered. Within a short period of time there was no demand for braille output. The students only wanted the normal printout, if for no other reason than that they did not want to cause their future employers any extra work. They look up things in the normal manuals, analyze the error messages, find what they are looking for in the computer listings, and read the messages printed out on the console typewriter. They also use their Optacons for personal matters, such as reading mail and for bank statements.

These students successfully completed their vocational training in data processing by the end of 1972. Early in 1973 thirteen of the original fifteen students had signed employment contracts, ten of these being in private industry. All the subsequent classes of blind computer programmers at this institute have also been supplied Optacons.

Concurrent with this field experience in Germany, an Optacon evaluation was conducted in England by St. Dunstan's and the Royal National Institute for the Blind under the leadership of Professor Michael Tobin of the University of Birmingham.[2]

In this evaluation, information was first obtained from a set of 30 blind adults and adolescents who participated in an initial Optacon training course. Since only 10 Optacons were available in this program, the Optacons had to be time-shared over the year's duration of the program. In the later months of the program, information was obtained from 17 of the original trainees who participated in extended training and practice.

The initial training showed that the most successful Optacon learners were, on average, above the norm in terms of tactual discrimination ability, short-term memory capacity (letter-span), and braille reading speed; they were, in general, below the average of the whole group in age and in age at which braille was learned.

Previous visual experience did not produce a significant correlation with performance in the initial training program. Figure 2.1 gives the major results from Tobin, et al, which compares the significant variables from the 10 best performers in the brief Optacon training course with the 10 worst performers.

From the 17 participants in the extended training and practice, Optacon reading rates of some readers were only 10 to 12 wpm, while others were able, for short periods, to read from books of their own choice at speeds of about 40 wpm.

A similarly sized field experience has occurred in Sweden as well.[3] There, 27 blind people were trained with nine Optacons over a one-year period. Two of these people have already achieved reading rates over 45 words per minute, and at least 22 of this first group are considered to be successful readers.

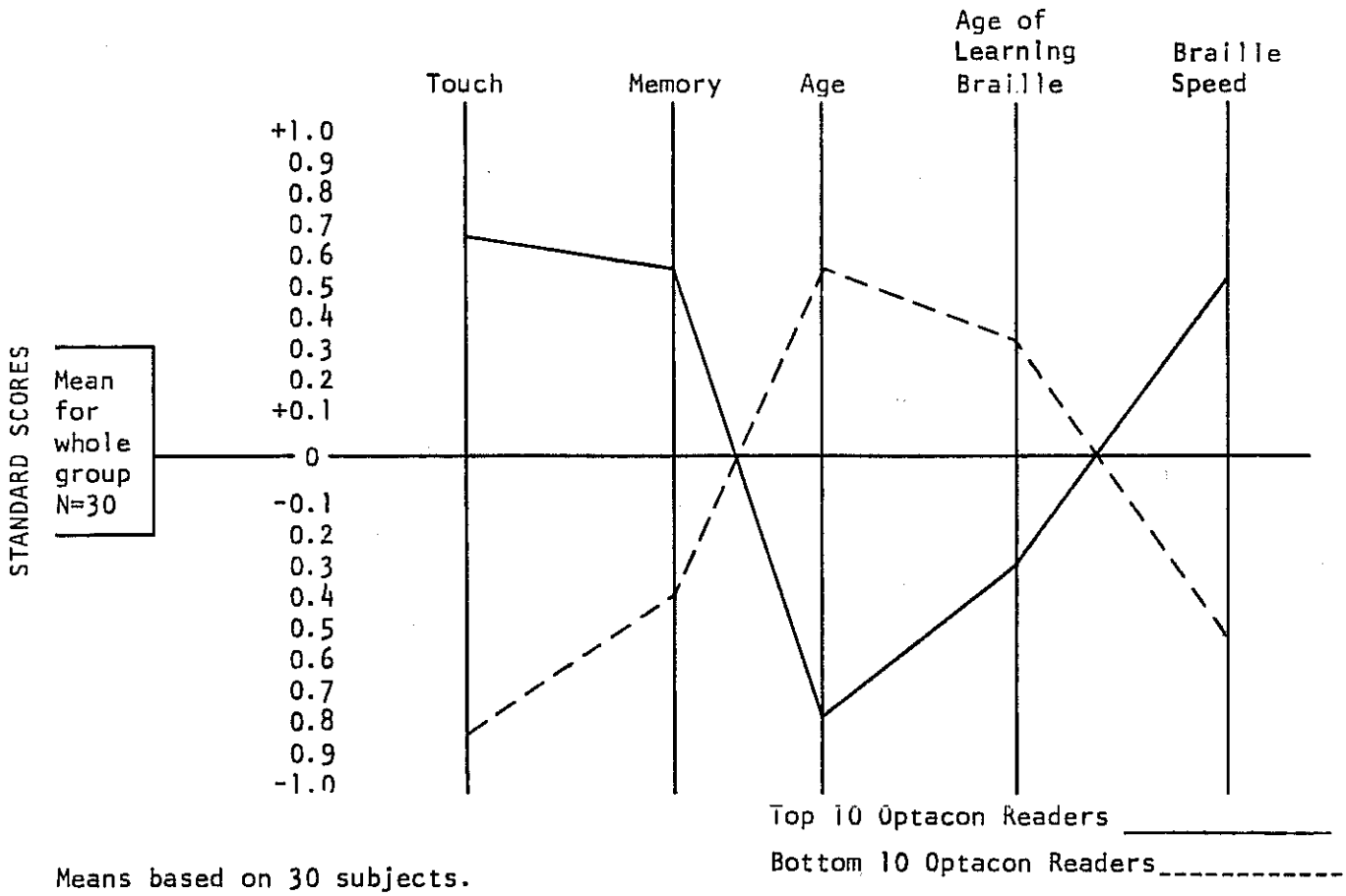
Of the field experiences in the United States, the American Institutes for Research has been conducting an educational evaluation under contract with the U.S. Office of Education since September, 1972. This study involves over fifty Optacons in about fifteen schools throughout the United States. About eighty-five blind students from fourth to twelfth grade are participating. At this writing no results are yet publicly available from this project.

The larger field experience in the United States has resulted from the participation of about 150 blind individuals, in training classes given at about a dozen locations. From this experience, considerable knowledge of the learning process has been acquired and a five-volume training course has been developed. The essential importance of training in Optacon reading in order for a blind person to develop his reading potential has become clear. The amount of training varies greatly from person to person, but in general, development of fluent Optacon use takes at least several months.

2.12 Basic Components of the Optacon Reading Task

Several approaches to the assessment problem are possible. The first approach described here involves consideration of the basic component factors which must be combined for skillful Optacon reading.

PROFILES OF TOP 10 AND BOTTOM 10 OPTACON READERS



Means based on 30 subjects.

Baseline derived from means of all 30 subjects	Tactual Discrimination	S.T.M. (letter span)	Age (Years)	Braille Reading
High Scorers (N=10)				
Mean	17.8	14.3	21.7	628.8
S.D.	1.78	2.45	7.86	199.99
Low Scorers (N=10)				
Mean	14.6	11.5	39.5	371.3
S.D.	1.49	3.14	12.58	254.96
t	4.13	2.11	3.60	2.38
P	$<.01$	$<.05$	$<.01$	$<.05$

Figure 2.1

Comparisons between selected independent variables and Optacon performance after only 10 hours of initial training. Braille reading scores are the number of words read aloud in five minutes. (Tobin et al Ref. 2).

An analysis of the Optacon reading task yields the following basic components:

- Muscular Control. The student should be able to make smooth coordinated movements with his hand and should be able to grasp the camera normally and comfortably. The ability to make extremely small, fine, and coordinated movements is especially desirable.
- Orientation Concepts. The student should have a good concept of spatial relations such as which direction is up, down, left, right, near, far, parallel, and perpendicular. The ability to know which way a grasped object is pointed is needed to prevent camera skew.
- Two-hand Coordination. The ability to perceive the relation between hand movement of the camera and corresponding tactile image movement is needed. The student should be able to automatically comprehend the effect of camera movements on the tactile display.
- Tactile Sensitivity. The tactile pressure threshold needs to be within the normal range. If conditions exist which effect tactile sensitivity, such as diabetes, the status and future status of these conditions need to be carefully considered with respect to the possible limitations they might impose on Optacon performance.
- Tactile Resolution. The tactile 2-point threshold (i.e., the minimum separation 2 points can be distinguished from 1) needs to be within normal ranges. As with tactile sensitivity, conditions such as diabetes are reason for careful assessment in this area.
- Tactile Image Perception. The student needs to be able to perceive tactile images as complex as lettershapes.
- Attention Span. Normal attention span is needed.
- Language Skills. The student needs adequate comprehension of vocabulary and of the longer language units of sentences, paragraphs, and complete stories. He should have the ability to comprehend and anticipate words in context and different grammatical structures.
- Motivation, Persistance. The student needs to have sufficient motivation and persistance to be able to stick to a difficult task.

- Mechanical Aptitude. The student needs to be able to develop a mastery of operation and control of equipment.

Ideally tests would be administered to assess the candidate's abilities in each of the basic component areas listed above. The resulting profile then could be compared to analogous profiles from known good and bad Optacon candidates to obtain an overall assessment. Unfortunately, this approach to evaluation has not been developed, so that calibrated tests are not yet available for each of the component areas, and the characteristics of good and bad Optacon candidates are not accurately known on a component-by-component basis. Therefore, the practical value of this approach lies only in the insight it gives an evaluator, who may make subjective judgements with respect to each of the component abilities in the process of formulating an overall evaluation.

2.13 An Experimental Assessment Test Battery

A second approach to assessment is to measure performance on another skill, already mastered by the candidate, which requires capabilities similar to those required by Optacon reading. Braille reading is such a task, which combines all the basic components listed above except mechanical aptitude. Thus, in many cases, braille reading speed can be a good indicator of Optacon reading potential. However, this approach doesn't work at all if the candidate hasn't been taught braille, and it isn't very accurate if the candidate has not developed his braille reading potential because of circumstances unrelated to Optacon reading.

A hybrid approach combining evaluation of some basic factors with higher level skills is under development at the time of this writing. This assessment battery is composed of tests to measure the following factors: immediate memory span, tracking ability, tactile pattern recognition ability, learning potential, and braille reading speed (if appropriate). These tests are given in Section 2.131. Table 2.1 gives typical scores obtained by good Optacon readers on these tests. In addition, the interview form provides other relevant information to be taken into account in the assessment and in planning a training course.

Table 2.1

ASSESSMENT TEST RESULTS

(Averages and Standard Deviations
for Eight Good Optacon Readers)

TEST	AVERAGE SCORE	STANDARD DEVIATION
Part 1: Immediate Memory Span	14.4 letters*	1.49
Part 2: Tracking	24.5 seconds 0.9 times line lost	5.5 0.9
Part 3: Pattern Recognition	39.1 letters correct out of 40	1.3
Part 4: Learning Potential	11 letters correct out of 11	0

*Sum of forward and backward scores.

2.131 Experimental Interview Form and Test Instrument General Instructions

Follow this sequence:

1. Show the subject the Optacon
2. Do the interview form
3. Do Parts 1, 2, 3, and 4 in that order

Make clinical observations and notes.

TELESENSORY SYSTEMS, INC. OPTACON PRE-TRAINING APPLICATION

Name _____ Date _____

Address _____ Telephone (H) _____

_____ Telephone (O) _____

Age _____ Age at onset of blindness _____

Cause of blindness _____

Are you a diabetic? _____ Present state of health _____

Any other handicaps? _____

Occupation: Present _____ Before Blindness _____

Education: Highschool (1) __ (2) __ (3) __ (4) __ College (1) __ (2) __ (3) __ (4) __

Graduate Degrees _____

Are you a braille reader? _____ If not, why not? _____

_____

Braille reading speed _____ Are you right or left handed? _____

Do you have any disabling injuries to your fingers or hands? _____

Do you have any motor coordination problems or other muscular abnormalities? _____

_____

Which hand do you read braille with? _____

Are you familiar with the upper and lower case letters of the print alphabet? _____

Do you want an Optacon? _____ If so, since when and why? _____

_____

At what minimum speed would you wish to be able to read with the Optacon before it would be useful to you? _____

How much time can you devote to learning to read with an Optacon? _____

_____

Have you had mobility training? _____

Are you an independent traveler? _____

Interviewer: If recently blind, has individual had adjustment training? _____

Remarks and Observations: _____

_____

_____

_____

Interviewer

_____
Name and Title

_____
Address

_____

_____
Telephone

Place of Interview

_____

_____

_____

_____

PART 1 - IMMEDIATE MEMORY SPAN

LETTERS FORWARD

Directions: Say the letters at the rate of one per second. Let the pitch of voice drop with the last letter of each series. Begin by saying, "I am going to say some letters. Listen carefully, and when I am through, say them right after me." If the subject repeats Trial I correctly, proceed to the next higher series. If the subject fails Trial I, give Trial II of the same series, then proceed to the next series, if he passes. The second trial of a series is given only if the first trial is failed. Discontinue after failure on both trials of a given series.

Scoring: The score is the number of letters in the longest series repeated without error in Trial I or II. Maximum score: 9.

SERIES	TRIAL I	TRIAL II
(3)	M-K-A	O-V-H
(4)	I-S-Z-A	F-Z-V-E
(5)	P-A-E-C-R	J-F-P-T-U
(6)	W-H-Q-A-F-G	A-Q-H-W-R-D
(7)	M-Q-I-L-T-A-U	L-O-F-M-G-I-D
(8)	D-I-X-H-U-G-K-T	Y-L-T-C-J-P-B-G
(9)	H-K-E-R-X-B-Y-Z-D	O-W-J-Z-D-T-U-E-A

Score: _____

LETTERS BACKWARD

Directions: Introduce this test by saying, "Now I am going to say some more letters, but this time when I stop I want you to say them backwards. For example, if I say 'O-V-F', what would you say?" If the subject responds "F-V-O" correctly, say, "Here are some others," and proceed with the test beginning with Trial I of the 3-letter series. If the subject does not reply correctly or fails to understand, give the right answer and another example, saying, "Remember you are to say them backwards." If the subject succeeds this time, proceed with the test using Trial I of the 3-letter series. However, if he fails the second example, proceed with the test by giving Trial I of the 2-letter series. If a subject passes an example but fails both trials of the 3-letter series, go back and give the 2-letter series, then discontinue the test. Discontinue after failure on both trials of a given series.

Scoring: The score is the number of letters in the longest series repeated backwards without error in Trial I or II. Maximum score: 8.

SERIES	TRIAL I	TRIAL II
(2)	R-O	S-L
(3)	H-M-D	B-R-E
(4)	I-G-M-O	S-P-T-H
(5)	T-A-Q-I-L	P-F-Z-G-X
(6)	I-N-O-S-F-J	J-Z-C-F-V-M
(7)	P-T-E-J-H-W-R	I-H-D-M-D-A-Z
(8)	S-X-H-E-T-P-I-A	E-R-X-O-B-O-I-S

Score: _____ Sum of scores Letters Forward & Backward: _____

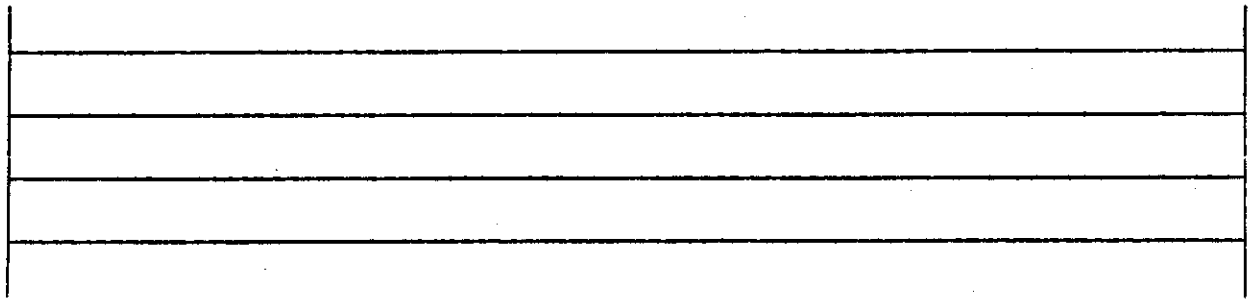
PART 2 - TRACKING

Directions: Do not use the Tracking Aid. Use the first two lines to teach the subject to track across the line, retrace the same line to the left vertical, and move down to the next line. When you are satisfied that he understands the task, say to him, "Track these four lines as fast as you can in the manner we have just practiced. If you lose the line, find it and go on."

Scoring: Begin timing when you tell him, "Begin," starting at the top left and stop timing after he has tracked all four lines forth and back. Count the number of times he loses the line. Give general comments about his ability to move the camera, change lines, etc.

Time: _____ Number times line is lost _____

Comments:



PART 3–PATTERN RECOGNITION

Directions: Using a horizontal line, show the subject how to correctly position his finger on the tactile array. Say to the subject, "I am going to show you some patterns. Feel the first pattern and then identify the duplicate of that pattern from among the four possible choices. Your response should be 1, 2, 3, or 4. You will be allowed to feel the stimulus pattern and the four possible answers one time and then you must select an answer. If your answer is incorrect you will have a second trial." The examiner should move the camera over the stimulus pattern (taking about five seconds) and then over the four answers at that rate. Do not backtrack. If his response is correct, tell him, "That's right"' and go on to the next pattern. If he is incorrect, say you will repeat the line one more time, beginning with the stimulus pattern. Tell him the correct answer if he is right or wrong on the second trial.

Scoring: Write the response for each problem in Trial 1 (and Trial 2 if taken). Give 2 points for a correct response on the first trial, 1 point for a correct response on the second trial, and 0 points for no correct response. Maximum score is 40.

		Trial 1	Trial 2
O	J J O J		
I	B B B I		
X	X L L L		
E	O E O O		
V	B V B B		
7	4 8 2 7		
1	9 1 5 4		
3	3 9 7 8		
6	0 6 8 2		
5	2 3 5 4		

		Trial 1	Trial 2
T	Z M K T		
C	J O S C		
H	X H D U		
B	V B N R		
M	M A I W		
i	o s v i		
w	e t w r		
n	y h n z		
a	e m a f		
d	k g b d		

Total Score: _____

Comments: _____

PART 4—LEARNING POTENTIAL

Directions: Teach the subject the nine upper case letters. Do not spend more than 10 minutes teaching and reviewing these nine letters before giving the Criterion and Reading Tests. If he gets 8 out of 11 correct on the Criterion Test, do the Reading Test. Give general comments about his ability to read the words and sentences.

O O O O C C C C I I I I

E E E E S S S S T T T T

H H H H A A A A M M M M

Criterion Test:

T H C S O H E I A M S

Number Correct out of 11_____

Reading Test:

TOM IS A CAT. HE EATS MICE. THE MICE HATE TOM.

Comments:_____

_____

_____

_____

_____

2.2 OPTACON PERFORMANCE EVALUATION

At various stages during training and afterwards, it may be desirable to evaluate an individual's Optacon reading performance. The two major test areas for this type of evaluation are letter recognition ability and reading ability. Each of these areas can be evaluated with the individual being tested having control of the camera or with a fixed-rate presentation device such as the Optacon Cassette Trainer (OCT) or the Automatic Page Scanner (APS). The difference between camera control and fixed-rate performance is usually a good indicator of tracking ability.

2.21 Letter Recognition

The two measured variables in assessing letter recognition ability are accuracy and speed. In the case of the individual being tested controlling the camera, these two variables interact in accordance with the strategy or emphasis imposed by the individual and the instructions to him. In the case of fixed-rate presentation, the speed is set by the evaluator, so the measured variable is accuracy.

Another possible variation in the testing procedure with fixed-rate presentations involves whether or not the task is to report every letter being presented or not. For reasonable reporting accuracies, the speed of letter presentation is limited by the reporting task, rather than the recognition task, if every letter is to be reported. This limitation can be circumvented by using a sampling procedure in which the subject reports a letter only when a cue is also presented. For example, if variable length (e.g., 2 to 8 letters long) strings of random letters are presented, with the subject's task to report the next to last letter in each string, then much faster letter presentation rates can be used for the same reporting accuracy. In this way letter recognition ability can be tested at rates approaching normal text reading speeds with the Optacon.

An expert Optacon reader can achieve over 50% accuracy in recognizing and reporting every letter presented at a rate of one letter per second. By using the sampling procedure, the same accuracy can be achieved at presentation rates three times as great.

2.22 Reading Rate Measurements

In addition to the considerations involved in measuring letter recognition, reading rate measurements can be performed with the subject reading aloud, or silently with a subsequent measurement of comprehension. Silent reading rates are generally higher than oral reading rates because of the elimination of the necessity of recognizing every word within a constrained time and because mental energy is not being consumed in speaking aloud.

A convenient and practical way of measuring reading rates is to tape record the test session, thus permitting the timing to be done later. This method also can be done remotely, with the test being mailed to the subject, who then mails a tape recording of his reading aloud back to the evaluator.

2.23 An Example of a Letter Recognition and Reading Rate Test

INSTRUCTIONS FOR ADMINISTERING OPTACON READER EVALUATION TESTS

1. Explain that some measures of Optacon reading accomplishment will be made on the last day of training.
2. Give the letter recognition tests first.
   -- use any two of the optional tests on page 9.5 of the Stage 1 Manual for upper case letters
   -- use page 20.2 of the Stage 1 Manual entirely for the lower case letters
3. "Husky" (Stage 2 Manual p.11) will be the reading text. Don't assign this story for homework or read it in class.
   -- Read the first paragraph aloud to the student
   -- Ask him to read the second paragraph aloud for practice.
   -- Using the stopwatch, ask him to read paragraph 3 silently and then give you a resume. Time counts from the first letter of the first sentence until you see that he has scanned the last line.
   -- Give the same directions and time in the same way for paragraphs 4 and 5. Ask for a summary at the end of each paragraph.
4. Write a one sentence comment/evaluation for each of the four criterion on the log sheet.
5. The supervisor will then collect the test results, add anything she feels appropriate to the narrative section.

UPPER CASE LETTERS	LOWER CASE LETTERS	READING TEST
1st test, # correct out of 28 _____	test 33, # correct out of 7 _____	3rd para, time _____
2nd test, # correct out of 28 _____	test 34, # correct out of 6 _____	comprehension _____
	test 35, # correct out of 11 _____	4th para, time _____
	test 36, # correct out of 10 _____	comprehension _____
	test 37, # correct out of 20 _____	5th para, time _____
	test 38, # correct out of 28 _____	comprehension _____

REFERENCES

1. Ford, David H., "Educational Applications of the Optacon for the Blind Student." Evaluation Report presented to San Diego Unified School District.

2. Tobin, M.J., W.R.K. James, Alison McVeigh, and Rita M. Irving, "Print Reading by the Blind". An evaluation of the Optacon and an investigation of some learner variables and teaching methods. Research Centre for the Education of the Visually Handicapped, School of Education, University of Birmingham, England (1973).

3. Erkisson, K., M. Holm, O. Holm, L. Kampp, M. Tobiasson, E. Ohman, "Skandinaviska erfarenheter av Optacon - ett lashjalpmedel for helt blinda", Lakartidningen Volym 70. NR32, 1973.

SECTION 3 EQUIPMENT FACTORS

3.1 PRINCIPLES OF OPERATION FOR THE MAJOR OPTACON SUBSYSTEMS

Although the Optacon embodies many advanced technological features, its principles of operation are not especially complex. The machine can be divided into three parts as shown in Figure 3.1.

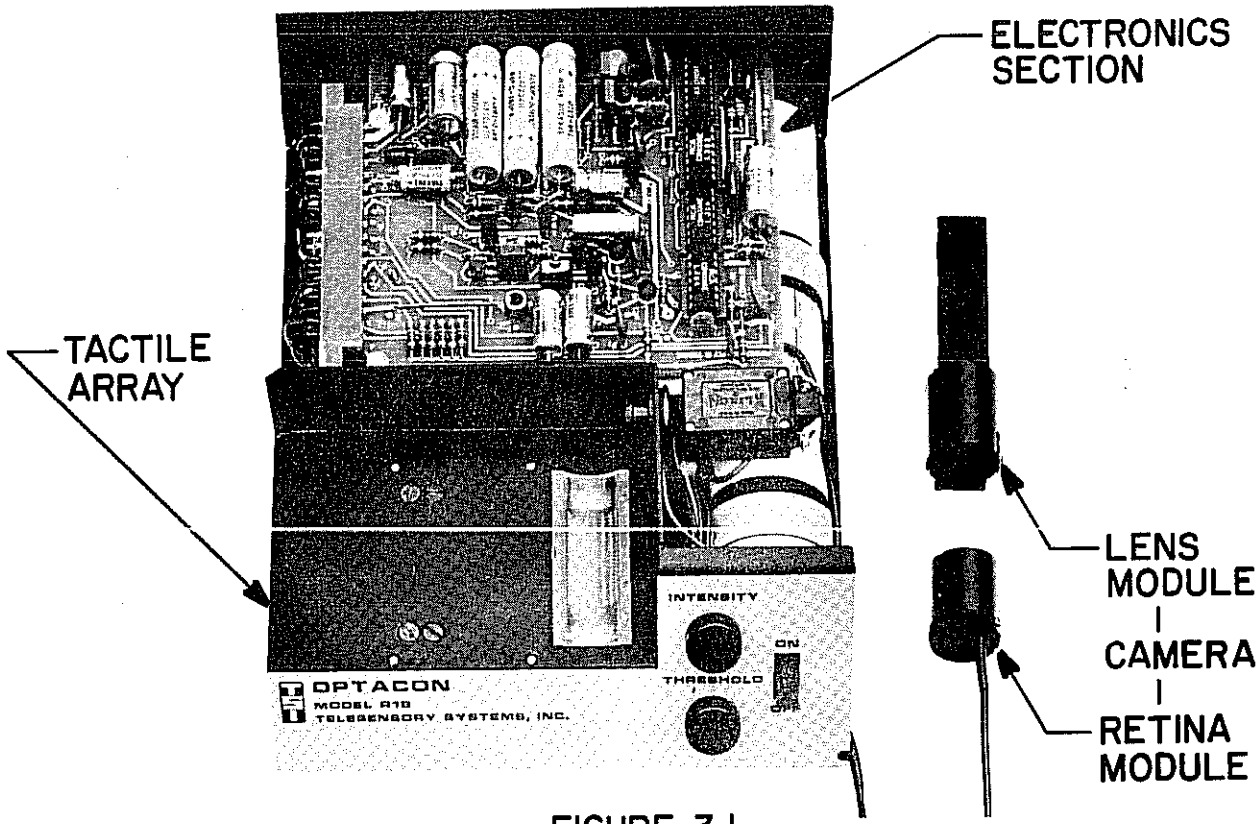


FIGURE 3.1
MAJOR SECTIONS OF OPTACON

The Camera converts images of the print to be read into corresponding electrical impulses.

The Electronics Section processes these electrical impulses and generates electrical power to drive the vibrators and other systems.

The Tactile Array displays in vibrating form the page information transmitted by the electronics from the camera.

The following paragraphs describe the principles of operation in more detail of the above three components of the Optacon. Additional descriptions are in the Optacon Instruction Manual supplied with each Optacon.

3.11 The Camera

The camera functions much like a television camera in converting light to electronic impulses. Two miniature lamps, in an opening or "camera window", illuminate the material to be read. Light reflected from the page is focused by the zoom lens system onto the silicon "retina", which is in the cylindrical housing at the end of the camera cable. If the lens module is detached from the retina module (by simply pushing in on the retina module, twisting the retina module counter clockwise with respect to the lens module, then pulling the retina module away from the lens module), the silicon "retina" may be seen. The silicon "retina" corresponds to the "rods and cones" of the camera's "eye". It contains 144 phototransistors arranged in the same 24 row, 6 column fashion as are the tactile array and the Visual Display. Each phototransistor is a miniature solar cell, converting the impinging light into electricity. The magnitude of the electrical signal thus generated is proportional to the intensity of the light. These 144 electrical signals contain the optical information and are transmitted by the camera cable to the electronic section.

One of the reasons that the retina module is detachable from the rest of the camera, or lens module, is that alternate lens modules are available for specialized reading tasks, such as reading electronic calculator displays. Another reason is so that the retina module can be inverted (with the cord at the top instead of at the bottom) to enable reading with the camera upside down in situations in which there is a restriction below the print, such as a page in a typewriter or a library card in a drawer. The standard lens module for reading has a "zoom" lens system which can vary the magnification, or size, of the image. See Section 3.44 for use of the magnification control button on top of the camera.

3.12 The Electronics Section

The electronics section is contained within the main chassis of the Optacon. The electronics, together with the battery, generate the proper electrical power and timing signals to operate the camera and tactile array. In addition, the electronics perform a "light-dark" decision on each of the signals received from the retina phototransistors. In other words, if a phototransistor signal exceeds a threshold level, a "light" decision is reached. Conversely, if the phototransistor signal is smaller than the threshold, a "dark" decision is reached.

This threshold level can be varied with a knob on the front of the Optacon and its usage is described further in Section 3.43.

The way in which the electrical signals are extracted from the silicon retina and transmitted to the electronics is of interest, because an understanding of this can explain certain characteristics of the Optacon and certain potential malfunctions which the teacher should be alert to. If each phototransistor in the silicon retina had its own wire to transmit its signal to the electronics, then the camera cable would have to contain 144 wires, which would make it stiff and unwieldy. To circumvent this problem a read-out process called multiplexing is used. By this process the signals from many phototransistors are transmitted on the same wire. This is accomplished by specifying a particular sequence, or time "slot", in which each phototransistor transmits its signal. Since the electronics at the other end of the cable is wired to expect the signals in this particular time sequence, the electronics always know which phototransistor is sending each signal and therfore can route its decision on this signal to the appropriate vibrator.

The particular multiplexing sequence used in the Optacon can be explained as follows: there are six wires which simultaneously transmit these signals from the silicon retina, one for each of the six columns (which are labeled from left to right A, B, C, D, E, F). Each of these wires carries the electrical signals from the 24 phototransistors in its column to one of six corresponding "light-dark" decision making circuits in the electronics. For each wire the time order of these 24 signals is first the odd numbered rows, starting from the top, then the even numbered rows, starting again from the top (or 1, 3, 5, 7, 9, 11, 2, 4, 6, 8, 10, 12). This is called an "interlace" scan since the odd numbered rows are read out then the in-between, or even numbered rows are read out. All of these electrical signals, completely specifying one image from the silicon retina, are transmitted in the time of one cycle of the tactile array vibration, so the time spent in this transmission process has no effect on performance of the system. Thus, the

Optacon works in much the same way as television and motion pictures in that it presents a sequence of still pictures. In the case of the Model R-1B Optacon, about 240 of these still pictures are presented every second, which is much faster than television or motion pictures.

There are actually two separate electrical systems in use -- one for the odd-numbered rows and one for the even-numbered rows. These two systems take turns driving their corresponding vibrators; that is, they are out-of-phase, which helps to reduce the audible "buzz" the Optacon makes and to keep the power supply load more constant.

The importance of understanding all of this is that the user and teacher should be alert to the possibility that only one of the two systems is functioning properly. That is, in the worst case, every other row of the tactile array could be inoperative. The row check as described in Section 3.5 is a good test for determining this. Also, if a row or column in the array always stays on, it may be that one of the wires in the camera cable is broken.

The power to run the Optacon comes from the rechargeable battery within the main chassis. The Optacon draws about $\frac{1}{2}$ ampere from the battery when in normal use. More or less than $\frac{1}{2}$ ampere of current can be drawn depending on how many vibrators are turned on and the intensity setting. The capacity of a fully charged battery is about 2.2 ampere-hours. Thus, this battery, when fully charged, should run the Optacon for over four hours of normal use (2.2 amp/hours divided by $\frac{1}{2}$ ampere). It can be recharged at any time and if the charger is connected all the time, no harm results.

The battery charger is capable of supplying about $\frac{1}{2}$ amp. It is especially designed for the Optacon (it has exceptionally low ripple) and therefore replacement should be from TSI. If only a few vibrators are turned on, on the average, then the charger will supply more than enough power, so the extra current can help to charge the battery. However, if a large number of stimulators are activated on the average (e.g., when the camera is left on its side), then the charger will not by itself

supply sufficient power, and the battery will have to contribute as well. Therefore, it is possible for the battery to become discharged even though the charger is plugged in. To avoid running the battery down, the charger should be plugged into the Optacon, with the Optacon turned off, for a sufficient period of time (time to recharge will be roughly twice discharge time) to allow the charger power to be used to charge the battery only. Leaving the Optacon with the charger plugged in overnight is often a convenient way to ensure that the battery is always charged (See Section 3.45).

3.13 The Tactile Array

The tactile array consists of 144 pins, arranged in 24 rows and six columns like the silicon retina. If the impulse from a particular phototransistor is considered "dark", the pin in the same geometrical location is vibrated. A vibratory pattern is thereby generated that exactly duplicates the pattern of "dark" elements of the retina. Since print is dark, this vibratory pattern closely approximates the printed letter patterns on the page material being read.

The vibrating pins protrude through holes in a curved plastic fingerplate. Inside the unit, the pins are attached to piezoelectric beams that generate the mechanical vibrations. This mechanical vibration generates the characteristic "buzz" of an Optacon in operation and its intensity can be varied with a knob on the front of the Optacon. See Section 3.42 for further details regarding the intensity control.

3.2 MODES OF OPERATION FOR THE OPTACON

The Optacon can be switched into one of several modes of operation. There are two independent types of modes -- "normal" and "invert" modes, and "master" and "slave" modes.

3.21 "Normal" and "Invert" Modes

If the electrical signals from the phototransistors are inverted, the "light-dark" decision will be reversed, and "light" retinal elements will correspond to vibrating pins and "dark" retinal elements will correspond to no vibration. A switch on the back panel of the Optacon enables this reversal which is useful in reading white (or light colored) print on a black (or dark colored) background.

3.22 "Master" and "Slave" Modes

The I/O connector on the back panel of the Optacon can be used to switch the Optacon into one of two overall operating modes: output (master) and input (slave). In the first or "master" mode, the Optacon operates normally but, in addition, image signals from the Optacon camera are sent out from the connector to another device, such as a Visual Display. In the second or "slave" mode, the camera signals are functionally disconnected from the Optacon; instead, signals taken in through the connector are used to drive the tactile array.

3.3 TEACHING AIDS

Several teaching devices are available for use in association with the Optacon. The "Master/Slave" cable, the Visual Display unit, and the Tracking Aid are three.

3.31 Master/Slave Cable

The Master/Slave cable (shown in Figure 3.2) enables two or three Optacons to be connected together so that all of the tactile stimulator arrays present the image from one camera. The cable is V-shaped. The connector at the base of the V will switch an Optacon into "master" mode so it is plugged into the input-output (I/O) connector of the "master" Optacon. Note the "male" and "female" guide pins on each side of the connectors which permit only one orientation of the plugs when connected. The two branches of the V are of varying lengths: the connector at the end of the long one will switch an Optacon into "slave" mode so it is plugged into the Optacon that will duplicate the image from the master Optacon; the short cable may be left unconnected or it may serve to receive either the connector from a Visual Display unit or the master connector from another cable. The slave threshold control should be set to the maximum clockwise position.

This cable makes it possible for a teacher to work with two or three students at a time, or for a teacher who is blind to work with a student.

3.32 Visual Display

The Visual Display simply presents the same "dark" electrical signals presented to the stimulator array, in visual form by means of a 24 by 6 array of lamps as shown in Figure 3.3. The Visual Display cable is connected to the I/O connector from which these electrical signals are received. As with the Master/Slave cable (see Section 3.31), be sure the guide pins are lined up with the mating socket before pushing in the connector. When disconnecting the cable, the plug should be gently wiggled from side to side.

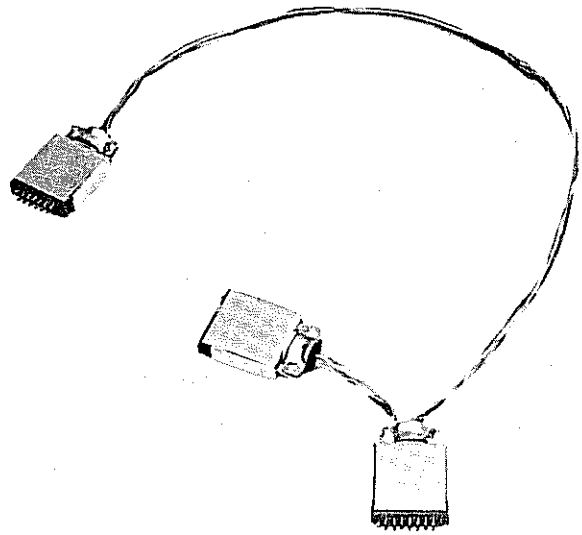


FIGURE 3.2
MASTER/SLAVE CABLE

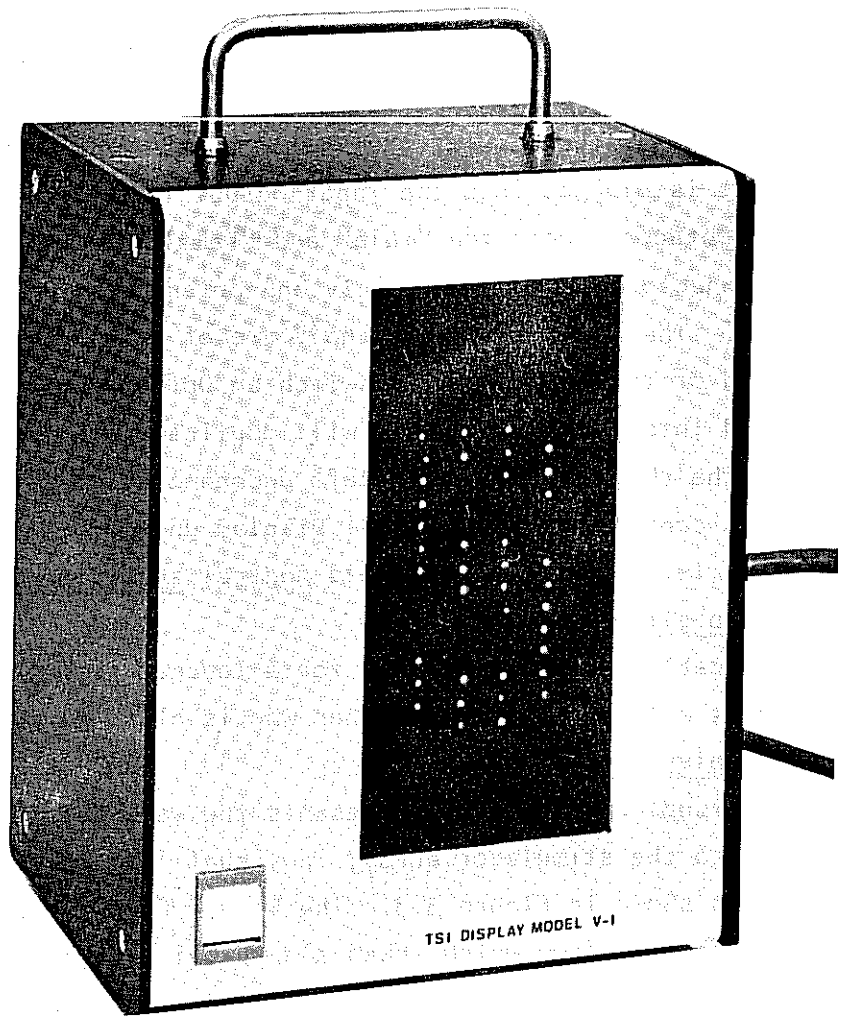


FIGURE 3.3
VISUAL DISPLAY VI-A

The signals which the Visual Display receives from the Optacon are from the silicon retina in the Optacon camera after the electronics have made the "light-dark" decision of each image point. These signals are the same as those sent to the tactile array. The Visual Display multiplexes this information into the array of lamps (which are solid state devices that should last indefinitely) in the same way as the Optacon electronics routes the proper information to the proper vibrator (see Section 3.12). This means that if everything is functioning properly, the Visual Display will show the same image that the tactile array shows. It should be noted that there is an intensity control for the tactile array but not for the Visual Display. As explained in Section 3.42, it is possible to have the intensity set so low that the tactile array does not actually display the same image as the Visual Display.

However, an instructor should not take it for granted that the Visual Display image is identical to the tactile display image. Malfunctions do sometimes occur so the teacher should check for tactile array and Visual Display correspondence by feeling the tactile array as described in Section 3.5.

There is a fuse holder on the rear panel of the Visual Display. The fuse, which can be easily removed by rotating the fuse holder cap clockwise and pulling out, protects the Visual Display circuitry from power line surges and component failures. An instructor should be sure the Visual Display is unplugged before removing the fuse holder cap. Spare fuses are easily obtained at electronics stores, TSI, or in later models of Visual Displays there is a spare fuse mounted under the top panel of the Visual Display box.

3.33 Tracking Aids

A Tracking Aid guides the camera along a line of print for the student, holding the camera in alignment with the letters and a horizontal line. Two types of Tracking Aids are available -- T-1B and T-2A or B. Either type may be used by right-handed or left-handed students.

3.331 Tracking Aid, Model T-1B

This Tracking Aid, shown in Figure 3.4, consists of a fixed rod and a moveable rod which are attached at right angles to one another at their intersection by ball bearings mounted in a metal block. The camera is attached by a hold-down screw at the end of the moveable rod. The Tracking Aid is normally used only during the early stages of training, as most students acquire freehand tracking skills by the end of the formal training course. The Model T-1B allows materials of varying thickness, such as textbooks, to be read with the aid. The hinged joint at the camera attachment point will accomodate for the curvature found in books near the binding.

3.332 Tracking Aid, Models T-2A and T-2B

This Tracking Aid, shown in Figure 3.5, serves the same basic function as Model T-1B described above. However, it is lighter and takes up less table space than the T-1B. The page to be read is placed on a flat plate in which the right and left edges have been turned up to form two vertical rails. A carriage slides on these rails. This carriage provides the horizontal tracks on which the camera holder rides. Thus the camera is moved left to right by sliding the camera holder along the horizontal tracks of the carriage. The camera is moved up and down by sliding the carriage along the tracks on the plate. There is an adjustment on the carriage which can be used to increase the vertical friction. This Tracking Aid (T-2A or B) is used for reading a small thickness of single sheet paper, and the carriage is removable for easy insertion of paper.

Model T-2A -- approximate dimensions $8\frac{1}{2}$" x $15\frac{1}{2}$" -- used for reading normal or legal-sized paper.

Model T-2B -- approximate dimensions 11" x 14 7/8" -- used for reading standard computer printouts.

See Section 3.8 for additional teaching aids.

3.4 THE CONTROLS

In ordinary operation, the Optacon requires the use of only four controls. One of these -- the magnification adjustment button -- is located on the top of the camera section. The other three -- the on/off switch, the stimulator intensity adjustment knob, and the

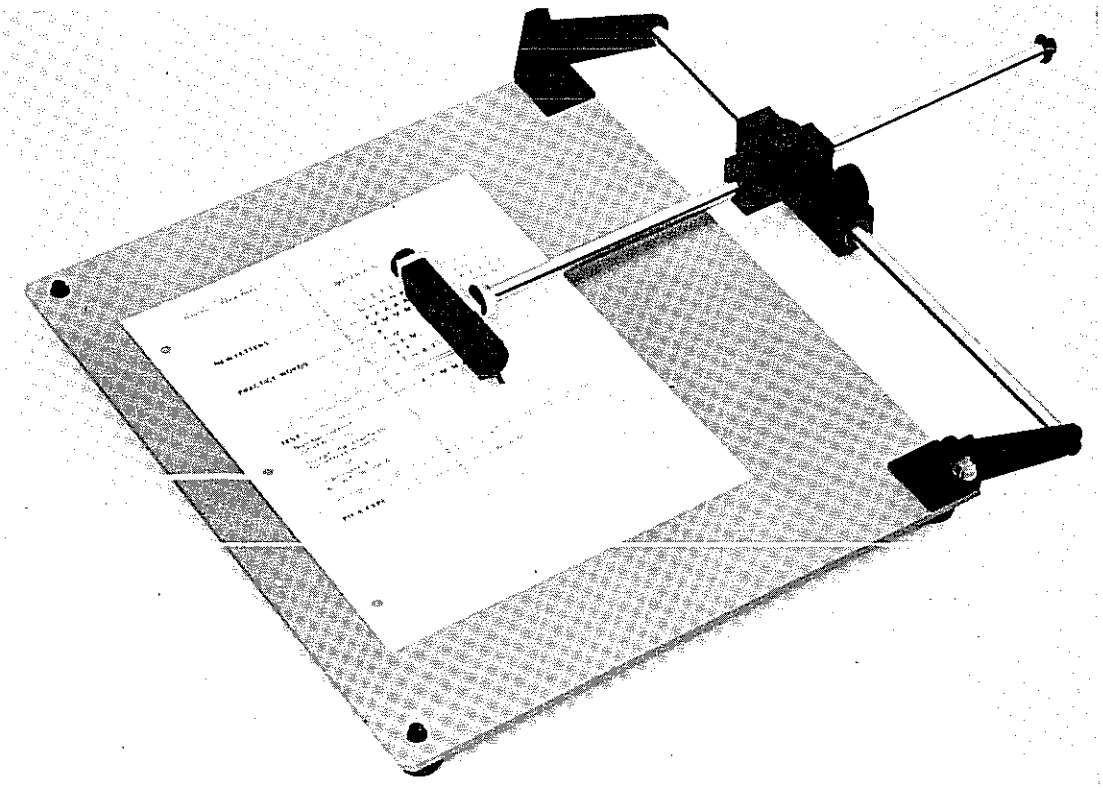


FIGURE 3.4
TI-B TRACKING AID

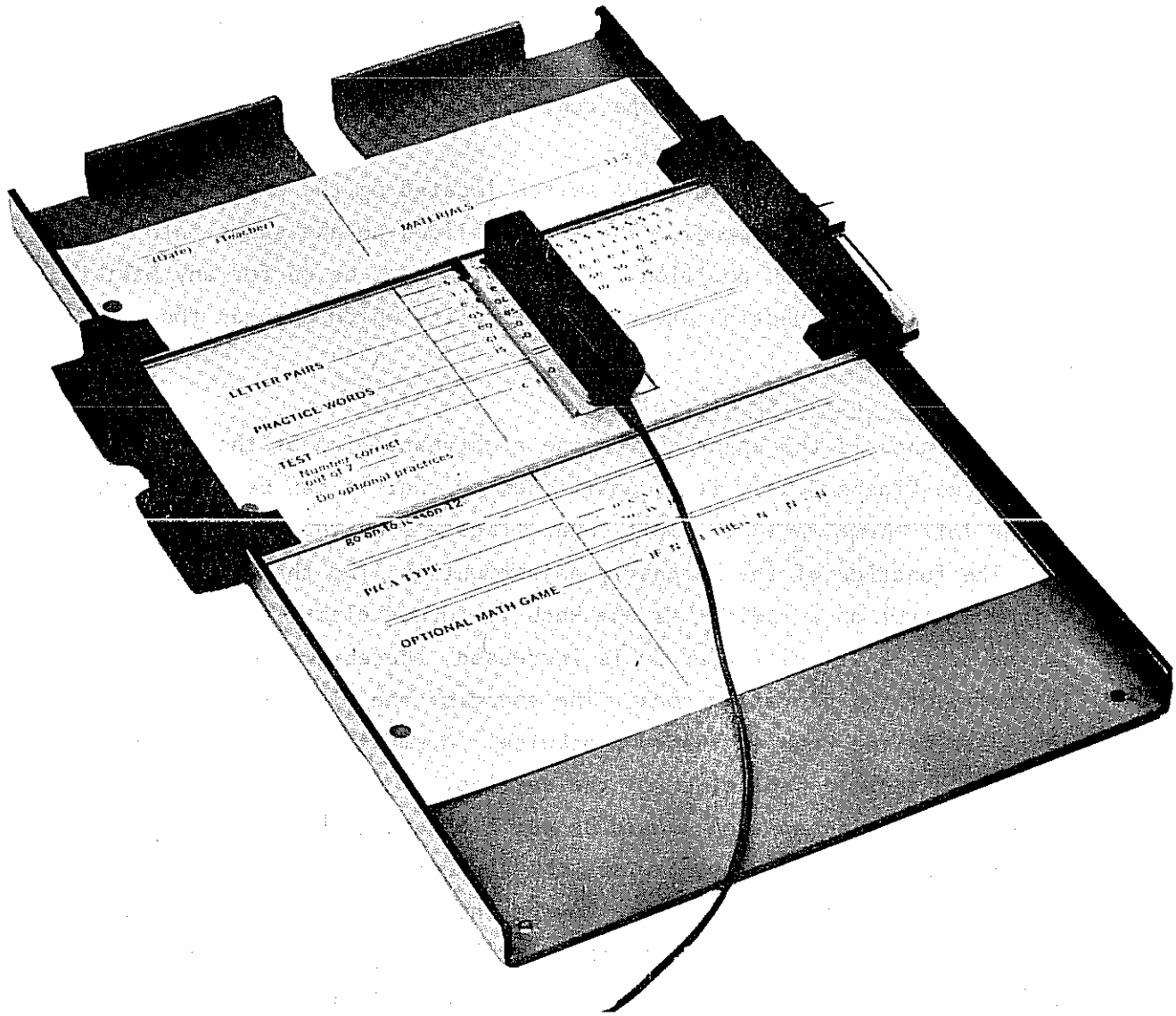


FIGURE 3.5
T2-A TRACKING AID

threshold adjustment knob -- are located on the front panel of the main chassis. In addition, the Optacon contains a circuit breaker that protrudes from the right-hand wall within the stimulator array compartment. The back panel holds a normal/invert switch, a battery check button, a jack for the connector from the battery charger, and an input-output (I/O) connector for use with accessories. The following paragraphs describe the controls.

3.41 On/Off Switch (See Figure 3.6a)

The on/off switch is a slide switch located on the extreme right-hand side of the front panel. The switch slides up and snaps into place in the full "on" position. This switch must be on for any part of the Optacon to function except the circuitry which charges the battery.

3.42 Tactile Array Intensity Control

This knob is the upper one on the right-hand side of the front panel (see Figure 3.6a). It is positioned so that it can be controlled by the left thumb while the left index finger is on the stimulators.

The function of the intensity adjustment is like that of the volume control on a radio. As the knob is turned clockwise, the voltage to the tactile stimulator array is increased, thereby increasing the intensity of the vibrating rods. The sound of the vibrating rods also increases as the knob is turned clockwise. A small bump on the knob provides a tactile indication of the setting.

The intensity control should be set high enough so that all of the stimulators can be felt; otherwise, the student's reading performance may be adversely affected since there may be "holes" in his tactile image. These "holes" will not appear on the Visual Display image since this image is independent of the tactile array intensity setting (see Section 3.32). Settings in which the bump on the knob indicates a corresponding clock reading greater than 12 o'clock are usually safe in this respect. At lower settings it may not be possible to feel all the vibrators even if the finger is moved over the array. A row and column check (see Section 3.5) can be used to determine the minimum safe setting; however, many people always read with the Optacon at full intensity and no harm results in this.

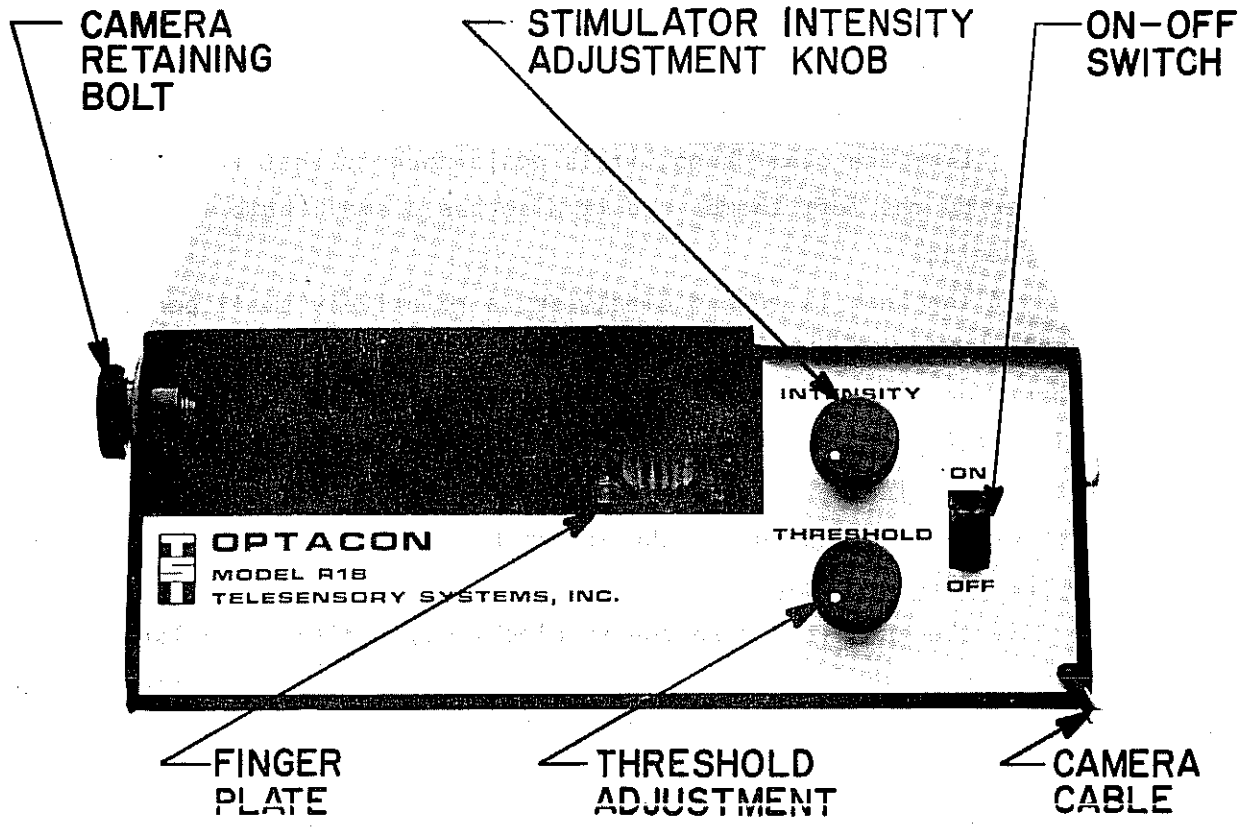


FIGURE 3.6A
OPTACON FRONT PANEL

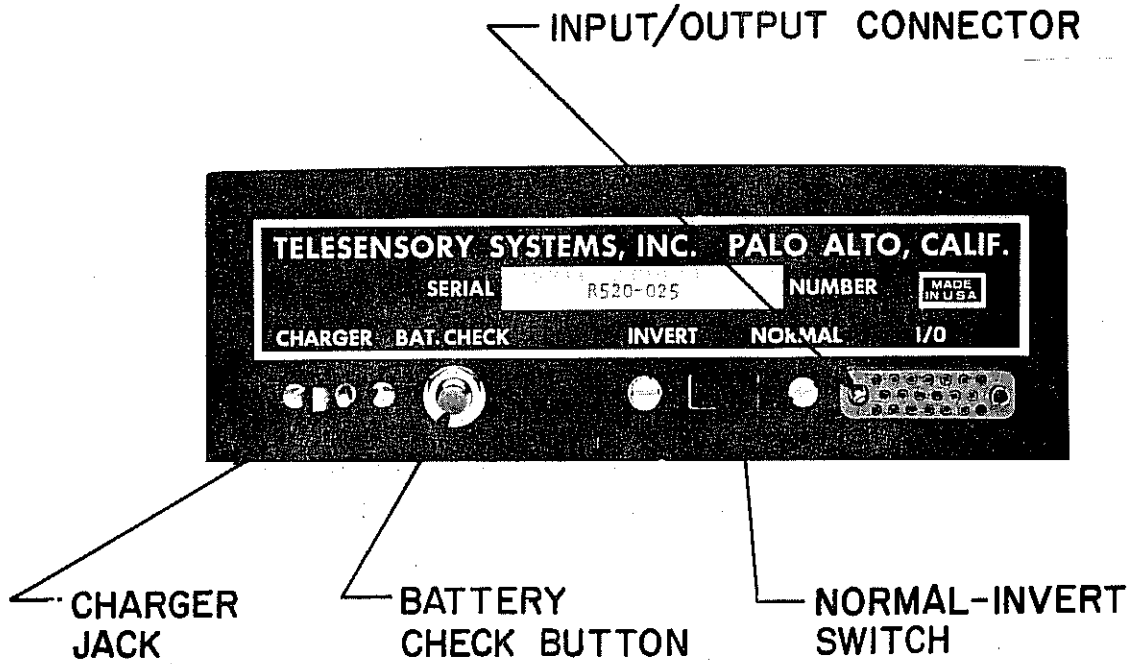


FIGURE 3.6B
OPTACON BACK PANEL

3.43 Threshold Level Control

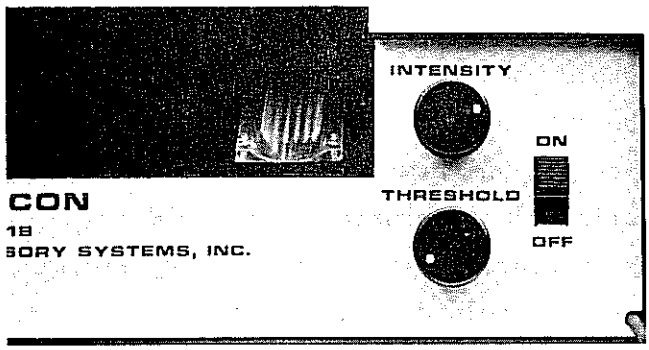
This knob is the lower one on the right-hand side of the front panel. Like the other knob, it is positioned so that it can be controlled by the left thumb. and it also has a small bump to indicate its setting.

If the knob is turned clockwise, a relatively small percentage of black under a phototransistor will cause the corresponding rod to vibrate as if the area were entirely black. To the user of the Optacon, this setting will have the effect of making the strokes of the letter seem wide. If the knob is turned farther clockwise, the strokes will seem wider and wider until the letter becomes an unrecognizable blur in the vibrating image.

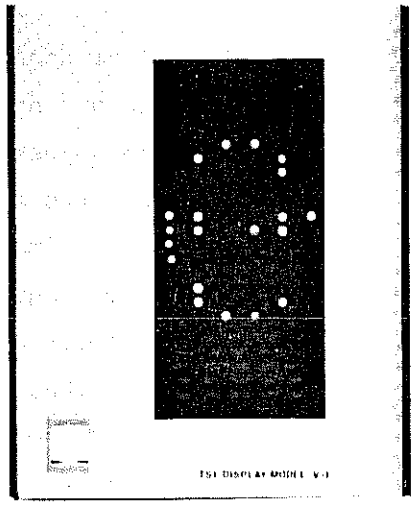
If the knob is turned counterclockwise, a relatively larger percentage of black in an area will be required to make the corresponding rod vibrate, and the strokes of the letter will seem thin. If the knob is turned farther in this direction, the strokes will seem thinner until gaps may appear in some parts of the vibrating image. (If the normal/invert switch is in the invert position for reading white letters on a black background, the effect of turning the threshold adjustment knob is reversed).

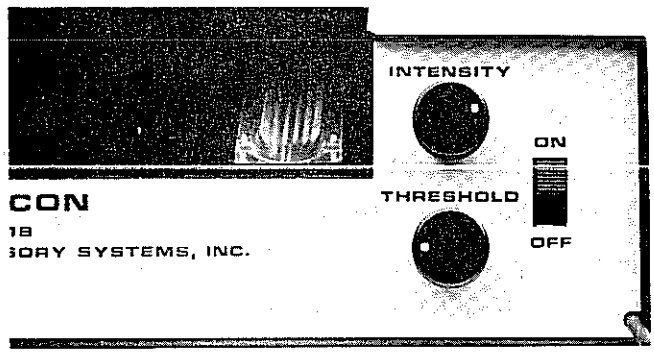
The optimum threshold control setting (see Figure 3.7) is not always the setting that produces the most faithful reproduction of the printed image. Tactually, it is easier to recognize letters whose strokes are very thin than those that are thick-stroked (i.e., boldface print). By adjusting the threshold control, boldface print can often be made to appear on the Optacon with thinner lines than it actually has. However, this "trick" is more practical when the print has a constant stroke width. With variable stroke width printed letters, the threshold adjustment should be set so that the thinnest printed strokes are not missed and do not have incorrect gaps. The minimum threshold setting, which correctly reproduces the thinnest strokes, determines the limit to which the threshold adjustment can be used to artificially "thin" the thickest strokes.

If the magnification control is changed, the brightness of the

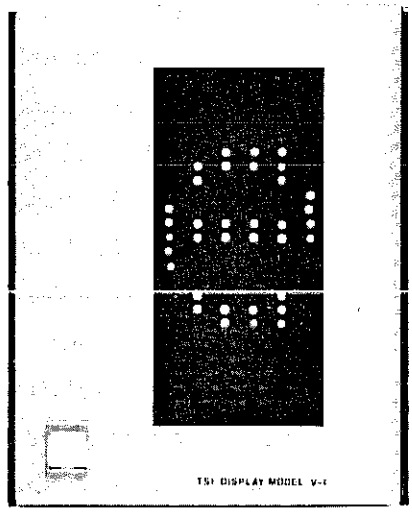


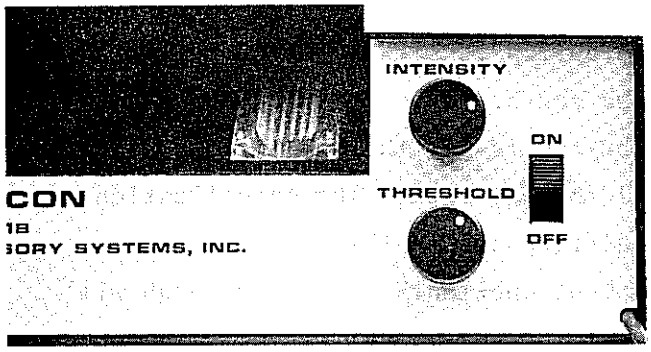
TOO LOW





JUST RIGHT





TOO HIGH

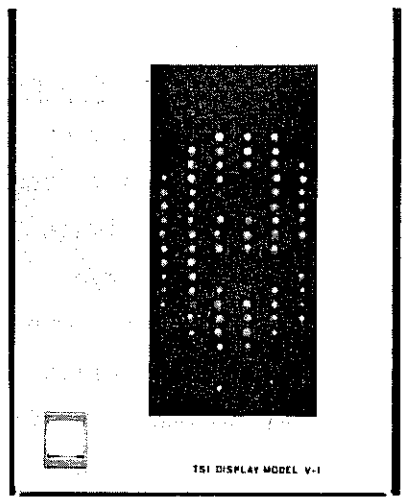


FIGURE 3.7
THRESHOLD ADJUSTMENT

image will be changed on the silicon retina and the width of the strokes will be changed because of the size change. These changes may mean that a threshold adjustment would be beneficial. The teacher or student should always feel free to change the threshold whenever it appears that some improvement in image quality could be obtained. This is particularly true with poor quality print, in which the uniformity of the ink may vary from letter to letter necessitating almost constant threshold adjustment. Thus, unlike the intensity control, the threshold adjustment may be varied frequently and the student should develop his ability to do this appropriately.

Also unlike the intensity control, the absolute position of the bump on the threshold control knob means very little. It depends on many factors, such as reflectivity of the ink and paper, state of battery charge, magnification setting, etc., so the absolute position should not be used as a reference.

The "best" adjustment of the controls varies with type style. It is important to make initial adjustments for letter size with the magnification adjustment (see Section 3.44) and then for width of letter strokes with the threshold button before commencing to read. A common mistake for a new student is to attempt to make a threshold adjustment when the camera is on a space or only a small portion of a letter. Threshold and magnification adjustments are best made when a letter is centered on the array.

3.44 Magnification Control

This button is located on the top of the camera section. This control has a "zoom" effect. As the button is slid forward, the size of a given image increases. The size can be adjusted through a range from the largest setting, when the button is all the way forward, to the smallest, when the button is all the way back. The magnification adjustment helps to compensate for differences in the size of letters. At maximum magnification, a letter about one-tenth of an inch high will be discernible in the tactile stimulator display. At minimum magnification, a letter about one-fourth of an inch high will fill the array vertically.

Usually, the magnification is set so that an upper case letter will fill about the upper eighteen of the twenty-four rows. (Then lower case letters that have descenders, such as "p", will fill the lower rows). See Figure 3.8 for examples of magnifications settings. The magnification adjustment may interact with the threshold adjustment, as explained in Section 3.43.

3.45 Charger Jack

To charge the battery, plug the charger directly into any standard 110-volt, 60-cycle outlet. (The charger is designed to be wall mounted in the outlet, and it can be left plugged in when it is not used). Then take the connector at the end of the charger cord and plug it into the jack on the back panel of the Optacon (see Figure 3.6b)

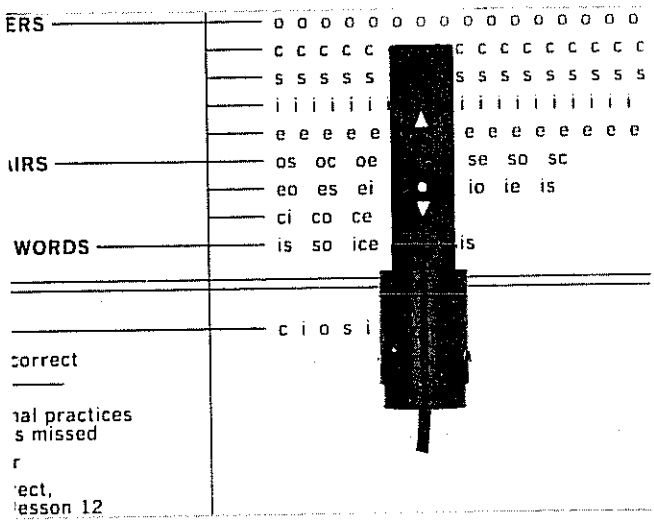
3.46 Battery Check

The Optacon contains a rechargeable battery. When it is fully charged, it can power the Optacon for at least four hours of continuous operation, independent of the battery charger. To determine when the battery needs recharging, use the battery check button located on the left-hand side of the back panel (see Figure 3.6b)

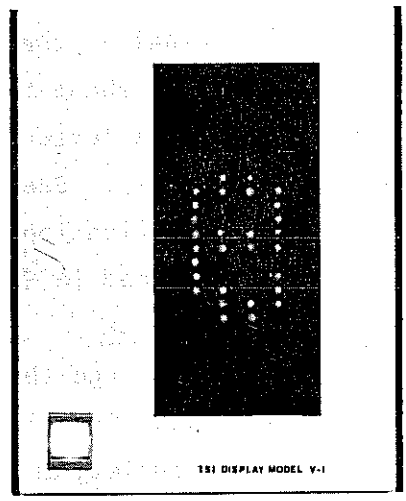
The button must be used when the Optacon is in operation, with some of the stimulators turned on and clearly audible. The battery charger should not be plugged in during the test. Depress the button. If the pitch of the stimulator vibrations rises or remains the same, the battery is well charged. If the pitch falls, the battery requires charging, and the charger should be used as soon as convenient.

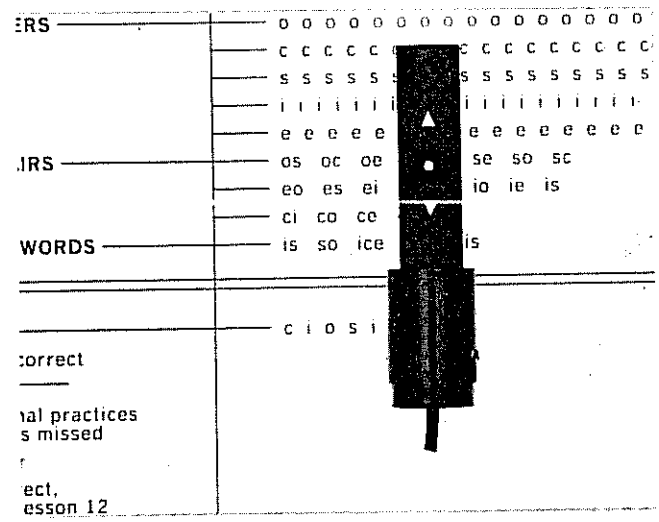
3.47 Circuit Breaker

The circuit breaker on the right hand wall within the stimulator array compartment acts like a fuse. It is there to protect the battery and wiring from damage due to accidental shorts. The Optacon will not run from a battery if the circuit breaker is not pushed in (but should run when the Optacon is connected to a charger). To engage the circuit breaker, push firmly. It will then remain engaged. If the circuit breaker will not stay engaged, a defective condition exists in the circuitry that must be repaired.

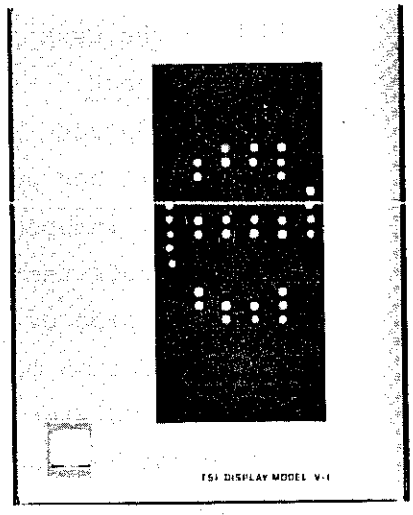


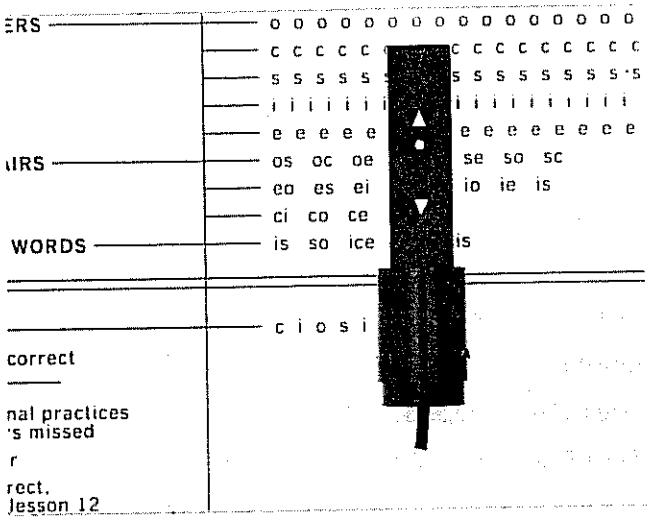
TOO SMALL





JUST RIGHT





TOO LARGE

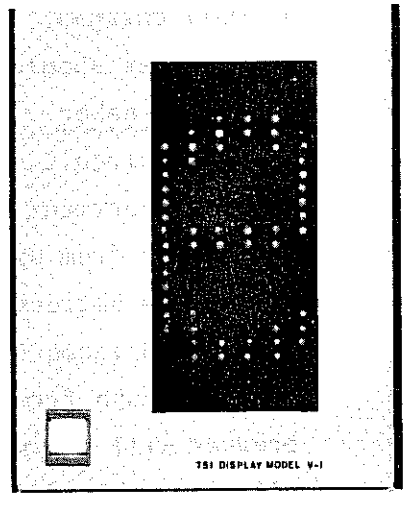


FIGURE 3.8
MAGNIFICATION ADJUSTMENT

3.5 METHOD FOR CHECKING FOR PROPER FUNCTIONING OF THE EQUIPMENT

It is important that the teacher briefly check for proper functioning before each training session. Faulty equipment can waste precious training time and frustrate the student. After one becomes accustomed to working with the Optacon, it is usually rather easy to detect faulty equipment. A careful row and column check, performed as follows, is sufficient at the beginning of each training session.

3.51 Row and Column Check

To perform the row check, plug in a Visual Display (see Section 3.32) and turn on the Visual Display and Optacon. Find a horizontal printed line and place the camera window over it with the body of the camera perpendicular to the line. With the magnification adjustment all the way back toward the retina module, adjust the threshold control so that a corresponding single horizontal line appears on the Visual Display. (You may have to reposition the camera slightly or push the magnification adjustment a little forward). Now turn the intensity fully clockwise and feel the vibrating line on the tactile array. Next, gradually move the camera up and down, feeling the tactile line move up and down while observing the line on the Visual Display.

To perform the column check, repeat the above steps while "reading" a vertical printed line. In this case, move the camera from side to side while observing, tactually and visually, one vertical line at a time.

With the above tests, look particularly for missing or weak areas of vibration. The column test is particularly useful in this regard. On the tactile array it is generally helpful to scan the fingertip up and down a vibrating column, looking for any weak or uneven spots. Look also for any discrepancies between the tactile and visual displays; i.e., a light on but no corresponding stimulation or vice versa. In a normal Optacon, the visual and tactile images will always correspond. However, in case of trouble, the two may disagree. To restate this important point in another way. a good letter image on the Visual Display does NOT necessarily imply that the tactile array is working properly. The tactile array can ONLY be checked tactually.

3.52 Trouble Shooting

If the Optacon does not function at all, check to see if the camera lamps are lighted. If not, be sure that the circuit breaker is engaged. Also, always check the battery in case of trouble. If the battery is weak or badly discharged, the audio battery check signal should drop markedly in pitch when the battery check button is pushed.

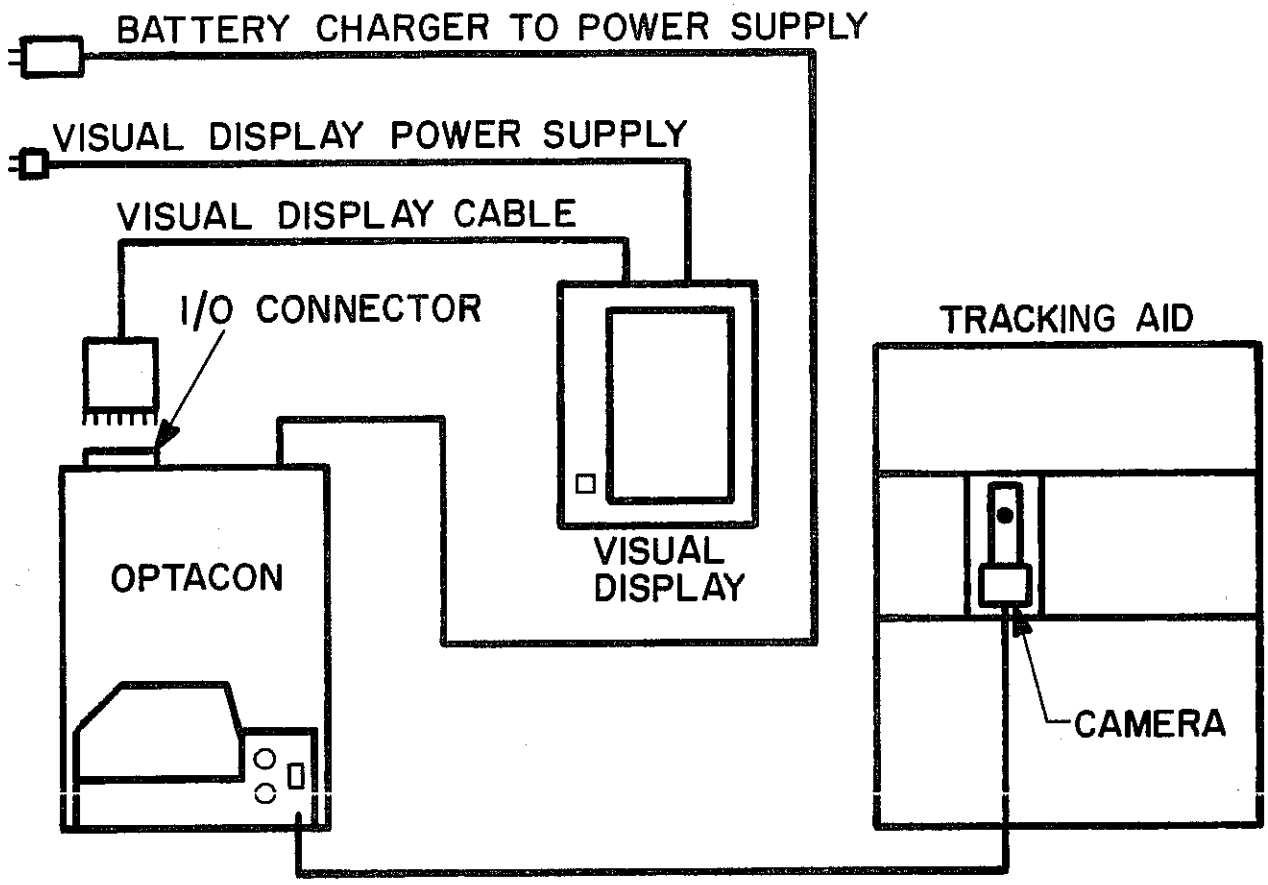
There are several DO's and DONT'S in case of trouble:

DO: Be sure that the battery is charged.
Be sure equipment has been properly hooked up (see Section 3.6).
Try to always use grounded (3-prong) ac receptacle.
Call TSI if you are convinced a real problem exists.
Be prepared, before calling TSI, to describe the problem as explicitly as possible; for example, "The third row of stimulators always vibrates."

DON'T: Damage the equipment by dropping or over-heating.
Try to make repairs yourself.
Interconnect equipment without being sure all switches are "off". (To prevent transient power surges from damaging the equipment).
Use defective equipment for training.

3.6 EQUIPMENT ARRANGEMENT FOR TRAINING

A normal teaching station will require a quiet area, a desk-height table (with surface area greater than 2' x 4') and handy electrical power (with two or three 3-wire receptacles). The student and teacher sit on the same side of the table, or around the corner of a table, with the student normally to the left of the teacher (see Figure 3.9). The Optacon and Tracking Aid (or reading material) will be comfortably in front of the student, and the Visual Display must be placed for easy viewing by the teacher. It is usually simpler if the Optacon is used with the battery charger plugged into electric power. Figure 3.9 shows the interconnections to be used when the equipment is set up. All equipment should be off before making any interconnections. The order of making the connections makes no difference.



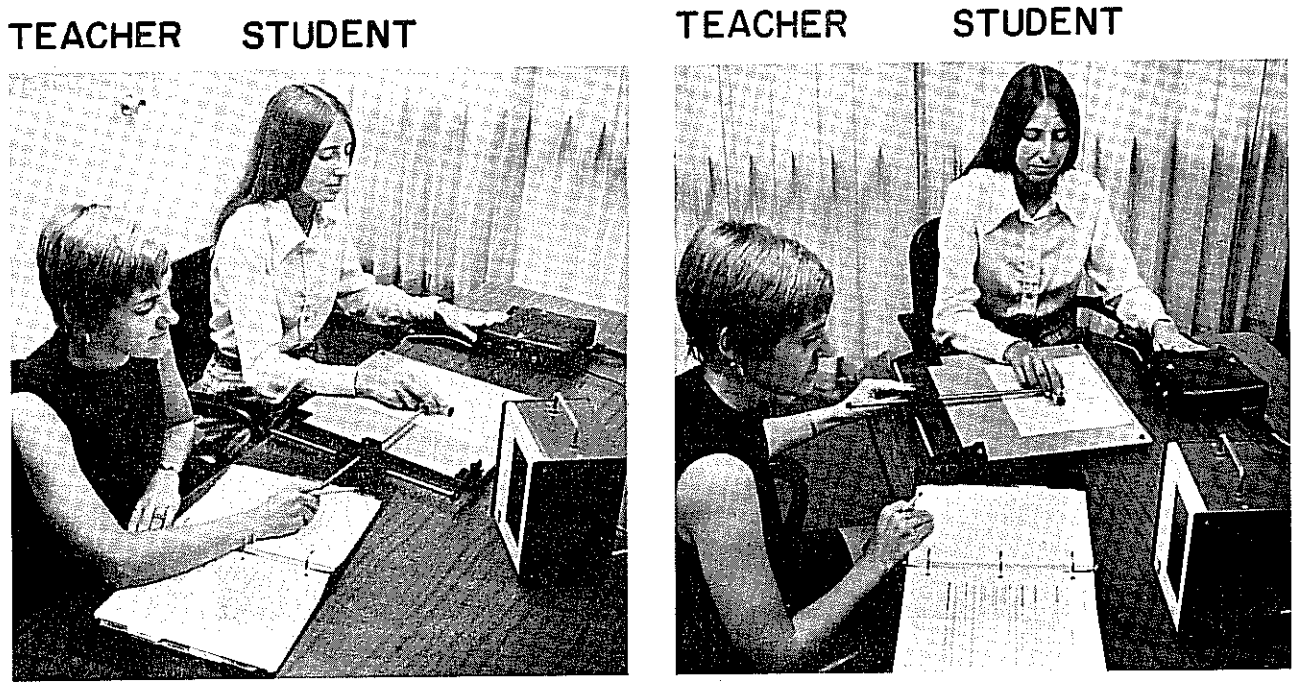
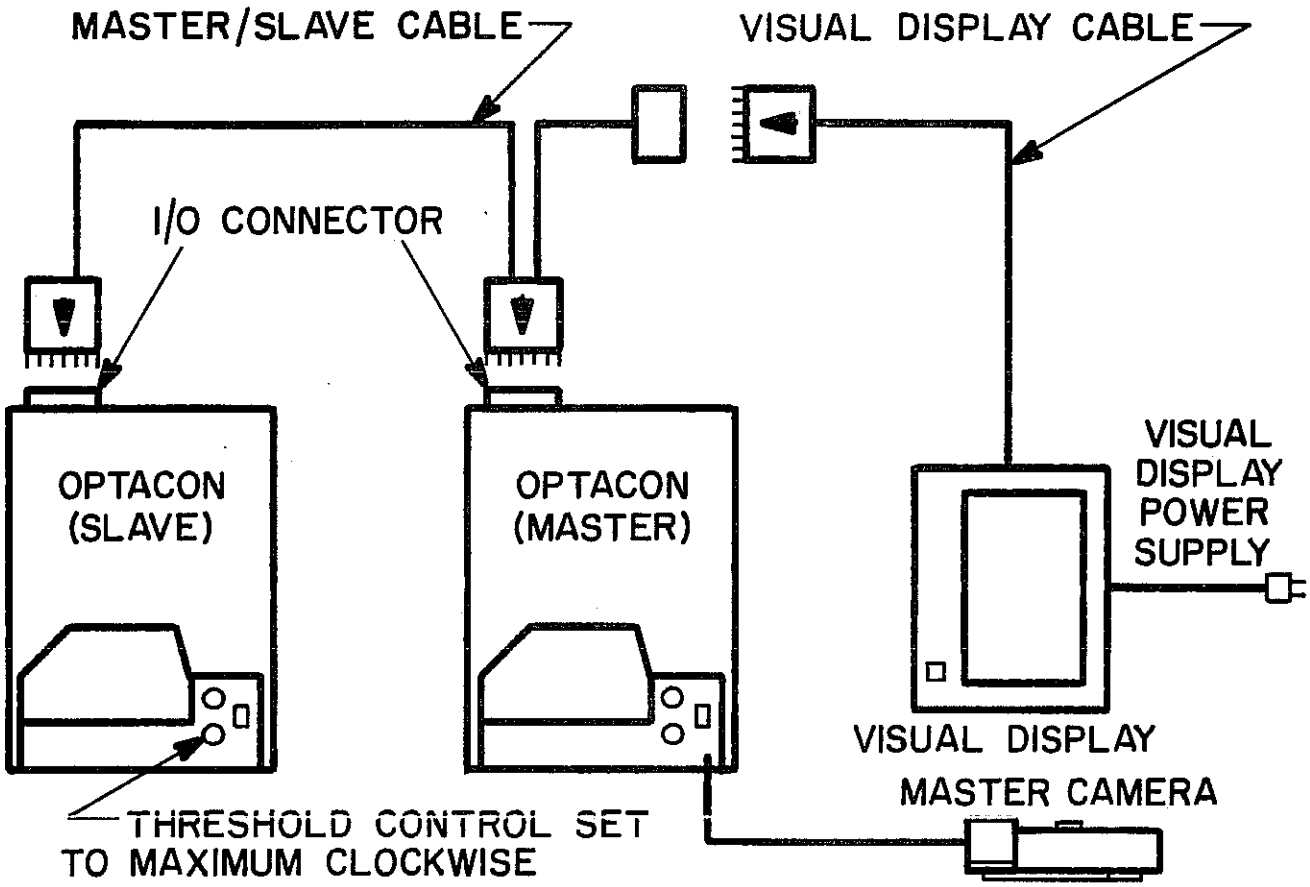


FIGURE 3.9
EQUIPMENT ARRANGEMENT FOR TRAINING



STUDENT

TEACHER

FIGURE 3.10
TWO OPTACON OPERATION USING
THE MASTER/SLAVE CABLE

Figure 3.10 shows the arrangement for the operation of two Optacons together. The master Optacon camera is used for tracking since the slave camera is not functioning in this mode.

3.7 INTRODUCTION TO THE STUDENT

In introducing the Optacon to a student, a teacher must be aware of the importance of the student understanding the physical make-up of the equipment as well as the electronics functions. Time should be spent allowing the student to have a "tactile tour" of the Optacon. The same is true when the student meets the Tracking Aid, Visual Display, and fixed-rate presentation devices.

3.71 Step-by-Step Procedure (Teacher's Directions)

1. The introduction of the Optacon begins with the Wooden Case (see Figure 3.11). The fitted wooden case is extra insurance against damage and can be used to carry or store the Optacon and charger. When traveling, the Optacon should either be carried over the shoulder or hand carried in the wooden case. If the Optacon is to be shipped or travel as checked luggage, it should be in the wooden box which is in turn suspended in foam in the shipping carton.

Each piece of the Optacon standard equipment is packed in an individual compartment in the case. The student needs to see how the compartments are adapted to the equipment.

2. When the student is familiar with the wooden case and equipment, he can begin feeling the size and weight of the Optacon. After unsnapping the front cover, he will find the front controls as well as those in the back.

Just as the Optacon can be divided into three parts: Camera, Electronics Section, and Tactile Array, so too, can the operations.

3. The student can first remove the Camera from the compartment in the main chassis by unscrewing the camera retaining bolt on the left side. The student can understand better the function of the camera when he finds the camera window and lightbulbs. He needs to feel the separation

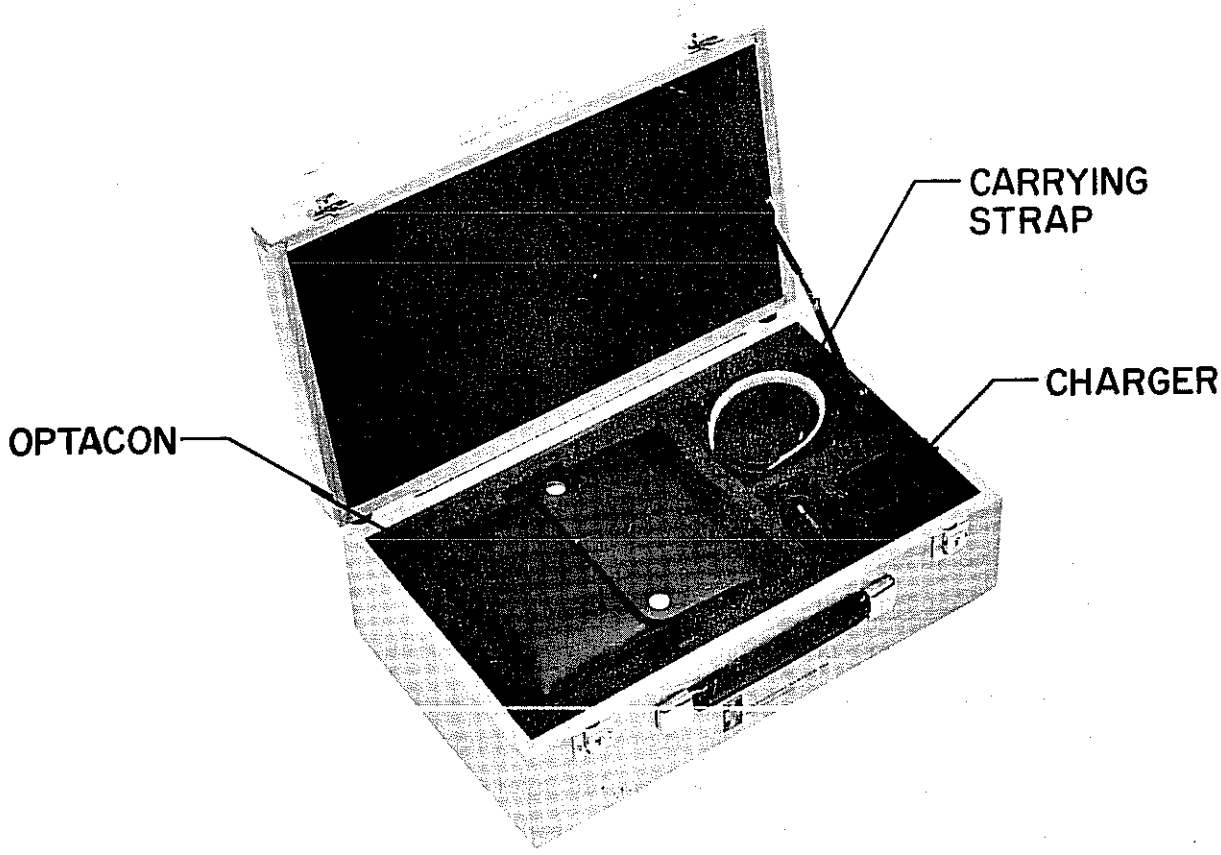


FIGURE 3.11
WOODEN CASE

of the lens module from the retina module and actually detach and replace it himself. At that time a teacher can explain the use of other lens modules and the advantage of being able to invert the retina module (see Section 3.11). Also, while handling the camera, the student will be able to feel the rollers on which the camera glides, and the magnification adjustment button on top of the camera. The magnification adjustment and its interaction with the threshold adjustment could be explained now and again when the student actually begins to operate the threshold control.

It is worth taking time for the student to practice the proper sequence of removing the camera from the storage compartment, unraveling the cable with his hand, and then wrapping the cable around his fingers and replacing it and the camera within the compartment (see the Optacon Instruction Manual). The wrapping of the cable and handling of the camera retaining bolt is awkward at first, but can become comfortable with several tries. It is important not to twist the cable excessively in this process because this may eventually break some of the wires in it.

4. In introducing the Electronics Section of the machine, a teacher should stress the fact that the internal electronics are extremely complicated. The student must never allow anyone to tamper with the machine. The machines are serviced under the warranty only by TSI authorized technicians.

Show the student the Circuit Breaker, explain its function, and have him engage it if necessary.

5. The Tactile Array is the most delicate part of the Optacon and the most difficult to repair. The student should understand the need to protect it from jolts and from materials that may fall into the holes in the finger plate. In particular, the student's finger that is used for reading must be clean and free from lotion or hand cream. The correct way to place a finger on the array is described in Section 4.21.

6. The On-Off Switch is a simple one to explain to the students, but the location of the intensity knob and the threshold knob are often confused. As the student becomes involved in training, he finds a level of pin vibration that is comfortable for him and rarely varies the Intensity setting. Thus, the upper knob is rarely moved. The Threshold, though, is frequently changed since the thickness of the letter stroke is changed when necessary to compensate for variations in printing and changes in magnification. When the Magnification Setting increases a letter's size greatly, the letter strokes may seem unusually wide, and the threshold adjustment knob must be turned counterclockwise to make the strokes feel thinner (see Section 3.43). Conversely, when the magnification is decreased, the letter strokes may seem too thin, and the threshold adjustment knob must be turned clockwise to compensate.

7. The final controls to be explained are those on the back panel. The student has already seen his Battery Charger in the wooden case, and he can now plug it into the Charger Connection and into a power supply. The teacher should make sure that the student has tried the Battery Check BEFORE plugging in the charger. The Battery Check will not give an accurate signal if the Optacon is drawing current at the time the check is made.

Since the invert position of the Normal/Invert Switch is only necessary when the Optacon is used with white print on a black page, the student should check for the switch to be in the normal position. The switch must always be completely at one end or the other of the slide. When a student is reading with the "invert" position, the threshold knob will function in reverse.

The student may plug the Visual Display cable into the I/O connector and begin training.

3.72 Special Precautions and Hints

In this section, we have summarized a few special equipment considerations for training which have been learned through actual experience.

1. Remember to turn all equipment OFF before plugging and unplugging cables.
2. Watch for "cable twisting" by the student. Sometimes students tend to repeatedly rotate the camera, especially when stowing it. As a result, the camera cable eventually becomes twisted up like a corkscrew and this causes wires to break. This potentially damaging situation is easily remedied if caught during training.
3. It is normal for the battery charger to feel warm, especially after a long training session.
4. Remember that "slave" operation disables the camera of the "slave" Optacon. The Master/Slave cable or OCT cable must be unplugged to return a "slave" Optacon to normal operation.
5. Remember to put the threshold control of a "slave" Optacon in the maximum clockwise position.

6. When using "Invert" mode (e.g., reading white print on black background), the operation of the threshold control is reversed.
7. Remember to always check equipment for proper functioning each day before training, and that a good visual image does not guarantee a good tactile image (see Stage 1, Pre-Training Equipment Check).
8. Be sure that the camera of a slave Optacon is out of the way in a position safe from accidentally being knocked off the table. Also, be sure that the camera is safely positioned when an Optacon is left at a training station.
9. Always unplug the battery charger before using the battery check switch.
10. In order to insure proper functioning, it is recommended that the battery be charged overnight. Always charge the battery overnight between training sessions.

3.8 SPECIAL OPTACONS AND TRAINING DEVICES

Two special Optacons have been designed at this time -- the left-handed Optacon and the R-1C Optacon.

3.81 The Left-Handed Optacon (See Figure 3.12)

The left-handed Optacon is identical to the standard Optacon except that the camera retina module and the stimulator array unit have been rotated 180 degrees. (It is not necessary that a left-handed student use a left-handed Optacon. Figure 3.13 illustrates left-handed use of a right-handed Optacon. Many left-handed students prefer a right-handed Optacon. See Table 4.1 for suggestions on how to determine whether the student should select a right or left-handed Optacon). The stimulator array is rotated so that a left-handed user can easily detect the tactile image with his right index finger. All of the considerations mentioned above apply to the left-handed Optacon, except for the following interface problems:

1. The Visual Display must be rotated 180 degrees (turned over) to be used with a left-handed Optacon (it will need to be blocked up because of the handle).
2. If left- and right-handed Optacons are master/slaved together, the image on one will be up-side down, so this is not a practical mode of operation.
3. The left-handed Optacon will not give a right-side-up image from the Optacon Cassette Trainer.
4. The Model T-1B Tracking Aid should be rotated 180 degrees so the fixed rod is on the left, and the teacher should also sit on the left.

3.82 The Model R-1C Optacon

The R-1C Optacon is a specially designed unit for reading electronic calculators and computer terminals. The only difference between the R-1B and the R-1C models is that in the "invert" mode the R-1C multiplex system (see Section 3.12) scans and displays the sequence of "still" images at a rate of 60 times per second rather than 240 times per second. This gives the silicon retina more sensitivity in this mode and also interfaces better with video displays with a 50 or 60 HZ refresh rate. For training purposes the R-1C is identical to a normal R-1B Optacon with one exception: the R-1C Optacon will not function as a "slave" unit in the invert mode.

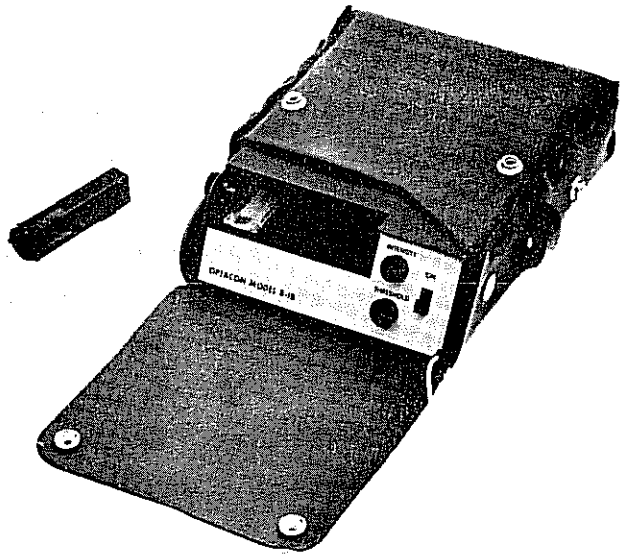


FIGURE 3.12
THE LEFT-HANDED OPTACON

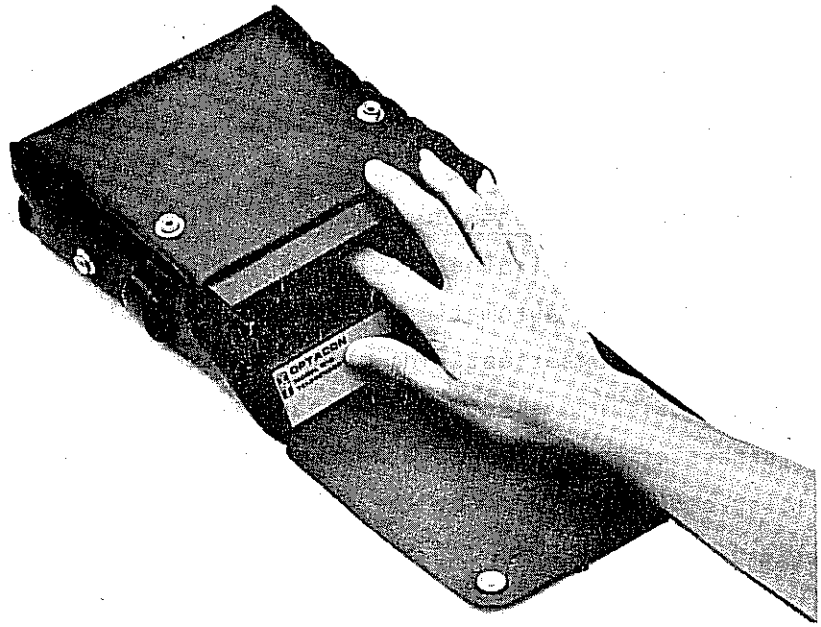


FIGURE 3.13
RIGHT-HANDED OPTACON AS USED
BY A LEFT-HANDED PERSON

3.83 Fixed-Rate Presentation Systems

Two types of "fixed-rate display systems" are available for Optacon training. Although the two units work differently, their purposes are the same: 1) to allow the two tasks of tactile sensing and camera tracking to be separated and trained separately, and 2) to serve as a pacer in building speed. Because signals are inserted into the Optacon through the fixed-rate devices, the student is presented a continuously moving belt of text across the tactile array. The need for controlling and manipulating the camera is eliminated. The reader can thus give his full attention to the task of sensing and interpreting the letters and words.

The variable speed feature of the machines allows students of different degrees of reading proficiency to use the same lesson. This feature also allows different parts of the same lesson to be presented at different speeds since speed is controlled directly by the trainer. Each student is taken at "his own rate" through the lessons.

Another advantage of using these machines is that of forcing the student to read faster than he would if he were controlling the tracking. Students tend to track unevenly with much backing up to re-scan letters. With the fixed-rate devices, the student is not able to back up but develops a skill of piecing together the information through language patterns or context of material.

3.831 Optacon Cassette Trainer (See Figure 3.14)

The Optacon Cassette Trainer (OCT) was designed to replace the use of the Optacon camera by automatically scanning computer-programmed lesson files stored on tape cassettes. The stored information on a cassette is converted by the OCT into electrical signals that operate the tactile stimulator arrays of the attached Optacon. Up to four Optacons plus a Visual Display can be operated by the OCT. A library of taped lessons is available for use with the OCT and is listed in Section 1.4.

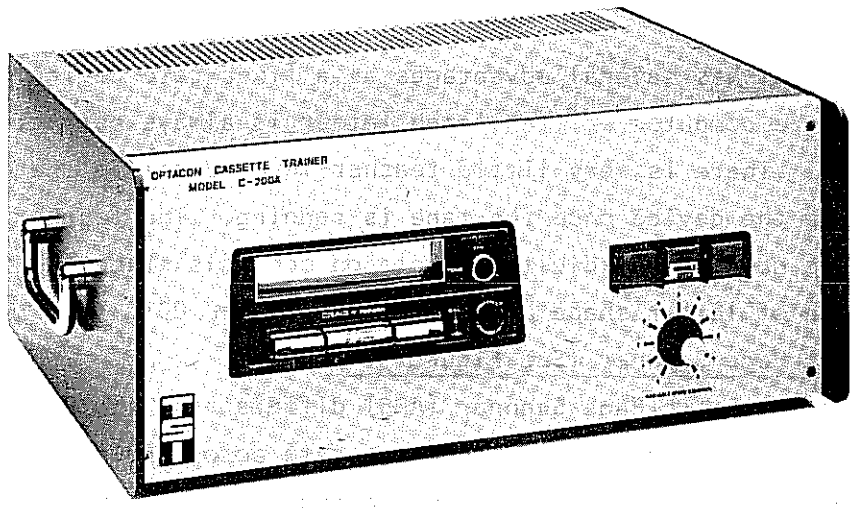


FIGURE 3.14
OPTACON CASSETTE TRAINER
(O.C.T.)

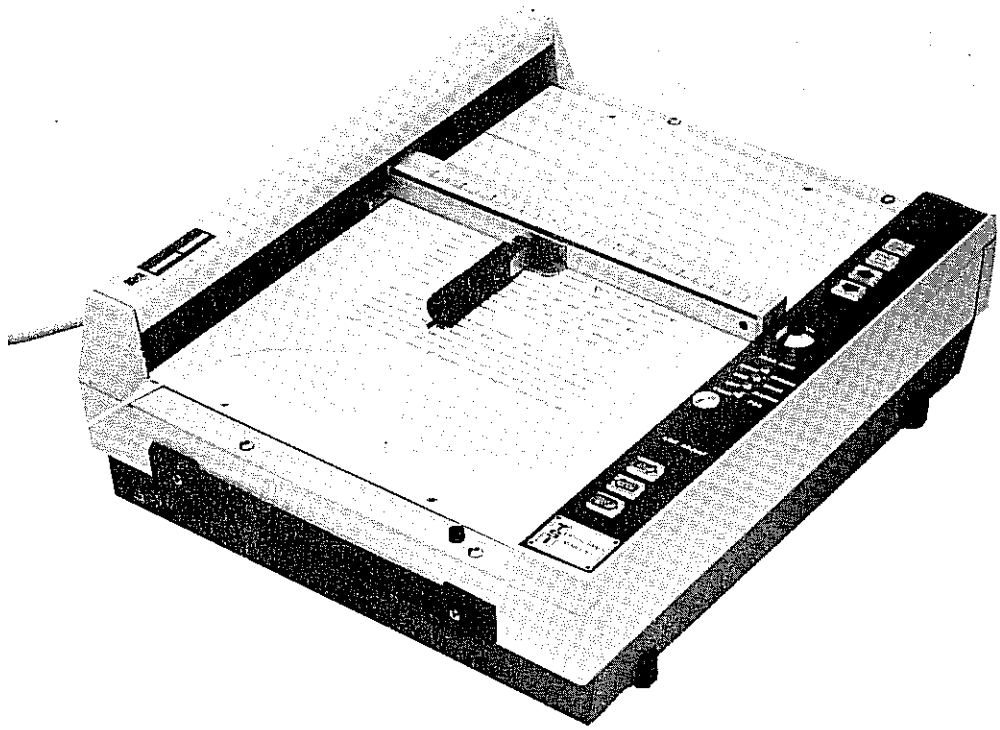


FIGURE 3.15
AUTOMATIC PAGE SCANNER
(A.P.S.)

The OCT has several advantages as a fixed-rate device. Since the letters are computer written, each letter is always perfect in size and position. There is very little teacher involvement in the mechanics of operating the device once the tape is running. The teacher and student also have no need to adjust the Optacon controls since the letter size and width of letter shape are controlled by the OCT.

3.832 Automatic Page Scanner (See Figure 3.15)

The Automatic Page Scanner (APS) differs from the OCT in that the Optacon camera is moved at a constant rate across printed matter. Any typed page can be used for the lesson thus avoiding the need for tapes. The ability to use typed material means that a variety of prints can be used, lessons can be easily developed in foreign languages, each typed page can be scanned with a wide speed range, and a great variety of materials can be used for lessons since the camera is functioning normally. With the Automatic Page Scanner, the student or teacher can set the controls for letter size and width of letter shape. The scanner allows flexibility in training as the teacher can easily repeat or skip single words or whole sections of material.

SECTION 4 TEACHING TECHNIQUES AND MATERIALS

4.1 GENERAL CONSIDERATIONS

Teaching Optacon reading involves 1) imparting certain basic information about the equipment and the techniques for using it, 2) aiding the student in developing the receptive language skills required for reading, and 3) assisting the student in the acquisition of the cognitive and motor skills needed for fluent Optacon reading.

To impart the basic information, it is essential that the teacher have a thorough knowledge of the equipment and how it is used. This manual is intended to be a source of this information which, together with direct experience, should provide the knowledge needed.

The degree to which a student will need to further develop his language skills will depend greatly upon his age and background. The youngest student may be learning language simultaneously with learning to use the Optacon. This will present a very different teaching situation from that of the adult who has already mastered reading skills in another form such as visual reading or braille. The instructional program will need to be correspondingly varied for each of these cases.

For the adult who has already developed certain reading skills, teaching reading with an Optacon may be largely teaching a skill. As with any skill, this will require enough drill and practice to make the skill automatic. Learning such a skill is a cumulative process, and success in the beginning stages is necessary to ensure mastery of the skill. The teacher's function is not to transmit large quantities of knowledge, such as in teaching history, for instance, but rather to act as a coach and guide. The teacher is successful when he can eliminate himself from the learning process.

4.11 Student Involvement

Especially for adults, involving the student in the learning process from the beginning so that the student always understands the reasons for the exercises, is very important in the process of freeing the student from the teacher. It is also important for the teacher to institute self-check guidelines throughout the skill learning so that the student becomes more and more independent as his skill increases. Reading with

an Optacon covers two general skill levels or stages. The function of the teacher differs slightly from level one to level two, but the goal of the teacher is always student success. The challenge to the teacher comes in individualizing the instruction,with each student proceeding at a pace which is fast enough to be interesting but slow enough to ensure eventual mastery.

4.12 Stage 1 - Emphasizing Feedback and Success

The first level in reading with the Optacon is largely physical in nature and involves motor coordination and coding touch sensations. The student must learn the relationship between the hand controlled camera motions and the sensations on his finger, and he must learn the relationship between the finger sensations and the letters of the alphabet. At this level the teacher is a drill coach. Making the connection over and over, for example, that a certain feeling is the letter "h", helps the student to make this connection automatically. Hearing someone tell him over and over whether the letters are centered on his finger enables the student to reach the point where the letters in the optimal reading position feel "normal." During this process, the teacher needs to give constant feedback to the student and needs to elicit the same from him. A one-student-to-one-teacher relationship is effective here. In order to give the student a feeling of progress during this repetitious and demanding stage, a careful choice of material is necessary. Generally, the material should present only one learning task at a time, making a change of pace available to even a poor student. The teacher should, at this time, be as encouraging as possible without setting up unreal expectations and without being falsely flattering. Explaining the purpose of each lesson and analyzing the student's habits with him can help avoid these two pitfalls.

A key function of the teacher in this stage of learning is to provide feedback to the student which will allow him to reinforce or correct his tactile impressions. Thus it is essential that the student read aloud and the teacher interact with him with appropriate information provided at the appropriate time.

Varying the timing of the feedback can be used as a teaching tool. For example, for a slow student, or one who is having letter recognition problems, the teacher may begin by telling the student the letter in advance, progressing to telling him simultaneously with the tactile presentation, then progressing to only telling him after he has had a chance to attempt to recognize the letter himself.

4.13 Stage 2 - Emphasizing Individualized Materials

Stage 2 concerns language skills and involves remembering and anticipating within words and within phrase and sentence contexts. Every student comes equipped with language skills; what the teacher must do is extend, redirect, and adjust them to the particular skills needed to read with the Optacon. Reading letter by letter and word by word means that the student must be able to remember long strings of letters or words before the word or sentence becomes clear. The student must learn to narrow down his guess of what the word is as each letter appears. With appropriate clues, the teacher can reinforce what language skills the student has and show him how to use them to his best advantage. Whereas in Stage 1 the student had to be reinforced immediately for each letter, in Stage 2 the student can be encouraged to guess, to use the clues within the context or within the word, even if he can't yet trust his sense of touch. Stage 2 is an appropriate time for the teacher to begin removing himself from the learning process. Individualizing the instruction is still important, but students at similar levels can work together on the OCT or APS using the master/slave mode. (If there is any question of undue competition, students should not work together. Although it is difficult to accomplish, a non-competitive atmosphere should be established. Students can use the Optacon successfully in their lives at varying levels of reading speed and ability. The student should get the feeling from the teacher that his own progress is the only valid measuring stick for his success).

During Stage 2 the teacher may spend less time reinforcing, but must spend more time selecting material. Once the upper and lower case

alphabets are reasonably well in hand, the teacher can use any material in which the student is interested, providing the print style or length doesn't make it too difficult. A student can begin to build speed and hone his guessing skills by reading interesting or familiar material. Once again, tasks should be presented one at a time, allowing the student to gain a feeling of accomplishment. A difficult print style can be presented with an easy writing style, a difficult length can be presented with an easy print style, a difficult format can be presented with an easy length. The student needs to become familiar with many varieties of printed material.

A teacher can feel successful: if he has taught the student how to work and control his equipment; if he has taught the student the basic characteristics of each letter; if he has taught the student how to concentrate on what he feels and how that feeling relates to letters; if he has taught the student how to guess from context; and if he has taught the student how to find his way around a page.

4.2 MANUAL SKILLS

4.21 Finger Position Considerations

The tactile screen is a little over one inch long and a half of an inch wide. This area is much larger than a braille cell and therefore different finger positioning is required to properly sense it. Faster reading speeds can be achieved if the student can develop adequate sensitivity over a correspondingly large area on his finger so that he doesn't need to move his finger on the tactile screen. Since the tactile screen is flat in the vertical direction, this requires him to use an area on the flat part of his finger, as shown below, which spans the distal phalange and a portion of the middle phalange (see Figure 4.1).

The tactile resolution and ability for pattern perception of the normal tactile sense is best at the tip of the finger and gets noticeably worse as you move down the finger. It may be possible to develop greater

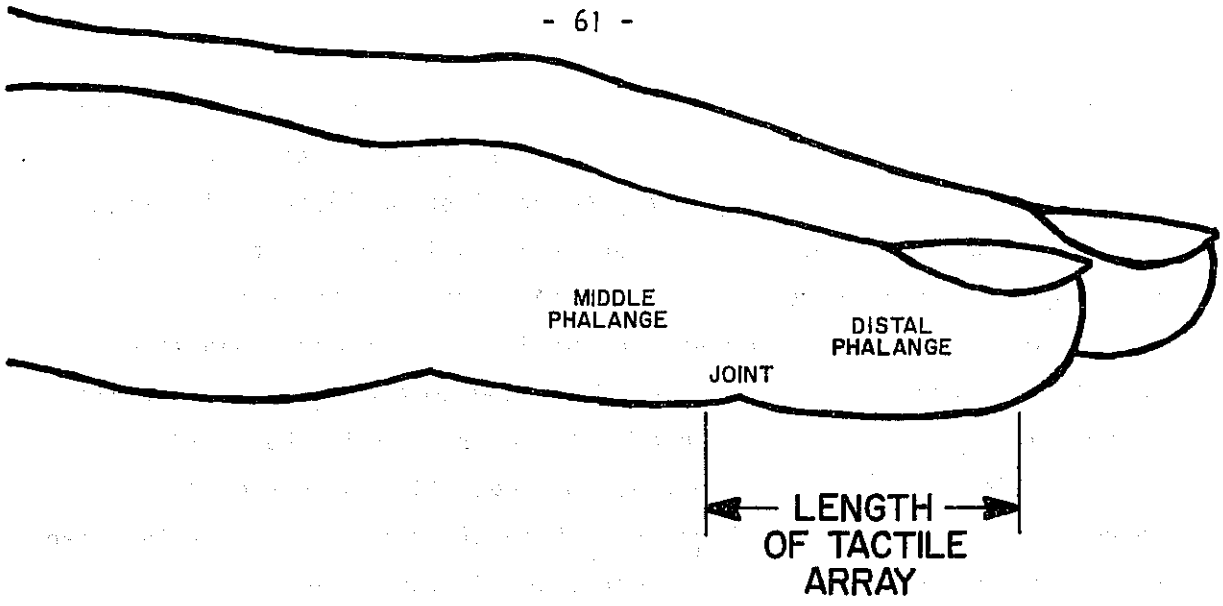


FIGURE 4.1
FINGER POSITION ON TACTILE ARRAY

tactile resolution further down the finger with Optacon practice. However, experiments with experienced Optacon readers indicate that good pattern recognition ability has only been developed over an area corresponding to the upper two-thirds of the array.[1*] The resolution on the area of the finger corresponding to the bottom one-third of the array is still too poor to tell much more than if something is there or not. The ability to make letter shape discriminations in the region around the joint is dramatically reduced over that of the fingertip. Therefore, this lower area is useful only in detecting descenders and in noticing that the letters are getting too low so that a tracking correction should be made in the camera movement.

This sensitivity characteristic of the finger means that the student should position his finger so that the top row of the array is as near the end of the finger as possible consistent with holding his finger flat so that he can feel every row. In reading, the letters should be kept as high on the array as possible to maximize the use of the most sensitive finger area.

The tactile sensations on the finger are produced by small pins which protrude through the holes in the finger plate in a vibratory fashion.

---

*References are located at the end of the section in which they occur.

These pins produce a stronger sensation if they actually make and break contact to the skin as they vibrate.[2] This effect is analogous with driving a nail with a hammer in the normal fashion instead of keeping the hammer and nail always in contact and pushing on the hammer. If the finger is held lightly on the tactile array, the pins are more likely to make and break contact and produce the stronger sensation. Heavy finger pressure on the array will tend to damp out the vibration of the pins, reducing sensation and, therefore, should be avoided.

Experiments also indicate that the index finger is superior for Optacon reading over other fingers.[1] Even after extensive reading practice with their middle finger, experienced Optacon readers have not been able to read at even one half their index finger reading rate. A right-handed person will usually be able to develop his best Optacon reading performance with the left index finger and vice versa for a left-handed person.[3]

Skill in letter recognition developed on one finger with the Optacon does not transfer immediately to another finger. It is therefore important to make the decision as to which finger to use to sense the tactile array before beginning training; otherwise a major portion of the training time prior to changing fingers may be lost. Table 4.1 explains the considerations involved in choosing which hand to use to manipulate the camera and which index finger to use to sense the tactile array. If the index finger on the non-dominant hand is missing or numb due to injury, another finger on that hand should be considered for sensing the tactile array.

4.22 Problems of Finger Positioning and Possible Solutions

Refer to the above sections as indicated, for explanations of the following problems:

4.221 Heavy Finger Pressure on Array

- Explain reasons for not pressing on array (Paragraph 4 of Section 4.21)
- Check periodically for signs of tension (thumb is good indicator if left hand is tensing)

TABLE 4.1

RELATION BETWEEN HANDEDNESS AND OPTACON READING

Dominant Hand *	Best Braille Finger	Recommendations
Right	Left Index	Use the right hand to manipulate the camera and the left index finger to sense the tactile array.
Right	Right Index	Assess whether it would be easier to develop the tactile capability in the left index finger or the fine movement coordination in the left hand. In most cases the former will be easier and therefore the right hand will manipulate the camera and the left index finger will sense the tactile array.
Left	Left Index	Assess whether it would be easier to develop the tactile capability in the right index finger or the fine movement coordination in the right hand. If it is decided that using the left hand to manipulate the camera and the right index finger to sense the tactile array would ultimately result in best performance, then a left-handed Optacon (see Section 3.81) should be considered. Many left-handed people prefer the standard right-handed Optacon because of the greater ease of adjusting the controls.
Left	Right Index	Use the left hand to manipulate the camera and the right index finger to sense the tactile array. A left-handed Optacon (see Section 3.81) can be considered, but many left-handed people prefer a right-handed Optacon.

*Hand with best coordination

. Keep reminding student to rest hand lightly on array

. Use OCT, APS, or Tracking Aid -- remove tracking task so student can give full attention to sensing problem.

4.222 Excessive Finger Movement on Array

. Explain that the technique used with Optacon is different than that used in reading braille (Paragraph 1 of Section 4.21)

. Encourage student to substitute camera movements for finger movements.

. Keep reminding student to keep finger motionless and flat.

Note: Some tracing of letters may be necessary at the beginning stages if the student is unfamiliar with letter shapes.

4.223 Finger In or Out Too Far

. Give reasons for optimal finger placement (Paragraph 2 and 3 of Section 4.21)

. Establish correct finger position by horizontal line check as follows: the index finger should be placed so that a vibrating row at the top of the array is felt as close to the end of the finger as possible. A horizontal line should then be scanned to check that the finger is flat and that the student knows approximately where the midpoint and the bottom vibrating rows will fall on his finger. This finger check should be done often in beginning learning stages until the student has learned to do it independently.

. Help the student to solve his own problems. If he is not feeling descenders, maybe his finger is too far out causing him to move the camera down, cutting off the descenders. Conversely, if he is not feeling ascenders, maybe his finger is too far in causing him to move the camera up, cutting off ascenders.

4.224 Finger Lifted from Array

. Explain the importance of feeling whole display area at once (Paragraph 1 of Section 4.21)

. Check periodically for lifting

. Encourage the student to keep finger flat on array.

Note: If he is getting the full image on the array, he may be moving the tip of his finger up and down (see Section 4.222).

4.225 Diffusion of Sensitivity in Early Stages (Letters fade out or become solid)

. Have student take a break to overcome fatigue

. Change intensity control setting

. Change magnification control setting

. Wash hands.

4.226 "Dead" Spots

. Determine cause. If caused by callouses, etc., remove source of irritation (i.e., remove callous by using skin softener). If caused by injury, assess extent of damage; either adjust finger position accordingly or change fingers.

4.23 Tracking Considerations

Optimally the letters should sit on an imaginary line about 2/3 of the way down from the top of the array. Therefore, the body of the lower case letters should occupy the center one-third of the array, leaving room for the ascenders in the upper one-third and the descenders in the lower one-third. The upper case letters will then almost fill the top 2/3 of the array. In good free-hand tracking, the camera will be moved steadily and accurately along the line of type, with the magnification setting such as to permit the letters to drift up or down several rows on the array without losing critical features at the top or bottom.

The method of scanning the camera along the line of type changes as the student progresses from slow to rapid reading. A beginning student, reading less than 20 wpm with good tracking skills, will be able to vary the speed of the camera to match his requirements for letter recognition.

However, as the student's reading speed increases above about 20 wpm, it will be less and less possible for him to tailor his camera movements to aid the letter recpgnition process, because the human reaction time of a quarter of a second becomes more and more significant with increasing reading speed. For example, if a student reading at 10 wpm wants to slow down to "see" a particular letter better, his reaction time delay will cause him to scan only a quarter of the letter before the slow-down is accomplished. However, if a student is reading at 40 wpm, the reaction time delay will cause a whole letter to be scanned before the camera is slowed down, so he will have missed the chance to "see" it better.

Therefore, a rapid Optacon reader must develop a method of reading in which he tracks the line of print at a more uniform speed than the slower reader. The mental process developed involves storing the perceived letter features in his immediate memory until enough pattern and contextual cues are accumulated for words to be recognized and meaning to be comprehended.

This difference in the steadiness of camera scanning as reading speed increases, can affect how well the student is able to read on a fixed-rate device (such as the OCT or APS) in comparison to camera reading as his skill develops. Since the fixed-rate device eliminates speed variability, the slower reader may actually do worse with the fixed-rate device, especially if he has good tracking skills. However, the fixed-rate device encourages him to develop the uniform speed reading method which is characteristic of faster readers. On the other hand, since controlling the camera consumes some mental energy, the faster reader, who has learned to read with relatively uniform tracking, may be able to read faster on a fixed-rate device than with the camera since he is relieved from the burden of tracking. At any reading rate, the difference between manual reading speed and fixed-rate reading speed is a good indicator of the student's tracking skill, with a small difference indicating good tracking skills.

An example of actual reading times and line changing times for a fast Optacon reader is shown in Figure 4.2. Note that the reading rate along a line is roughly equivalent to one word every second. Thus,

CL's LINE TIMES AND LINE-CHANGE TIMES (seconds) FOR A TYPED PAGE

Average line time = 57 wpm
Average overall time = 50 wpm

LINE CHANGE TIMES (SEC)		LINE READING TIMES (SEC)
1.8	Jean Parks. Jean was one of the most beautiful women who ever lived in Harlem.	14.7
3.6	She once sang with Sarah Vaughan in the Bluebonnets, a quartet that sang with Earl	18.6
2.2	Hines. For a long time, Jean and I had enjoyed a standing, friendly deal that we'd	19.3
2.3	go out and celebrate when either of us hit the numbers. Since my last hit, Jean had	16.7
1.4	treated me twice, and we laughed on the phone, glad that now I'd treat her to a night	17.4
1.8	out. We arranged to go to a 52nd street night club to hear Billie Holiday, who had been	16.6
	on the road and was just back in New York.	7.8
1.9	As I hung up, I spotted the two lean, tough-looking paisanos gazing in at	13.1
8.7	me cooped up in the booth. I didn't need any intuition. And I had no gun. A cigarette	18.1
1.4	case was the only thing in my pocket. I started easing my hand down into my pocket,	15.8
1.7	to try bluffing . . . and one of them snatched open the door. They were dark-olive,	18.2
	swarthy-featured Italians. I had my hand down into my pocket.	12.3
1.5	"Come on outside, we'll hold court," one said.	7.6
6.2	At that moment, a cop walked through the front door. The two thugs slipped	13.3
2.5	out. I never in my life have been so glad to see a cop.	7.2
3.4	I was still shaking when I got to the apartment of my friend, Sammy the Pimp.	12.5
2.3	He told me that not long before, West Indian Archie had been there looking for me.	13.5
1.6	Sometimes, recalling all of this, I don't know, to tell the truth, how I am alive	13.8
2.5	to tell it today. They say God takes care of fools and babies. I've so often thought that	18.2
2.3	Allah was watching over me. Through all of this time of my life, I really was dead --	14.7
2.6	mentally dead. I just didn't know that I was.	8.5
2.1	Anyway, to kill time, Sammy and I sniffed some of his cocaine, until the time	19.1
3.0	came to pick up Jean Parks, to go down and hear Lady Day. Sammy's having told me	15.2
	about West Indian Archie looking for me didn't mean a thing . . . not right then.	11.8

SKIPPED LINES

FIGURE 4.2
READING TIMES

the time across a full line of print is roughly 15 seconds. The time it takes to change lines can average about 2 seconds with a variability from about 1.5 to 4 seconds, if a line is not inadvertently skipped. If these goals are achieved, i.e., reading one word per second and line changes in 2 seconds, then the overall reading rate including line change times will only be 10 to 20% less than the line reading rate.

4.24 Goals of Tracking Instruction

The goals of training in tracking are for the student:

- To move the camera smoothly across the line of print while keeping the letters accurately positioned on the array.
- To understand the relationship between camera movement and image movement so that corrective movements are "automatic"
- To "grip" the camera in a way that is comfortable and that utilizes the camera to the best advantage.
- To acquire the spatial concepts needed for orientation on a page and for attacking various formats.
- To make line changes efficiently.

4.25 Instructional Techniques for Tracking

4.251 Use of Tracking Aid (See Section 3.33 for Description of Aids Available)

The purpose of the Tracking Aid is to enable the student to give full attention to development of recognition skills in the initial stages of learning and to demonstrate correct tracking movements. The Tracking Aid also allows the teacher to make corrective camera movements by exerting forces on parts of the aid without interfering with the student's use of the camera.

The decision of when the student should give up the aid and begin free-hand tracking can be made jointly between the teacher and the student. The teacher should be alert for indications that the student is ready to try free-hand tracking. This is normally after between 10 and 20 hours of training. Factors to be considered in deciding to initiate free-hand tracking are:

1. Motor coordination -- the student should be making smooth, controlled movements.

2. Understanding of relationship between camera movement and image movement — the student should be making proper movements to correct tracking errors.
3. Manner -- the student should be relaxed, not tense or jerky.
4. Letter recognition -- the student should have a high accuracy.

It should be emphasized that the decision may be made to return to the Tracking Aid if problems arise.

4.252 Sitting Position and Camera Grip

The student will need to sit in a comfortable position facing the table with the Optacon far enough back so that the arm used to sense the tactile array can be supported by the table. It is usually best if the arm used to manipulate the camera does not rest on the table so that the tendency to move the camera in an arc instead of a straight line is reduced. The camera can be held in any grip that permits easy camera manipulation and the ability to adjust the magnification control. Several grips that have been successfully used are shown in Figure 4.3.

The student should be careful not to inadvertently move the magnification control on top of the camera. Care should also be taken to keep the rollers flat against the paper, not allowing the camera to tip forward, which would make the rollers inoperative and the image out of focus. The camera is best held in a position parallel to the vertical lines in the letters and perpendicular to the imaginary line on which the printing sits.

It is usually best for the student to tend to move his whole arm along the line of print, being careful not to pivot at the wrist or elbow., which will cause him to track off the line or to skew. (Skewing means that the camera as normally held is not perpendicular to the line of print and thus the letters appear slanted. See Section 4.26). A downward pressure on the camera will increase the tendency of the rollers to move the camera in a horizontal direction.

The printed page can either be "square" with the edge of the table (i.e., the bottom edge of the paper parallel with the table edge) or rotated counterclockwise from this position (for a right-handed student), whichever is the most comfortable and causes the least problem.

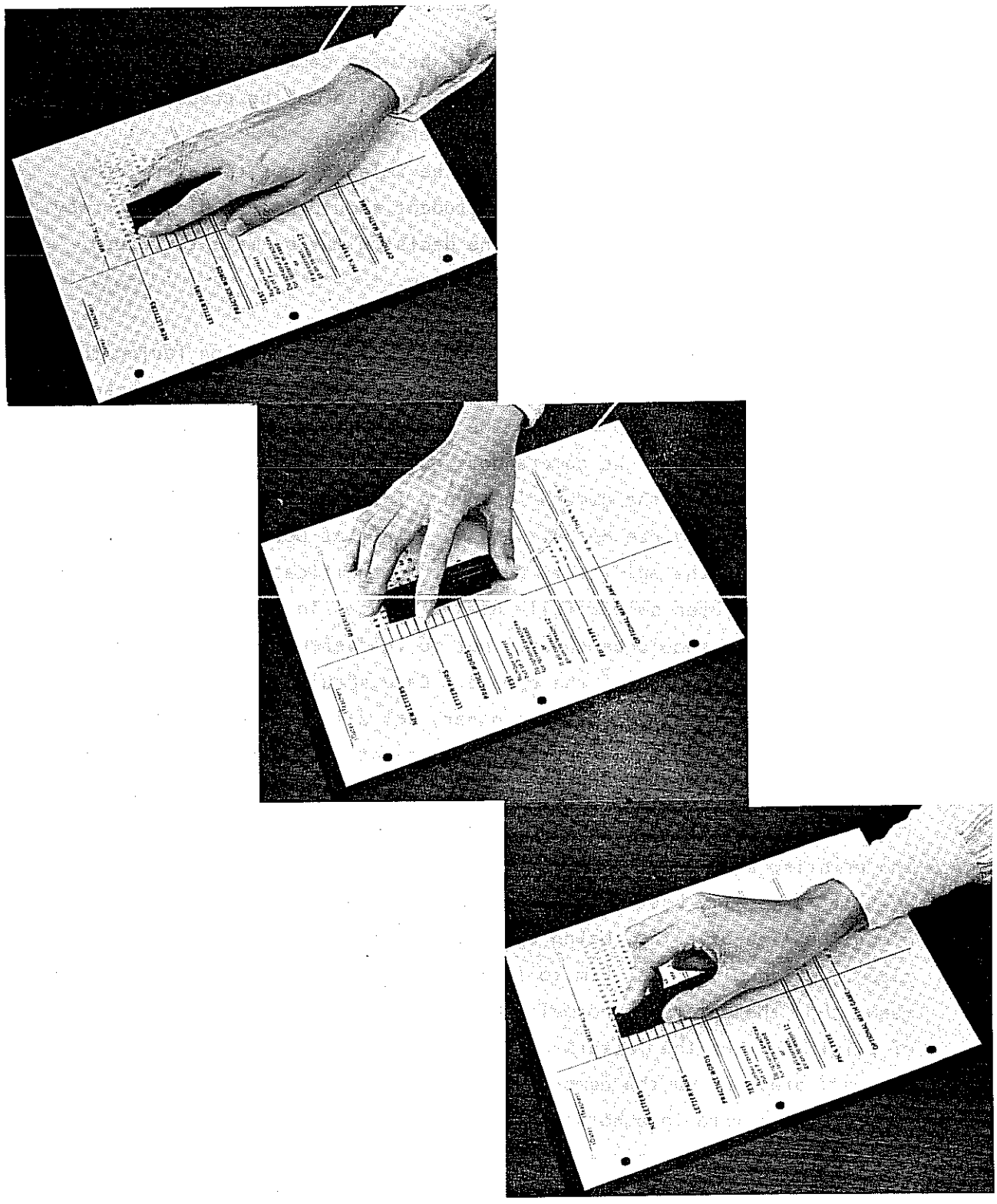


FIGURE 4.3
CAMERA GRIPS

4.253 Spatial Relations

The student should develop an understanding of the following relationships between camera movement and image movement:

Horizontal -- when the camera moves across the print from left to right, the image is felt moving from right to left across the finger.

Vertical -- when the camera is moved up across the line of print, the letters move down on the finger. Conversely, when the camera is moved down across the line of print, the letters move up on the finger.

Skew -- if the camera is rotated counterclockwise the image is slanted clockwise on the finger, and if the camera is rotated clockwise, the image is slanted counterclockwise on the finger.

4.254 Building Rapid Smooth Tracking

If good tracking habits are emphasized from the beginning, even when the student is using the Tracking Aid, then the progression to rapid smooth tracking will be relatively easy. The camera should always be kept moving, because a moving image appears clearer and the student will not be confused by trying to recognize a part of a letter as a whole. Initially, the student may be encouraged to slow down in the spaces between words because the lead-in edge of first letters usually contains critical features and the first letter usually contains most of the information in the word. When reading words, it often helps to make a slow smooth sweep over the entire word, making a second pass if necessary. Otherwise, the student is apt to get confused in separating the letters and will be unable to get a perspective of the relation of the letters to each other. As skill is developed, the student should tend to move smoothly ahead and the meaning of a missed word will often become clear later.

4.255 Making Line Changes

There are several methods for changing lines (described in the Teacher's Edition of the Stage 1 Manual, paragraph 13.1-T). None is foolproof and a line will occasionally be skipped. Which method is best often depends on the format of the text being read, so it is useful

for the student to learn several methods. One procedure is to retrace the line just read, stop when the camera reaches the left margin, go back over a few words (to avoid skipping a line in case the next line was indented), then drop down to the next line and find the beginning of that line. This method may fail if the new line is very short. A somewhat more efficient method is to gradually move the camera downward as you return to the left margin. Make a diagonal descent, pick up the line below, trace it to the left margin, and then read the line. The following diagram shows this method:

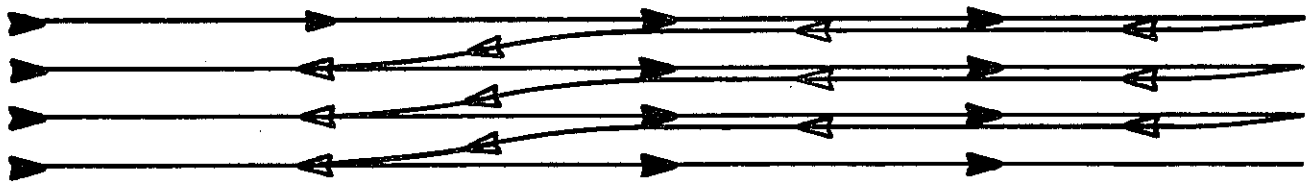


FIGURE 4.4
IDEALIZED TRACKING
AND LINE CHANGE PATHS

4.256 Orientation to a Page

Before reading, a rapid scan of the first two lines of a page will give the student a feel for the length of the lines and the line spacing so that he can anticipate line endings and how far below the next line is. See the Stage 2 manual for format considerations.

4.26 Problems of Tracking and Possible Solutions

The student may have one or more of the following problems. As mentioned earlier, one solution is to return to the Tracking Aid, which is suggested when applicable.

4.261 Pivoting

- Correct the sitting position -- see Section 4.252
- Encourage moving whole arm -- discourage wrist movement
- Make sure problem is not caused by the student resting his arm on the table.

4.262 Skewing

- Make sure camera is held parallel to the vertical letters. Suggest that the student look for a lower case "l" to determine if the vertical letters are straight up and down. If the "l" is slanted clockwise, move camera clockwise to correct; if the "l" is slanted counterclockwise, move camera counterclockwise to correct. Encourage student to determine needed corrections. Practice tracking across a horizontal line with lower case "l's" as follows:

- Check to see that student is not pivoting from wrist or elbow.
- Instruct student to exert greater downward force on camera rollers
- Practice with Tracking Aid.

4.263 Tense, Jerky Movements

- Suggest that student relax or take a break
- Correct the sitting position; avoid pivoting
- Practice tracking exercises with minimal reading (Independent Practice, pages 3, 16, 25, 41, 43)
- Try easy reading material (Independent Practice and Stage 2 stories -- ample spacing between letters and lines)
- Use Tracking Aid -- passive tracking with teacher guiding student steadily along line of print.

4.264 Sitting on Letters (i.e., Keeping Letters Stationary on Array)

- Explain reasons for desirability of moving image (see Section 4.254)
- Explain need for developing uniform speed (see Section 4.23 and 4.51)
- Discourage finger movement (see Section 4.222)
- Practice letter recognition (see Section 4.3)
- Use OCT or APS.

4.265 Backtracking

- Explain need for developing uniform speed (see Section 4.23 and 4.51)
- Discourage desire to see letter detail
- Encourage the student to scan the whole unit of language he is working on (e.g. letter, word, phrase, or sentence), using all possible cues to make a guess.
- Allow the student to make a fixed number of passes over the language unit
- Use OCT or APS.

4.266 Cutting Off Tops or Bottoms of Letters

- Check that the magnification is not too great
- Check finger position (see Section 4.21)
- Make sure the student knows how to make corrective movements. If image is too high, move camera up to catch "tops" and if image is too low, move camera down to catch "bottoms."
- Check for pivoting which may cause student to track off the line
- Use OCT or APS for reinforcing optimal reading position of letters
- Do tracking exercises to practice centering (Independent Practice, pages 3, 16, 25, 41)
- Practice with Tracking Aid.

4.267 Excessive Up and Down Camera Movements (Preferable to Excessive Finger Movements)

- Do finger position check (see Section 4.21) to make sure finger is in the right position
- Make sure the student knows how to make corrective camera movements

. Suggest that student try to expand sensing area on finger
. Practice centering letters so that ascenders and descenders aren't lost (Stage 1 and Independent Practice stories)
. Encourage student to center the first letter and then force himself to move horizontally across the word.
. Use OCT or APS
. Practice with Tracking Aid.

4.3 GRAPHEME RECOGNITION

4.31 Grapheme Recognition Considerations

A basic assumption in most theories of the mental processes involved in grapheme recognition is that an "image" of each letter shape, in the set of letter shapes to be recognized, exists in the reader's memory. Associated with each of these mental "pictures" is stored a "name" or "label." For example, a mental image of the shape of the letter "A" is recallable when the name "A" is mentioned.

In conjunction with each of these mental images of the letter shapes, the good reader also knows the particular features (i.e., critical features) of the pattern which are important in distinguishing it from the other letter shapes in the set. For example, the opening of the right side of a "C" is the critical feature distinguishing it from an "O".

The grapheme recognition process then consists of the following steps:

1. Acquiring clues and features of an unknown letter shape from the display (i.e., the tactile array in the case of the Optacon).
2. Comparing these recognized features and clues with the stored mental images of the likely letter shapes.
3. Associating the unknown shape with its label or name when enough clues and features are accumulated and compared to the stored images that a match is found.

This process is clearly easier when the number of patterns in the set is small, since fewer comparisons will need to be made, on the average, and fewer and less detailed features will need to be detected. Thus,

recognizing a letter out of the set of five letters O, C, S, I, E, as initially presented in the Stage I Manual, is much easier than recognizing one of these same five letters when the possibilities include the entire alphabet.

4.32 Goals of Grapheme Recognition Instruction

The goals of grapheme recognition training are for the student:

- To associate touch sensations with grapheme shapes and their corresponding names
- To rapidly identify letters, numbers, and symbols

Manuals R17450-A and R17452-A are intended to provide instructional material during this stage of training.

4.33 Instructional Techniques for Grapheme Recognition

The student may need to be presented with clear, accurate detailed representations of the letters to establish appropriate mental images of all the letter shapes. Plastic tiles or thermoform patterns are especially useful for those students who are unfamiliar with letter shapes and provide review for students who presumably already know the letter shapes. In addition to tracing the tiles, the student studying these tiles should simulate as much as possible the Optacon reading process. For example, the student can move his index finger from left to right across the raised image. Contrary to many new teachers' thinking, formerly sighted students may not necessarily be at an advantage in learning Optacon reading. Students often have a faulty memory of letter details (direction of diagonals, descenders, size proportions, etc.). Some may confuse lower case print with handwritten letters. Others may have difficulty transferring their memory of the total letter as perceived visually to a tactile image moving from right to left across the array.

To facilitate the student's learning of which clues and features are important to search for in distinguishing letter shapes, the teacher can verbally describe each letter shape and point out critical features of

each letter. For example, the lower case "t" has a hook at the bottom right which makes it unique; this hook also helps to make it distinguishable from the lower case "f" which has the hook at the top right. Included in this manual is a sample catalog of suggested descriptions (see Section 4.332) which assume an understanding of the terms ascenders, descenders, verticals, horizontals, diagonal lines, circles, gaps, humps, hooks, and closed or open portions. Consistent and meaningful terminology is important. If the student chooses different terms to describe a letter than the teacher has chosen and it is apparent that he understands the relevant information, it might be expeditious for the teacher to employ the terms the student uses.

The student should learn to recognize features and acquire clues as the letter moves from right to left across his finger. He can be encouraged to feel the left edge of the letter first, then the middle, then the right edge. Because the letters are presented in temporal sequence, it is more appropriate to the task to describe the letter features from left to right (i.e., capital letter "E" comes in with a long vertical, followed by three horizontals and is open on the right side) and to get the student thinking in terms of what comes on first, what next, and what goes out. In general, the more features that appear simultaneously -- one above another -- the more difficult the letter is to recognize.

The student should also be made aware of the relationship of the letters to the bottom line (i.e., the letters sit on an imaginary line approximately two-thirds down the array), and that some letters (g, j, p, q, and y) have descenders, or portions that fall below this line.

4.331 Initial Instruction

It is suggested that training begin with the upper case letters. (See Stage 1 Manual, Design of Lessons, Page 1 - 2, for the basis of the order of letter presentation as well as the basis for the initial typestyle presented). The threshold and magnification adjustments should be at their optimum for ease of letter recognition (see Section 3.4). When

using the Stage I manual, vertical lines should fill one column with no gaps (but not two columns), and horizontals should fill two rows. The adjustments can be checked with an"E" or an "L". It is also advisable that the student initially start out with the Intensity Control set at two o'clock and then increase it as needed. This procedure has the advantage of starting with a low intensity setting so as not to startle the subject yet sufficient for most people to feel all the stimulators (see Section 3.42).

If at all possible the student should be given the opportunity to study the plastic tiles mentioned above before the class begins so that mental images of the letters will be somewhat established. In a training situation when looking at a new letter with the Optacon, the student should be urged to track into the letter slowly and smoothly and to track all the way across it. If the image is kept moving, it will appear clearer and also there will not be the danger of attempting to recognize a part of a letter as a whole.

The student may be encouraged to describe what he feels (in terms of lines, circles, etc. and their positions) and discouraged from naming the letter until the teacher is convinced that what he is feeling is an indeed accurate representation of the letter. If he is missing some portion of the information, the teacher can ask him, "What else do you feel?" For example, if the letter is an "R", and the student describes it as a vertical line on the left followed by a circle, the teacher may ask him if he can feel that it also has a diagonal line extending from the bottom of the circle (or the middle of the vertical line) to the lower right. If he is not made aware of this feature, he may later confuse the "R" with a "B" of a "P". Once the student is aware of all the pertinent information, the teacher can tell him the name of the letter and have him go over it again. If there is no problem, the next letter can then be introduced. THE STUDENT SHOULD NOT BE SUBJECTED TO UNNECESSARY DRILL.

In an intensive full day training program, the teacher may introduce the student to all the letters in three to four days. (With

a more leisurely training schedule, the teacher would naturally lengthen this period of letter introduction). At some point during this process, and especially with lower case letters, many students will begin to experience letter confusions. The first step to correct this is to try to determine the cause and extent of such confusions. To do so, the teacher should keep a careful log of which letters a student cannot identify, which confusions he makes, and whether he has trouble with the letters presented singly, or in context, or both.

Problems with letter confusions will not clear up immediately. The students' problems will only disappear completely with more and more practice in reading. If the student seems to make no progress after remediation, the teacher should not belabor the issue but should go on to something less difficult or more interesting, such as introducing new letters. If the problem continues to be severe; that is, the student more often than not cannot recognize the letters in context, the teacher can always come back to it in the next few days.

4.332 Catalog of Critical Features

A - Diagonal from lower left to upper right, forming a point with a reverse diagonal; a horizontal connects the diagonals at mid-points

B - left vertical with two curved sideways humps connecting to the vertical at the top, middle, and bottom (may be seen as 3 horizontals closed on right by curved lines). The bottom sideways hump is sometimes larger.

C - large circle with opening on the right

D - left vertical with curved sideways hump to the right, connecting at top and bottom

E - left vertical with 3 small horizontals attached at the right top, center, and bottom (center horizontal is sometimes slightly shorter)

F - left vertical with short horizontals to the right from the top and middle of the vertical

G - large circle with opening on the right and a small internal horizontal attached to the lower right opening

H - left vertical with small center horizontal connecting a right vertical

I - vertical line (sometimes has small horizontal at top and bottom); same as small "L" in many prints

J - bottom left hook connecting with right vertical (sometimes has a small horizontal "hat" on top)

K - left vertical line with two diagonals fanning to the upper right and lower right from its mid-point

L - left vertical with small horizontal attached at the bottom right

M - left vertical; diagonal from upper left to bottom right; reverse diagonal; right vertical (widest letter -- usually won't go on screen all at once). Note: diagonals are sometimes only half the depth of the verticals

N - left vertical; diagonal from upper left to lower right; right vertical

O - large closed circle

P - left vertical with a curved sideways hump to the right connecting the top and middle

Q - large circle with small diagonal line intersecting at the lower right

R - left vertical with curved sideways hump to the right connecting the top and middle, and a diagonal line extending from the hump to the lower right

S - large upper left sideways hump connected to lower right sideways hump. Bottom hump can be larger than top

T - top horizontal line with a vertical extending down from its midpoint

U - left vertical with a curved line from the bottom connecting a right vertical

V - diagonal from upper left to lower right, forming a point with a reverse diagonal

W - two V's connected

X - two diagonals intersecting at midpoint

Y - small V in upper half of the array with a vertical extending down from the point

Z - horizontals top and bottom connected by a diagonal from lower left to upper right

d - small circle with short vertical on right side

a - small circle with hook above, attached vertical on the right

b - left ascender attached to small circle

c - circle with opening on right

d - circle with right ascender attached

e - circle with horizontal line through middle and opening in lower right

f - tall vertical with right hook at the top and crossbar in the middle

g - small circle with hook below, attached on the right

g - two circles, one above the other, connected on the left with a line (can be described as "eyeglasses turned on their side")

h - left vertical ascender attached to one hump

i - short vertical with a dot above it

j - vertical descender with bottom hook to the left; dot over it

k - left vertical ascender with 2 short diagonals fanning outward in lower portion

l - tall vertical

m - short left vertical with two humps attached to the right

n - short left vertical with one hump attached

o - small circle

p - left vertical descender attached to small circle

q - small circle attached to a right descender (sometimes has small upward right hook at bottom of descender)

r - short vertical with top hook to right

s - upper left hump connected to lower right hump. Can be seen as three horizontals attached by curved lines upper left and bottom right.

t - tall vertical with bottom right hook and small crossbar in the middle

u - short left vertical that hooks at the bottom to the right into a short right vertical

v - short diagonal from upper left to lower right; forming a bottom point with a reverse diagonal

w - two v's attached side by side

x - two short intersecting diagonals

y - short diagonal from upper left to lower right, connecting to a reverse descending diagonal

z - two parallel horizontals attached by a diagonal from lower left to upper right

4.34 Problems of Grapheme Recognition and Possible Solutions

4.341 Periods of Poor Letter Recognition Ability

. Suggest that the student rest, or take a break by working on something else such as tracking

. Review critical features of the letters verbally

. Review letter tiles, having student press over shapes from left to right, and trace shapes

. Using your finger, draw letter on student's hand; then have him draw it on your hand

. Use OCT or APS to practice quick recognition

. Review appropriate Stage 1 manual material. If the student is unable to identify a great many letters (50% or more), start the review with those easiest to identify and progress to the more difficult. On the other hand, if he misses some regularly and others only occasionally, work on those with which he has the most trouble.

. Vary timing of feedback (see Section 4.12).

4.342 Letters are Commonly Confused

The groups of lower case letters most often confused by Optacon readers are, in order of frequency: (a-e-s), (t-f-r), (c-o), (m-n-w), (l-i-j), (n-h-b), (g-s), (v-y), (k-x), (z-s), (w-v). Occasional reversals are (d-b), (p-q), (n-u), and (b-p). Common upper case confusions include (M-N-W), (E-F-P), (B-R), (O-C-G), and (D-O).

. Check for proper tracking, especially that information is not missed by tracking too low or too high (see Section 4.23)

. Check for proper finger position (see Section 4.21)

. Encourage concentration on perceiving critical features.

. Discuss importance of viewing entire letter before making decision

. Use OCT confusion tapes or corresponding APS materials.

4.343 Concentrating on Only Part of Letter, Neglecting Rest

. Encourage student to concentrate on neglected part

. Ask questions about neglected part

. Use OCT confusion tapes and corresponding APS materials

. Check finger position (see Section 4.21)

. Discuss importance of viewing entire letter before making decision.

4.4 WORD RECOGNITION

4.41 Word Recognition Considerations

Research has indicated that seventy-five per cent of the English language is redundant.[4] This conclusion implies that the reader can ascertain the meaning of a word or sentence by focusing on the important parts as well as identifiable patterns. This was demonstrated in a study of subjects' abilities to correctly guess letters in a mystery sentence.[5] A tally of the number of guesses needed to identify the next letter space before the student was allowed to move to the subsequent letter showed that the subjects generally needed fewer guesses per letter as they progressed into the sentence. In addition, out of 102 symbols, the subjects correctly guessed the first time in 79 cases by using context and the logic of language.

Several studies have provided knowledge of word statistics, the awareness of which will improve a student's predictive capabilities. These studies [4,5,6,7] indicate that in continuous text the most commonly used initial letters are t, a, and o; the most commonly used bigrams are th, on, he, er, on, and in; the most commonly used terminal letters are e, s, d, t, and n. In proper nouns the common initial letters are B, S, M, H, and C. In subject words and proper nouns, the vowels a, e, i, o, and u appear in the second letter position 60 - 70% of the time, and er is the most commonly used bigram.

4.411 Learning Sequence

The learning sequence in word and text decoding proceeds from the student seeing single letters, to seeing letter-space-letter combinations, to seeing chunks of letters, and then to thinking in phrases and whole concepts. The Stage 1 manual is designed to integrate all of these on a simple level so that the student can quickly build on known material. For example, as soon as the student learns the letters c, s, i, and e, he is introduced to the widely spaced letters reading i s, i c e. Two lessons later he is given words with widely spaced letters, followed by those words printed in regular spacing, and then presented in short

phrases and sentences. As learning proceeds, the student should develop a tactile vocabulary of quickly recognized words and phrases. This is realized through exposure and practice. Once the student has learned the upper and lower case alphabet he can begin to read books with easy print, vocabulary, and format, and then progress to difficult print, vocabulary, and format. See Section 6 as well as the Stage 2 manual Section 1, Independent Practice manual, and the OCT tapes for source material.

4.42 Goal of Word Recognition Instruction

The goal in word recognition is for the student to associate the tactile letter combinations received with words used in the English language. By helping the student to take advantage of word characteristics and to use word attack skills, the teacher will make attaining this goal more certain.

4.43 Instructional Techniques for Word Recognition

There are several techniques to be verbally stressed to the Optacon trainee. Recognizing the first letter of a word is important because 75% of the information about the word is in that first letter.[7] The student should develop the ability to quickly recognize bigrams -- especially those most commonly used. Clues provided by spelling patterns enable the student to decode a word more quickly by anticipating suffixes, prefixes, bigrams, and compound words. By using his knowledge of vocabulary a student can fill in "hazy" letters by scanning the entire word, thinking about possibilities and then rescanning the entire word to check. (This rescanning should not be encouraged; in fact, it should be discouraged during text reading unless absolutely necessary). Initially, the student should verbalize each letter; however, as his decoding ability improves and the words become longer, he should be told to think about words in chunks or syllables when reading. This eliminates the slow process of spelling out words letter by letter and also may facilitate knowing what the word is without reading it in its entirety. For example, if he sounds out "con," then "trap," he will probably know that "tion" is coming and be able to move on rapidly. Since Optacon reading speed has not yet exceeded oral reading speed, this technique will not limit the reader's achievement.

4.44 Problems of Word Recognition and Possible Solutions

For some students, words of six letters or less are easily mastered. This is due, in part, to the fact that shorter words are more familiar and the small number of letters does not tax the immediate memory capacity. For some students, however, decoding is difficult because of poor letter recognition, poor spelling ability, or inability to remember letter sequences. When a student is having difficulty, an attempt should be made to determine the cause or causes, isolate one of them at a time, and work on increasing proficiency in that area. Define the problem for the student and describe the solution, explaining what you want him to do. The following are some common problems and their possible solutions.

4.441 Poor Letter Recognition

. Review critical features, etc. (see Section 4.332)

4.442 Difficulty with Normally Spaced Letters

. Practice smooth, steady tracking (see Section 4.254)

. Have the student count number of letters in a word on the first pass

. Have the student verbalize what is coming in and going out (see Section 4.33)

. Use Stage 1 manual lessons (4, 6, 13, 15, 17) for "seeing" words with letters widely spaced and then normally spaced.

. Practice letter pairs in Stage 1 manual (11.2, 12.2, 13.4, 17.5, 17.6, 17.7, 22.2, and 22.3 as well as Independent Practice manual pp 16 and 26). The short word tape or corresponding APS material would also be appropriate. Gradually build up the number of letter combinations that can be decoded.

. After using Stage 1 manual, bridge the gap to closer spacing and more difficult print styles by using Independent Practice manual and Stage 2, Section 1.

4.443 Failure to Get the First Letter of Word

. Review letter recognition (Section 4.3)

. Point out importance of recognizing first letter

. Encourage the student not to speed up in space between words. (See Section 4.26 for tracking help).

. Practice reading shorter words -- words of six letters or less -- which will increase student's liklihood of getting the first letter (OCT tapes or APS materials: Common Words, Short Words, Limited Alphabet Speed Building; Manuals: Stage 1 and Independent Practice appropriate pages).

. When reading in context have student concentrate on getting the first letter of word and say it aloud.

4.444 Fixation on Reading Letter by Letter (Not Perceiving Letter Groups in Context of Words or Syllables)

. Encourage student to scan through whole word or syllable before saying what it is

. Emphasize smooth, steady tracking (see Section 4.254)

. Practice short, simple sentences (OCT Tapes or APS materials: Limited Alphabet Speed Building, Four Short Stories; Manual: Stories in Independent Practice manual)

. For longer words, encourage the student to pronounce syllables as he is reading along (OCT Tapes or APS materials: Compound Word and Suffixes; Manual: Stage 1, Lesson 22)

. Use the common word/short word tapes or corresponding APS materials, for building up rapid, automatic recognition of familiar words

. Reread stories rather than going on to new material

. Read familiar material (see Section 1, Stage 2) or material of high interest to the student

. When reading spaced stories on tape or APS (Limited Alphabet Speed Building, Paul Bunyon, etc.), take advantage of space to give recognition clues or tell the student the word in advance.

4.445 Weaknesses In Sounding Out Words

1. Review vowel and consonant sounds in Stage 1 manual (e.g., Section 4.2).

2. Look at OCT tape or use APS, "Common Words -- Short Words."

4.5 INITIAL TEXT READING

4.51 Some Reading Considerations

Optacon reading and visual reading are basically different skills requiring different muscular actions and cognitive processes, as well as different senses. Understanding both reading processes and how they differ helps to explain the goal of the Optacon skill development process, how various training techniques help to achieve this goal, and the ultimate limitations.

First consider the objective of reading: to obtain the meaning and information intended by the author. Note that this objective does not require every letter to be recognized or every word to be identified. In fact, a good reader uses his knowledge of the redundancy of language and of the subject matter to aid him in obtaining the author's meaning, while actually seeing and identifying as few letters and words as possible. One reason oral reading is slower than silent reading is that in oral reading every word must be recognized while in silent reading this is not necessary.

The eyes, when they scan the lines of a printed page, move in a series of extremely rapid jerks (called Saccades). Between the saccades are periods of comparative rest (fixation pauses) during which the eyes take in information. This visual scanning provides the input to the cognitive process which converts the information stored in the spatial patterns on a printed page into a steady stream of thoughts.

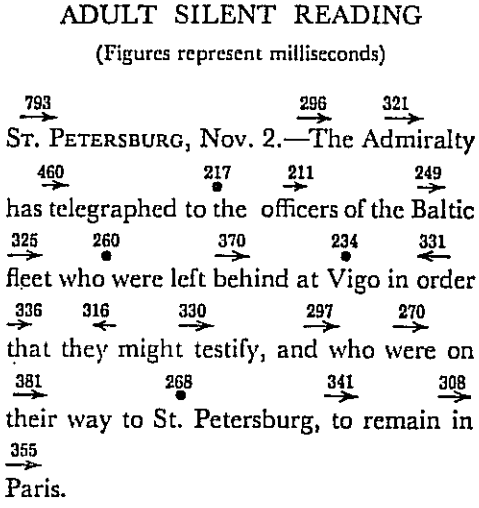


FIGURE 4.5
VISUAL FIXATION POINTS AND SACCADIC JUMPS WHILE READING (FROM REFERENCE 4)

Figure 4.5 shows an example of these fixation pauses while reading a passage of text. In visual reading the number of fixation points along a line depends on the familiarity of the text. Common phrases require fewer fixation pauses, or are leaped over by saccadic jumps. Interestingly, the number and duration of the fixation pauses, averaged per line, decreases smoothly with the age of the reader up to the age of ten years. The number of regressions, or backward saccades, owing to failure to comprehend the text, continues to decrease with age and experience.

The speed of visual reading is in part due to the way the eyes and brain work closely together as a team. The saccadic jumps and fixation pauses presumably group the printed letters and words into "chunks" of variable length but of approximately equal information content to the reader. In this way a fairly constant stream of information transmission is maintained, even though the individual letters and words vary greatly in the information they carry. A possible reason[8] for written language to have evolved so that equal length letter strings do not carry equal information may be that the wide field of view capacity of the visual sense is well suited to grouping letters into units of equal information content. This characteristic of written language permits word length to be another dimension for information coding.

While the tactile sense also has a spatial aspect, the equivalent "field of view" is much more limited than vision. Therefore, it is difficult, if not impossible, to build a display in which the user can tactually "see" a sizeable block of informational patterns at once. Experiments indicate that the limit is approximately one letterspace, while with vision the limit may be 7 to 10 letterspaces or more.[9] The design of the Optacon is based on this finding, so only an area equivalent to about one letterspace is displayed at a time. Since a letterspace is not a sizeable enough chunk to work on for grouping letters into equal information chunks, there is no advantage for tactile reading to consist of saccadic jumps and fixation pauses. Instead the brain and tactile sense have to work together in a different way. Rapid Optacon

readers tend to scan letters at a relatively constant rate, with practically no "fixation" pauses. The tactile sense evidently takes in information while the image is moving. Thus, the Optacon reader inputs letters at a fairly constant rate (instead of intaking information at a relatively constant rate as is presumably done in vision). These letters are accumulated in immediate memory until they can be organized into progressively larger language units, such as syllables, words, and phrases, leading to the attainment of meaning. It is interesting to note that, compared to tactile reading speeds (approximately 80 words per minute), visual reading is seven to ten times faster, roughly the same ratio as between the "fields of view" of the two senses.

This analysis suggests that one reason braille reading tends to be more rapid than Optacon reading is that the contractions used in braille help to equalize the information content of the symbols, thereby enabling the tactile sense to take in information at a more constant rate.

4.52 Goal of Text Reading Instruction

The goal of text reading and speed building training is for the student to obtain the essential meaning of sentences in a minimum time.

4.53 Instructional Techniques for Text Reading

Because he cannot use the rapid, all-encompassing line sweeps of the sighted reader when approaching textual material, the Optacon trainee must learn to use his knowledge of English grammar, words, and idioms to facilitate anticipating words and meanings. He should be told to look for the important words in a sentence -- the subject, verb, and object. Word size is one criteria to be used in judging the importance of a word -- short prepositions and articles are relatively unimportant. Adjectives and adverbs are not as important as the subject, verb, or object which they modify. This task is easiest when the reader is using text with simple sentences conveying familiar subject matter or a topic of interest to the student.

During the initial phases of text reading, it is very important for the student to read aloud each word so that the teacher may analyze

the learning situation. It is equally important for the teacher to set goals for the student and verbally affirm or correct the student frequently. As the student becomes more capable and confident, the teacher need only correct errors and give periodic affirmation.

When introducing a student of poor or medium capability to material which will be automatically scanned, the teacher should either preview the first paragraph as a whole or read the student the most difficult words and encourage him to sound out the longer words when he sees them. This is also a helpful technique to use for breaking the back-tracking habit while the student hand tracks.

OCT tapes and APS material are particularly helpful in teaching the student to anticipate and look for important words since he can concentrate on decoding while the words come across his finger in the optimum position. In addition, the teacher can set the tracking speed at a pace which challenges the reader to use his intellectual capabilities. Once the student discovers his potential reading speed by using tapes, he should be encouraged to work faster on hand tracking.

Along with Section I of the Stage 2 manual and the Independent Practice manual, books should be used for free tracking speed building since they provide "real world" experience as well as a change of pace from the OCT tapes. Care should be taken in choosing books or magazines with typestyle and letter-size suitable for the student's ability level (see the bibliography in Section 6.2). The reader will have to force himself to read through missed words and missed letters. Usually he will get enough information from contextual clues.

The teacher should check for comprehension by previewing a sentence or paragraph and then asking the student to read the following sentence or paragraph to himself and summarize its meaning.

Once the student has mastered the fundamentals of text reading, speed building should be improved by practice during the training as well as the post-training period.

4.54 Problems of Text Reading and Possible Solutions

Student difficulty in following the text may be caused by poor letter recognition, poor spelling skill, inability to focus on important words, failure to read in phrases or use contextual clues, inadequate vocabulary level, overly rapid tracking, lack of motivation, or just plain fatigue. For remedial suggestions for letter recognition problems see Section 4.3. Sometimes a student will overcompensate for poor letter recognition by depending too much on context. This will result in good performance at times and very poor performance at others. Tracking influences on decoding and speed building are discussed in Section 4.23.

In order to train the student to place a high priority on recognizing the subject, verb, and object, use any appropriate material and ask him to scan it quickly, picking out those parts of speech and tell you what they are. Talk to him about simple sentence structure and how he can use this awareness in anticipating words. Quite often longer words in the text throw the student off balance and cause subsequent errors. Make the student more comfortable with long words by reviewing Stage 1 manual, Lesson 22 as well as practice word pages in Stage 2, Section 1.

Should a student lack motivation or seem bored, you may:

1) take a break -- that boredom may actually be fatigue; 2) perservere and quote a successful person who said hard work brings success; or 3) change material -- he may indeed work better with other subject matter.

4.6 TYPE STYLE AND FORMAT

The goals of training with different type styles and various formats are 1) that the student be able to use his Optacon to read materials that are important in his work or daily living, and 2) that the student know how to approach a new unknown typestyle or format. In order to accomplish this independent use of his equipment, the student must acquire methods of scanning material which will enable him to find the pertinent information quickly and ignore the rest of the page. He also must learn to adjust the threshold

and magnification on his Optacon according to various type style and letter size requirements (see Section 3.4 for optimum adjustments).

It is usually better for a student to develop some initial text reading skill with one type style before introducing many type styles. Before the student looks at various formats, he should become familiar with several different type styles. Experience with pica type is provided throughout the Stage 1 manual and examples of three different type styles are provided on page 21.1 of the Stage 1 manual. In the Stage 2 manual, Section II Page 46, various aspects of print styles are presented and discussed in a format which the student may peruse independently. The Independent Practice manual features a page of upper and lower case alphabets (page 40) as well as a page of upper case alphabet (page 9) in three type styles which provide an excellent opportunity for the student to compare serifs and stroke widths of letters.

When working on the student's own material -- memos, IBM cards, computer printouts, manuals, filing forms, letters, etc. -- ask him what information he must obtain from this source, then determine a strategy for finding same. Describe the general format of the page -- columns, headings, sections, location of page numbers. Then allow the student to find the information on his own after having been given a starting point and reference points. Some students need more guidance than others. The Stage 2 manual, Sections I and II, provide comprehensive guidelines and sample material for readers to use with or without teacher aid.

When approaching unknown material, the Optacon user should turn the threshold up and make sweeping movements on the page to determine whether the format consists of columns, pictures, large open spaces, and/or titles. If he cannot identify anything, the teacher should describe the page to him.

Generally speaking, do not waste time looking at unimportant material, print that is impossible to read (outside the 6 point to 20 point range), or an especially complicated format unless it is vital to the person's work. Materials which may be used include paperback as well as hardback books, magazines, bank statements and checks, the dictionary, a telephone book, bills, a sample ballot, and currency.

4.7 EXAMPLES OF STUDENT LOGS

Two students' logs follow which are used as realistic examples of the progress of a fast student and a slow one in an intensive 10-day Optacon training course.

EXAMPLE LOG 1 - SLOW STUDENT

Description of student: Newly blinded (in last couple of years), 40 years of age; computer programmer. It was questionable whether he should begin training at this time because of the recency of blindness and a low predicted level of Optacon performance. The decision was made to initiate Optacon training because he had realistic expectations, the predicted Optacon performance level would be useful to him in his job situation, and his home situation gave the opportunity for extended training after the Optacon course; Braille reading rate - Read 41 words in 9 minutes (4.5 wpm.) with poor comprehension.

Final test scores following Optacon training:

Letter recognition accuracy - 76% of 136 letters

Reading rate (average of three tests) - 3 wpm.

Note: Both Optacon and Braille reading rates have relatively little meaning at these slow speeds.

Student's Name ---

Uses Tracking Aid? Yes

Control Settings:
I 1-2 T _____ Z Top 1/3

TELESENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/APS (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)
First day	Ind. Pract. Pages 4, 9, 41	1) Stage 1: Lessons 1 through 5 3) Lesson 6 5) Pages 7.2 and 8.2 (Finished U.C. quickly)	2) APS: U.C. Tests 1, 2 (slowest speed) 4) U.C. Test 3 (slowest speed; repeat)	A. Uses Tracking Aid; very smooth, steady; goes back only to study letters when learning; makes good camera adjustments B. Good - seems relaxed! C. Does well on sentences. D. Hard letters S, E, N Confusions H/M, R/B	Stage 1: p. 6.1, 7.1 (Needs review before retaking test tape) 9.5, optional tests, practice as needed. Finish U.C. tests on APS. Start lower case letters.
Second day	Ind. Pract. p. 4 (#5, 6, 7) p. 6 (any) p. 16 p. 41	1) Stage 1: p. 5.3 (letters B & G) 3) p. 11.2, 12.1 12.2 4) Ind. Pract.: p. 6, sentences 1 and 4	2) APS: All U.C. tests at slow speed	A. Uses Tracking Aid; good control but reads high; pretty good at correcting if you tell him to center. B. Good C. Very good on picking up cues from words and sentences, especially if he gets 1st letter. D. Hard letters & confusions B/R, D/O, G,S He needs 2 or 3 passes. His guessing is better than he credits himself with. Encourage him to go through his guessing process aloud so you can reinforce! Generally, round letters are harder for him; will have trouble with a,e,s,c.	Stage 1: p. 11.3 (tests e,s) p. 12.3 (tests a,m)for warm-up p. 13.2 through 13.5 for practice go on to new letters APS: Upper case suffixes (needs U.C. work for computer) Limited alphabet speed building Note: Needs context work periodically to encourage himself with.

Student's Name _____

Uses Tracking Aid? off aid

Control Settings:
I 2 T 9 Z letters large

TELESENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/APS (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)
Third day	Ind. Pract. Finish story, p. 11 p. 43 (tracking) p. 29	1) Stage 1: p. 13.1, 13.2, 13.5, 14.2 14.3, 15.3 (off tracking aid) 3) 16.2, 17.4, 18.2, 19.2 4) Ind. Pract.: p. 11 p. 41 (numbers)	2) APS: Suffixes (para. 1 & 2) Slow speeds	A. So steady on aid that I took him off; skewing and high in a.m., but in p.m. experimented with new camera holds and he tracked well. B. Perfect C. Would guess more than adequate D. Some difficulty with "ae" together. Needs practice on numbers; confuses 2/3 and 5/6 Worked with letters larger today.	Look at his materials; Read a few sentences. APS: Numbers Four short stories
Fourth day	Ind. Pract. p. 30, 41 Stage 1: p. 10.1	1) Ind. Pract.: p.11 (Story to practice U.C.) p. 29 (for l.c.)	APS: 2) Random numbers 3) Four short stories Policeman (slow speed) Football (faster speed)	A. Started with very straight letters but read too high; correctly centered later but began to skew clockwise; work on moving elbow to keep hand straight and on getting him to relax his arm. B. Fine C. Worry about recognition sometimes gets in way of language skills; keep forcing him to verbalize if only to keep you in touch with his processes. D. Confusions a/e/s; l/f/t/r; could use more practice on later letters, g, y, j.	Read Policeman story at high speed on APS Note: Liked moving faster this afternoon on something he was familiar with; helped build his confidence; do this as often as possible. Number practice Work on tracking and word building in Stage 1: (any of the following) p. 22.1 (contractions) 22.6 & 7 (suffixes) 22.8 (prefixes) 22.11 (increasing length words)

Student's Name _____

Uses Tracking Aid? _____

Control Settings:
I 2-3 T 9 Z high

TELESENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/APS (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)
Fourth day (con't.)					20.3 y practice 20.7 j & q practice 21.2 & 3 (sentences) Do last stories of Limited alphabet on APS; then do again at faster rate. Do a little of own materials
Fifth day	Ind. Pract. p. 7, 31	3) Stage 1: p. 20.3 5) Lincoln story from Ind. Pract. (repeat) 6) Looked at computer print out briefly 8) Phone directory from work. 9) Stage 1: p. 10.2 thru one digit #'s	APS: 1) Policeman story (review) 2) Lincoln story 4) Random numbers (continued) 7) Additional letter exercises (good experience; spent 1½ hours on this with breaks)	A. Still pivots, skews a bit; encourage him to move whole arm (lead with right elbow) and relax; reads high or low; have him center first letter of a word and go on from there. (APS good for showing him where letters should be) B. Good C. Okay; seemed to get meaning from short stories inspite of reluctance to guess individual words. D. Needs lots of drill on letters (U.C. too) and numbers; many confusions: a/e/s, h/n, t/f, b/d. Start with letter pairs (short words) and build up word length; also give him easy stories and familiar material so he can use clues	APS: Alphabet and number warm-up tape Flying Saucer story (review) Short Words Numbers (continue) Method Row 1 - Tell him # ahead of time Row 2 - Tell him # simultaneously with image. Row 3 - Tell him only if he misses it Stage 1: p. 10.2 - continue numbers 17.5, 17.6 - (two consonant beginnings) 22.10 Stage 2: Pledge of Allegiance Look at some formats: check, etc. Note: Alternate APS with hand tracking

Student's Name _____

Uses Tracking Aid? _____

Control Settings:
1 2 T thin Z large

TELESENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/APS (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)
Sixth day	Ind. Pract. p. 8, 17, 27, 32 Stage 2: Preamble	Ind. Pract. 1) Flying Saucer (U.C.) 2) Punctuation 9) Stage 2 Preamble	APS 3) Alphabet/number warm-up 4) Flying Saucer Football stories (fast speeds) 5) Limited Alphabet speed build. 6) Did a few letters on addit. tape exercises (good one for him) TAPES 7) short words (speed #4) 8) Number drill	A. Good tracking B. Good C. See fifth day comments D. See fifth day comments	Ind. Practice: Go over homework Denver story APS: 4 short stories - Red Cross Number drill (continue) Letter drill (additional tape exercise or confused letters) Short words, common words (continue)
Seventh day	Ind. Pract. p. 34, 41 Printout of addit. tape exercises (to work on l,f,r, & words)	1) Ind. Pract. p. 17 (worked on word structure guessing-did well) 7) Denver story 1st para. 8) Computer print out numbers pract. (did okay)	APS 2) Alphabet & number warm-up 3) Short words (fast speed) 4) Suffixes, p. 2 (rescanned alot) TAPES 5) Short words Side B(#2-5) 6) Random #'s	A. Smooth, steady; tracks low; knows about using top 2/3 of array; get him to center first letter in middle 1/3 of array B. Okay C. Good; does anticipate some, but takes long time to put pieces of words together. D. Letters: s,f,t, give him trouble in words; can feel openings in vowels but needs lots of time putting clues together; confusions: t/f/r - hasn't learned height differences.	Start with warm-up Stage 1: p. 17.5 (word beginnings) 17.7 (paired vowels) Hand track APS printout of Paul Bunyan - 2 or 3 sentences; then put it on scanner; if too difficult do first letter of word only.

Student's Name _____

Uses Tracking Aid? _____

Control Settings:
I 2 T thin (9)Z large

TELESENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/APS (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)
				Words: Needs practice on beginning letter; also sounding out; doesn't use context too well to get words. Numbers: Learned 2 & 9; problems: 3/8 5/6; can't always feel openings.	TAPES Random number for short period (vary timing of feedback - see fifth day) Compound words (sound out syllables) His materials Note: He needs format work
Eighth day	His 3 pages from work Ind. Pract. p. 38	2) Stage 1: p. 17.5 p. 17.6 p. 17.7 5) His material from work, p. 1 of tables and formulas	APS 1) Alphabet warm-up 3) Paul Bunyan, (first hand tracking a few sentences then on APS) More success with clues. 4) Red Cross Story	A. Tracking still needs work; sometimes tips camera on end; worked on tracking back to the next line. B. Okay C. Adequate. Think he discovered he could guess successfully. Did well with "phrasing" on APS D. Slow and cautious still; recognition still average - will come only with more drill Note: He liked the phrasing - seeing 4 or 5 words and then putting them together.	Stage 1: p. 21.2 p. 22.6(for sounding p. 22.7 larger words) Explore his materials with him, especially a punched card and his 3 page typed formula from work. This is his secretary's type style. Tracking work - might try "Rule One" Book Note: Needs drill. Will probably use Stage 1 when he goes home.

Student's Name _____

Uses Tracking Aid? _____

Control Settings:
I 2 T thin Z large

TELESENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/ (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)
Ninth Day		Ind. Pract. 1) left-handed dict. (A-F) 2) Caveman (review) 3) Tests 4) Computer cards (read fairly easily) 5) "I've Got a Name" book		A. Good B. Good C. Good D. Fair to good; excellent U.C.; some trouble with l.c., esp. a,e,s Note: Regarding tests, very slow but good comprehension; language skills help in guessing but he likes to be positive so backtracks a lot over difficult words.	

EXAMPLE LOG 2 - FAST STUDENT

Description of student: Enthusiastic, highly motivated, capable; in early 20's; congenitally blind; one year college; switchboard operator. Braille reading rate (average of three tests) - 98 wpm.

Final test scores following Optacon training:

Letter recognition accuracy - 98% of 136 letters

Optacon reading rate (average of three tests) - 19 wpm.

Note: Student left one day early because of rapid progress and home commitments and test scores should be interpreted in light of eight instead of nine days of training.

Student's Name _____

Uses Tracking Aid? _____

Control Settings:
I ___1___ T normal Z medium to small

TELESENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/APS (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)
First day	Stage 2 "Good-By Old Sam"	Stage 1 1) Lessons 1 through 19 4) Stage 2 "Good-By Old Sam" (to last para. on 1st page)	TAPES 2) Test 3, lower case 3) a-e-o-s confusion letters only (Speed 5-5½)	A. Gave up aid after finishing upper case letters; generally good; occasionally too low; some very light skewing which she can correct easily B. Sometimes finger slips down; you can tell by when her tracking gets low C. No problems apparent yet D. Good; occasional a/e/s/g and t/f confusions; also reverses 6 and 9.	TAPES Practice numbers Paul Bunyan Chanticleer Stage 1 Practice long words at end Practice pica type
Second day	"Girl Who Knew Rule One" (Book) Stage 2 Preamble and Pledge of Allegiance	1) Finished "Good-By Old Sam" 4) Stage 1 p. 22.11 5) Ind. Pract. p. 42 6) Stage 2 "He Carried A Curse" 9) "Girl Who Knew Rule One" (First two para. and table of contents)	TAPES 2) Alphabet warm-up 3) Paul Bunyan (Speed #1, 2, 3, 4) 7) Random Single digits 8) Suffixes (Speed #1)	A. Occasionally tracks low; rarely skews. B. Excellent C. Fabulous! Good word recognition; sounds out syllables; anticipates well when reading sentences. D. Confusions: a/e/s and f/t	TAPES or APS Note: she hasn't tried APS yet More numbers Chanticleer Goodyear Common words Stage 1 p. 22.7 and 22.8 (long word practice) p. 21.4 (a,e,o confusion) p. 21.2 (f, t confusion)

Student's Name _____

Uses Tracking Aid? _____

Control Settings:
I ___1___ T _____ Z _____

TELESENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/APS (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)
Third day	"Girl Who Knew Rule One"	1) "Girl Who Knew Rule One" (to p. 12) 3) Her own check 4) T.V. guide 5) Phone book 6) Dictionary	APS 2) Chanticleer (moderate speed) TAPES 7) Goodyear (Speed #1-4)	A. Very good; self-corrects well. B. No problems C. Excellent language skills; loves to read. D. Minor problems with t/f, a/e/s, & j/l	Newspaper articles Tapes for speed building Casey Jones Limericks Formats - wants to see encyclopedia
Fourth day	Continue "Girl Who Knew Rule One"	3) T.V. Times from Palo Alto newspaper (found Star Trek) 4) Stage 2 "Gettysburg Address" (Read in 35 minutes)	APS 1) Limericks for warm-up 2) Casey Jones (moderate speed) TAPES 5) Newspaper articles (speed to #4)	A. Tracked Gettysburg Address only; Conflict between pushing for speed and staying on the long line; experimented with page angles - no problems; reads high B. Sometimes rests finger too heavily C. Excellent; wants to be positive she is correct so does a lot of rereading; when she does look again, she is always right; read silently and whole sentences at a time most of day. D. Confusions: l/i and a/s	Stage 2 Do story to practice tracking long lines Explore format section Loves APS Continue with level three stories

Student's Name _____

Uses Tracking Aid? _____

Control Settings:
I ___ T ___ Z ___

TELESENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/APS (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)
Fifth day	"To Kill a Mocking-bird" from I've Got A Name	Stage 2 1) "What's Next?" 2) Questionnaire (Practiced making pen-cil marks) 3) Easy Gourmet cookbook - (read one recipe) 6) Stage 2 Bank State-ments 7) Height-Weight chart 8) Stage 2 "I Was Afraid of the Water" (Timed her on 2nd & 3rd para. at 16 wpm)	APS 4) Morse Code (fast speed) 5) Napoleon (fast speed) TAPES 9) Ants (side one) (Speed #7-8)	A. Good; little skewing; keeps paper slanted counterclockwise and elbow off the table. B. Finger seemed relaxed today. C. Superb! Today we read easier stories (Ants & Napoleon) at faster speeds. D. Good	TAPES Finish Ants at fast speed (#8-F) APS or TAPES Start Level 4 stories Read more of "To Kill a Mockingbird" or Stage 2 to practice steady, smooth tracking, no backtracking Note: Discourage her from rereading sentences Look at encyclopedia (We didn't get to it today)

Student's Name _____

Uses Tracking Aid? _____

Control Settings:
I 1 T _____ Z _____

TELESENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/APS (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)
Sixth day	"To Kill A Mocking-bird"	4) Junior Encyclopedia (p. 94 on Mary 1) 5) Stage 2 Newsprint, p. 41 6) Stage 2 "Tribute to the Dog"	TAPES 1) Ants (side 2) (Speed #8-9) 2) Indian Joe (Speed #1) 3) Eskimos (Speed #1) Note: All tapes successful. For last two tapes we needed to go over vocabulary first.	A. Still skews a bit but corrects self; remind her not to backtrack. B. Fine C. Needed some reminding about "sounding out", especially when tired in late p.m. D. Confusions: l/i, f/t/r	TAPES Most Unusual Father APS or TAPES Any level 4 stories Stage 2 For print & format Also look at format book in library Read homework book for smoother tracking
Seventh day	"The Girl Who Knew Rule 1"	1) "To Kill a Mockingbird" (continue) 2) Ind. Pract. Left-handed dictionary page 4) Crochet pattern book 5) Read TSI eval. sheet so I could fill it out 6) Read a printed postcard received from parents	TAPES 3) Wild Ride (side 1) (Speed #2-5) 7) Wild Ride (side 2) (Speed #S) Loved this tape!	A. Good; wants to track too fast which results in missed words or letters. B. Good; relaxed C. Excellent - good reader; speller; anticipates well; once she got into the story of the Wild Ride tape, recognition improved remarkably. D. Slows down sometimes on the usual a,e,s; quickly adjusted to different type styles.	Stage 2 University Days (for tracking practice) Testing & evaluation TAPES The Great Molasses Flood Read from book she will be taking home or other material she may want to look at.

Student's Name _____

Uses Tracking Aid? _____

Control Settings:
I] __1____ T _____ Z _____

TELESENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/APS (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)
Seventh day (con't.)		8)"I Touch the Earth" (Read selections from this book)			
Eighth day		1) Stage 2 "University Days" 2) Reading test and evaluation 4) Read from Indian Books on Jewelry	TAPES 3) The Last Molasses Flood (Side 1) (Speed - #4) (Side 2) (Speed - #5)	A. Slight deviations from centering letters (keeps letter slightly too high or too low) didn't interfere with her reading; no skewing B. Good C. Excellent D. Just a little a,es,s confusion	

REFERENCES

1. Baer, J.A., and J. W. Hill, "Optical-to-Tactile Image Conversion for the Blind." Stanford Research Institute Final Report on Project 8647 and 1417 under Grant 14-P-55296/9-02 with the Social and Rehabilitation Service of the Department of Health, Education, and Welfare, June 1972.

2. Rogers, C.H., "The Importance of Vibration Frequency in Tactile Pattern Perception." Stanford Research Institute Report on Project 7529 prepared under National Institute of Neurological Diseases and Stroke Grant NS-08322, February 1970.

3. Hermelin, B., and N. Connor, "Right and Left Hand Reading of Braille," Nature, 231, 5307, p. 470. 1971.

4. Cherry, C., On Human Communication, Technology Press and John Wiley & Co., New York, 1957.

5. Shannon, C.E., "Prediction and Entropy of Printed English." Bell System Technical Journal, 30, (1951), pp. 50-64.

6. Attneave, F., Applications of Information Theory to Psychology, Henry Hold & Company,, Inc., New York (1959).

7. Bourne, C.P., and D. F. Ford, "A Study of the Statistics of Letters in English Words." Information and Control, 4, (1961), pp. 48-67.

8. Bliss, J. C., "Communication via the Kinesthetic and Tactile Senses," Ph.D. Thesis, Massachusetts Institute of Technology, Department of Electrical Engineering, June 1961.

9. Taenzer, J.C., "An Information Processing Model for Visual and and Tactile Reading," Perception (1972) Volume 1, pp 147-160.

SECTION 5 CLASS ORGANIZATION & ADMINISTRATION

Proper preparation and planning for an Optacon program can do much to ensure its success. The TSI Training Program is a nine-day, intensive course designed for adults. Other formats for a training course may be more appropriate in certain situations and localities. However, many factors will remain constant throughout the field, so the considerations given below are generally applicable.

5.1 BEFORE THE CLASS STARTS

5.11 Decide on a Training Model

There are two basic types of models used in initial Optacon Training Programs:

- Short Term -- full days of intensive training designed to get the student reading as quickly as possible (not suitable for children)
- Long Term -- shorter, part-day sessions several times per week over a period of weeks or months.

Decide on which model (or combination of the two) is most suitable for your situation. A good initial program should include 50 hours of one-teacher-to-one-student instruction. Make sure that daily sessions are long enough to maximize learning (2 to 5 hours for adults) and often enough to minimize re-learning. Generally, morning sessions are best.

Consider the availability of your students, time limits of your instructors, facilities and equipment available to you, etc.

Follow-up Training may be incorporated into the training model. These should be short, infrequent sessions to help build speed or deal with problems according to the individual needs of students. Adequate time should be given the student for independent practice at home before follow-up training is considered -- a period of several months is suitable.

5.12 Arrange for a Teaching Area

Since the learning task requires intense concentration and a great deal of oral communication between teacher and student, keeping

students separated as much as possible is essential. The ideal setting for Optacon instruction is a small room sufficient to house one teacher, one student, and a large table to handle all the equipment and teaching materials. If students must share a room, plan for them to work back to back to reduce the possibilities for distraction.

Include a teachers' area in your space plan. This will house all manuals, logs, library and resource materials, a bulletin board, a fixed-presentation trainer (such as the Optacon Cassette Trainer or the Automatic Page Scanner), tapes, and tape print-outs, etc. Ideally, this area should be private to allow for confidential discussion of student progress among the teachers.

5.13 Arrange for Equipment

During the initial training period, each student will require one Optacon, one Visual Display for a sighted teacher (or one Master/Slave cable and a second Optacon for a blind teacher), one Tracking Aid, and sufficient plugs and extension power cords. Plastic tiles* with raised letters and a thermoform drawing kit are helpful teaching aids. Once the Tracking Aid is given up by the student, a rubber mat to keep pages from slipping and heavy clips to hold back books are helpful.

The Optacon Cassette Trainer (OCT) or Automatic Page Scanner (APS) are extremely useful though not mandatory teaching aids. Since their use is alternated with camera materials, one of these and accompanying materials may be shared by several students. Be certain you have sufficient connecting cables or Master/Slave cables for the number of students you wish to use the OCT or APS simultaneously.

Be sure all Optacons are fully charged in advance of class, and set up all equipment ahead of time (see Sections 3.5 and 3.6 for proper set-up).

5.131 Optacon Arrangements

Several different methods are commonly used to supply Optacons for student use during training. So that classes can be scheduled at

---

*Available from Nobel & Nobel Publishing, Inc., New York, New York (Item #F680-1 or from TSI).

any time independent of Optacon delivery, most training centers own several Optacons for use by students during and after a training course. This arrangement has the advantage to the student of permitting him to delay the decision to purchase an Optacon until he becomes fully aware of what is involved and has a good assessment of his Optacon reading potential. It should be mentioned, however, that some advance financial commitment (such as the cost of training, or Optacon rental cost) borne by the student will often increase his motivation and perseverence during the intense training period.

Ideally, the student should be permitted to have complete access to the Optacon during the training and trial period, including taking it home with him. Of course, this trial period needs to have a specific termination date so the equipment will be available for the subsequent class. The time it takes to obtain an Optacon needs to be taken into account so that the purchase decision is made early enough to insure the student's being without an Optacon for a minimal period of time.

If the student purchases an Optacon before the class, he could then be trained on his own Optacon. Delivery schedules should be checked to insure that the Optacon will indeed arrive before the class starts.

Another possibility is for the student's Optacon to be rented from TSI during the training and trial periods. However, the supply of "rental" Optacons is limited, so check with TSI regarding availability well in advance.

5.14 Gather Teaching Materials

Each teacher will require:

- Teaching Guidelines (R17454-A)
- Optacon Training Manual - Stage One (Teacher's Edition R17451-A) will be used over again with each student.
- Independent Practice - Stage One (R17452-A)
- Optacon Training Manual - Stage Two (R17453-A)

Each student will require:

- Optacon Training Manual - Stage One (Student Edition R17450-A).

. Independent Practice - Stage One (R17452-A)

. Optacon Training Manual - Stage Two (R17453-A).

It should be noted that, in a teaching situation, the student reads from the Teacher's Manual (R17451-A) while the teacher writes the date and notes errors on the pages of the Student Manual (R17450-A).

In addition, an Optacon Training Center should develop a library of books with good print for Optacon reading, suitable for their students. Section 6.2 gives a bibliography of suitable books developed for our training situation, including some guidelines for choosing books.

5.15 Arrange for Students

The Optacon is not appropriate for every blind person and an important ingredient in a good Optacon program is accurate candidate assessment and counseling. See Section 2 for factors to be considered in student assessment.

If students are coming from out of town, check on housing and transportation needs, and arrange for greeting and mobility training around the training area. Certain advance information is helpful to the training situation. Obtain all screening test results for background information (See Section 2).

. Obtain from the student in advance: date, time, and mode of arrival; job description; age; left or right-handed; does he read braille with left or right index finger (if not covered in screening); is a guide dog coming; date of onset of blindness; past knowledge of letters; educational background (See Section 5.4).

. Send to the student in advance

1. A short description of the training program, including accommodation and transportation arrangements if applicable. Include exact time commitments, proposed scheduling, etc.
2. Suggestions of suitable materials to bring to the training session or to send in advance for instructors to see. Examples are personal checks, memos on his own typewriter or from his job, forms, printouts, local telephone book, copies of bills, stationery, bank

statements, magazines he likes, reading materials for hobbies, and anything else with which teacher assistance is needed.

3. Plastic tiles. Enclose an explanation that the letters will move across his finger on the tactile array from right to left. Thus, the student should study the left edge, then the center, then the right edge. The study of these letters in advance of class facilitates the learning process considerably.

5.16 Arrange for Teachers

As with teaching many other skills, it is difficult to specify the characteristics of a good teacher. However, it is important to recognize that Optacon teaching is a demanding task that requires organizational ability, intelligence, good judgement, and an ability to relate well with other people. Training and experience in the field of blindness is very helpful, although not essential. Training specifically in teaching Optacon reading is essential and TSI offers a nine-day course for this. Since a large part of Optacon training involves "problem solving," experience in Optacon teaching increases ones ability to recognize the cause of problems and to take remedial actions.

Arrange for a trained Optacon teacher for each student being trained. Teachers may be rotated so that a student has several teachers during the course, but a teacher should be assigned to every student for every hour of instruction. Be certain that adequate preliminary instruction has been given to teachers. Send each one a copy of the class schedule and a biographical sketch of each student.

5.2 NOTES ON TEACHER/STUDENT SCHEDULING

- In drawing up a schedule for teaching, regardless of the model used, it is essential to have a one-to-one teacher/student ratio during the initial training stage. Immediate feedback, so necessary for the Optacon student, can only be obtained by having individual teachers.
- Allow extra time for teachers to read logs and prepare for class before student arrival; log the student's progress after each

class; plan for the next session; discuss student progress with one another.

- Provide for the rotation of teachers and students where possible. The more teachers who work with students, the more different approaches and problem-solving techniques can be applied to his individual situation. If this rotation system is used, good logging of student progress is essential (See Section 4.7 for sample logs and Section 5.4 for logging forms).
- Keep a large master copy of the schedule of teacher assignments in the teachers' area. Make switches to avoid obvious personality conflicts, or to repeat exceptionally good teacher/student combinations. In the close one-to-one situation, both of these are bound to occur.
- Consider the teacher's total time on Optacon teaching. The teaching is intensive, tiring work requiring much patience and energy. Teachers should be scheduled only for two or three full days in a row. If scheduling is every day, consider partial days for teachers.
- If working on a part-time model, Optacon training is best first thing in the morning when students are fresh. Because of its intensive nature, Optacon training should not be sandwiched between other learning tasks such as mobility and typing.
- If possible, stagger the times which your initial students begin, to give new teachers the chance to internalize newly-learned techniques as you go along. Begin your program with your best students. Later on, teachers will be better able to handle problems of students with lesser skills.
- Teachers should be scheduled to supervise more than one student only when students are to the level where they can work independently. Periodically, two students at the same level can work on the OCT or APS simultaneously; however, exercise caution that the competitive aspect of this situation does not become a negative factor.
- Schedule time for on-going training of teachers to deal with the various problems encountered in learning. Optacon reading is a serial learning process and students break down at various

points -- the learning problems must be solved at these points. Regular teachers' meetings for this purpose are helpful.

5.3 CLASS SUPERVISION

If an Optacon class is larger than two students, it is suggested that a regular class supervisor be assigned in addition to the instructors. The supervisor is then available to consult with teachers on problems, trouble-shoot with equipment, do overall scheduling and coordinating, fill in for absentee teachers, oversee the learning progress of each student, and provide an on-going personal contact for students' questions and problems when their teachers are being rotated.

Though a supervisor's job description will vary according to the individual class model, his duties could include:

- Check with TSI re delivery dates and make arrangements for student Optacons.
- Keep track of all equipment by serial number (on the back); check daily to see that tapes, equipment, and teaching materials are in their proper place.
- Do a regular row-by-row, column-by-column check on each Optacon to ensure that it is in proper operating condition. (See Section 3.51).
- Run the demagnitizer tape through each OCT after approximately five days of operation.
- Maintain a bulletin board with daily notes to teachers, schedule changes, teaching reminders, etc.
- Help teachers with problems, locating supplies, etc.
- Ensure that Optacons are charged overnight and other equipment is unplugged nightly.
- Read student logs and observe each student for a short period each day. Make suggestions and add pertinent information to the student logs. Often the supervisor, in reading the entire log or observing while removed from the actual teaching situation, can see areas of training omitted, or problems overlooked.

- If final written evaluation of student progress is necessary, suitable check-out and final testing should be done and the evaluation should be written by the supervisor.
- Plan on-going teacher training sessions, and plan to factor in and train new teachers.
- Maintain records of instructors' teaching experience, and hold regular individual evaluation interviews with teachers.

5.4 FORMS USED IN TRAINING

Several forms have proven to be useful in Optacon Training Courses. These are described briefly below and examples of each form are attached.

PROFILE SHEET

This sheet is kept as a separate permanent part of the student's folder, together with his log. It contains statistics about the student, interests and hobbies, and other helpful facts for selection of materials and lesson planning. Teachers may add to this as they learn more about the student.

LOG SHEET

Accurate, up-to-date daily logs of student progress are very important in the Optacon Training Program. In the intensive training model when many teachers are involved, accurate information must be passed from one teacher to another. In the long-term model, logs are essential to overcome the time period between sessions. Once accumulated, good daily logs will show developing learning patterns, indicate recurring problems, and give teachers an overall indication of the pacing of the student's training. They also help to formulate a final evaluation of student progress at the end of training.

Daily logs should contain only what is relevant to that day's learning. Avoid repetition of comments of former days' teachers. Brief, explicit phrases are more useful than lengthy sentences.

The information to the left of the double line on the log sheet should be filled out as the session progresses. Indicate the sequence of the work by numbering 1, 2, 3, etc. The columns to the right of the double line are completed at the end of the teaching sessions.

Uses Tracking Aid? - Check if student uses aid. Indicate which model.

Control Settings: - I - (Intensity) - Indicate setting preferred, e.g. "2 o'clock"*

T - (Threshold) - Indicate if student prefers letters thick, thin, or normal.*

Z - (Zoom Lens) - Indicate size of letter preferred, e.g. "large", or make sketch of zoom lens to show position of control.*

Homework Assigned Column - Name book or manual, pages assigned, and preparation done with student. e.g. "Ind. Pract. Man., Page 5 read instructions together."

Camera Materials Column - Name manual or book, pages completed, degree of success e.g. "Stage 1, Lessons #1-6, rapid progress."

Tapes/APS Column - Name title of Tape or APS page, approximate speed, degree of success. e.g. "Upper Case Test Tape - Test 1-3, slowest speed, did well."

Comments/Difficulties Column - Note the four categories to be considered and see the Short Guidelines for suggested areas of assessment under each category. Log only the relevant ones to the day's session. Jot down your observations on paper during the session to facilitate logging at the end of the day.

Next Lesson Column - Suggest APS work, camera work, tapes. Give purpose of suggestion. Underline methods strongly recommended. e.g. "Do suffix tape to force sounding in syllables. Insist that he sound words aloud.

---

*See Sections 3.43 and 3.44 for optimum settings of Intensity, Threshold, and Zoom lens during training.

SHORT GUIDELINES

This short form of instructions for filling out the log sheet serves as a handy reminder for trained teachers.

PERSONAL INFORMATION

This form provides useful information, together with results from an assessment test (see Section 2.13) before training begins. This information can be helpful in planning an individualized course of instruction.

TEACHER SCHEDULE

This simple form illustrates how teachers can be scheduled in a rotation system during an intensive training course. A more detailed schedule would also be used making specific teacher-student assignments.

PROFILE SHEET

STUDENT'S NAME _____

OCCUPATION _____

DATE TRAINING BEGAN _____ ESTIMATED LENGTH OF STAY _____

AGE _____ AGE AT ONSET OF BLINDNESS _____ PAST KNOWLEDGE OF LETTERS _____

LEFT OR RIGHT HANDED _____ OPTACON MODEL CHOSEN _____

SPECIAL NOTES: (Other disabilities, interests and hobbies, etc).

Student Name _____

Uses Tracking Aid? _____

Control Settings:
I _____ T _____ Z _____

T .SENSORY SYSTEMS, INC.

OPTACON TRAINING LOG
FORM 020

TEACHER/ DATE	HOMEWORK ASSIGNED (Circle if not done)	CAMERA MATERIALS (Give page no's finished)	TAPES/APS (Indicate speed, degree of success)	COMMENTS/DIFFICULTIES Key: (A) Tracking (B) Finger Position (C) Language Skills (D) Recognition	NEXT LESSON (Suggest tapes, camera work, and problem-solving methods)

GUIDELINES FOR WRITING LOGS

LOG FOR BOTH A.M. & P.M. - BE BRIEF AND EXPLICIT!

INDICATE SEQUENCE OF WORK COVERED - 1, 2, 3 (Camera Materials & Tapes/APS Columns)

CONSIDER THE FOLLOWING AREAS - LOG ONLY THE RELEVANT ONES: (Comments/Difficulties Column)

A. TRACKING

Jerky? Too fast? Camera too high or low? Sits on letters? Backtracks? Skews? (Which Way?) Pivots? Orientation on page? Changes line well?

B. FINGER POSITION

Searches the array? Lifts? Rolls? Presses array? Too far in or out? Perspires?

C. LANGUAGE SKILLS

Sounds out syllables? Spelling? Vocabulary level? Does he anticipate?

D. RECOGNITION

Sense of touch? (Dead areas of fingers?) Letter confusions? Letter integration?

GIVE PURPOSE OF LESSON SUGGESTED: 15.6 - practice vowels, letter integration (Next lesson Column)

UNDERLINE METHODS STRONGLY RECOMMENDED FOR A PARTICULAR STUDENT.

TELESENSORY SYSTEMS, INC.

2626 Hanover Street
Palo Alto / California 94304
Telephone 415 / 493-2626

In preparation for evaluation and analysis of the Optacon Training Programs conducted by Telesensory Systems, Inc., we are asking all of the participants for personal information which will be used in statistical form but will not be reported as individual identification. For example, we need to document the ages of the participants, but we have no need to identify anyone by name. Any analyses of the readers' training will be labeled "Subject 1", etc.

This information will be considered confidential. We would appreciate your completing this information sheet and returning it to us.

Name _____

Home Address _____

Business Address _____

_____

Home Telephone _____ Business Telephone _____

Age _____ Occupation _____

Age at Onset of Blindness _____

Cause of Blindness _____

Do you read braille? _____ Speed _____

Education completed _____

Are you right or left handed? _____

Which hand do you use to read braille? _____

Are you fluent in any foreign languages? _____

Person to notify in case of Emergency _____

_____

Address Telephone

June 4, 1973
Class Date

All Day - 8:30 a.m. to 4:00 p.m.
Lunch 12:00 - 1:00

	6/4	6/5	6/6	6/7	6/8	6/9	6/11	6/12	6/13
TEACHERS	MON.	TUES.	WED.	THURS.	FRI.	SAT.	MON.	TUES.	WED.
Joan B.	X	X					X	X	
Gayle	X		X	X			X		X
Marge			X	X		X	X		X
Helen	X	X					X	X	
Joan H.	X					X			X
Pat	X	X		X	X				
Betty	S	S	S	S	S	S	S	S	S
Ellen	X		X	X		X		X	
Addie		X	X		X				
Kay					X	X	X	X	
Mary		X			X	X	X		
Larrie			X	X				X	X
Linda		X		X	X			X	A.M. ONLY
Jackie			X		X	X			X

S - Supervisor

SECTION 6: FOLLOW-UP TRAINING

6.1 GENERAL CONSIDERATIONS

Few students leave the training session clutching a copy of War and Peace, confident that the world of print holds no surprises for them. Most students have not reached their top reading speed, and building speed takes dedication and discipline. The easier the reading becomes, the more the students will use the Optacon. It is the poor student, therefore, who will suffer the most without the teacher's guidance. Proper selection of material will help make reading less of a chore and more of a joy for these students.

A student with a cassette reading speed of 20 wpm or more, and a hand tracking speed of at least half that could do well at home, particularly if he enjoys books. Even top readers do not use the Optacon all day but mix reading with other forms of getting information. If a good student uses the Optacon consistently in his work, even if he doesn't use it for long periods at a time (say two hours a day), and if he works at building speed for an hour or so in the evening, he should have no trouble reaching his top speed. It would be beneficial for the good reader to build speed with a long selection that has either good, simple print, or an easy, predictable syntax. That way, the student can concentrate on speed building alone and not have to slow down for a complicated letter or unusual wording. If he finds the book interesting, he can approach his task with enjoyment. An example of such a book would be Jonathan Livingston Seagull, by Richard Bach.

A student who reads slowly and who has many letter confusions will find reading at home a difficult and time consuming task. It's very discouraging to spend an hour reading a small paragraph and then not be sure of the contents. It is very important that poor students be proficient enough to use the Optacon in some small way in their work. Seeing how reading with the Optacon is a unique and important source of information will spur them on to continue their hard task. Oftentimes students will be using the Optacon with familiar materials which will practically "read themselves". If the students can find their way around their pages they will be able to use the Optacon just to check certain areas of their materials and they won't have to read all of them. For poor students, materials containing many clues are a must.

Their reading selections should also be short so that they can have the satisfaction of finishing something. Poor students should probably not spend any more time practicing their reading than good students. The job is, after all, tougher for them and probably gives them less enjoyment. The important thing for slow students is to practice consistently and avoid unrealistic goals, both high and low. A book of short quotations or short unrelated paragraphs would be best for the slow student. It should also have clear, large print to minimize confusions.

Two sources of materials to help both good and poor students choose reading matter have been compiled as an efficient and organized starting point. The Stage 2 manual, R17453-A, covers common formats, such as a bank check and dictionaries, so that students can practice finding their way around various forms. Stage 2 also offers a graduated reading program for speed building that has a wide variety of material from songs to short stories. The format of Stage 2 offers many clues to the reader so that it's easy for him to find the passages he needs or wants. The other materials source is an annotated bibliography which judges books in three areas important to Optacon reading: format, print style, and level (based on length of selection and syntax). Since it is difficult to find a book that is exactly right for speed-building out of all the books in a book store, the bibliography is a short cut of preselected material. The bibliography is given in Section 6.2 of this material.

Sometimes students may find it too difficult to build speed at home. They may also get into bad reading habits (skewed or not centered reading) that slows them down. These students might benefit from a "retread" course that would brush up their skills and increase their speed. Such a course could rely primarily on the fixed-rate systems, such as the OCT or APS. These systems have the advantages of variable speed with regular letter size and placement reinforcing reading in the optimum recognition area.

A list of good reading habits and a check list of accomplishments should be provided for student reference during post-training practice.

6.2 BIBLIOGRAPHY FOR OPTACON READERS AND TEACHERS

The following bibliography is designed to help the Optacon teacher find the book most suited to the student's interests and ability to read with the Optacon. The books provide a range of difficulty, and they may be used after the student has been introduced to all of the upper and lower case alphabets. The books may be used in conjunction with the manual to introduce different formats and to provide extra reading practice, and they may be used upon finishing the manual to provide speed building practice.

The books cover three levels of difficulty -- easy, medium, and hard -- in three different areas -- print style, format (layout of the book), and reading level. A book is usually not consistent in difficulty in all three areas. One with easy, short selections may be put together in a confusing and inconsistent manner. Each book is judged in each area. The levels are defined as follows:

Print. Print varies in difficulty for the Optacon reader according to the number of complications on the letter itself (serifs, curlicues, varying stroke widths), the size of the letter, and the amount of contrast between the letter and the background.

a) Easy -- sans-serif; even, narrow stroke widths, medium to large size

b) Medium -- simple serifs; uneven stroke widths; medium to large size

c) Hard -- many serifs; extreme variations in stroke widths; small size.

Format. Book layouts vary in difficulty according to the amount of unused space on the page, the page numbering system, the number of type styles, the number and placement of pictures, and the variety of written material.

a) Easy -- little empty space; consistent written material (all essays, all quotes); consistent placement on page; consistent, easy print style.

b) Medium -- moderate use of pictures or different types of material or print styles

c) Hard -- inconsistent placement of material on page; use of many different types of material or print styles.

Level. Books vary according to literary difficulty (reading level, and sophistication of content) and length of selection.

a) Easy -- short selections and/or simple syntax and/or simple themes

b) Medium -- longer selections (one to four pages) and/or more complicated syntax and/or more adult themes

c) Hard -- novels, or long selections; sophisticated, complicated syntax and/or adult themes.

The category of "appeal" is included to designate whether the book is geared to elementary or high school students, or to adults. The abbreviations "pb" and "hb" after the copyright date refer to paperback and hardback respectively. Publishers' addresses are listed at the end of the bibliography.

BIBLIOGRAPHY

All of Us Are Searching for Success, Bevins Jay; Stanyan Books, c 1972, hb, $3.00
Print : easy
Format: medium -- short quotes from famous authors (widely spaced); consistent format
Level : easy -- short selections suitable for beginning students
Appeal: adult, high school

easy gourmet from stanford,The Mothers' Club of Stanford University, c 1969, ph, $2.75
Print : easy -- sans-serif, no capitals
Format: easy cookbook -- ingredients in double column above instructions; consistent format
Level : medium -- useful for practice in numbers, abbreviations, tracking
Appeal: adult, high school

I've Had Troubles Too . . . So I Brought You This Book, Keith Fallon, Stanyan Books, c 1972, hb, $3.00
Print : easy
Format: medium -- widely spaced, humorous short quotes from famous authors; consistent format
Level : easy -- short selections suitable for beginning students
Appeal: adult, high school

Jonathan Livingston Seagull, Richard Bach, Macmillian Company, c 1970, hb, $4.95 (book available in paperback from Avon Books, same print style)
Print : easy
Format: medium -- long chapters and continuing story difficult for beginner; style not difficult
Level : hard
Appeal: adult, high school

Keep Smiling and Have A Happy Day, Allen James, Stanyan Books, c 1972, hb, $3.00
Print : medium -- varying print sizes, some white print on magenta background
Format: medium -- short quotes from famous authors; varying placement on page
Level : easy -- short selections suitable for beginners
Appeal: adult, high school

Notes To Myself, Hugh Prather, Real People Press, c 1970, pb, $2.00
Print : easy
Format: medium -- philosophical selections of varying length, from paragraph to page; end of selection signified by leaf design; unnumbered pages

Level : medium
Appeal: adult

Rafting Down The Neckar, Mark Twain, Fritz Gebhard, KG, European Places of Culture Edition, edited by Wolfgang Boehler, c 1966, pamphlet, 2 DM
Print : easy
Format: medium -- syntax complicated, vocabulary sometimes unusual, pictures
Level : hard
Appeal: adult

Short, Short Stories, Vol. 1, M.W. Sullivan Reading Program, Behavioral Research Laboratories, c 1972, pb, $1.99
Print : easy -- large typewriter print, simple serif
Format: hard -- short paragraphs, pictures; questions follow story
Level : easy -- 3rd, 4th grade reading ability; stories 50-150 words in length
Appeal: limited for adults since many stories very simple, good for elementary students, poor readers

Some Haystacks Don't Even Have Any Needle, Stephen Dunning, Edward Lueders, Hugh Smith; Scott, Foresman and Co., c 1969, pb, $2.10 (same print in hb)
Print : medium -- thick, dark strokes, sans-serif
Format: hard -- pictures, poems, uneven line length, inconsistency in placement of poems
Level : hard -- unexpected turns of phrase in poems difficult for beginning reader
Appeal: adult

Take 12/Action Plays, Mel Cebulash, Scholastic Book Services, c 1970, pb, $1.80
Print : easy -- sans-serif, some sans-serif italics
Format: medium -- 2-3 page, open-ended situation plays; italics used for stage setting
Level : medium
Appeal: high school

EDUCATIONAL CHALLENGES SERIES

The Girl Who Knew Rule One, Marilyn Lyman, Scholastic Book Services, SA 2092, c 1972, pb, $1.80
Print : easy
Format: medium -- story in 10 chapters of approximately 10 pages each, photographs; personal problem solving involving teenage girl on probation, drugs, love; hospital setting
Level : medium -- 2.5-2.9 grade reading ability; suitable for speed building
Appeal: geared to high school, some appeal for adults

The Ratcatcher of Whitestone, William F. Ryan, Scholastic Book Services, SA 1876, c 1971, pb, $1.80

Print : easy
Format: medium -- 10 chapters of approximately 10 pages each; mystery story
Level : medium -- 2.5-2.9 grade reading ability; suitable for speed building
Appeal: geared to high school; mystery aspect suitable for adults

The following titles in this series have limited appeal for adults -- strongly geared toward adolescents; not ordered by TSI

A New Life for Sarita, John Durham, SA 1563; Spanish-American culture clash

Crash At Salty Bay, Pete Pomeroy, SA 1925; adventure, seacoast setting

No Girls Allowed, Kevin Jane Harvey, SA 1878; surfing

One Punch Away, John Greenya, SA 1881; boxing

Silver Dollar Mystery, Leslie Carswell, SA 1924; kids get involved in a theft ring

The House That Half Jack Built, Eloise Engle, SA 1879; personal triumph, sibling rivalry

The Race Driver, W.E. Butterworth, SA 1923; adventure in race car setting

The '50 Ford, John Greenya, SA 1877; personal triumph, car setting

HOLT SERIES

I've Got A Name, Lawana Trout, Charlotte K. Brooks; Holt's Impact Series, Level 1; Holt, Rinehart and Winston, Inc., c 1968, pb, $1.84

Print : easy -- shaded sans-serif (titles hard)
Format: medium -- long and short stories interspersed with poems, songs, pictures; "growing-up" theme
Level : medium (some short selections easy and suitable for beginners)
Appeal: adult, high school

Larger Than Life, Edith Stull; Holt, Rinehart and Winston, Inc., c 1968, pb $1.84

Print : easy -- shaded sans-serif (titles hard)
Format: medium -- long and short stories, poems, fables, songs, photographs, pictures; myth, legend theme
Level : medium (some short selections easy and suitable for beginners)
Appeal: adult, high school

The following titles in this series have limited appeal for adults -- strongly geared toward adolescents

At Your Own Risk, Trout, Pierson; theme of adventure, daring

Cities, Stull; inner-city themes

SULLIVAN SERIES

Bad Luck Sam, M. W. Sullivan Reading Program, Story #3, Behavioral Research Laboratories, c 1971, pb, $.99

Print : easy
Format: medium -- large cartoons with sentences below, occasionally in middle of page; humorous story of a man with legendary bad luck
Level : easy -- 1st, 2nd grade reading ability
Appeal: high interest, low vocabulary book created for older non-reader

The Camp By The Pond, M. W. Sullivan Reading Program, Story #2, Behavioral Research Laboratories, c 1971, pb, $.99

Print : easy
Format: medium -- large cartoons with sentences below, occasionally in middle of page; humorous story of two men, two pets, and a rainy camping experience
Level : easy -- 1st, 2nd grade reading ability
Appeal: high interest, low vocabulary book created for older non-reader

PUBLISHERS

Avon Books
The Hearst Corporation
959 8th Avenue
New York, New York 10019

Behavioral Research Laboratories
Ladera Professional Center
Box 577
Palo Alto, California 94302

Fritz Gebhard, KG
Heidelberg, Germany

Holt, Rinehart and Winston
Crocker Industrial Park
Brisbane, California

Macmillian Company
866 Third Avenue
New York, New York 10022

Real People Press
Box F
Moab, Utah 84532

Scholastic Book Services
904 Sylvan Avenue
Englewood Cliffs, New Jersey 17632

Scott, Foresman and Company
855 California Avenue
Palo Alto, California 94304

Stanyan Books
(A Division of Random House)
8721 Sunset Boulevard
Suite C
Hollywood, California 90069

The Mothers' Club of Stanford University
P. O. Box 4445
Stanford, California 94305