A STUDY TO DETERMINE WHETHER THE PITCH OF CHILDREN IS INDEPENDENT OF THE PITCH OF THEIR PARENTS

A Thesis

Presented in Partial Fulfillment of the Requirements
for the Degree Master of Arts

by

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1960

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ACKNOWLEDGEMENTS

A most grateful note of appreciation is extended to all the people who helped to make this thesis a reality, but especially to my advisor, Dr. Courtney Stromsta, for his constant help and encouragement throughout the entire experiment; to Mrs. Mary Montebello, principal of Franklinton Elementary School; and to Mrs. Eugene Fusco of the Indianola Presbyterian Church, for their tireless efforts in helping to gather the preliminary data.

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CHAPTER I

INTRODUCTION

Statement of the Problem

The purpose of this study was to determine whether the vocal pitch of young children (from five to eight years of age) is independent of the pitch of their parents.

To accomplish this, two questions needed to be answered:

1. Is the vocal pitch of children a product of habit (imitation)?

2. Is the vocal pitch of children a reliable indicator of identification with either parent?

These and related questions were considered in the various sections of this study.

Review of the Literature

The human voice is, without a doubt, one of the most ingenious miracles of nature, and at the same time, one of the least understood by man. Speaking of just one aspect of voice, Van Riper[1] says that the

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[1]Charles Van Riper, Speech Correction (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1954), p. 282.

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pitch of the normal human voice presents many mysteries, and much research needs to be done before we can hope to understand its abnormalities. We know that the voice of a young child is high pitched when compared with that of the adult, and that in old age it tends to go back

again to higher levels. This, incidentally, is substantiated by Mysak[2]

[2]Edward D. Mysak, "Pitch and Duration Characteristics of Older Males," Journal of Speech and Hearing Research, 2:46-54, 1959.

in his study concerning pitch and duration characteristics of older men. However, exactly how and under what circumstances these complex changes of voice take place, remain unanswered questions. Of course, we may partly answer the question by attributing a certain type of pitch changes to the period of adolescence. However, even this phenomenon of voice has turned out to be something of a riddle. In a study conducted by Fairbanks, Wiley, and Lassman[3] the results show that the voice breaks of

[3]Grant Fairbanks, John Wiley, and Frank Lassman, "An Accoustical Study of Vocal Pitch of Seven-and Eight-Year-Old Boys," Child Development, 20:63-69, June, 1949.

a group of seven and eight year old boys were similar to those of older boys in number, extent, and location, thus indicating that voice breaks are not to be interpreted entirely as a sign of adolescence.

Concerning the actual production of individual pitch, we have a fair amount of information. Lee[4] says that the pitch of each vocal tone

[4]Charlotte I. Lee, Oral Interpretation (Boston: Houghton Mifflin Co., 1952), p. 130.

is determined by the rate of vibration of the vocal bands, and that this rate, in turn, depends upon the structure of the vocal bands and the larynx of each individual. Thus, in her words, ". . . the general pitch

level and the range of pitches of which his voice is capable are determined for the speaker to a certain extent by the physical fact of his structure, just as his normal height has a predetermined limit."[5] To

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[5] Ibid.

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what extent this physical factor contributes to determining the pitch level of an individual is one of the major concerns of this study. Therefore, it might be well at this point to review briefly the previous values which have been found, in terms of pitch, for men, women, and children.

According to Black and Moore[6] the male speaker representing all

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[6] John Black and Wilbur Moore, Speech: Code, Meaning, and Communication (New York: McGraw-Hill Book Co., Inc., 1955), p. 49.

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male voices has an average pitch a little higher than C below middle C, or 128 waves per second. This is approximately an octave lower than the average pitch of the typical female voice, or a little lower than 256 waves per second.

Berry,[7] however, states that women's voices are approximately

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[7] Mildred Berry and Jon Eisenson, Speech Disorders (New York: Appleton-Century-Crofts, Inc., 1956), pp. 192-3.

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two-thirds of an octave higher than the pitch levels of men's voices, and that the normal level for men is one octave below middle C on the musical scale or approximately 141 cycles. Accordingly, this calcu-

lation would place the female voice two tones below middle C or 233 double vibrations.

Snidecor[8] agrees with Berry when he places the pitch levels of

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[8]John C. Snidecor, "A Comparative Study of the Pitch and Duration Characteristics of Impromptu Speaking and Oral Reading," Speech Monographs, 10:50-56, 1951.

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six superior female speakers approximately two-thirds of an octave above the pitch levels of six superior male speakers. It is interesting to note that the women in this study have pitch levels ranging from 194 to 229 cycles per second, the composite pitch being 212 cycles per second; while the men range from 122 to 143 cycles per second, their composite pitch being 132 cycles per second.

Concerning the pitch of young children, there is not much information. We do know, however, that young children of both sexes tend to sound very much alike. This is verified by Judson and Weaver,[9] who

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[9]Lyman Judson and Andrew Weaver, Voice Science (New York: Appleton-Century-Crofts, Inc., 1942), p. 79.

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maintain that during childhood and until puberty there is little difference in the sizes of male and female larynges and vocal folds. Consequently, no great difference can be assumed in the pitch of their voices. Fairbanks, Wiley, and Lassman[10] conducted a study (mentioned

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[10]Fairbanks, Wiley, and Lassman, op. cit.

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previously) on the pitch of seven-and eight-year-old boys, in which the average pitch turned out to be 294 cycles per second. In this same vein, Fairbanks, Herbert, and Hammond[11] studied the pitch of seven and

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[11]Grant Fairbanks, Esther Herbert, and J. Marian Hammond, "An Accoustical Study of Vocal Pitch of Seven-and Eight-Year-Old Girls," Child Development, 20:71-77, June, 1949.

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eight year old girls and concluded that the average pitch was 281 cycles per second.

Despite the fact that information concerning pitch is relatively limited, we do know a great deal about the learning of speech by young children. Numerous studies have been undertaken, some going as far back as the birth cry, in which the conclusion has been reached that speech is something that is learned, or acquired. Children learn to speak by imitating their parents and those around them, and heredity has nothing to do with this acquisition of speech. For example, if a child born in Japan, of Japanese parents, is brought to this country as an infant, and placed in an environment in which only the American language is spoken, it is quite logical that he will acquire just as good American speech as an American-born child. Thus, it is not heredity, but rather the phonemic environment surrounding a child that determines the language he will use. Berry and Eisenson[12] agree that much of the stimulation for

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[12]Mildred Berry and Jon Eisenson, The Defective in Speech (New York: F. S. Crofts and Co., 1947), p. 5.

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sound production is supplied from without, especially in the later developmental stages. The child imitates and echoes other persons, and so learns to produce sounds which are prevalent in his environment. From Gray and Wise comes this statement: "When the utterance of speech sounds, singly or in combination, result from the child's thus hearing them from another, we have what is called 'imitation.'"[13] The child

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[13] Giles W. Gray and Claude Wise, The Bases of Speech (New York: Harper and Brothers, 1959), p. 482.

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simply repeats what he has heard from others, just as he has already been repeating what he has been hearing from himself.

Thus we see that it is an accepted fact that the speech of children is a process of imitation dependent upon the kind of speech or language used by the parents. The next logical question is: where does imitation leave off, and identification begin? Apparently the child is identifying, to a certain extent at least, with his parents when he imitates their speech. Lazowick supports this idea when he says, ". . . Identification takes place when one person copies another person. In this sense it is practically synonymous with imitation."[14] With this

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[14] L. M. Lazowick, "On the Nature of Identification," Journal of Abnormal Social Psychology, 51:175-183, 1955.

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in mind, the question we want to consider next is this: does this imitation of speech carry over into pitch? If so, is this imitation of the parent's pitch by the child, a reliable indicator of identification with

this parent? It is interesting to note that although Paul[15] found no

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[15]John E. Paul, "An Investigation of Parent-Child Relationships in Speech: Intensity and Duration" (PhD dissertation, Purdue University, 1959), p. 6.

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investigations attempting to explore the possible kind or degree of relationships which might exist within the family concerning the physical characteristics of the voice during speech (for example, pitch), nevertheless, hypotheses concerning familial resemblances with regard to physical characteristics do form a fundamental part of present speech theory. And, according to some authorities, the assumption of familial relationships in speech extends beyond the language function. For example, Davis and Havighurst say:

> This habit of taking an expected 'role' in one's language usage starts very early. By the age of three, little boys talk differently from little girls. When the little boy is asked, 'Are you a girl?' he says, 'No! I's not a girl; I's a boy' in a definitely masculine rhythm. There is also a masculine pattern of speech which the man-child learns, while the little girl learns a feminine speech pattern. This learning to speak according to the proper sex-pattern illustrates the basic process of cultural learning . . . (the little boy) also has the intimate learning experiences that come from identification with his father. This emotional bond pulls him toward imitating the father's intonation and his speech mannerisms. The father is a model of the sex-culture, which the child wants to learn.[16]

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[16]W. Allison Davis and Robert Havighurst, Father of the Man (Boston: Houghton Mifflin Co., 1947), p. 114.

This idea is definitely substantiated by Emmerich[17] in his study on

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[17]Walter Emmerich, "Parental Identification in Young Children" Genetic Psychology Monographs, 60:257-308, 1959.

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parental identification in children. He found that the subjects tended to identify more with the same-sex parent than with the opposite-sex parent. Another interesting thing which was broughtout by his investigation (and which supports the findings of Davis and Havighurst), was that with increasing age within the age range sampled, boys increasingly exaggerate in their behavior the controlling attitude that they associate with the father role. Interestingly enough, no parallel sex-typed age trend was found in girls. However, Levin and Sears partially answer this question when they say:

> By the age of five years, most children may be assumed to have developed their strongest identification with the same-sexed parent. This development is not the same for the two sexes, because the conditions for establishing primary identification are such that the mother is the initial identificand for both boys and girls. Only as the boy begins to perceive himself as male, 'like' his father and 'unlike' his mother, can he begin to shift his identificand from mother to father. Hence, identification is more straightforward in the girl, and she develops a stable sex-typing more rapidly in this respect than the boy.[18]

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[18]Harry Levin and Pauline Sears, "The Identification with Parents As A Determinant of Doll Play Aggression." Child Development, 27:135-155, 1956.

With this information, we can see why the boy's reactions would be much stronger due to his shift of identification at a later time.

Doll Play and Identification

Doll play as a measure of identification with parents has been used successfully with young children in recent years. Sears[19] used

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[19]Pauline S. Sears, "Child-Rearing Factors Related to Playing of Sex-Typed Roles," American Psychologist, 8:431-2, 1953.

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this technique with 202 boys and 177 girls, all kindergarten ages. The doll play activity plus interviews with the mothers, yielded these results:

1. Girls chose the mother doll as agent significantly more frequently than the father doll.

2. Boys do not make this differential choice; however, they use the father doll more than the girls do.

3. Positive choices for the same sex role and avoidance of the opposite sex role are in general associated with antecedent conditions of warmth, permissiveness, and low restrictions.

4. Delayed role playing . . . occurs in children whose homes appear to be lacking in warmth and high in restriction of activities which may bother the parents.

5. Boys take the mother role most strongly under the following conditions: mother, but not father, is high in warmth; mother is high in sex permissiveness, restrictive of the child's mobility outside the home, and critical in her evaluation of her husband.

To review briefly, we might say that although no actual research has been reported in support of the hypothesis, it is assumed by many

authorities that parents serve as models for children with regard to the typical vocal elements in their speech. Whether or not this is true of pitch is a question that up to now has not been answered, and it was with this question in mind that the present study was undertaken.

Definitions of Terms Used

Because pitch played such an important part in this study, it was felt that it would be appropriate to discuss the characteristics of pitch to some length. According to Fairbanks,[20] the pitch of a tone

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[20]Grant Fairbanks, Voice and Articulation Drillbook (Iowa City, Iowa: Athens Press, 1939), p. 127.

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refers to its position on the musical scale, and is related to the frequency of sound wave repetition. In voice production the fundamental sound wave frequency is directly determined by the frequency of vibration of the vocal cords.

By pitch level we mean the gross position of a sound or group of sounds on the musical scale. Every vibrating body has a certain frequency or band of frequencies which is said to be "natural" to the object, and the vocal cords are not exceptions to this rule. Therefore,it is assumed that each individual has a zone, or band of frequencies, at which it will be easiest for him to phonate. This is called his "natural pitch level." His "habitual pitch level" is that which he uses ordinarily, and the two may or may not coincide.

Along this same line of thought, Black and Moore[21] state that

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[21]John Black and Wilbur Moore, Speech: Code, Meaning, and Communication (New York: McGraw-Hill Book Co., Inc. 1955), pp. 50-51.

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vocal pitch is not a steady state, but rather a continuous variation achieved by inflections throughout the pitch range of the speaker. With "good" voices the range is frequently two octaves.

Fairbanks elaborates further when he defines inflection as a frequency modulation, whether upward or downward, without interruption of phonation; shift as a change in pitch which takes place between the terminal pitch of a given phonation and the initial pitch of the subsequent phonation; and (the) rate of pitch change as a measure of the rapidity with which frequency is modulated per unit of time during inflections, i.e., the relative "steepness" of the inflections.[22]

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[22]Grant Fairbanks, "Recent Experimental Investigations of Vocal Pitch in Speech," Journal of the Accoustical Society of America, 11:457-466, 1940.

It might be interesting, at this point, to look at pitch from the physical aspect, also. Berry discusses pitch with particular emphasis on the human vocal mechanism. She says:

> Pitch is not only partly dependent upon the intercostal-abdominal-diaphragmatic synergy of muscles, but also . . . upon the muscular action of the larynx which serves as a kind of oscillator to act upon the wave of compression initiated by the breath pulse. By the time the sound wave leaves the larynx, the pitch has been established. What we perceive as pitch is a subjective auditory impression of the frequency, or the number of

> vibrations per second, of those oscillating waves of compression and rarefaction.[23]

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[23]Mildred Berry, Speech Disorders (New York: Appleton-Century-Crofts, Inc., 1956), pp. 192-193.

Another interesting thing about pitch is that vocal intensity can be increased by raising the habitual pitch. It is a common observation that children's voices "carry" much better than do adults'. While this may be due in part to the concentration of energy within a narrow group of overtones, the higher pitch level is also important.[24]

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[24]Charles Van Riper, Speech Correction (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1954), p. 307.

Concerning frequency and pitch, one authority clarifies the definition somewhat when he says that the physical attribute of frequency of an audible wave is primarily responsible for the psychological sensation of pitch. As the frequency of a sound increases, the pitch of the sound as heard becomes higher. The relationship between frequency and pitch is such that, as frequency is doubled (intensity remaining constant), pitch is raised one octave; conversely, as frequency is halved, pitch is lowered one octave.[25]

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[25]S. S. Stevens, and H. Davis, Hearing (New York: Wiley, 1949), p. 21.

Travis clarifies the relationship of pitch to frequency further by saying:

> Fundamental frequency is significant . . . because it is the component of the complex auditory stimulus which is identified by the listener as the pitch of sound. The fundamental frequency of the human voice is determined by and is, in fact, identical with the rate of vibration of the vocal cords, measured and reported in cycles per second.
>
> Two aspects of frequency have contributed to the difficulties encountered in devising instruments for its measurement. First, voice frequency and the frequencies of other stimuli within the auditory range are, compared with many other physiological phenomena, quite high. Hence, a fast-acting instrument is required to follow the signal. Second, the fundamental frequency in most acoustical signals is but one component in a complex wave. Therefore, the instrument must be capable of responding only to the fundamental, or of making a response in which the fundamental is clearly to be distinguished from the other components in the sound.[26]

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[26]Lee Travis, Handbook of Speech Pathology (New York: Appleton-Century-Crofts, Inc., 1957), p. 193.

From this background of information, one cannot help becoming aware of the complexities accompanying any study of pitch. Not only are there bound to be complications arising from pitch changes and frequency modulations, but an added problem that arises is the determination of the sound to be spoken, so that there is a high degree of uniformity among the subjects being tested. The objective was to test only one vowel sound for each person, but it was also important to get as close to the subject's habitual pitch as possible, and for this reason one possibility considered was to have each subject say a carrier phrase containing the vowel to be analyzed, such as, "In winter I like to ski." In this case

the /i/ sound would be the vowel which would then be analyzed. However, it is a known fact that the effect that various sounds have upon each other is tremendous. This is brought out by Scripture, who says, "A vowel begins as a fact of inner speech activity . . . /an/ inner activity that is overlapped by other vowels or speech sounds before being spoken."[27] Because of this factor, it was decided, in the last

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[27]E. Scripture, "The Nature of the Vowels," Quarterly Journal of Speech, 22:359-366, 1936.

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analysis, to have each subject simply phonate the vowel /a/, as in father. Still, even this procedure is not as clear-cut as one might be tempted to believe, because the vowels, simple though they seem to be in ease of production, have some definite (yet changeable) qualities all their own. For example, again turning to Scripture for reference, we find the statement that when the vibrations of a vowel reach the ear, three things are heard: (1) the note on which the vowel occurs (the "voice tone"), (2) the speech character of the vowel, and (3) a characteristic that depends on the person speaking.[28] Said another

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[28]Ibid.

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way, no one ever reproduces exactly any sound he has made. According to Judson and Weaver:

> Only the ear's sensitiveness limits us in detecting and giving symbolic value to all sounds. Analysis of

> the acoustic spectra of some vowels reveals that from twenty to forty partials may be identified. Inasmuch as a vowel may be characterized if only two or three frequency areas are reinforced, it seems to be a logical mathematical deduction to say that the possible number of permutations and combinations that can be obtained from forty factors, varying in pitch and/or intensity is, for all practical purposes, infinite.[29]

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[29]Lyman Judson and Andrew Weaver, Voice Science (New York: Appleton-Century-Crofts, Inc., 1942), p. 75.

The last term of significance to this study is identification. According to Lazowick, identification usually implies a relationship between two persons; a subject and a model. He goes on to say:

> Views on the nature of this relationship may be classified arbitrarily into three categories. The first represents those definitions which imply that the subject behaves as if he and the model were one and the same person. We may label this category of definitions pseudo identity . . . . A second category of definitions, which we may call imitation, is one in which most definitions fall . . . . 'Identification takes place when one person copies another person. In this sense it is practically synonymous with imitation.' A distinction has been drawn between identification and imitation on the grounds that identification refers to the action of the entire personality, while imitation is more restrictive in terms of referring to isolated skills or acts; furthermore, identification usually presupposes an alteration of the ego after a pattern set by the model. With these statements a third category of definitions characterizing identification is introduced, change in personality structure.[30]

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[30]L. M. Lazowick, "On the Nature of Identification," Journal of Abnormal Social Psychology, 51:175-183, 1955.

Last but not least, one author puts it very well when he says that a child gives its emotional allegiance to one of its parents and tries to duplicate in its own life the ideas, attitudes, and behavior of the parent with whom it is identifying.[31]

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[31] *Ibid.*

CHAPTER II

EXPERIMENTAL PROCEDURE

Pitch

Subjects. The purposes of the study were: (1) to determine whether the pitch of young children is independent of the pitch of their parents, and (2) to discover whether the pitch of children can be used as a reliable measure of identification with either parent.

In order to answer these questions, certain criteria were adopted in the selection of families to be used in the study.

1. Only children between the ages of five and eight years were used in the study. (The older the child, the greater is the possibility that he might be identifying with a teacher, rather than a parent.)

2. Only children who possessed normal hearing were used.

3. With three exceptions, only children living with both natural parents weree used.

4. Only children were used whose home environments were such that their vocal patterns were not influenced by a relative or friend living with the family.

In all, 28 families participated in the study. The first group, composed of 19 families, was taken from Franklinton Elementary School, Columbus, Ohio. The second group, composed of nine families, was taken from the Indianola Presbyterian Church, Columbus, Ohio.

The mean age for children tested was six years, three months (the range being from five to eight years). Most of the parents tested were in the thirty-to-forty age group.

Equipment. The following equipment was employed in the testing procedure:

Tape recorder. A tape recorder (Wollensak, Model T-1500) with associated crystal microphone was used to record the names and vowel samples of the subjects participating in the study. A circle of wire was attached to the microphone so that it could be placed around the neck of each subject while he recorded. In this way, the distance from mouth to microphone (approximately 18 inches) was kept relatively uniform for each subject.

Load meter. The output of the tape recorder was bridged to a load meter (General Radio Co., Model Type 583-A) that was used by each subject to monitor his voice at a relatively constant level. This was important to the study because an increase of intensity usually raises the pitch level of a person's voice, thus changing the fundamental which served as the criterion measure in the study.

Recording procedure. The subjects were brought into a room where the tape recorder and load meter were situated on a table. In the case of each family unit, the three subjects were positioned so they could see the equipment. Families were always recorded in the same order; the father, the mother, and then the child. The recording procedure was

explained to the subjects in the following way:

> You are to record a very short sample of speech in this manner: put the microphone around your neck and let it hang directly in front of you. Do not touch the microphone while recording. You may sit or stand when you record; it makes no difference. When I signal for you to start, you are to give your name, and then say the vowel /ā/, holding it until I signal for you to stop. Say the vowel on the pitch level you think you normally use in everyday speech; and say it loudly enough so that the needle on this instrument (the load meter) moves up to twenty. Let's practice it once before we start.

Each subject practiced the above procedure before recording. When a subject had trouble attaining sufficient volume, the volume control was adjusted on the tape recorder so as to peak the needle at the beforementioned position on the load meter.

Each subject was instructed to maintain the vowel for at least four to five seconds. The children, especially, found this difficult to do. For some, many practice attempts had to be made before the vowel sample was actually recorded.

Measurement of frequency. The original recorded vowel samples were used to re-record specific segments, one to two seconds in length, of each vowel. Two tape recorders (Wollensak, Model T-1500) were used to accomplish this. By using identical recorders it was hoped to eliminate any sound distortion that might have resulted from a different type of recorder. An electric timer (Standard, Model S-10) was used to time the segments taken from each five-second vowel sample.

The next step consisted of reducing the fundamental frequency of the recorded vowel segments 8:1 (as well as a calibration tone that

preceded the vowels) so as to visually display them on a pen-writing oscillograph (Edin, Model 8062). A two-second sample of each vowel was tape recorded at 7½ inches per second (Wollensak, Model T-1500) as was a 400 c.p.s. calibration tone that preceded each vowel. The material was then re-recorded at thirty inches per second (Ampex, Model 300) and played back at 3 3/4 inches per second (Wallensak, Model T-1500) to the pen-writing oscillograph at a paper speed of 125 millimeters per second. By this process, the fundamental frequency of the recorded vowels was reduced 8:1 as was the calibration tone. The fundamental frequency of the vowels was measured (number of wave peaks per 125 mm.) at three intervals along the graphic record of each vowel. The calibration tone allowed a correction factor to be applied to compensate for minute recorder-speed variations and tape slippage. The mean fundamental frequency was then calculated for each vowel.

Identification

Test materials. The next step in the study consisted of finding some method whereby it could be determined whether each child was identifying with (1) the mother, (2) the father, or (3) neither parent. In order to do this, a simple scale of identification was devised which consisted of a series of six pictures, three pertaining to girls and three to boys, to be shown to the children. The pictures were sketched and colored on 9x12 inch white construction paper, and scenes were used which showed a child (1) with the father, the mother being apart; (2) with the mother, the father being apart; (3) an equal distance from both parents. (See Appendix for examples of the pictures.)

Testing procedure. The child was brought into the room where the examiner was seated at a desk. At the child's entrance, the examiner chose the three appropriate pictures (according to the sex of the child) and placed them in the order mentioned above. The child was then told to look carefully at each picture and then to tell the examiner which picture he liked best. The assumption was that the child would choose the picture depicting his own relationship to his parents. Because the test was short and to the point, it was easily administered, and the children appeared to have no trouble deciding on which picture they preferred. The subjects tested were 25 of the thirty children previously recorded for pitch level.

CHAPTER III

TREATMENT OF DATA AND RESULTS

The purpose of this study was to determine two things:

1. Is the vocal pitch of children a product of imitation?

2. Is the vocal pitch of children a reliable indicator of identification with either parent:

In order to determine these answers, the data were treated by the Chi Square technique. Because the gathering of the data was divided into two parts (pitch recordings later followed by tests of identification), the results obtained will be presented in two parts; pitch results and identification results.

Pitch Results

Stated in the form of null hypotheses, the basic question concerning pitch may be divided into four parts:

1. There is no significant relationship between the pitch of boys and the pitch of their fathers.

2. There is no significant relationship between the pitch of boys and the pitch of their mothers.

3. There is no significant relationship between the pitch of girls and the pitch of their fathers.

4. There is no significant relationship between the pitch of girls and the pitch of their mothers.

In testing these four hypotheses, a Chi Square Test was run between the pitch level of each parent and child, with regard to his or her position above or below the median for their respective group. (See Tables I and II). Concerning Hypotheses 1 and 3, the value of Chi Square was non-significant (X^2 = 0.20, 5% = 3.84, df = 1), a condition which held for Hypotheses 2 and 4 (X^2 = 0.26 and 0.28, respectively, df = 1). Thus, the analyses would indicate that an assumption of independence of the two dichotomies was not rejected.

The conclusion reached was that there is no significant relationship between the pitch of boys and girls and fathers and mothers with regard to the median pitch level.

Identification Results

To ascertain whether or not a relationship existed between children and parents in terms of which parent the child chose as identificand, a Chi Square Test utilizing a six-cell contingency table related girls to boys and "mother," "father," or "neither." In this case, the value of Chi Square was non-significant (X^2 = 1.4, 5% = 5.99, df = 2).

Last of all, a Chi Square Test was run which related both pitch and identification. Here the two dichotomies were: (1) whether the identified parent fell above or below the median (in terms of pitch) for parents of his or her sex, and (2) whether the child in each case fell above or below the combined median for boys and girls. The value of Chi Square was non-significant (X^2 = 0.60, df = 1).

TABLE I. FUNDAMENTAL FREQUENCY OF VOWELS OF FATHERS, MOTHERS, BOYS, GIRLS, AND BOYS AND GIRLS COMBINED.

Family	Father	Mother	Boy	Girl	Boys & Girls combined
1	168	227	277	---	277
2	143	227	282	---	282
3	139	244	---	320	320
4	101	219	278	---	278
5	93	236	---	270	270
6	109	194	---	227	227
7	160	248	409	---	409
8	93	189	278	---	278
9	149	209	211-314*	---	211
10	110	211	---	270	270
11	139	202	---	286	286
12	143	244	---	244	244
13	109	211	---	244	244
14	105	219	---	261	261
15	126	181	---	261	261
16	135	236	270	---	270
17	109	211	270	---	270
18	122	211	291	---	291
19	143	253	253	---	253
20	101	202	215	---	215
21	109	202	261	---	261
22	109	219	---	227	227
23	97	173	270	---	270
24	122	181	261-337	---	261
25	93	244	---	345	345
26	135	194	---	261	261
27	147	168	---	244	244
28	105	168	---	270	270
					314
					337
Median	116.5	212	273.5	261	270

* A double entry means that two children in the same family were tested.

TABLE II. TABLE SHOWING POSITION OF EACH PERSON IN RELATION TO THE MEDIAN OF THEIR RESPECTIVE GROUP, AND THE IDENTIFIED PARENT AS CHOSEN BY THE CHILD.

Family	Father	Mother	Boy	Girl	Children	Identified parent
1	a	a	a	--	a	f
2	a	a	a	--	a	m
3	a	a	--	a	a	n
4	b	a	a	--	a	f
5	b	a	--	a	a	f
6	b	b	--	b	b	n
7	a	a	a	--	a	m
8	b	b	a	--	a	n
9	a	b	b a	--	b a	f n
10	b	b	--	a	a	n
11	a	b	--	a	a	n
12	a	a	--	b	b	m
13	b	b	--	b	b	m
14	b	a	--	a	b	f
15	a	b	--	a	b	m
16	a	a	b	--	a	f
17	b	b	b	--	a	n
18	a	b	a	--	a	m
19	a	a	b	--	b	f
20	b	b	b	--	b	m
21	b	b	b	--	b	--*
22	b	a	--	b	b	--
23	b	b	b	--	a	--
24	a	b	b a	--	b a	n
25	b	a	--	a	a	--
26	a	b	--	a	b	m
27	a	b	--	b	b	m
28	b	b	--	a	a	m

a = above median, b = below median
f = father, m = mother, n = neither parent.

* No entry in the right-hand column signifies that the child was not included in the Identification Test.

Hence, the conclusion reached is that there is no significant relationship between pitch and identification, in terms of children and their parents.

Discussion

In view of these findings, it would appear that there is no significant relation between:

1. the pitch of children and the pitch of their parents in terms of median pitch level.

2. identification and pitch, regarding children and their parents.

However, it was interesting to note that, concerning the identification test administered, the six-year-old boys identified with neither parent, whereas the seven-year-old boys identified exclusively with their fathers. This would tend to support the hypothesis of Davis and Havighurst, who say that as boys grow older, they increasingly exaggerate in their behavior the controlling attitude they associate with the father role.

Only six children (out of thirty) showed identification with the (same) parent with whom they were more closely associated in terms of pitch. Of these six, two were boys and four were girls. Two children were seven years of age, three were six, and one was five.

Another conclusion reached in the test of identification concerned a comparison of six and seven year old girls. Testing four six-year olds showed that all four identified exclusively with the mother. However,

when the group of seven-year olds were tested, only two identified with the mother, two chose the father, and three identified with neither parent. This would tend to support, in part at least, the hypothesis set forth by Levin and Sears, who maintain that by the age of five, most children may be assumed to have developed their strongest identification with the same-sexed parent. However, this finding also questions another statement made by Levin and Sears, namely: ". . . and she [the girl] develops a stable sex-typing more rapidly . . . than the boy." (Refer to reference 18, p. 8.) The findings of the present study indicate very little, if any, stability on the part of girls or boys, with regard to identification in general. In fact, using a simple method of tallying at each age level, the following was disclosed: At the five-year-old level, the only girl identified with neither parent and the only boy identified with his mother. At the six-year-old level, the four girls all identified with their mothers, and of the five boys, two identified with their mothers and three identified with neither parent. At the seven-year-old level, of the seven girls, two identified with their mothers, two with their fathers, and three with neither parent. However, the boys at this particular age level all identified with their fathers. Last of all, at the eight-year-old level, only two boys fell into this group, one identifying with his mother and the other identifying with neither parent. Thus, in terms of the present study, at least, there does not seem to be any relationship between age and sex of child, and stability of identification.

On the whole, disregarding specific age groups, the 13 boys tested were rather evenly distributed (four boys identified with the mother, five with the father, and four with neither parent). However, of the 12 girls tested, two "clusters" appeared. Six girls identified with their mothers, four chose neither parent, and only two identified with the father. Thus, it would seem that boys tend to identify more with the opposite-sexed parent than girls, at least up to a certain age. This, once again, supports the findings of Levin and Sears, who say that the conditions for establishing primary identification are such that the mother is the initial identificand for both boys and girls.

The last finding of interest concerns the three step-children used in the study. They consisted of a girl, six years old; a boy, six; and another boy, seven. All three children had stepfathers. It would be expected that almost without exception, these children would tend to identify with the natural parent; however, this was not the case. The oldest boy, in contact with his stepfather for three years, identified with the stepfather. The other boy, in contact with his stepfather for six months, identified with neither parent. The girl, on the other hand, in contact with her stepfather for four months, identified with her mother.

To summarize briefly, one could hypothesize, under the conditions of this study, that pitch is not based on identification. Thus, a further hypothesis might be that pitch of children is governed by physiology, or

the particular physical structure of the individual. A further finding of the study showed no relationship between pitch of children and identification with parents.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Summary

According to the literature, there have been no investigations concerning familial relationships in regard to the physical aspects of speech. Thus, the question posed by this study was: Is the pitch of children independent of the pitch of their parents? This in turn led to the question: Is pitch of children a reliable indicator of identification with either parent? With these two questions in mind, the present study was undertaken.

The subjects used in the study were 28 family units consisting of father, mother, and a child. All the children were between the ages of five and eight.

In order to determine the fundamental frequency of each subject's voice, each family was tape-recorded (father, mother, then child) with each person sustaining the same vowel for five seconds. A load meter was used to help each subject maintain his vowel at a relatively constant sound pressure level. The recorded vowels were reduced to two-second segments, re-recorded at a speed-reduction of eight-to-one, and visually displayed on a pen-writing oscillograph. On the basis of this procedure, the wave peaks were counted to determine the fundamental frequency of each subject's vowel.

The second part of the experimental design consisted of giving each child in the study a simple test of identification which consisted of colored pictures depicting the child in close relationship to (1) father, (2) mother, or (3) neither parent. The picture the child preferred was used as an indication of the parent (if either) with whom he was identifying.

The Chi Square technique was used to analyze the data regarding pitch and identification. The analysis of the pitch relationships consisted of determining median fundamental frequencies for fathers, mothers, boys, girls, and boys and girls combined. Chi Square tests were run between: (1) boys and fathers with regard to their positions above or below their respective medians; (2) boys and mothers with regard to their positions above or below their respective medians; (3) girls and fathers with regard to their positions above or below their respective medians; and (4) girls and mothers with regard to their positions above or below their respective medians.

With respect to identification, a Chi Square Test was used which related boys to girls and their preferences for "mother," "father," or "neither."

Last of all, a Chi Square Test was run which related pitch and identification. Here the two dichotomies were: (1) whether the identified parent fell above or below the median (in terms of pitch) for parents of his or her sex, and (2) whether the child in each case fell above or below the combined median for boys and girls.

In all of the tests, the value of Chi Square was non-significant, thus indicating that under the conditions of this study: (1) there was no significant relationship between the pitch of children and that of their parents and (2) the pitch of children could not be used as a reliable indicator of identification (on the part of the child) with either parent.

Conclusions

This study showed that the pitch of children is independent of parental pitch; thus, a further hypothesis might be that the pitch of children is governed by physiology.

In terms of identification, the findings of the study, in part at least, supported the theory that by the age of five most children may be assumed to have developed their strongest identification with the same-sexed parent. However, the study also showed great instability on the part of both boys and girls with regard to identification in general. Under the conditions of this study, there did not seem to be any relationship between age and sex of the child and stability of identification.

The study also supported the theory that as boys grow older they increasingly exaggerate in their behavior the controlling attitude they associate with the father role. This was shown specifically with regard to the six-and seven-year-old boys used in the study. The older boys identified exclusively with their fathers, while the younger boys showed no identification whatsoever.

Last of all, this study substantiated the theory that boys tend to identify more with the opposite-sexed parent than do girls, at least up to a certain age. This substantiated previous findings which state that the mother is the initial identificand for both boys and girls.

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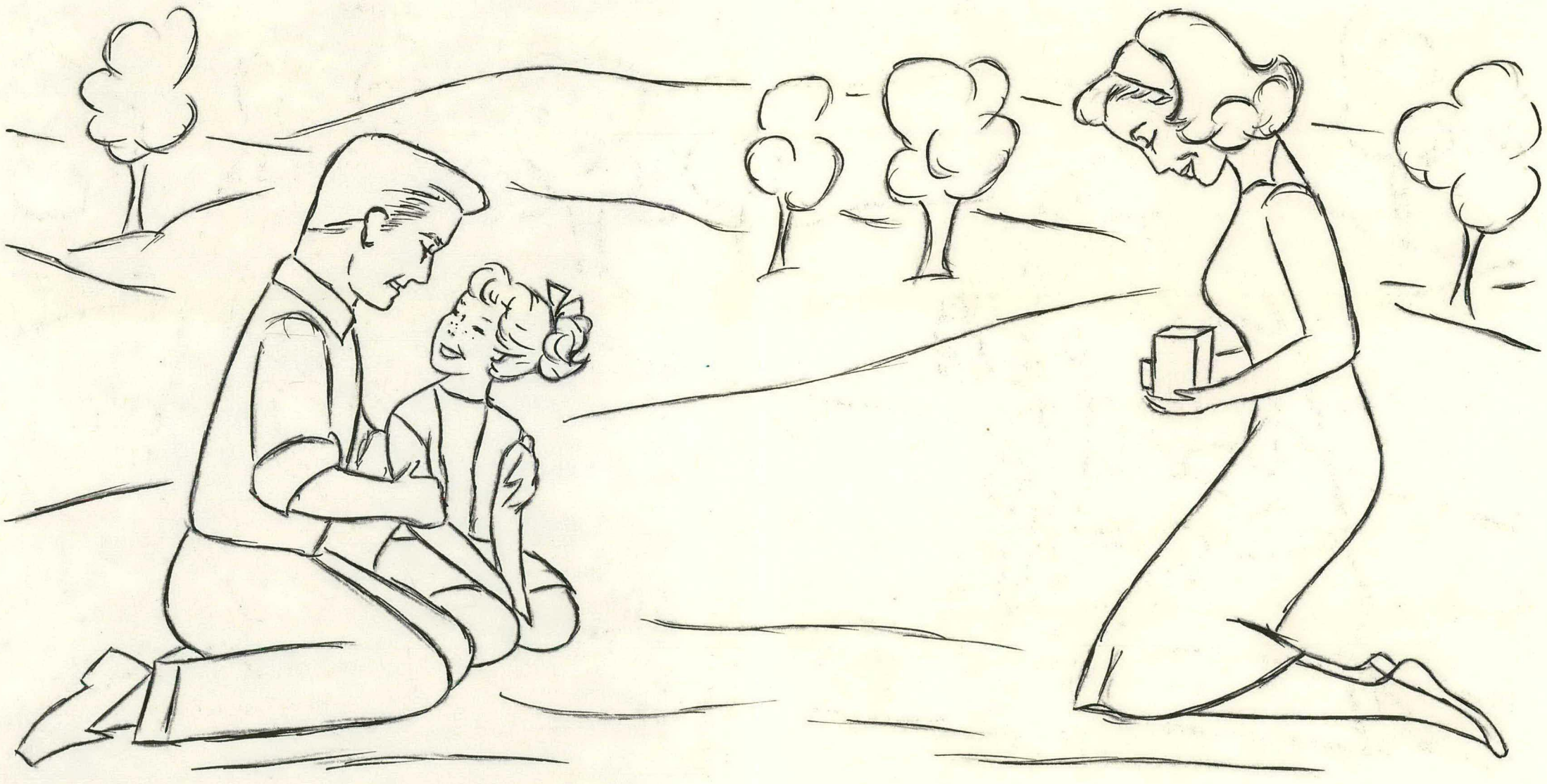
APPENDIX

GIRL

Picture #1

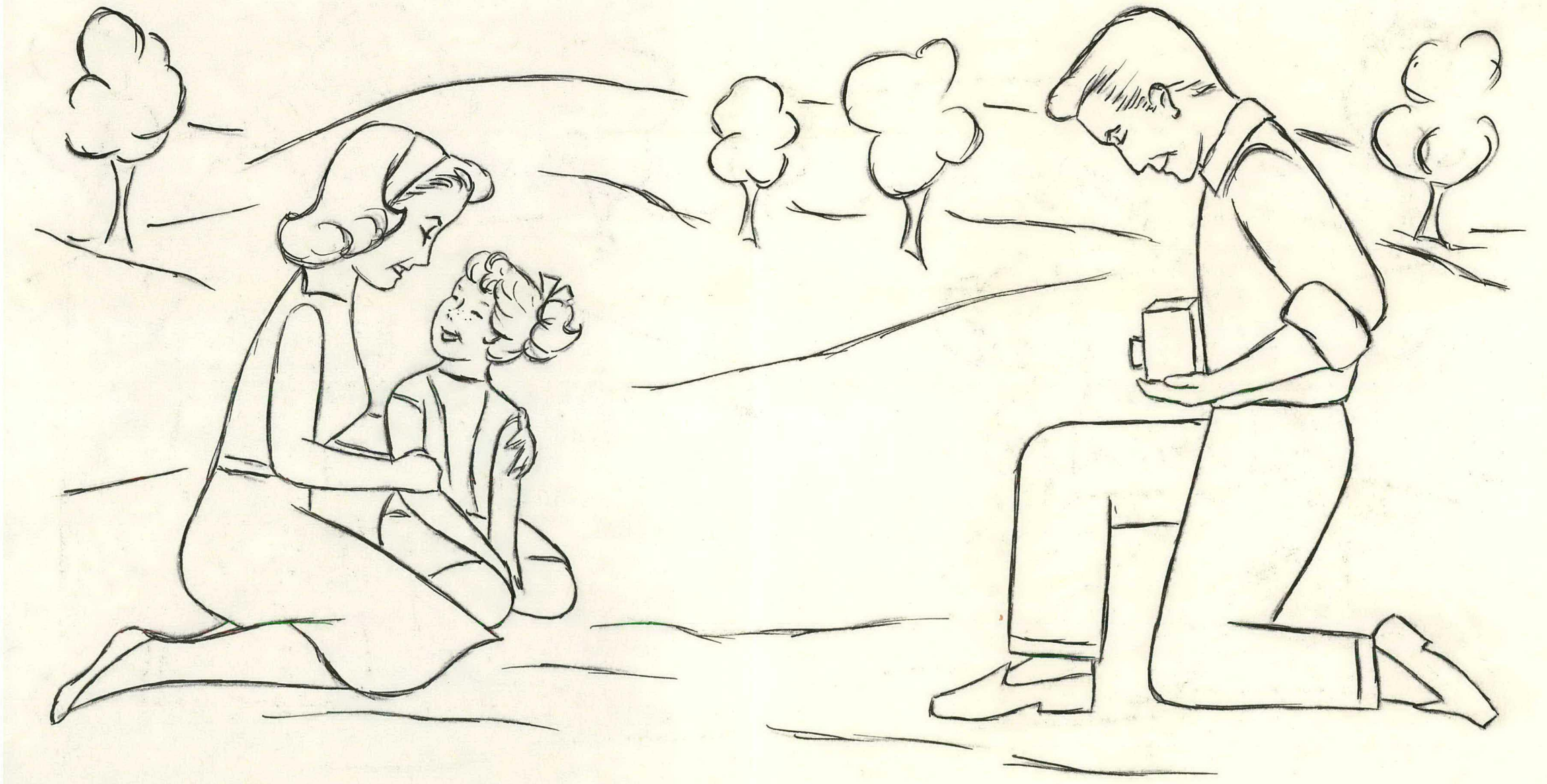
(used in Identification Test)



GIRL

Picture #2

(used in Identification Test)



GIRL

Picture #3

(used in Identification Test)