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An investigation of the effects of oral tactual and kinesthetic sense deprivation on the ability of male children to discriminate auditorily perceived stimuli

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AN INVESTIGATION OF THE EFFECTS OF ORAL TACTUAL AND KINESTHETIC SENSE DEPRIVATION ON THE ABILITY OF MALE CHILDREN TO DISCRIMINATE AUDITORILY PERCEIVED STIMULI

by

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CHAPTER I

INTRODUCTION

It has been theorized by numerous researchers that language has three rather well defined stages or levels of development. However each level of development has nebulous limits and overlaps the other. Each stage enhances the growth of succeeding levels and appears prerequisite to normal language development. Myklebust (1966, pp. 230-231) describes the developmental stages as inner language, receptive language and expressive language. He describes inner and receptive language as follows:

> The relating of experience and symbol is the basis of inner language. As this process develops the child can think in words. . . . This process of relating the words he receives through audition to experience is the basis of receptive language.

He contends that receptive language is enhanced by inner language growth and that a "reciprocal feed-back" system evolves between them. The increased growth of these two systems allows the child to begin "using the spoken word to relate experience to others . . ." and is called expressive language. As expressive language develops "a

reciprocality and feed-back are noted. As the child speaks he enhances his receptive and inner language." Various authors use somewhat different terminology to describe sequential language development, but there appears to be little variation in basic meaning. Myklebust's (1966, p. 230) description of this sequential development can serve to illustrate the process. First, inner language develops from birth to nine months; second, receptive language develops from nine to twelve months; and third, expressive language develops from twelve months to seven years. Because each stage continues to develop and overlaps the succeeding stage the time limits referred to by Myklebust are approximate and do not delineate exact limits for each stage of development. Lenneberg (1967, p. 127) discusses language as a maturational process with approximately the same pattern described by Simon (1957, pp. 23-38), Brain (1965, pp. 19-22), Wood (1965, pp. 16-21) and Berry and Eisenson (1956, pp. 18-28). Clearly, then, early language development according to these observations is considered to be a maturational, sequential, developmental process involving sensory development and maturation, environment, attitudes and learning factors.

Within the concept of normal language development appropriate sensory integration appears to play a vital role. The auditory, visual, kinesthetic and tactual

senses appear to be the most important modalities concerned with normal language development. Reference is made to these senses and how they integrate and function by Myklebust (1966, pp. 50-55),

> Although all sensory avenues are not stimulated simultaneously, a specific sensory experience is interpreted on the basis of what has been learned from all sensory experience. When a certain sensory input is lacking, however, the experience gained from the remaining senses is structured differently.

The proper utilization of these sensory modalities is important in language development as is quite apparent when one or more of them cannot or is not employed adequately. Myklebust (p. 50) further reports that "loss of information from a given sensory channel must result in reduced perceptual reciprocation."

McDonald and Chance (1964, p. 50) report that "reduction of tactual-kinesthetic stimulation without interfering with visual and auditory functions impair intellectual functioning in normal male subjects." To the extent that language can be considered an intellectual function it would appear that adequate integration of those senses suggested by McDonald and Chance might also play an active role in language development. Oyer (1966, p. 28) describes Hudgin's concept on perception and sensory integration as follows:

> Hudgins viewed perception as a synthesis of information that is fed to the organism from several sensory avenues simultaneously.

> He emphasized the fact that the sensory modalities are not compartmentalized but that one modality may dominate the process. Thus, as the organism is stimulated, the appropriate sensory pathway in neural impulses to the cortex, at which level a patterning occurs. The patterns are related to previous ones and hence are determined to be similar or dissimilar. Following discrimination of similarity or dissimilarity and integration of the decisions made, perception occurs.

The process of perception and integration of the senses as they relate to language development may be stated as (Myklebust 1966, p. 230),

> This process of relating words he receives through audition to experience is the basis of receptive language. . . . After minimal inner and receptive language have been established, the infant begins to use the spoken word expressively.

Van Riper and Irwin (1958, p. 144) express the view that if adequate speech patterns are not learned, that person has not "internalized" the proper auditory patterns. After expressive language has become an integral part of behavior, Van Riper and Irwin (1958, p. 111) state,

> In the normal speaker there exists for each sound or word a similar master pattern against which the utterance is matched and measured. This standard pattern can be described crudely as a homogenized blend of auditory, kinesthetic, tactual, and visable features. The auditory and visual feedbacks, once so important in learning a sound, are of less importance than the other two once the pronunciation skills have been mastered.

They further state (p. 110):

> Soon the kinesthetic or tactual feedback is sufficiently stabilized to serve as

> the dominant control for the speech, and the ear feedback though still present takes a secondary role. . . . Once thoroughly mastered, the movements and contacts of the tongue are almost sufficient by themselves to govern the articulation and the person learns to rely primarily upon them rather than upon the ear to insure the correctness of his utterance.

Twaddell (1952, p. 607) seems to corroborate this information.

> We know that a speaker controls his speech actions primarily by proprioceptive, kinesthetic feedback with his acoustic monitoring acting more as a calibration than as a direct control. We know that a hearer matches the acoustic stimuli he receives against his own habits of muscular speech actions, and identifies the incoming sound as corresponding to this or that of his own speech articulations. At both ends of a speech transmission it is the muscular activity, not the acoustic character, which dominates the identification.

From these and other observations by Brain (1965, pp. 19-20) and Myklebust (1957, pp. 510-511), it seems that many experts consider that in the beginning the auditory sense is foremost in importance with kinesthetic, proprioceptive and tactual senses interacting but being of secondary importance. The utilization of those same modalities is described by Luria (1966, p. 102).

> The development of the ability to perceive spoken sounds and to hear speech requires the closest participation of the articulatory apparatus and assumes its final character only in the process of active articulatory experience. The first years of development of speech are taken up with this acquisition of the ability to hear speech, with the participation of articulation. This process of auditory-articulatory analysis is at first manifest and overt in character. As electromygraphic studies have shown (Sokolov, 1959;

> Novikova, 1955; etc.), it recedes into the background only gradually, so that when or shortly before the child begins to attend school the hearing of speech ceases to require the actual participation of articulation. However, if the child is told a word with a complicated sound or, still more, asked to write it, the articulatory apparatus will again be brought into visible use to aid in the perception and recognition of the precise sound structure of the word.

In these statements Luria suggests the automaticity of language after some level of maturation has been reached and after the proper "auditory-articulatory" processes have had sufficient opportunity and time to establish the necessary language patterns. It is further suggested that if a pattern is not present when new or different words or language patterns are presented auditorily the articulatory function is again initiated.

The sensory interrelationship suggested by Luria, McDonald and Chance and others provides the basis for this research. Is the actual participation of kinesthetic and tactual feedback necessary for the normal maintenance of receptive language? To demonstrate the role played by these senses requires more than just superficial observation.

Studies have been devised to determine the effects of a defective auditory monitoring system and kinesthetic and tactual interference on expressive language in adults (McCroskey 1958, pp. 84-90; Ringel and Steer 1963, pp. 369-378; Weber 1961, M.S. Thesis; Guttman 1955,

pp. 166-167). The primary purpose of these studies was to determine to what extent expressive language was altered in adult subjects by kinesthetic and tactual deprivation and by masking the auditory sense. A summary of the above findings indicates that adult expressive language was altered only slightly in articulation, but responses indicated that comprehension of auditory stimuli was not significantly changed. It would seem that if articulation and comprehension were not significantly changed the deprivation of the auditory, kinesthetic and tactual senses is of little consequence in short term routine language maintenance. These findings appear to bear out Luria's theory that after a certain age the tactual and kinesthetic senses are no longer necessary for the discrimination of auditory stimuli. However, it may be argued that no significant change was noticed because deprivation of the tactual and kinesthetic senses was of such short duration that the adult subjects did not have time to react to the loss of feedback information. It has been reported by Frick (1964, p. 203) that no reports of this type of observation or research have been done on children during the important years of language development. Within the theoretical framework of the cited research integration of the tactual and kinesthetic senses with the auditory sense is necessary for expressive speech development and maintenance. In accordance with this

concept it appears reasonable that a similar activity might be important to receptive language development. The previous reference by Luria suggested that the senses stimulated by articulatory activity are used to aid perception and recognition of new or difficult sounds. Patton (1942, p. 305) reports on the kinesthetic modality in this sense stating, "The kinesthetic sense is also fundamental to speech at any stage of its development." In the developmental process a motor (articulatory) activity is utilized to help perceive and discriminate sounds received through the auditory channel. As representative of research done relating articulatory ability and discrimination, Reid (1947, pp. 143-150) found in her investigation of functional articulation problems that there existed a significant positive correlation between articulatory ability and the ability to discriminate between speech sounds.

At this point it appears that efforts toward determining how senses integrate during important language development years should be evaluated and consequently have priority in the study of language acquisition.

This study was developed to investigate one aspect of the concept that the articulatory feedback system plays an active role in discrimination of verbal stimula received through the auditory channel.

Statement of the Problem

Because of the suggested integration of certain senses necessary to language development, this study was designed to demonstrate that the ability of children to discriminate auditorily perceived verbal stimuli would be affected directly by deprivation of oral tactual and kinesthetic sensory information. Specifically the hypothesis to be tested is stated as follows: There is a significant change in the ability of young male children to discriminate verbal auditory stimuli under conditions of oral tactual and kinesthetic deprivation.

CHAPTER II

PROCEDURE

Subjects

The subjects consisted of 25 male children chosen on the basis of the following criteria: (1) having minimum intelligence (90 I.Q.) as determined by the Ammons and Ammons Quick Test (Q.T.),[1] (2) hearing within normal limits,[2] (3) being between the ages of 6.2 and 7.6 years, (4) being in the first year of school and (5) having been exposed to essentially the same approach and degree of and degree of training.[3]

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[1]Although this test is not an I.Q. test in the usual sense, it is reported to have satisfactory reliability and correlates highly with the Stanford-Binet vocabulary scores. The testing procedure of the Quick Test is very similar to the procedure employed in this study. Specifically both tests utilize a simple pointing activity in response to verbal stimuli. The subjects seemed to condition rapidly for the test in this study, possibly because of the similarity to the Quick Test. It is of interest to note that the authors of the Quick Test administered their test to the four first grade classes in the school from which the subjects were selected.

[2]Hearing limits were determined by sweep screening through the speech frequencies of 500, 1000 and 2000 Hz at 20 dB. A Belton portable audiometer calibrated to ISO standards was used for screening. The testing was done in an IAC sound treated room.

[3]All subjects were taken from the same school, which according to the principal, Mr. George Hall, utilized the same approach to reading in all four first grades.

Test Development

The instrument used to test the hypothesis was a verbal auditory picture discrimination test designed specifically for this investigation. (See Appendix A.) The test consisted of 30 plates with four 4X4 inch black outline pictures on white cardboard background. The pictures were used to illustrate the stimuli words. Each stimulus "word-picture" represented a monosyllabic word similar in sound to the three other "word-pictures." Each stimulus "word-picture" was chosen so that the initial consonant matched at least one of the other three initial consonants in that particular sequence of words based on at least one of the following criteria and in this order: (1) place of articulation, (2) phonation (voiced-voiceless) and (3) manner of articulation. Another criterion used in the selection of test words was based on statements by Brown (1963, p. 278) that vocabulary growth in children progresses from concrete picturable words to more abstract and less picturable words. Therefore picturable words that were likely to be part of the vocabulary of this age of subjects were used. The test stimuli were tape recorded and presented to the subjects at approximately 70 dB spl.

Complex noise masking was recorded simultaneously with each stimulus word at a signal to noise ratio of 1/1.

This was done in an attempt to increase the sensitivity of the test. The rationale used in reducing the ceiling score by introducing complex noise masking was that if the subjects under plecebo condition achieved approximately 100% correct responses it might be that even though the introduction of a variable that affected their ability (on this task) would not be sufficient to change the score because of the inherent ease of the task. It was reasoned that although the subjects achieved 100% under normal conditions the task might be easy enough to allow them to keep this level of efficiency even when under conditions actually affecting their ability to perform. Because of this concern masking was used to reduce the average child's score under normal conditions to approximately 65%. Consequently it is felt that if the test condition did affect the discrimination task it would be evident by a change in percent of correct responses.

Instrumentation

All subjects were tested in the Speech and Hearing Clinic at the University of Montana. The speech discrimination test was administered in an Industrial Acoustics Corporation Sound Treated Audiometric Testing Suite #1204. The taped test material was presented on a Viking tape deck #87 at $7\frac{1}{2}$ i.p.s. at approximately 70 dB s.p.l. through

two speakers of an Allison Model 22 Speech Audiometer.[4]

Testing Procedure

As the subjects arrived for their initial appointments they were assigned second appointments not less than seven days following the first. Hearing screening was done on arrival at the clinic according to previously stated criteria. Assignment of subjects into two groups according to a list of random numbers and setting up test conditions were handled by assistants to fulfill the requirements necessary for a double blind approach to this investigation. According to the random schedule each subject was assigned to one of the two test conditions on the initial appointment. The two test conditions were as follows: (1) verbal auditory picture discrimination test administered under the condition of a standard dental dosage of 10% xylocaine (Lidocaine) topical anesthetic. On the second appointment each subject received the alternate oral treatment and was tested with the same discrimination test. At no time during the investigation was the experimenter aware of the subject's treatment condition.

After the screening procedure each subject was

[4]The presentation intensity was adjusted so that the signal peaked at approximately 70 dB s.p.l. at the level of the subject's ears. The intensity of the stimuli was measured by a sound level meter placed in the same position as the subject when the stimuli were presented.

taken to the University Health Center where a physician administered either the plecebo or anesthetic using aerosol-type containers with standard procedures and specified dosages.[5] Efforts were made to spray the plecebo or anesthetic on the anterior one-third of the tongue. The subject was then instructed to circulate the fluid in his mouth for approximately 40 seconds and then to expectorate all saliva. The recommended three minutes for maximal anesthetic effect elapsed before the subject reached the testing room to begin the test. The subject was seated midway between the two speakers of the audio system over which the test material was presented. The test plates were arranged in booklet form and were presented by the examiner who turned each plate after the subject responded by pointing to the picture that the subject attempted to match with the stimulus word presented. Each response was immediately recorded on an answer sheet. (See Appendix A.) Prior to the actual test each subject was given three sample words requiring appropriate responses. The test booklet was placed approximately 20 inches from the subject on a table slightly below eye level.

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[5]Instructions by the Astra Pharmaceutical Company accompanying the anesthetic stated that, "One metered dose of Xylocaine is recommended for children under 10 years of age. Maximum anesthetization should occur within 2-3 minutes following the recommended dosage."

Experimental Design

The basis of this study was to determine if any difference existed in the discriminative abilities in children under the two conditions of plecebo and anesthetic treatment.

The subjects were randomly divided into two groups on the first appointment. Each subject was given one drug treatment on the first appointment and the alternate drug treatment on the second appointment, then tested under these conditions. The groups were controlled for order of testing. The appointments were scheduled a minimum of seven days apart to minimize the memory factor as the same discrimination test was used for both appointments. The data was statistically analyzed using a repeated 2X2 Latin Square statistic for analysis of variance.

CHAPTER III

RESULTS

The results obtained in this investigation were evaluated by means of analysis of variance. The coefficient of risk accepted was .05.

The major variable of interest was the difference in discrimination ability of male children under conditions of oral topical anesthetic and comparable plecebo. Statistically no significant difference existed within subjects under plecebo or anesthetic conditions. However, since one-half of the subjects received the anesthetic treatment and the other half the plecebo treatment on the first appointment, and then received the alternate treatment on the final appointment, a second variable, order, was also of interest. The statistic chosen made it possible to evaluate this effect. The order effect was not significant. The means of errors produced in each condition on the first and second appointments are presented in Table 1, and a summary of the results of the analysis is presented in Table 2.

TABLE 1

MEANS OF ERRORS

	Plecebo	Anesthetic	Total
Order I	10.027	9.7	9.863
Order II	11.045	8.63	9.837
Total	10.536	9.165	9.850

TABLE 2

SUMMARY OF ANALYSIS

	df	Mean Square	F	P
Order I-II	1	1.84		NS
Conditions A-P	1	3.84	1.70	NS
Subjects (Between)	9	22.24		
Error (Within)	32	2.26		
Total	43			

CHAPTER IV

DISCUSSION

An attempt was made in this investigation to determine how oral tactual and kinesthetic deprivation might affect the ability of young male children to discriminate verbal stimuli presented auditorily under certain test conditions. The results failed to demonstrate any significant difference in the ability to discriminate verbal stimuli during oral tactual and kinesthetic deprivation.

Luria's description and explanation of feedback and integration of certain senses in language development is a concept that appears reasonable when viewed in the light of statements made by Twaddell, Patton and others. Luria explains that the first years of a child's life are taken up with the acquisition of the ability to hear and perceive speech. He further states that this ability is developed by the ". . . closest participation of articulatory mechanism" which recedes into the background at some time when it is no longer needed except for specific instances of different or complicated sounds. This concept appears inconsistent to this writer in that articulation does not seem to play such an important

role in early receptive language development as evidenced by the observation that children develop an ability to perceive and discriminate speech sounds before they develop the ability to adequately articulate speech. If receptive language can be considered a part of and a prerequisite to expressive language as reported by Myklebust, Patton's statement that the "kinesthetic sense is also fundamental to speech at any stage of its development" may be questioned. Twaddell indicates that he believes it is muscular speech activity mediated by the auditory signal that is the dominate modality in determining the identification of incoming auditory verbal stimuli. When these theoretical concepts are viewed in terms of language development, it would seem that the kinesthetic and tactual senses should be actively integrated in that process. A reasonable question generated by these and other writers is that if those senses that give the type of nonauditory feedback discussed above were disrupted then the ability to perceive auditory verbal stimuli should be affected. Therefore, it seems feasible that if the perception of auditory verbal stimuli is in some way not adequate it is conceivable that discrimination of that stimuli also might be affected. Under these conditions the subjects of this experiment were tested for discrimination ability by use of a verbal auditory picture discrimination test designed specifically for this purpose. It could not be

shown within the restrictions of this investigation that integration and feedback by the tactual and kinesthetic senses was as important to perception and discrimination as conceptualized by Patton, Twaddell and Luria.

It is of interest to note that receptive language does develop even though the suggested modalities are not always normally integrated as described in Luria's concept of an auditory-articulatory process. This can often be observed with respect to individuals with cerebral palsy, cleft palate and other disorders, who appear to have relatively normal receptive language but because of decreased motor ability do not develop normal expressive language. Myklebust (1966, pp. 50-55) describes a hierarchy of sense organization and the ways in which those modalities integrate differently when certain senses are deprived. It appears in conditions of long standing sensory deprivation that the other modalities are able to compensate by taking over part or all of the responsibilities of the deprived sense. This could conceivably be the method by which language is learned under conditions of abnormal or irregular motor and sensory feedback. When these concepts are viewed in terms of everyday observation of children in a clinical situation, it seems that those with a defective or completely deprived auditory sensory modality have much greater difficulty perceiving

and discriminating speech than those with disrupted or deprived articulatory ability.

Despite the weaknesses inherent in the present study, if the tactual and kinesthetic senses were as important to language maintenance as implied by the listed authors it seems reasonable to expect that the change in discrimination ability would have been demonstrable under the conditions of this experiment. Yet the subjects received and carried out commands and directions equally well under both conditions of the test, i.e. (1) kinesthetic and tactual sensory deprivation and (2) no deprivation of sensory modalities. Because of this investigation and other studies by Guttman, McCroskey and Ringel and Steer, it appears to this experimenter that there are at least two possible explanations for lack of difference in the receptive performance of subjects. First, as has been suggested, the kinesthetic and tactual modalities do not have a specific application in language maintenance but may assist the auditory sense in language maintenance if that modality is deprived. Second, there remains the possibility that the design and instrumentation of this experiment were not sufficiently sensitive to demonstrate a difference.

However, it should be noted that from the broad theoretical framework of language development and

maintenance discussed in Chapter I only a small part pertaining to short term maintenance was projected in the hypothesis of this experiment. Recognizing that language is a most complex behavior involving neurological patterning and systems not yet fully understood, it appears at this stage that to completely isolate only one facet and to eliminate all intervening factors is difficult at best. This experiment attempted to determine how disruption of the tactile and kinesthetic senses might affect language maintenance over a short period of time and it was concluded that disruption of these senses had no measurable effect.

Another theoretical concept left to possible future research is, What is the relationship, if any, between maintenance and development of language? It is the opinion of this investigator that certain aspects of language can be studied using a mechanical approach similar to that used here.

Limitations of this experiment and suggestions derived from evaluating the procedure that are deemed most important by this author are listed as follows:

1. Test results should be compared using subjects at different age levels.
2. Subjects with other approaches to reading training should be tested for discrimination.

3. The drug treatment should be studied to determine effective anesthetization for deep as well as topical structures to eliminate motor and sensory feedback.
4. A test designed to test discrimination on a scale of increasing difficulty could be useful.

Despite the fact that any of these suggested limitations possibly lessened the sensitivity of the study, it is felt that the study retained sufficient strength to indicate that the tactual and kinesthetic senses do not play the dominant role in early language maintenance as purported by the cited writers.

CHAPTER V

SUMMARY AND CONCLUSION

Numerous researchers have indicated that the articulatory sensory-motor feedback plays a vital role in the development of language in terms of proper integration with the auditory sense. It has been suggested that oral tactual and kinesthetic sensory and motor feedback must be present in order to correctly perceive and maintain normal speech. Out of this theoretical framework arose the hypothesis that discrimination of auditory verbal stimuli would be affected in children if they were deprived of oral tactual and kinesthetic feedback.

The subjects selected for this study consisted of male children between the ages of 6.2 and 7.6 years. They were randomly assigned into two groups. Each group was tested utilizing a discrimination test under two test conditions. The two conditions were (1) an oral topical anesthetic and (2) a comparable oral plecebo. (To insure an objective attitude during subject testing, a double blind experimental approach was used.)

The data was analyzed statistically using an analysis of variance. There was no difference shown in the discrimination abilities of the subjects under plecebo

or conditions of sensory deprivation.

On the basis of the results of this investigation and clinical observation, and personal discussion with considered experts in the field, it is felt that contrary to the literature cited in this study the auditory sense plays the prominent role in early language development and maintenance and probably remains the dominant language monitoring sense through life. The tactile and kinesthetic sense may well supplement the auditory sense when that sense is deprived.

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APPENDIX A

TEST INSTRUCTIONS

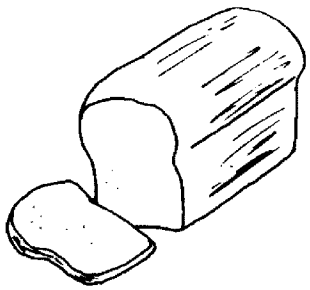
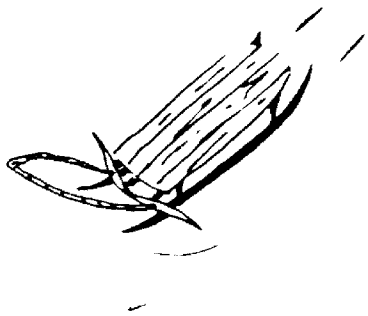
You will see in front of you some pictures on cards. There are four pictures on each card. You will be asked to point to only one picture in each group. Each word will be hard to understand because of noise, so listen carefully. Before each word you will hear the phrase "point to the." If you are not sure of the word, guess at the word anyway. For example, "point to the head." Then you point to the picture of the head. Let's try another one with the noise. "Point to the car." "Point to the girl." Good. Now we are ready to begin.

TEST

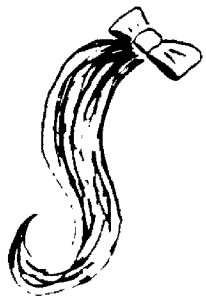
(Time interval, 6-8 seconds between stimuli words)

1. Point to the Pan.
2. Point to the Toes.
3. Point to the Rake.
4. Point to the Beet.
5. Point to the Mat.
6. Point to the Box.
7. Point to the Kick.
8. Point to the Fly.
9. Point to the Come.
10. Point to the Nail.
11. Point to the Hair.
12. Point to the Goose.
13. Point to the Dog.
14. Point to the Board.
15. Point to the Goat.
16. Point to the Keys.
17. Point to the Leak.
18. Point to the Wing.
19. Point to the Comb.
20. Point to the Lane.
21. Point to the Lamp.
22. Point to the Store.
23. Point to the Fire.
24. Point to the Coke.
25. Point to the Knight.
26. Point to the Dot.
27. Point to the Gun.
28. Point to the Bowl.
29. Point to the Sill.
30. Point to the Lamb.

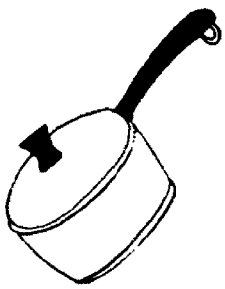


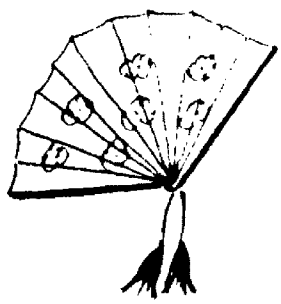



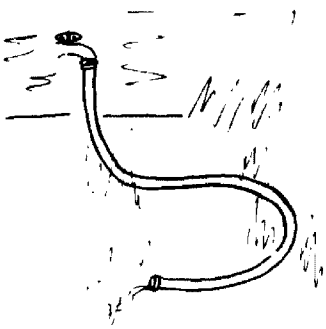
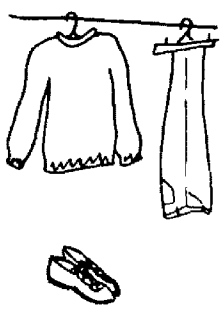


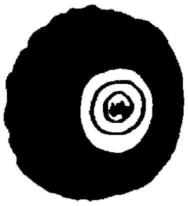


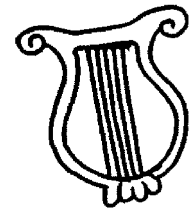


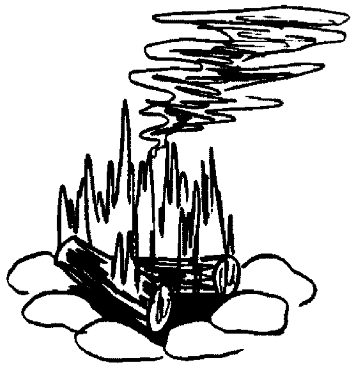
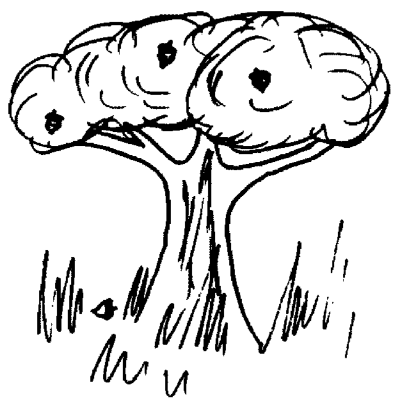


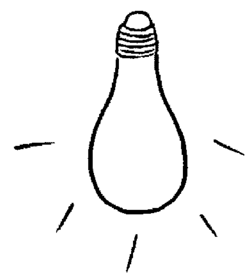
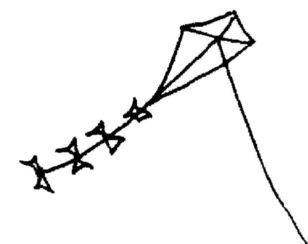
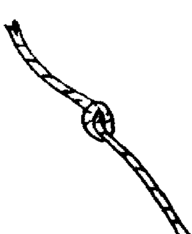



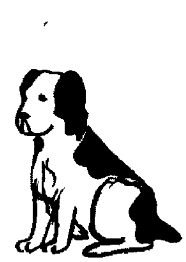
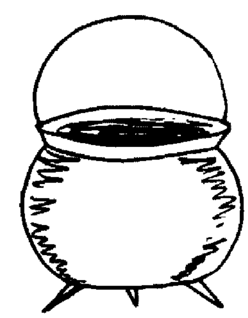
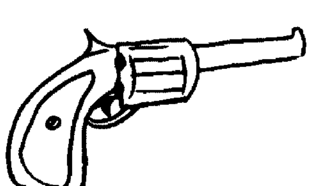



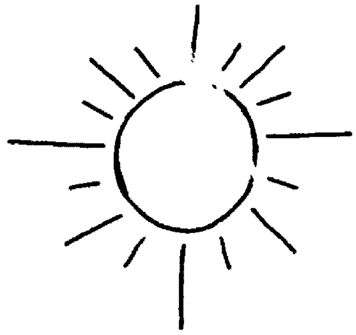
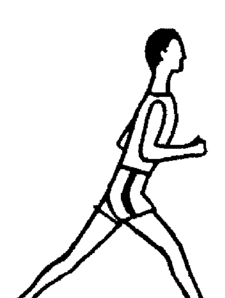


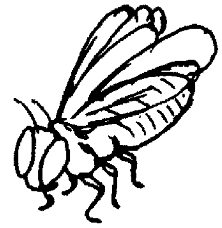
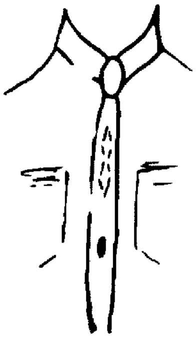
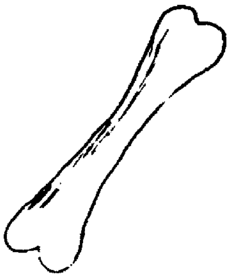


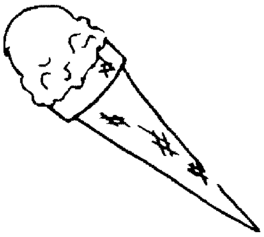




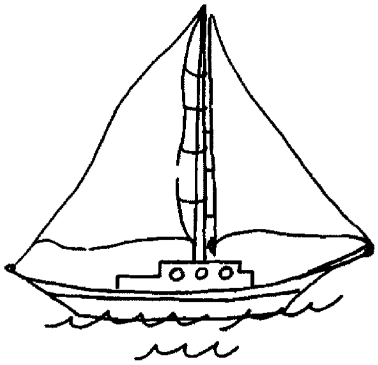




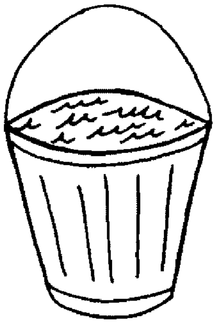
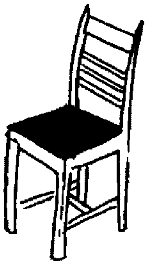
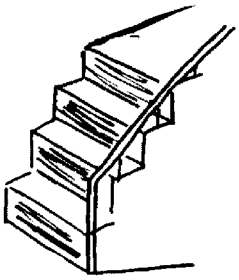
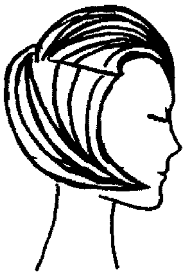
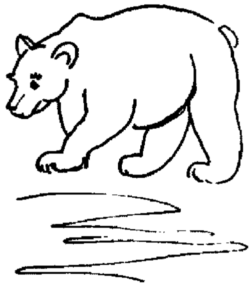
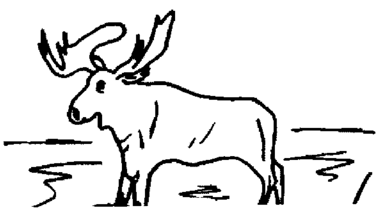
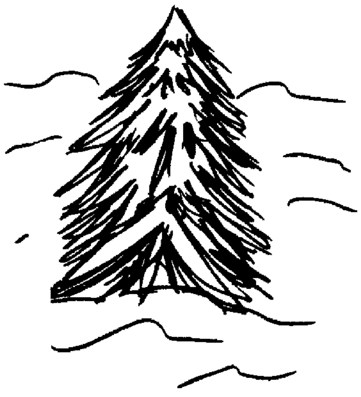
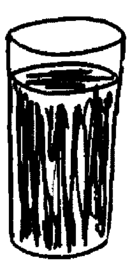
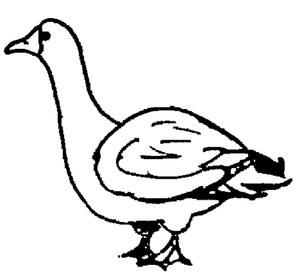



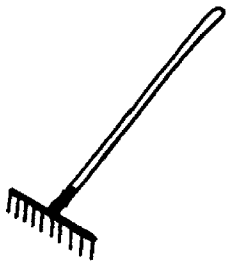
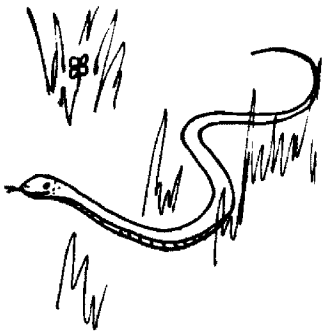


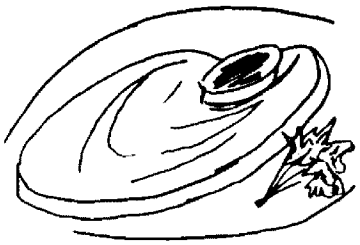




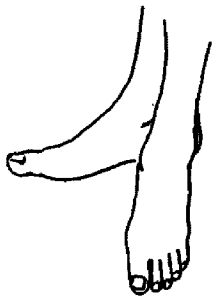
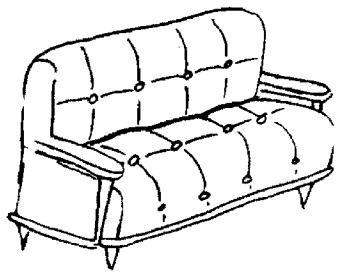
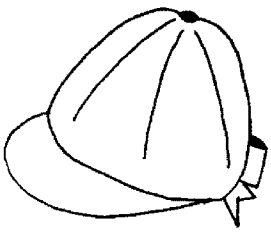
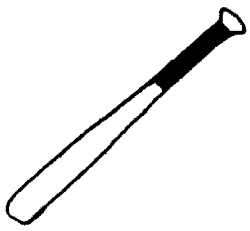



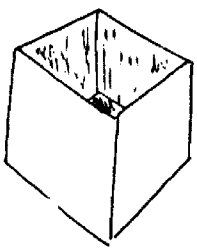


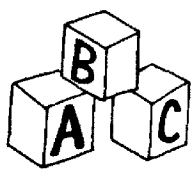










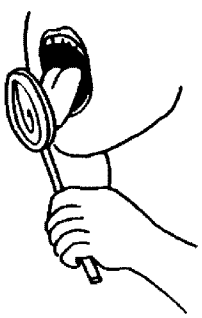




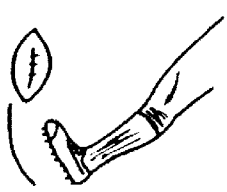
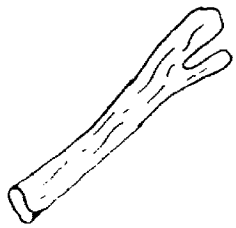


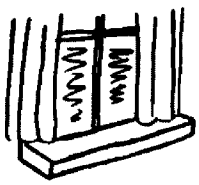





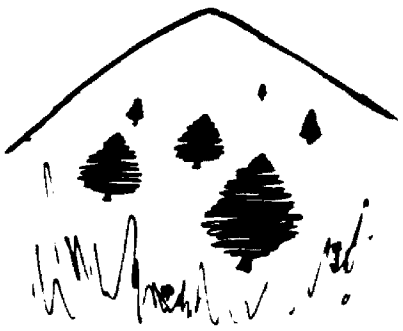


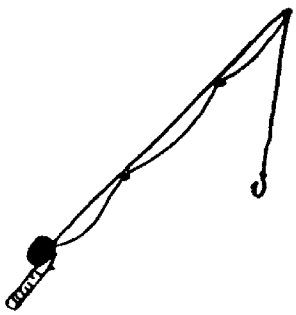



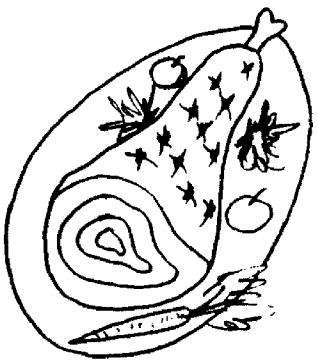


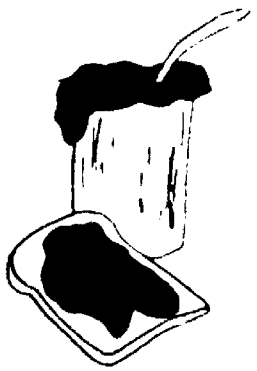













Scoring Sheet--Correct Responses
in Capital Letters

PAN	man	can	fan
TOES	hose	clothes	nose
cake	RAKE	snake	lake
meat	BEET	feet	seat
hat	bat	rat	MAT
BOX	fox	socks	blocks
lick	pick	KICK	stick
pie	eye	FLY	tie
bone	phone	stone	CONE
snail	sail	NAIL	pail
chair	stair	HAIR	bear
moose	spruce	juice	GOOSE
hog	DOG	log	frog
poured	cord	BOARD	sword
coat	GOAT	note	boat
knees	peas	KEYS	bees
beak	LEAK	peak	creek
king	swing	ring	WING
COMB	foam	home	dome
LANE	cane	train	rain
stamp	LAMP	camp	tramp
pour	STORE	floor	door

Scoring Sheet (Cont'd.)

tire	FIRE	lyre	wire
COKE	smoke	oak	cloak
KNIGHT	fight	light	kite
knot	DOT	spot	pot
GUN	bun	sun	run
pole	BOWL	coal	mole
bill	pill	SILL	hill
clam	LAMB	ham	jam

APPENDIX B

RAW DATA--NUMBER OF ERRORS ON FIRST AND SECOND APPOINTMENTS

I	II
* 9	7
9	* 7
* 7	8
7	* 9
* 6	7
12	*12
*12	12
13	*11
*12	12
9	*10
* 8	9
11	* 7
*10	10
13	*11
*10	7
9	* 7
*11	8
13	*20
* 8	7
8	*10
*14	8
9	*11

*Plecebo