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THE EFFECT OF A SYNTHETIC ONLY VERSUS SYNTHETIC PLUS ANALYTIC APPROACH TO AUDITORY TRAINING WITH ADVENTITIOUSLY HEARING-IMPAIRED ADULTS

City University of New York PH.D. 1985

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by

ADRIENNE RUBINSTEIN

A dissertation submitted to the Graduate Faculty in Speech and Hearing Sciences in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

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Abstract

THE EFFECT OF A SYNTHETIC ONLY VERSUS SYNTHETIC PLUS ANALYTIC APPROACH TO AUDITORY TRAINING WITH ADVENTITIOUSLY HEARING-IMPAIRED ADULTS

by

Adrienne Rubinstein

Advisor: Professor Arthur Boothroyd

Twenty hearing aid owners, aged 56 to 79, with mild to moderate sensorineural hearing impairments, were given structured auditory training. Ten of the subjects spent all of the time on global tasks (i.e. activites involving sentence perception and perceptual strategy) while the other ten spent half of the time on analytic tasks (i.e. activities involving consonant recognition).

Three tests of speech recognition were given to measure the effects of training: The CUNY Nonsense Syllable Test (NST), the low predictability items of the Revised Speech Perception in Noise (RSPIN) test, and the high predictability items of the RSPIN test. The tests were administered at a signal to noise ratio giving a score of approximately 50%, as determined by an adaptive procedure at the beginning of the study. Subjects were tested on four occasions: (a) at the beginning of the study, (b) after four weeks of "no treatment", (c) after a further four weeks of auditory training, and (d) after a final four weeks of "no treatment".

The results showed: (a) that performance improved only during the treatment period, (b) that improvement was maintained during the four weeks following training, and (c) that the improvement occurred only in the high predictability items. The effect of training method was not significant, either as a main effect or in interaction with

other factors. The results indicate that the two methods were equally successful in effecting change. Since the improvements were seen only in the materials with high redundancy, the findings suggest that effective listening while taking advantage of contextual cues was the most important feature of the program.

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Expressions of gratitude when put on paper often sound trite and fail to convey the power of the emotions behind them. At the end of a project such as this one, however, one feels so indebted to the people who have contributed to it that one desires at least to make the attempt.

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I also thank the other students and staff at the City University Graduate School, in particular, Tova Most, who has made the journey infinitely easier by sharing it with me, and Dr. Arlene Neuman, whose gentle counsel throughout my studies has enabled me to profit from her experience.

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The spouse of a doctoral candidate lives a difficult life, but when that spouse is also a doctoral candidate, the problems are compounded. I have been blessed with a partner whose generosity, warmth, and easy-going nature has made it possible for us to go through this experience simultaneously. I hope I will always be there for you, Aviv, the way you have been there for me.

Adrienne Rubinstein

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Chapter 1
Introduction

For a long time, aural rehabilitation has been of secondary importance to diagnosis in audiology (Hull, 1982), despite the fact that an interest in aural rehabilitation during World War II was the catalyst for the birth of audiology as a profession. This lack of interest is particularly reflected in the relatively low number of publications on aural rehabilitation (Oyer, 1982), which has continued despite the unanimous call for more scientific research (Bamford, 1981; McCarthy & Alpiner, 1978; O'Neill & Oyer, 1973; Oyer & Frankman, 1975; Tobias, 1982).

It may be inferred from several sources that there is a definite need for these services. In a review article on hearing aid use in the United States, Goldstein (1984) estimated that at best, only 19% of the hearing-impaired population use hearing aids, with most of the unmet need among adults. He concluded that the need is large, significant and bound to increase in view of our aging society and the correlation between hearing loss and age. Garstecki (1984) referred to a report by the British Society of Audiology (Markides, Brooks, Hart, & Stephens, 1979) in which the results of a survey of new hearing aid wearers revealed that less than 30% wore their hearing aids in the United Kingdom. This was contrasted with the situation in Denmark where a comprehensive

follow-up program is provided and over 90% of new wearers use their aids.

The development of aural rehabilitation programs may also be vital to the growth of audiology itself. Hardick (1977) made the following point: "If we are to stand as an independent profession, then we must deliver something worthwhile to the consumer and it must consist of a variety of services unavailable from other specialists or better delivered and reasonably unrelated to the practice of medicine. Without aural rehabilitation services, we will have a difficult time from [sic] becoming medical technicians."(p. 527)

Aural rehabilitation encompasses a variety of activities, such as hearing aid evaluation, counseling, speech reading and auditory training. While all areas of aural rehabilitation have been insufficiently investigated, some have received greater attention in the literature than others. Oyer (1982) reported that Hearing Aids and Education accounted for over 40% of the publications on aural rehabilitation in DSH Abstracts from 1972-1981. On the other hand, auditory training was the subject of only 3% of the aural rehabilitation articles, and most of those involved children. Furthermore, of the articles which looked at auditory training, only 18% of them dealt with quantifiable data.

The paucity of research on auditory training may be due, at least in part, to the difficulty in performing such studies, including the difficulties involved in controlling extraneous variables (O'Neill & Oyer, 1973), and the time consuming nature of

the research, resulting in relatively few data points. Another reason may be the difficulty in finding a valid and reliable measure of auditory training gains during therapy. In answer to a questionnaire, 49 out of 50 rehabilitation audiologists expressed dissatisfaction with the available evaluation procedures (Bloom & O'Neill, 1970). Unfortunately, those behaviors that are closest to real life communication tend to be the most difficult to quantify (Giolas, 1966; Markides, 1977). The type of test needed may also vary depending on the goals (Boothroyd, 1975).

Very little is known about which auditory training procedures, if any, lead to the greatest success. It might be assumed, however, that a thorough understanding of the normal speech perception process would be likely to lead to the most effective remedial methods. It is theorized that speech perception involves one process equivalent to auditory and phonetic feature analysis, and a secondary linguistic process based on perceptual expectancies and internal conceptual information (Sanders, 1977). The relative contribution of each, however, is currently a topic of great controversy. The former process is a low level analysis of sensory input which permits the internal representation of physical acoustic stimuli whereas the latter is a high level analysis which attempts to confirm linguistic and contextual expectancies from sensory information (Durity, 1982).

Early adult auditory training programs emphasized as part of their training the improvement of analytic skills in the form of enhancement of consonant recognition through the use of carefully planned drillwork (Carhart, 1947; Johnson & Sigenthaler, 1951).

Lessons usually included the use of minimally contextual material such as syllables and words, in additon to sentences. More recently, this analytic approach to auditory training has been rejected by some in favor of a more synthetic approach, which uses only the larger units of speech as material and emphasizes listening attentiveness and utilization of the redundancy of language (Sanders, 1982; Schow, Christensen, & Hutchinson, 1978). Bate (1980), for example, advocated the second type of approach with improvement of listening skills as the primary goal. While he did not negate activities for discriminating among speech sounds, he stated that extensive drill on such tasks is "a questionable use of time" (p. 332). Owens (1978), on the other hand, recommended an approach which incorporates prosodic, syntactic and semantic factors, listening training, along with efforts directed towards improvement of consonant recognition. This controversy parallels the one which began in the lip reading literature in the early 1900's when Nitchie (1912) rejected the analytic approach in favor of a synthetic one. The fact remains, however, that little scientific research exists to support or refute the use of or emphasis on either approach to auditory training. One study which did look directly at this issue, provided preliminary support for the inclusion of consonant recognition training a part of a total adult aural rehabilitation program (Walden, Erdman, Montgomery, Schwartz, & Prosek, 1981).

In summary, despite an obvious need, little research is available on the effectiveness of auditory training techniques with

the adventitiously hearing-impaired adults. It is not clear whether formal auditory training in general is beneficial, which method(s), if any, would be more productive in effecting change, and whether there is a relationship between method of instruction and the degree of improvement as reflected on different aspects of the speech perception process. The purpose of this study was to shed further light on these issues.

Chapter 2
Review of the Literature

For purposes of review, the literature of interest will be divided into the categories of goals and procedures in aural rehabilitation/auditory training programs for adults, and research in auditory training in adults. Prior to this, however, it is relevant to discuss speech perception processing and methods of measuring it in the hearing-impaired.

Speech Perception Processing

Speech perception may be defined as "the complete process by which speech is received, recognized and interpreted" (Boothroyd, 1975, p. 2). Speech perception is a little-understood process, and attempts to explain or describe it are only theories. One view of speech in which its units are identified through invariant features or properties which can be observed in the acoustic speech signal, has yet to be proved or demonstrated (Studdert-Kennedy, 1980). The parallel transmission of phonemes, however, contributes to the difficulty in segmenting the acoustic signal and may lead one to question whether or not speech can be divided into words, phrases, etc. at the physical (acoustic) level at all (Lindgren & Lindblom, 1983).

Given the present state of knowledge, two basic approaches have been taken to describe how linguistic value is derived from the acoustic speech signal. In the first, it is theorized that acoustic invariance does, in fact exist, and research is directed towards finding the invariants. This description of the speech perception

process is termed passive, non-mediated or direct decoding (Sanders, 1977). Empirical support for this line of reasoning may be seen in the work of Stevens and Blumstein (1977) and Blumstein and Stevens (1980). In the second approach, it is believed acoustically invariant cues do not exist; perception is thought to be facilitated by the listener's knowledge of language and the contextual constraints. Thus the input, i.e. the sensory pattern, is mediated by and compared to an internally generated pattern (Sanders, 1977), although the problem of describing how it is done, is also unsolved. Lindgren and Lindblom (1983), for example, question that the lack of invariance is mainly a measurement problem, and present as evidence the successful perception of elliptic speech, which is characterized by omissions and reductions eg. /djit/ = did you eat. They point out that such an utterance is missing certain phonemes and syllables totally; whether invariant cues potentially exist is academic, since even if they potentially exist, they are clearly absent in this signal, yet communication can still be successful. Furthermore, even if an acoustically invariant cue is found, there is no guarantee that this is the one used by the ear in a given context (Godfrey, 1984). On the other hand, Lindgren and Lindblom recognize that the process of perception does depend on sensory information and therefore, advocate a dual perception model, which is both stimulus and hypothesis driven. After reviewing the major theories of speech perception, Sanders (1977) concluded,

> ...it appears unlikely that the perception of speech will be explained by either a purely passive theory or a purely active one. Some combination of the two modes seems to be acknowledged by the exponents of both schools of thought. The solution to

> the problem of how speech is perceived probably lies not in the answer to the question "Does it involve active or passive processing?", but rather in evidence to indicate the relative contribution of these two modes of function, the variables which govern that contribution and the levels of processing at which it occurs (p. 129).

The advantage of linguistic cues to the perception of speech has been well documented. In a landmark article, Miller, Heise, and Lichten (1951) varied the number of possible alternatives progressively from 2 to 256 words and found that a 50% score was obtained for a list of two words at a -14dB signal to noise (SN) ratio, and for a list of 256 words at a -4dB SN ratio. The intelligibility of a word in isolation versus in a sentence was found to be comparable to the effect of restricting the vocabulary; the presence of a word in the context of a sentence led to increased predictability. O'Neill (1957) replicated the Miller et al. study using a different sentence test and included 39 naive listeners as opposed to the two experienced listeners included in the former study. He found an even greater difference in intelligibility between words in isolation and in sentences.

Teatini (1970) compared the intelligibility of scrambled versus unscrambled sentences with the same key words to one group of subjects who had first learned the words by heart (thus restricting the vocabulary of both scrambled and unscrambled sentence lists) and another group who had no prior knowledge. The performance intensity functions for the two sets of sentences were similar for the first group, while the performance intensity function for the unscrambled sentences was significantly steeper for the latter group. Traul and Black (1965) varied the degree of linguistic advantage of the

sentence by placing the test word in the middle of second and third order synthetic sentences. As predicted, intelligibility was worst in isolation and best in the third order sentence. Duffy and Giolas (1974) presented filtered CID sentences with precalculated word predictability status to subjects and found that the more predictable words were less affected by the distortion.

It should be pointed out that additional acoustic cues may be found in such features as stress, intonation, juncture, duration and coarticulatory variables, all of which may as well contribute to the intelligibility of the word in the sentence over the word in isolation. Goldman, Armour, and Schwartz (1980) spliced monosyllabic words in sentences and compared their intelligibility to the same words spoken naturally in the sentence, in a noise background. Using 25 preschoolers as subjects, the key words, when in medial or final position, were significantly easier to understand in the natural sentences. There was no difference in intelligibility when the key word was in initial position.

Besides the advantage of the sentence context, it has also been shown that words in isolation vary in degree of intelligibility. Black (1952) used 3697 words found to have 20-80% intelligibility in noise on preliminary tests and found that the more frequently occurring words were easier to detect. Words with more sounds or syllables were also easier to detect, although the more familiar words tended to have fewer sounds and syllables. Black concluded that two factors independently influenced word intelligibility - familiarity and complexity.

Owens (1961) hypothesized that the finding of better scores on

the CID W-22 lists over the PAL PB-50 list was related to greater word familiarity. To test his theory he constructed new lists, each with progressively less familiarity based on the Lorge count. Normal hearing subjects listened to the words through a continuum of low pass filters. Significantly better scores were found on the lists containing the more familiar words. The increase in discrimination errors with greater distortion even in the most familiar word list, according to Owens, suggests however, that phonetic content remains the major factor in word intelligibility. It was also found that the effects of word familiarity on discrimination was greatest when the distortion was neither too great nor too mild. Oyer and Doudna (1960) used hearing-impaired subjects and looked at the familiarity status of both the error response words and the W-22 word stimuli. While they did not find a consistent pattern between the familiarity of the stimulus versus the error response, there was a trend for the response to be from the most familiar category.

The effect of word familiarity on speech discrimination ability was explored in another manner by Gat and Keith (1978). Their three groups of 18 subjects differed based on the number of years in the United States. While their speech discrimination scores were essentially the same in quiet, the introduction of noise had a differential effect in the expected direction of poorer scores with less linguistic experience.

Evaluating the word frequency research, Broadbent (1967) suggested that listeners may be accepting a smaller amount of

information before deciding in favor of a more probable word than a less probable one and described this as a decision making bias on the part of the listener. Rosenzweig and Postman (1958) pointed out that the improvement with word complexity (e.g. word length) was a special case of the effects of list length (restricted alternatives); there are fewer longer words and therefore, less from which to choose. Savin (1963) noted that ease of discrimination will also be influenced by the number of possible acoustically similar alternatives, i.e. an uncommon word which is not easily confused with other words may be more easily perceived than a common word for which there are many acoustically similar alternatives.

In summary, while the exact means by which we perceive speech is still a mystery, it appears that the acoustic information present in the signal and the linguistic knowledge of the listener both play a role. A person's knowledge of his language increases the probability of a correct perception by restricting the alternatives as in the case of a sentence or in words of progressively greater length, and by enabling a bias towards words that are more likely to occur in the language. There is some evidence to suggest that the potential contribution of linguistic knowledge may vary depending on the amount of sensory information available, i.e. with many acoustic cues the linguistic information may be so redundant that it is not needed and with minimal cues, there may be insufficient information to even make a hypothesis. However, with moderate amount of sensory data, the linguistic knowledge may well make the difference between a correct and incorrect perception.

Methods of Measurement

Evaluation of speech processing ability may include a variety of materials, ranging from nonsense syllables to continuous discourse. Depending on the degree of sensory and linguistic information available, the relative demands for analytic and synthetic activities by the listener will vary. In this section, different types of speech material available for evaluating gains from auditory training will be briefly described.

One method frequently used for measuring auditory training gains (Bloom & O'Neill, 1970) has involved the use of single syllable words, typically in lists of 50, in an open set response mode. Known as phonetically balanced lists (PB), or more correctly, phonemically balanced lists (Lehiste & Peterson, 1959), they were constructed to contain common words and a representative distribution of the sounds of English. The Harvard Psychoacoustics Lab pioneered this work and at the Central Institute for the Deaf (CID), the Harvard lists were later revised and are known as the CID Auditory Test W-22. Along similar lines, Lehiste and Peterson (1959) developed lists consisting only of monosyllabic words of the consonant-neucleus-consonant type which were revised by Tillman and Carhart (1966) and labeled the NU test No. 6.

Typically, scoring for such tests is determined by the percentage of words correct. Since such tests remove syntactic and semantic redundancy, they increase the need for analytic skills. It has already been demonstrated, however, that word frequency effects play an important role in such a task. To reduce this problem,

Boothroyd (1968) has advocated the use of phoneme over word scoring. In addition to reducing the influence of word familiarity effects, phoneme scoring increases the reliability of the test by increasing the number of scoreable items. Alternatively, this method of scoring can reduce the size of the discrimination test list and consequently, the time required to administer it, as in the case of the ten-word lists developed by him. The reliability of the score is of obvious importance when assessing performance changes resulting from rehabilitation.

Boothroyd (1975) pointed out, however, that if the goal is to minimize the contribution of the synthetic skills of the subject, an even more suitable task is one which utilizes a closed set. In discussing the advantages of the closed response set format, Levitt and Resnick (1977) noted that the problems associated with learning and practice effects as well as the use of unfamiliar words are considerably reduced. In addition, this method is particularly amenable to a detailed analysis of errors which McCarthy (1983) suggested can be applied to the aural rehabilitation process for more consistent referral, effective planning and accurate documentation of progress, as oppposed to relying on a single percent correct score.

Among the first of such tests to appear was the Larsen Sound Discrimination Test (Larson, 1963). The listener is required to select the correct word from sets of minimal pairs. House, Williams, Hecker and Kryter (1965) modified the Fairbanks Rhyme Test (Fairbanks, 1958) into a six-word multiple choice format in which the alternatives within each set differ in the phonetic features of

only the initial phoneme. In the Fairbanks test, the listener was asked to fill in the missing phoneme based on the vowel-consonant portion of a word. A second modification of the later version involved the varying of the final consonant as well.

The Semi-Diagnostic Test (Hutton, Curry, & Armstrong, 1959) was specifically developed to assess a person's candidacy for aural rehabilitation and to measure progress throughout the program. In addition, the test was designed to measure auditory, visual and combined discrimination ability. The listener chooses two monosyllables from a choice of four words which differ only in vowels or consonants. The test has not been evaluated extensively.

More recently, the California Consonant Test, another monosyllabic multiple choice word test, has been developed (Owens & Schubert, 1977). Items were selected through a process of elimination by successive presentations of over four hundred items to hearing-impaired listeners. The final test consists of two forms of one hundred items each. Each item includes four choices of consonant-vowel-consonant words varying in either the initial or final consonant. The test has been shown to be especially sensitive to high frequency hearing losses and may be too difficult in its present form for patients with severe hearing losses. Pascoe (1975) prepared a set of fifty-word lists which also emphasize high frequency discrimination ability. Phonemic balance was not considered. Instead, the goal was to choose words that would be similar in sound to at least five other words on the list, enabling him to use the exact same words, in varying order on the other

lists, yet limit the effects of learning. In addition, the words were seen before testing and subjects were given pretest practice, so that the list could be considered a closed set.

One shortcoming in the use of meaningful words is that certain combinations of response foils may be limited by language constraints. (Levitt & Resnick, 1977). In addition, it has been shown that word frequency effects are present to some extent even within a closed response set format (Elliot, Clifton, & Servi, 1983). In order to overcome these problems, the Nonsense Syllable Test (NST) was developed (Resnick, Dubno, Hoffnung, & Levitt, 1975). It consists of 11 subtests, with seven to nine nonsense syllables of the consonant-vowel or vowel-consonant type in each. The test includes the major consonantal sounds and three vowels occupying extreme positions in the vowel triangle. Nonsense syllables have been criticized as being confusing and so abstract that they baffle many subjects (Carhart, 1965), unnatural, and affected by degree of experience with them (Markides, 1977). Dubno and Dirks (1982) looked at the NST with 38 sensorineurally impaired adults and found it to be highly reliable both in terms of overall scores and specific syllable confusions. Edgarton and Danhauer (1979) also made a strong case for the use of nonsense syllables in evaluating analytic skills and have developed their own nonsense syllable test, which consists of bisyllable, open-set, 25 item lists.

In contrast to the evaluation of analytic ability, the evaluation of synthetic skills demands the use of strings of words. While continuous discourse may have the greatest face validity for such a task, scoring and standardization problems limit its

desirability (Giolas, 1966). Evaluation at the sentence level is often chosen as a reasonable compromise. Frequently used in aural rehabilitation programs are a set of ten lists developed at CID, called the CHABA or CID sentences of Everyday Speech. Conflicting results have been obtained regarding the interlist consistency of this material (Giolas & Duffy, 1973; Sims, 1975). According to Davis and Silverman (1978), the lists were originally developed to serve as representing a sample of American speech against which more specific tests of intelligibility could be validated.

Incorporating a closed set response into a sentence test, Berger (1969) embedded five phonetically similar key words within sentences. Called the Kent State University Discrimination Test, the listener is asked to choose the key word presented in the sentence with all alternatives being meaningful. The 13 sentences in each of the eight forms are graded for difficulty and scored accordingly. The closed set response format restricts the opportunity for the use of synthetic skills, although scoring is simplified. In another closed set response sentence test, Speaks and Jerger (1965) limited the degree of redundancy by using third order approximations to real sentences. The sentences in the resulting Synthetic Sentence Identification (SSI) test are characterized by the semantic dependency of any word on the two words which precede it.

In recognition of the need to assess both acoustic-phonetic and linguistic-contextual components in sentence comprehension, Kalikow, Stevens and Elliot (1977) developed the Speech Perception In Noise

(SPIN) Test. Each form of the test contains 50 sentences and the task of the listener is to identify the monosyllabic word at the end. In half of the sentences, the target word is low in predictability based on the rest of the sentence (e.g. Mr. Black considered the fleet) and therefore must be identified primarily, though not exclusively, through acoustic-phonetic cues. The other 25 sentences are highly contextual in nature (e.g. The Admiral commands the fleet), thus providing linguistic-contextual cues from which the target word can be determined. In addition to the use of a sentence format for the test, everyday communication is further simulated by the use of multitalker babble which is located on the second track of the tape. McCarthy (1983) suggested that this test has intriguing possibilities for use in aural rehabilitation, including the identification of areas in need of work as well as in the charting of progress.

Evaluation of this test by Morgan, Kamm and Velde (1981) with normal hearing subjects has led them to conclude that all ten forms are not equivalent. These results have been supported by an extensive study using hearing-impaired subjects by Bilger, Nuetzel, Rabinowitz and Rzeczkowski (1984). As a result, a revised SPIN (RSPIN) has been developed based on the data from hearing-impaired subjects (Bilger, 1984) which consists of eight forms from the original pool of sentences.

In summary, a number of tests are available which may be applied to the measure of auditory training gains. The degree of linguistic information available is controlled in a number of ways, such as varying the length and meaningfulness of the stimuli, and

the number of alternatives. The decision regarding which test(s) to use must be based on the specific purpose of the measure. In cases where analytic abilities are being measured, tests which minimize the available linguistic information should be used. When global skills are being evaluated, tests which maximize this information should be chosen.

Goals and Procedures in Auditory Training For Hearing-Impaired Adults

Aural rehabilitation may be defined as a clinical treatment process which has as its principal objective the reduction of handicaps associated with hearing loss (Oyer & Frankman, 1975, p.11). It has already been noted that the aural rehabilitation process may include a variety of procedures, from a hearing aid evaluation and orientation to a comprehensive program also including counseling, auditory training, speech reading instruction, speech conservation, and the use of stage managing techniques. Among aural rehabilitation programs, the type of procedures used for auditory training varies, as does the degree of emphasis placed on these procedures. In this section, auditory training goals and procedures will be described within the framework of different aural rehabilitation programs described in the literature.

Auditory training has been defined similarly by many authors. Carhart (1947) described it as the process of teaching the hard of hearing to take full advantage of sound cues which are still available to him. Bode (1966) stated that auditory training refers

to the activities and processes by which the hearing-impaired are given an opportunity to make full use of acoustic events reaching the auditory mechanism. Sanders (1971) defined it as constituting a systematic procedure designed to increase the amount of information that a person's hearing contributes to his overall perception. Others have described it more specifically. Kelly (1973) suggested that auditory training is a plan of study leading to greater attention in listening, improved awareness, discrimination and retention of speech sounds. Jeffers and Barley (1979) stated that auditory training consists of training designed to improve one's listening habits or skills and, they hoped, his short term memory as well. McCarthy and Alpiner (1982) defined it in terms of the following three parameters: learning to recognize auditorily those sounds which are confused with one another, pre and posthearing aid orientation including adjustment to amplification, and improvement of tolerance levels. These last definitions more clearly demonstrate the particular orientation of each author.

The auditory training program developed by Carhart (1947) has had a strong impact on the concept of many professionals regarding how auditory training should be performed. There are four goals in the program: the establishment of an attitude of critical listening, the development of precise and rapid recognition of phonetic elements, the re-establishment of recognition of significant noises, and the improvement of listening under poor acoustical conditions. For the first goal, listening assignments were provided as well as drill work of progressive difficulty using minimal pairs in a closed set. For the second goal, words, sentences and connected speech were

presented only once. Procedures for the third and fourth goals included presentation of environmental sounds, and drills presented in noise and through the telephone.

In another early program, Johnson and Sigenthaler (1951) included the following goals: to improve personal-social attitudes and relationships, to increase use of hearing aid and knowledge of its limitations, to increase tolerance, to improve localization, and to improve aided speech perception. Lessons included (a) discussions on hearing aid care, problems of and adjustments to hearing loss and amplification, and anatomy and pathology of hearing (b) phoneme and viseme training in isolation and in sentences (c) practice in listening to the radio and telephone, as well as to music and sound effects (d) speech conservation and (e) localization training. Although no data were provided, the authors reported that discrimination testing and subjective impressions of former patients supported the effectiveness of the program. Their use of the term "auditory training" to describe all of the above activities demonstrates that it was used in a very broad sense. Bergman (1951) cited goals which were also mentioned by the two previous authors, including the development of efficient listening habits and speech sound discrimination. It was his opinion, however, that localization training had proved unsuccessful. In fact, later programs did not include this as a goal.

Oyer (1966) recommended that the relative amounts of auditory training, speech reading instruction, hearing aid orientation and speech therapy in any rehabilitation program should depend upon the

needs of the individual. In addition, he advocated multisensory stimulation in therapy, an approach which is currently enjoying a revival of interest (McCarthy & Alpiner, 1982). Simultaneous auditory training and speech reading instruction were first preceded, however, by isolated work on each (O'Neill & Oyer, 1961). In support of the multisensory approach, Oyer explained that while a spoken word might be auditorily distorted or visually obscure, the combination of both modalities might provide sufficient information for correct perception.

Sanders (1971) agreed that it is valuable to separate auditory and visual training at first and that emphasis of each component of aural rehabiltition will depend on the degree of hearing loss. Counseling and hearing aid orientation were also emphasized. An innovative feature of his auditory training program was a discussion of linguistic constraints and how they can be used to improve communication. Also included in his 1971 approach was the traditional emphasis on discriminating between words or phrases that could be confused on the basis of their auditory pattern, thus forcing the listener to make better use of the auditory signal. He reasoned: "If we can improve the subject's ability to discriminate speech sounds under conditions of low redundancy, then we may be sure that he will function much better when the additional [contextual] cues are added" (p. 268).

The growing trend away from speech sound discrimination drill is reflected in the changes in Sander's (1982) position. At this time he questioned his earlier position that systematic training in auditory and visual speech processing can improve one's abilities.

He asserted that many new hearing aid users need no more than two listening-orientation sessions and advocated a structured program of auditory training only with the more severely impaired. Such a program, he suggested, should use material representative of messages the client would be likely to hear, with single word discrimination used only occasionally and within the context of the synthetic program (e.g. key or topic words). He stated that "individual speech sound discrimination is rarely justifiable. It is a boring task that has little to do with spoken language" (p. 435). Instead, his aural rehabilitation program placed greater emphasis on addressing the specific needs of the individual through proper amplification, counseling, stage managing techniques, and other communication strategies.

The role of speech sound discrimination drill has been minimized or eliminated in a number of programs developed since the early 70's. The main focus of an aural rehabilitation program outlined by Hardick (1977) and Davis and Hardick (1981) was to find the optimal amplification system. Different aids are tried during the course of therapy in an attempt to minimize the inadequacies of current hearing aid evaluation procedures. Information and adjustment counseling is an important feature as are discussions of sensory aids other than hearing aids. The advantage of visual information is described and demonstrated; extensive drill is not included. The improvement of listening skills is achieved through listening activities and group discussion about it. Some environmental sound and speech practice is provided to reawaken

interest in listening as well as to learn the limitations of amplification. Other important features of the program are that significant others (e.g. spouses) are involved and the program is short term in duration.

Jeffers and Barley (1979) supported a combined auditory training/speech reading instruction method and provided a great deal of training material in which linguistic constraints are available and their use is encouraged: for example, idioms, overlearned speech and colloquial sentences cued by clue words (words which are related to the sentences, but do not appear in them). Material at the word level is included only for the purpose of providing some speech reading training in the rapid recognition of elements. Bate (1980) also incorporated both speech reading instruction and auditory training into a synthetic framework. While drill in auditory discrimination may be used, the majority of time is spent on listening training. He stated that "[t]here is good reason to believe that much of the improvement clients often experience is attributable to changes in attitude and confidence rather than in specific auditory discrimination skills" (p. 333).

The most extreme position against auditory training and speech reading instruction has been taken by Fleming and her colleagues (Fleming, 1972; Fleming, Birkle, Kolman, Miltenberger, & Israel, 1973). The thrust of their communication therapy program is counseling, learning stage managing techniques, and developing communication strategies. The group includes a psychologist, self-responsibility is emphasized, and each person makes a contract in which he specifies his goals. Significant others are encouraged to

attend in recognition of the two-sided nature of communication. Through group discussion, the person is encouraged to become a better listener by being more interested and attentive. The program is geared towards behavior modification. According to McCarthy and Alpiner (1982), advocates support this type of approach because data proving the benefits of speech reading instruction and auditory training is lacking.

Not all programs in recent years have abolished, or severely reduced the amount of auditory discrimination drill. Owens (1978) for example, described his orientation in the following manner: "Our particular preference is for a holistic approach capitalizing on [prosodic, syntactic and semantic factors] along with direct work on the communication process and encouraging the hearing-impaired to listen (and watch) for meaning. At the same time, an analytic approach directed to enhancement of consonant recognition per se, may contribute substantially to speech perception ability" (p. 344).

Smith and Karp (1978) included a similar variety of techniques as described above. In their auditory discrimination training, they suggested a ten-step order of increasing difficulty which began with vowel contrasts having large differences in the second formant frequencies and ended with exercises varying consonant place of articulation.

Kirby and Rogan (1981) described a four-week auditory-visual training program in which sessions were held in a home-like room, and which incorporated such activities as communication tactics training, hearing aid orientation, and auditory visual training.

Garstecki (1984b) described a program in which the goals were to optimize the sensory capacity of the individual, maximize his communication ability, and actualize his own management of problems. Communication training included the systematic variation of the redundancy of his training material along four parameters (Garstecki, 1981): (a) messsage (e.g. paragraphs unrelated sentences, words) (b) noise type (e.g. quiet, white noise, multispeaker) (c) situational cue (related, none, distractor) (d) signal to noise ratio (>+12 to -6dB). Motivation is maintained because the client is able to see his progress in perceiving material with progressively decreasing redundancy. This method is used by Garstecki for both combined auditory-visual and auditory only training.

In summary, there appear to be three prevailing attitudes regarding the inclusion of auditory training in general and analytic type drill in particular into an aural rehabilitation program. There are those who believe that emphasis should be almost exclusively on listening training and/or use of linguistic constraints; others believe that discrimination training is of value as well, and still others who choose to reject the use of auditory training exercises entirely. Unfortunately. none of the authors cited above support their positions with scientific evidence. Empirical research is clearly needed to clarify the issue.

Research in Auditory Training With Hearing-Impaired Adults

Several lines of research have been followed in the area of auditory training with adults: the effect of auditory training on

performance, the effects of procedural variations in the training and/or evaluation on auditory training gains, and the effects of different characteristics of the hearing-impaired subject and auditory training gains. The following is a review of this work.

The concern of all of the early research with hearing-impaired adults was simply whether or not auditory training could effect a change on some performance measure. Typically, an experimental group was chosen but no control group was included. Goodfellow (1942) looked at six hearing-impaired subjects over a period of four months with approximately one hour per week of therapy. A significant improvement in test scores (Northwestern University Speech Perception Test), and a subjective impression of improved conversational ability in social environments were reported. These improvements were attributed to the accomplishment of the following therapy goals; adaptation to frequency distortion, clarification of phonetic concepts, attention to secondary cues in the gross pattern of speech, and changes in the subject's attitude to his handicap.

Browd (1949) provided individual therapy varying in length from several weeks to six months depending on progress and the needs of the subject. Training emphasized discrimination of phonemes in minimal pairs, sentences and conversation. It was reported that 37 of the 45 subjects who completed training showed little or no evidence of disability at the end of the program. Evaluation was based on a consonant articulation test, and a subjective measure obtained from the subject and significant others.

DiCarlo (1948), summarizing work done in the military auditory

training program, reported the pretest and posttest results from 472 veterans receiving it. Unlike the previous studies, a control group was included, which consisted of 53 veterans who received no training. DiCarlo found that the experimental group improved about 19 percentage points in mean performance on a live-voice discrimination test as opposed to a 3 percentage point improvement in the control group.

Following this early research, investigators began looking at methodological variations in the experimental design. Specifically, they varied the training and/or evaluation procedures in order to discover differential effects. As mentioned earlier, the use of bisensory stimuli presentation is an issue which continues to be discussed in the literature (McCarthy & Alpiner, 1982). Hutton (1960) recognized that visual clues alone were not likely to provide enough information for efficient communication. He and his colleagues (Hutton, Curry, & Armstrong, 1959) developed the Semi-Diagnostic Test which Hutton (1960) presented live-voice auditorily alone, auditorily and visually, and visually alone before and after a three month analytic training program in which stimuli were presented almost exclusively in a bisensory mode. Sixteen subjects were given eight hours of training and two subjects were given sixteen hours. Significant improvements were found in the auditory-only (5.7 percentage points) and auditory-visual (8.3 percentage points) scores, but not in the visual-only (3.5 percentage points) score. Most of the auditory-visual improvement was therefore attributed to the auditory component.

Pitzer (1971) compared the effects of a combined auditory

training/speech reading instruction program using five hearing-impaired subjects on an auditory versus auditory-visual evaluation of word (NU 6 list) and sentence (Revised CID sentences) recognition. The only significant improvement was seen in the auditory-only word condition. Auditory-visual scores were significantly better than the auditory-only scores only during pretesting, using the single word material. Pitzer hypothesized that demonstration of differences among other conditions were confounded by ceiling effects.

Watts and Pegg (1977) evaluated the effects of speech reading instruction alone versus speech reading instruction plus auditory training during a six month program. Each of two groups (about 25 subjects in each) received a minimum of 20 hours of speech reading instruction while only one group received up to six additional hours of individual analytic auditory training. Using PB word lists as test material, they evaluated subjects before and after training through an auditory trainer, and under the following conditions in free field: auditorily and visually (aided and unaided), and auditorily alone (aided and unaided). For the speech reading instruction only group, significant gains were reported only on measures which included visual cues, while significant gains were reported on all measures for the speech reading instruction plus auditory training group. Procedural issues suggest, however, that these results must be interpreted cautiously. A major point not addressed, for example, concerns the way the test stimuli were presented and calibrated. It is not clear whether the stimuli were

presented through a tape recorder or by live voice, and if the latter, how the voice was monitored. The test environment was not specified either.

A frequently cited project by Bode (1966) and Bode and Oyer (1970) investigated aspects of both training and evaluation procedures in auditory training. Specifically, they looked at the effects of different materials used during training (open versus closed set response of monosyllabic words) and the effects of different methods of increasing difficulty of the material (constant speech level and increasing SN ratio versus decreasing speech level and constant SN ratio) on three different tests of speech perception. Thirty-two adults were divided into four groups according to the above two parameters and were evaluated before and after training using alternate forms of the CID W-22, Rhyme, and Semi-Diagnostic Tests. Due to a lack of enthusiasm, training was reduced from a six to eight week period, to five 25 minute training sessions given all on one day. Statistically significant improvement was obtained with the W-22 (7.7 percentage points) and Rhyme (3.5 percentage points) tests. Procedural variations did not result in significantly different scores, although there was a trend for the subjects trained on the open set material to do better on the open set test and for the subjects trained on the closed set material to do better on the closed set test.

Walden, Erdman, Montgomery, Schwartz and Prosek (1981) cited a study by Jerger and Speaks (1968) who studied the effects of four hours of training using random scramblings of a seven word first order approximation synthetic sentence, as reflected by three tests:

a Synthetic Sentence Identification (SSI) Test in quiet and noise using the same materials used during training, an SSI test using different materials, and PB word lists. Five hearing-impaired adults with relatively severe sensorineural hearing loss served as subjects. Average performance increases were 15 percentage points and 25 percentage points in quiet and noise for the first test, 12 percentage points for the second and 8 percentage points for the PB words. They noted that the results suggest that the more similar the test materials are to the training materials, the greater the observed improvement.

Colten (1975) attempted to clarify whether or not formal auditory training and general exposure to amplified sound are equally beneficial. Eleven sensorineural hearing-impaired adults, aged 60-85, were given ten hours of traditional auditory training, while a second group of 11 subjects listened to stories from the recorded library for the blind. The second group was led to believe that the sessions were merely activity sessions provided for their benefit. Testing before and after training consisted of a Speech Reception Threshold, the NU 6 Speech Discrimination Test and the Hearing Handicap Scale. Results for the Speech Discrimination Test revealed significant improvement for the experimental group. Every subject in this group improved between 6-18 percentage points with a mean of 10.18 percentage points, whereas in the control group there was no change. In fact, the test-retest reliability of this group was extremely high; eight subjects obtained exactly the same pretest and posttest scores while the other three subjects had scores which

differed by only 2 percentage points. These findings cannot be explained by a ceiling effect; scores ranged from 64-80% with a mean of 75%. Since Colten's results are not typical of clinical findings in this respect, replication of these findings would be useful.

As part of the training, Colten provided phoneme drills on the three most common phoneme confusions in her population, but she found that auditory training did not reduce the error rate of these specific phonemes. She concluded that drill on isolated phonemes did not appear to be as beneficial as words and sentences, and suggested that the effect of her program may have been an increase in the subjects' listening skills. Schow et al. (1978) pointed out that improved scores may have been due to the feedback given the experimental group and not the differences in the type of material.

Another study which addresses the issue of analytic auditory training benefits was performed by Walden et. al. (1981). One purpose of the study was to determine if auditory consonant drill in a nonsense syllable context would enhance performance on a sentence test which they developed. In order to avoid ceiling effects, the pretest presentation level was set at the signal to noise (SN) ratio for each subject which had previously been estimated to result in a 40-50% score. The retest was presented at the same level. A consonant recognition test, consisting of the 22 consonants in a vowel-consonant-vowel context, was also administered. The 35 subjects (male adults with predominantly high frequency hearing losses) were divided into three groups. Fifteen subjects received a standard 50 hour group program including hearing aid orientation, counseling, auditory training, speech reading instruction, and

speech conservation. Ten subjects received the standard program plus seven hours of individual consonant recognition training using a programmed instruction approach through the auditory channel, which generally replaced the group auditory training. Ten subjects received a protocol similar to that of the second group but involving the visual channel. In contrast to Colten (1975), the authors found that the phoneme drills were of benefit since scores on the auditory consonant recognition tests significantly improved, the average being 11.6 percentage points. In addition, although all groups significantly improved on the sentence recognition test, the auditory and visual groups improved significantly more than the group which did not receive consonant recognition training. The authors acknowledged that a possible confounding factor was the individual attention given the auditory/visual consonant recognition groups, however, the study does provide preliminary support for the inclusion of auditory analytic training into an aural rehabilitation program.

Lundborg, Risberg, Holmqvist, Lindstrom and Svard (1982) recently evaluated methodological variations within their own program. Nineteen hearing-impaired subjects were placed in each of three groups (a) Hearing aid fitting (HAF), (b) HAF and prescription of additional devices as needed followed by a six-hour information course, (c) HAF, prescription of devices followed by a three-week intensive training in handling the different aids, auditory training, speech reading instruction and tolerance training. Pre/Posttesting was performed using a sentence test which had been

developed for central disorder detection. There were no statistically significant differences in the scores except that Group A's performance deteriorated in the quiet, auditory stimulus condition. Lundborg et al. hypothesized that the measuring technique may not have been sensitive enough to show training effects. They did find that Group C tended to report extensive hearing aid usage. It may also be relevant to note that although the groups were matched according to audiologic data, group assignments were also based on some aspects of the initial subject interview, which were not specified in the article.

Innovative techniques using special instrumentation have been utilized in training at times. Santore (1978) presented data from 30 cases who had been given auditory training using the verbotonal method. Patients who were given this method demonstrated particular problems regarding amplification and/or discrimination ability. Evaluation and training included use of special auditory training units. Known as SUVAG I and II, these units permit low and high pass filtering of the signal to determine the person's "optimal field of hearing", and are connected to a special tactile vibrator which facilitates transmission of the rhythm of speech. The goal is to amplify that part of the frequency range which causes the least distortion to the speech signal. Also used in the evaluation are tonality tests, 25-word lists which are divided into five frequency groups (e.g."moon" would be on a low frequency list and "cease" would appear on a high one). Therapy consisted of two one-hour sessions per week for one and a half to three months. Training included presentation of words and connected discourse while varying

the frequency response on SUVAG when necessary to further approximate the "optimal field of hearing". Exercises on speed of presentation, auditory memory, and rhythm were also included where needed. In the final stage of training, different hearing aids were selected and evaluated. Santore reported clinical as well as functional improvement in 57 cases. As she noted, however, the data were not collected as part of a scientific investigation. Many methodological issues limit the conclusions which can be drawn from these data.

In a study by Montgomery, Walden, Schwartz and Prosek (1984), group auditory training and speech reading practice was replaced with a novel training paradigm for an experimental group during an intensive ten day aural rehabilitation program. The auditory-visual integration (AVI) technique utilized a voice-activated switch which permitted only the higher intensity components of speech to pass through e.g. vowels and glides were audible and visible while unstressed syllables and fricatives were visible only. Materials were presented by live voice and consisted of phrases, sentences, paragraphs and conversation. Both traditional and AVI groups significantly improved in performance on an auditory-visual sentence recognition task while a control group of normal hearing subjects showed no improvement. The improvement in the AVI group was significantly greater than the traditional group. It should be noted that while the AVI training technique included both auditory and visual presentation, it was developed with the goal of enabling one to work on the visual recognition of phoneme length segments

within the context of more realistic and natural units of speech.

Only one study has quantitatively investigated auditory training gains as a function of individual differences. Hill (1967) compared subjects with conductive versus sensorineural losses, who were new versus old hearing aid users, and were trained versus untrained. Eight subjects were in each group (eg. new conductive user with auditory training), making a total of 64 subjects in the study. Measurement included W-22 word lists and CID 12 sentences, however, presentation was by live voice. Training consisted of eight sessions, one hour each using a traditional approach. Results indicated a significant improvement in the trained group only, with experienced sensorineural hearing aid users deriving the greatest benefit. Since new conductive users showed improvement, but old conductive users did not, the author hypothesized that the new users would probably reach optimal performance without formal training.

In summary, review of the literature does lend some support to the inclusion of formal auditory training as part of a total aural rehabilitation program. Almost without exception, studies in the area of auditory training with hearing-impaired adults revealed improved performance following training. Of the studies using statistical tests, all but one (Lundborg et al. 1982) demonstrated significant improvement on at least one test measure, although it must be noted that in many cases the degree of improvement was only modest.

Studies which compared auditory training gains as reflected by different test measures suggest that the greatest improvement will be seen on those tests which most closely resemble the training

material (Bode, 1966; Jerger & Speaks, 1968). If this is true and since everyday communication involves both analytic and synthetic skills, it would be logical to conclude that training should include both types of material.

Another issue dealt with in more than an isolated case was the subject of audiovisual training. It appears that the improvement in the auditory channel following training is at least equal to (Walden et al. 1981) or even greater than (Hutton, 1960) the improvement in the visual channel. The addition of auditory training to a speech reading instruction program may result in significantly improved scores (Watts & Pegg, 1977).

It appears that no study on auditory training gains in hearing-impaired adults has looked at the question of retention. Typically, investigators measure posttest gains immediately, and only immediately following training. Though not carried out with postlingually deafened adults, a study by Nittrouer, Devan, and Boothroyd (1976) suggests that the issue of retention cannot be ignored.

While most of the studies discussed above included a variety of materials in their training (i.e syllables, words, sentences, conversation), only one study directly attempted to isolate the contribution of the analytic component (Walden et al. 1981). Although this study provides support for the inclusion of consonant drill, it was partially contaminated by the simultaneous addition of individual attention to the analytic group. More information is needed on this controversial issue.

Chapter 3
General Method and Testing Procedure

The study was designed to answer the following questions:

1) Will auditory training result in a significant improvement in speech perception performance?

2) Will differences in training approach result in a significant difference in auditory training gains found?

3) Will significant improvement be seen on both analytic and synthetic measures of speech perception ability?

4) Will differences in training approach result in significant differences in the gains found on different measures of speech perception ability?

General Method and Rationale

After volunteers were screened to assure that they met the selection criteria, they were placed into one of two matched groups. The subjects in one group were assigned a synthetic plus analytic approach to auditory training while the subjects in the second group were assigned a synthetic approach only. Each subject was given three tests of auditory perception: The City University of New York (NST), the low predictability items of the Revised Speech Perception In Noise (RSPIN) test, and the high predictability items of the RSPIN test. The tests were administered at a SN ratio giving a score of approximately 50%, as determined with an adaptive procedure at the beginning of the study. They were tested on four occasions: a) at the beginning of the study, b) after one month of "no treatment", c) after a month of intensive auditory training, d) after a further month of "no treatment". During the treatment period, the subjects in the synthetic only group spent all of the time on global tasks (i.e. activities involving sentence perception

and perceptual strategy) while the second group spent half of the time on analytic tasks (i.e. activities involving consonant recognition). Figure 3.1 provides a summary of the entire format.

The following rationale served as a basis for the experimental design:

1. If performance significantly improved after training but not during the "no treatment" baseline, it would support the hypothesis that the auditory training program was the cause of the improvement.

2. If improvement were to be maintained during the month following training, it would provide evidence of retention of the new skills.

3. If one group performed significantly better than the other group after training, information would be gained regarding which method resulted in the most productive use of time.

4. Depending on which tests, if any, demonstrated improved performance for each group, information would be obtained on the type(s) of knowledge and skills being acquired during training.

Subjects

Twenty hearing-impaired adults served as subjects for the study. They fit the following criteria:

1. Subjects had mild to moderate sensorineural hearing losses, defined as air-bone gaps not greater than 10 dB at any test frequency, Speech Reception Thresholds (SRT) not greater than 65dB HTL in the aided ear. Subjects with SRT's which fell within normal limits were accepted (e.g. those with high frequency hearing losses) as long as they met the second criterion

2. Subjects were hearing aid owners

3. Subjects had postlingually acquired hearing losses (operationally defined as having been acquired after age six)

4. Subjects were aged 50 to 80 years

5. Subjects were interested in improving communication (as evidenced by willingness to participate in study)

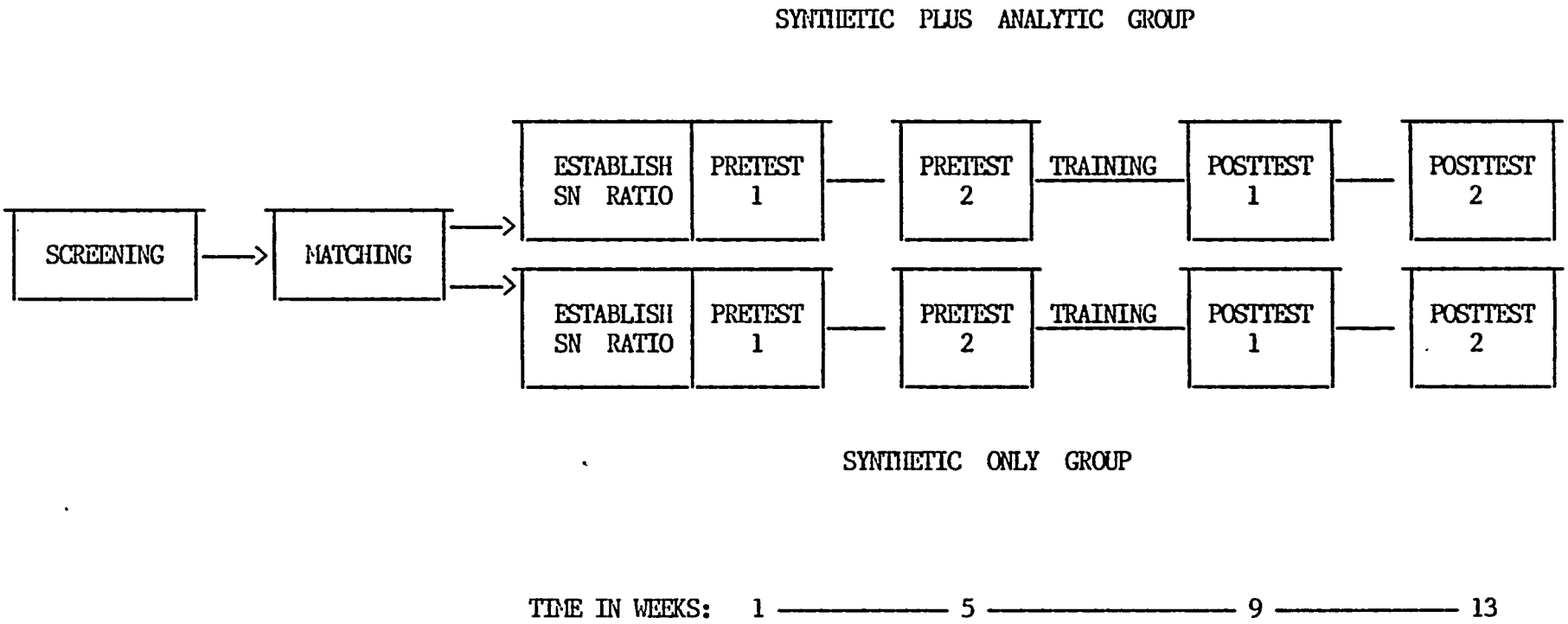

Figure 3.1: Description of experimental design

All subjects were given a consent form to read and sign which explained the goals of the study and informed them that they were free to withdraw at any time without penalty (Appendix A).

Subject Recruitment

Participants were identified in the following manner: a) Letters were sent to patients of the Brooklyn College Speech and Hearing Center who had been evaluated within the last four years and were likely to meet the necessary criteria according to available records (Appendix B), b) An announcement was made at a meeting of the Brooklyn Chapter of Self Help for Hard of Hearing People (SHHH) and included in the newsletter sent to all members, c) An announcement was posted in the offices of two local hearing aid dealers.

Of the 20 subjects, 15 were identified through patient records, 3 were identified through the SHHH group and 2 volunteered upon hearing of the program from other subjects.

Screening Tests

Following otoscopy to rule out impacted cerumen and collapsed canals, volunteers were given audiological evaluations, using standard clinical procedures, as follows:

1. Bilateral air conduction thresholds at octave frequencies from 250-8000 Hz under earphones
2. Bilateral bone conduction thresholds from 500-4000 Hz
3. Bilateral speech reception thresholds (SRT) under earphones
4. Bilateral speech discrimination scores at 40dBSL re: SRT or at the level of most comfortable loudness, under earphones

5. Unaided air conduction thresholds in sound field using warbled tones at octave frequencies from 250-4000 Hz

6. Aided air conduction thresholds in sound field using warbled tones at octave frequencies from 250-4000 Hz

7. Aided speech discrimination scores at 75dB SPL at a +20dB signal to noise ratio (SN) using speech noise in sound field from a single speaker

Prior to testing, the audiometer was calibrated (re: ANSI S3.6-1969) using a Quest M155 Impulse Precision Sound Level Meter with a 7023 one inch pressure microphone and OB 145 Octave Band filter. Calibration was performed at weekly intervals throughout the experiment. Testing was performed in a two chamber IAC booth using a Tracoustics III Programmable diagnostic audiometer with a built-in stereo playback unit. The following transducers were used: TDH-39P headphones with MX/AR 41 cushions, a Radioear B-71 bone oscillator, and a Grason-Stadler sound field speaker which was connected to a McIntosch 250 amplifier.

Aided testing, both screening and experimental, was performed at a single volume setting on the hearing aid, as adjusted by the subject based on a tape of continuous discourse presented at 75 dB SPL at a +20dB SN ratio using multitalker babble. Subjects were informed that they would be hearing a man talking amid a background of noise. They were instructed to vary the volume of their hearing aids several times between soft and loud until they had narrowed it down to, and eventually set it at, the level at which the man's voice sounded the clearest. At the end of testing, the hearing aid gain was determined by placing the aid in a Fonix FC5010 Sound Chamber and evaluating it with the Fonix 5510 Hearing Aid Test Set.

Commercially prepared cassette tapes (Tracoustics Autoplay) of the CID W-1 and W-22 word lists were used for the speech material. For the continuous discourse, a tape recording which had been prepared at the City University of New York Graduate Center was used. This consisted of an essay on the pronunciation of English that had been recorded using a male speaker who had attempted to keep intensity variation to a minimum. The calibration tone had been set to be equivalent to the average RMS levels of peak intensity fluctuations. The second track of the tape contained multitalker babble.

Matching Groups

Volunteers meeting the selection criteria were divided into two groups, ten subjects in each. The two groups were matched as closely as possible according to the following:

1. unaided three frequency pure tone averages in aided ear
2. audiometric configuration, classified as follows (Dubno & Dirks, 1982):
   a) flat - $\leq$ 20 dB difference in threshold from 250 to 4000 Hz
   b) gradually sloping - 25-40 dB difference in threshold and < 30 dB difference in threshold between adjacent octave frequencies
   c) sharply sloping - $\geq$ 45 dB difference in threshold from 250 to 4000 Hz or > 30 dB difference in threshold between two adjacent octave frequencies
3. aided speech discrimination score
4. age
5. education, classified as follows:
   a) reached junior high school
   b) reached high school
   c) reached college

6. duration of hearing loss

7. duration of hearing aid usage, classified as follows:
   a) three to six months
   b) seven to twelve months
   c) over one year

8. age of acquisition of English

Group data on these variables appear in Table 3.1.

Tests

Three tests were used to measure the effects of auditory training. These tests varied in the relative degree of linguistic/contextual information available, and were selected in order to gain insight into the type of knowledge and skills acquired during training.

To measure the more analytic skills, the City University of New York Nonsense Syllable Test (NST) was chosen (Appendix D). The degree of linguistic/contextual information is minimized since the test is made up entirely of nonsense syllables, in a closed set format. This test has been used successfully with subjects whose hearing loss was similar in degree to the hearing loss of subjects in this study (Dubno & Dirks, 1982), and while it has never been used to chart progress in auditory training, it has been shown to be a sensitive measure of differences among hearing aids (Nabelek, 1983). Four randomizations of the NST were made from submasters obtained at the City University of New York Graduate Center. These are two-track recordings which contain 11 subtests on one track and multitalker babble on the other. The recordings were copied onto four Ampex 406 reel to reel tapes using two Teac 35-2 stereo tape

TABLE 3.1
Descriptive and Audiometric Data for Two Groups

	SS Group	SA Group	t Test
Pure Tone Average, in dB	44.4	44.7	t= -0.06 NS
Aided Speech Discrimination Score, in % Correct	76.6	74.0	t= 0.36 NS
Age, in years	70.8	68.3	t= 0.08 NS
Duration of Hearing Loss, in years	10.0	9.3	t= 0.47 NS
Slope of Hearing Loss, in number of subjects			
Flat	3	4	
Gradual Slope	4	3	
Sharp Slope	3	3	
Duration of Hearing Aid Usage, in number of subjects			
3-6 months	3	3	
7-12 months	1	1	
over one year	6	6	
Education, in number of subjects			
reached JHS	0	1	
reached HS	4	3	
reached college	6	6	
Language			
native speaker	9	9	
acquired during early adolescence	1	1	

SS= Synthetic Only
SA= Synthetic Plus Analytic

decks with associated amplifiers. At the end of each recording, an extra set of 25 syllables from the glides subtest was added for use in approximating the SN ratio at which a 50% score would be achieved by each subject for the test as a whole (Appendix E).

The second and third tests included were the low probability (PL) and high probability (PH) sentences of the Revised Speech Perception In Noise (RSPIN) test (Appendix F). The PL sentences contain syntactic and prosodic cues in addition to the acoustic/phonetic information available, however, they were constructed to be contextually neutral. The PH sentences, on the other hand, are so contextual in nature that it is often possible to figure out the last word based solely on what came before it, i.e. one could produce a correct response with minimal, or even no, acoustic information on the word itself. While these materials have been endorsed for use in aural rehabilitation (McCarthy, 1983), and as part of an overall communication profile for hearing-impaired adults (Schow & Nerbonne, 1982), they have not been previously used in a published study as a measure of auditory training gains. Oja and Schow (1984), however, did find that the RSPIN test was a successful measure of hearing aid benefit.

A recording of the RSPIN test, with the PL and PH sentences on separate tapes, was obtained from UCLA School of Medicine. The four hundred sentences were divided into four lists and recorded onto four TDK metal alloy cassette tapes using a Teac 35-2 stereo tape deck and a Nakamichi 482 two head cassette deck. Each tape contained 50 PL and 50 PH sentences. In addition, preceding both the PL and PH material, 25 sentences were included for use in estimating

the presentation levels for each type of material at the first session, and for practice during subsequent sessions (Appendix G). These sentences were the same for each tape, but varied in order.

Testing Procedures

All testing was performed at the same hearing aid output, established at the original test screening with the use of continuous discourse. Before each test session, the subject's hearing aid was run through the Fonix Hearing Aid Test set and the volume control was adjusted until the insertion gain was equivalent ($\pm$ 1 dB) to the insertion gain established at the first session.

In the case of the NST, subjects were given the following instructions to read:

> This is a test to measure how well you hear certain speech sounds in noise. You are going to hear a list of nonsense syllables such as "la" and "wa". Some of the syllables may sound like words, but most will not.
>
> The test will proceed this way: you will hear the phrase "You will mark" and one of the nonsense syllables listed below. Please tell me the number next to the syllable you believe you heard.
>
> Please ask, if you have any questions.

At the bottom of the page appeared the following:

1. LA	5. RA
2. DA	6. YA
3. WA	7. GA
4. BA	8. JA

Subjects were placed so that the speaker was at a 0^{o} azimuth and they were asked to face directly towards the speaker during presentation of the stimuli. Calibration was accomplished using the calibration tones on each track of the recording. The recording was

played on a Teac X-7 MKII Stereo reel to reel tape deck which was connected to a Grason Stadler speaker via a Tracoustics Program III audiometer and McIntosch 250 amplifier. The presentation level for the test stimuli was set at 75 dB SPL. The intensity of the multitalker babble, presented through the same speaker as the signal, was varied using a simple up-down adaptive procedure (Levitt, 1971; Dirks, Morgan, & Dubno, 1982) in order to determine the SN ratio at which a 50% score would be obtained for this subtest. The ultimate goal was to estimate the SN ratio at which a 50% score would be obtained for the entire test. Pilot data had revealed that this could be accomplished by first determining the noise level for the 50% point for the glides subtest and then setting the noise level for the whole test at the 2 1/2 dB step increment on the intensity dial which fell between 2 1/2 and 5 dB below (better than) that level. The noise was initially set at 55 dB SPL and varied 10dB until the first reversal, 5 dB until the second reversal, and 2 1/2 dB thereafter. The midpoints of the last four reversals were averaged in order to determine which noise level would result in the 50% point for the glides stimuli.

Once the noise level for the entire test was estimated, the complete NST was given to the subject, with the syllables at 75 dB SPL and the noise at the estimated level. Subjects were informed that they would continue to hear similar sets of nonsense syllables, but now they would be asked to put a mark through the syllable they thought they heard on an answer sheet. (Appendix H). The subject was given a booklet consisting of eleven pages, one for each subtest. A sample page is shown in Appendix I. All subsequent

testing using the NST was performed at the SN ratio established during this first session. The adaptive testing was omitted and subjects went directly to marking the booklet.

A similar procedure was followed for the RSPIN test, with the low and high probability sentences being treated separately. First, the SN ratio for the estimated 50% score was established. The following instructions were given to the subject:

> You are going to hear a man saying a number followed by a sentence. Please listen to the sentence and tell me the last word in each sentence. For example, if he says "Number three - I am going to the store", your answer should be "store". You will also be hearing the noise of people talking in the background. Please try to ignore the noise and tell me the last word in the sentence.
>
> Don't be concerned if you have trouble understanding. The test will be very difficult at times. Please ask, if you have any questions at all.

The recording was played through a Realistic SC T-17 stereo cassette tape deck with the rest of the instrumentation as described above. Half the subjects were given the PL sentence material first while the other half were given the PH material first. The order was reversed for each test session. The signal was set at 75 dB SPL and the multitalker babble was initially set at 55 dB SPL. The subject was then presented with the 25 practice sentences in order to estimate the 50% point. The practice material consisted of either PL or PH sentences, depending on which type was to be evaluated first. As in the case of the NST, the noise was increased in 10 dB steps with every stimulus presentation until the first error was made. This was followed by a 5 dB step size until the next reversal and finally a 2 1/2 dB step size. The noise was set for testing at the

nearest 2 1/2 dB step to the 50% point based on the last four reversals. If this fell exactly between two step increments on the intensity dial of the audiometer, the more difficult SN level was chosen. Because of the sharp performance intensity function of the highly contextual material, this sometimes resulted in a very low score for the PH sentences (<28%). When this occurred, the list was repeated with the easier SN ratio used. In order to maintain similar conditions during all four test sessions, the PH material was presented twice during subsequent sessions, at both SN ratios. Only the second, higher score was used in the the analysis of the data. Once a score was obtained for the first sentence type, it was repeated for the second, beginning with the appropriate set of practice sentences. Therefore, the PL and PH material were presented at different SN ratios. On subsequent sessions, the pretest material was presented in an adaptive fashion as before, however, only for purposes of practice, since the SN ratios established at the first session were the ones used for all future testing.

Once the SN level for testing was established, subjects were instructed to continue performing the same task, however, at this point they were requested to write down their responses. They were assured that they could take as much time as they needed, but were asked that if they had no guess at all, to draw a line on the space. This provided the signal that the test could be resumed.

Four weeks prior to the initiation of training, each subject was tested with the NST and RSPIN tests, with the specific version randomized among subjects. Subjects were tested again immediately before training began, thus providing a no treatment baseline for

each subject. Testing was performed again immediately following the four week training in order to study its effects, and one last time four weeks after the end of training to evaluate retention. During the final session, air conduction thresholds were again obtained for each subject to determine if any changes in hearing acuity had taken place during the period of the study. Each test session lasted one hour on average and not longer than one hour and fifteen minutes. At the end of training, subjects were also given an informal questionnaire to fill out in order to give the subjects an opportunity to evaluate the program (Appendix J).

Scoring

For the NST, and the PL and PH lists of the RSPIN test, the number of correct responses were counted and converted into percentage scores. These raw data were then changed by an arc sine transformation in order to increase the homogeneity of the variance. In the case of the RSPIN test, an answer was accepted as correct when it exactly matched the target, i.e. singular/plural conversions were scored wrong (Bilger et al. 1984). Identifiable misspelled words were counted as correct.

Analysis

This investigation used a 2x3x4 (method of instruction by test type by test period) factorial design. Analysis of Variance techniques were applied to the arc sine transformed data and Tukey post hoc testing was performed where statistically significant differences were found. In addition, a Pearson Product Moment

correlation coefficient was obtained on several variables to evaluate the strength of their respective correlations with improved posttest performance.

Chapter 4
Training Procedures

Training Goals and General Procedures

The goal of the synthetic training was to improve the listening skill of the subject, specifically to increase concentration and to expand the subject's intentional use of context to derive meaning. The procedures used included the following: describing the components of listening, and factors affecting successful communication, discussing the means by which listening can be improved (including the use of redundancy), providing practice in listening based on the above material, and analyzing the causes of listening errors. Material for listening practice consisted of sentences, paragraphs, and stories. As recommended by Sanders (1982), use of single words was limited to key words or topic description.

The added goal for the analytic training was to improve consonant recognition ability. To achieve this, a sequence of exercises was developed using the NST stimuli. These exercises included both discrimination and identification tasks, were graded in difficulty and were based on the types of errors typically made by this population (Dubno & Dirks, 1982).

Training for both groups consisted of eight one-hour private sessions over the course of four weeks. Within each session, listening practice/consonant drill was interspersed with discussion in order to provide rest periods from high levels of concentration. The synthetic group received an average of 45 minutes of listening

practice and 15 minutes of discussion at each session. The group receiving both synthetic and analytic training received an average of 15 minutes of discussion, 15 minutes of listening practice and one-half hour of consonant drill. Listening exercises and consonant recognition drills were all performed without the benefit of visual cues. Subjects were instructed to take advantage of these cues whenever possible in real life situations, but since no one had worse than a moderate loss and subjects often found themselves in situations where they had to rely solely on hearing, a purely auditory presentation was chosen for the study.

Training was performed by live voice, except for one portion in which the Auditec of St. Louis Auditory Training Tapes were used. All drill materials were presented in the presence of varying levels of noise, depending on the difficulty of the task. The party noise section of the Audiotone No. 1042-1 Noises cassette tape was used for the noise. Both the Auditec and Audiotone recordings were played on two Panasonic RQ-30AS tape recorders.

Training Procedure (Synthetic Only Group)

All training was performed in the patient's chamber of an IAC booth. Exercise and discussion materials were adapted from a variety of sources including: Jeffers and Barley, Look Now, Hear This, Combined Auditory Training and Speech Reading Instruction, Ordman and Ralli, What People Say, Broberg, Over Fifties Nifties, Scott, Learning to Listen Again, Smith and Karp, A Workbook in Auditory Training for Adults, Haug and Haug, Help for the Hard-of-Hearing, Auditec of St. Louis Auditory Training Tapes, and Weaver, Human

Listening Processes and Behavior. Topical material, such as newspaper and magazine articles, was used as well. The actual materials used may be found in Appendix K. The following is an outline of the procedures used in the eight lessons for this group.

Lesson I

A. Introduction (ten minutes)
   1. Purpose - to improve listening skill
      a. increase concentration - for now become aware of level of concentration
      b. learn to make use of available cues
   2. Method
      a. explanation and discussion
      b. practice drills

B. Exercise - relate essence of sentence (fifteen minutes)
   1. Related sentences with topic given
      Ordman and Ralli: **About the Weather**
   2. Unrelated sentences with part of sentence given
      Auditec of St. Louis Auditory Training Tape - 10 sentences

C. Discussion (fifteen minutes)
   1. When does communication break down for you?
   2. Hearing vs. Listening - what is the difference?
   3. Three components of listening (Weaver, 1972) - willingness, capacity, habit

D. Exercise (twenty minutes)
   1. Short stories with title given - explain point of story
      a. Ordman and Ralli - **Shop Worn**
      b. Haug and Haug - **Hospital Waiting Room**
   2. Current events articles, first paragraph - establish topic

Lesson II

A. Exercise - relate essence of sentence (twenty-five minutes)
   1. Related sentences with topic given
      a. Ordman and Ralli - **About Time**
      b. Smith and Karp - **Familiar Questions**
      c. Jeffers and Barley - **Telephone**
   2. Unrelated sentences with part of sentence given
      Auditec of St. Louis Auditory Training Tape - 15 sentences

B. Discussion (fifteen minutes)
   Factors affecting how we hear - explanation of subject's audiogram

C. Exercise (twenty minutes)
   1. Stories with title given - explain point of story
      a. Haug and Haug - **ESP**
      b. Ordman and Ralli - **Courtesy of the Road**
      c. Haug and Haug - **Life After Death**
   2. Stories with title given - answer questions at end of story
      a. Jeffers and Barley - **Streaking**
      b. Broberg - **Longevity**

Lesson III

A. Exercise - relate essence of sentence (twenty-five minutes)
   1. Related sentences - without topic given
      a. Ordman and Ralli - **At the Dinner Table**
      b. Ordman and Ralli - **At the Garage**
   2. Unrelated sentences - with key word given
      Auditec of St. Louis Auditory Training Tape- 20 sentences

B. Discussion - Factors affecting how we hear (fifteen minutes)

C. Exercise (twenty minutes)
   1. Stories with title given - explain point of story
      a. Haug and Haug - **Repairman's Problem**
      b. Haug and Haug - **Congressman's Wife**
      c. Ordman and Ralli - **He Always Wins**
      d. Broberg - **Not Bad**
   2. Current events articles, first paragraph - establish topic

Lesson IV

A. Exercise - relate essence of sentence (twenty-five minutes)
   1. Related sentences without topic given
      a. Ordman and Ralli - **At home**
      b. Ordman and Ralli - **At the Restaurant**
   2. Unrelated sentences with key word given
      Auditec of St. Louis Auditory Training Tape - 20 sentences

B. Discussion - How previous knowledge aids comprehension (fifteen minutes)

C. Exercise (twenty minutes)
   1. Stories without title given - explain point of story
      a. Haug and Haug - **Honesty is the Best Policy**
      b. Ordman and Ralli - **She Needed Practice**
      c. Ordman and Ralli - **Shrewd Management**
   2. Stories without title given - answer questions at end of story
      Broberg - **Columbus and the Egg**

Lesson V

A. Exercise - relate essence of sentence (twenty-five minutes)

1. Related sentences without topic given
   a. Ordman and Ralli - **Looking for an Apartment**
   b. Ordman and Ralli - **At the Bank**
2. Unrelated sentences with key word given:
   Auditec of St. Louis Auditory Training Tape- 25 sentences

B. Discussion - Improving Listening Skills: preparing for the listening situation (fifteen minutes)

C. Exercise (twenty minutes)
   1. Conversation in noise - Topic: **A Typical Day**
   2. Current events article - answer questions

Lesson VI

A. Exercise (twenty-five minutes)
   1. Related sentences without topic given
      a. Ordman and Ralli - **At the Movies**
      b. Ordman and Ralli - **When a stranger stops you**
   2. Unrelated sentences with clue word given
      Auditec of St. Louis Auditory Training Tape- 25 sentences

B. Discussion - Improving Listening Skills - while in the listening situation (fifteen minutes)

C. Exercise (twenty minutes)
   Stories without title given - answer questions
   1. Jeffers and Barley - **Rubber**
   2. Osgood - **Kick Me Once and Kick Me Twice and Kick Me Once Again**

Lesson VII

A. Exercise (twenty-five minutes)
   1. Related sentences without topic given
      a. Jeffers and Barley - **Backseat driving**
      b. Jeffers and Barley - **Forgetfulness**
   2. Unrelated sentences with no cue given
      Auditec of St. Louis Auditory Training tape- 25 sentences

B. Discussion - Strategies of hearing-impaired towards listening situations (fifteen minutes)

C. Exercise (twenty minutes)
   1. Story - answer questions
      Jeffers and Barley - **Fish Cough**
   2. Conversation in Noise - Topic: **Living in New York**
   3. Current events article - answer questions

Lesson VIII

A. Exercise (twenty-five minutes)

1. Related sentences without topic given
   a. Jeffers and Barley - **Cost of living**
   b. Jeffers and Barley - **Clerk**
   c. Jeffers and Barley - **Expressions of Stress**
2. Unrelated sentences with no cue given:
   Auditec of St. Louis Auditory Training Tape - 25 sentences

B. Exercise (twenty minutes)
   1. Story - answer questions
      Scott - **Tinnitus**
   2. Story - explain point of story
      Haug and Haug - **Golfer's Day off**

C. Discussion - summary of training program (fifteen minutes)

Each type of material was chosen with specific purposes in mind:

Related sentences - During these exercises, subjects were shown how conscious use of the topic could help them to complete a message only partially heard. Subjects were encouraged to listen carefully and to try to make guesses regarding the meaning of the message even if they were unsure. If the subject did not make a guess, he/she was reminded of the topic, told there was no penalty for wrong answers and asked to try again. It was also emphasized that there was no need to respond verbatim; it was important only to get the gist of the message. In cases where subjects were overly eager to guess, i.e. where they used it as a replacement for careful listening, they were encouraged to pay closer attention to the actual message and to make sure that they listened until the end. In later sessions, the topic was not provided and subjects first had to establish it. Once established, sentences which had been missed were repeated to demonstrate how the task was thus facilitated. It was also meant to show how task difficulty varied depending on the familiarity with the topic. In final sessions, subjects were asked to state a confidence level regarding accuracy of these responses

(in terms of content) to help reveal their success at self assessment. In these exercises as well as all the others, subjects were encouraged to learn to disregard the noise.

Unrelated sentences - This material was also chosen to demonstrate how previous knowledge can facilitate comprehension. During the exercises, subjects were shown that the amount of previous knowledge can be so great that one can predict the missing part without even hearing it at all. (e.g. ____ will bear many apples this year.) An added goal was to give the subjects the opportunity to drill on a voice other than the therapist's.

Current events (establish topic) - In this exercise, an extremely adverse SN ratio was used to demonstrate that even under such conditions, one may choose to continue attending, since a perceived word here or there may be sufficient to figure out at least the topic. Once this topic is established, one may be able to add from there, or at least be in the position of being able to clarify the details at a later time if the topic was of interest. Therefore, subjects were discouraged from giving up prematurely, both during the exercises and in real life situations. Frustration could be controlled by having a realistic expectation regarding the amount of information which could reasonably be obtained in a given situation (topic versus details). It was also meant to show that the more familiar a person is with what is going on around him (e.g. current events), the less he must hear to follow what is being said.

Stories - Subjects were encouraged to continue listening when they missed something rather than dwell on what was missed and thus

lose what came after it as well. It was explained that what was missed may not have been critical or it may become clear later. Listening for the gist of the message was emphasized in order to avoid devoting all attention to the words themselves and none to the meaning behind them. This error became especially clear when subjects were able to describe the story in total but did not understand the "joke". In the final session, a story was used in which the entire joke hinged on hearing a /p/ when linguistic content suggested a /b/. This example provided the opportunity to acknowledge the limitations imposed by the hearing loss even with training. For the longer stories, the main goal was to increase the subject's concentration for longer periods and avoid listening errors (e.g. daydreaming) while at the same time taking advantage of breaks in the flow of speech to try to reconstruct missing information.

Conversation - This provided practice in listening strategies during conversation. The subjects were asked to answer questions posed by the therapist on a given topic. The subject had to decide if he/she had heard sufficiently to figure out what was asked and therefore be able to answer accordingly. It was explained that if they adopted a strategy which depended too much on guessing, they might not answer appropriately while if they insisted on being certain before responding, they would be likely to ask for repetition more frequently than they needed, thus frustrating their speaker unnecessarily. (They were also told to observe themselves outside therapy to see how often they were told they misunderstood versus how often they asked for a repetition when they had correctly

interpreted the message.) They were instructed to take advantage of the time right after the speaker finished talking and before they were obligated to reply to give themselves an opportunity to fill the gaps before asking for clarification; they were reminded of times when undoubtedly it had happened that they had realized what had been said before the speaker had had a chance to repeat it, resulting in an unnecessary request for a repetition. Finally, if they heard only part of the message and couldn't fill in the rest, they were shown how to phrase a question so the speaker would know which part was missed. Rather than repeating it exactly the same way, the speaker will restate it, naturally emphasizing the part that was missed.

Discussion Material - In the first session, subjects had an opportunity to describe their communication complaints so that references to these problems could be made during training. Also, a distinction was made between hearing (the passive reception of sound) and listening (the active attention to sound) to demonstrate the opportunity for control over their handicaps as opposed to the sense of feeling victimized by it. The concept of listening was further elucidated through a description of its three components, as described by Weaver (1972). In the second session, they were given insight into their hearing losses and hearing aids through a discussion of their audiograms. For the next four sessions, handouts were provided (Appendix L) which were intended to illustrate the factors affecting communication, many of which are controllable, and to summarize the strategies available for improving listening

skills. During the seventh session, subjects were asked to assess the most common response strategies toward difficult listening situations in terms of which were productive and which were conceivably harmful, as well as in terms of which they used and which they didn't. The final session provided a summary of the training.

Training Procedures (Synthetic/Analytic Group)

The procedures used for the synthetic training in this group were the same except in the amount of time devoted to practice of listening skills using synthetic materials. The consonant recognition training was performed using both chambers of an IAC booth. The nonsense syllables were presented by live voice through a Beltone 200-C Diagnostic Audiometer which was connected to an Allison sound field speaker through a Kenwood Model KA-51 stereo amplifier. A Realistic SC T-17 stereo cassette tape deck connected to the audiometer allowed for the party noise to be presented through the same speaker. The speech was presented at 75 dB SPL and the noise level varied for each subject and was based on the noise level which had been established during testing using the NST. Noise was included since communication in quiet was not a major problem for the subjects. Exercises were developed based on the confusion matrices obtained by Dubno and Dirks (1982) using the NST on a hearing-impaired population. For each target phoneme in each position and vowel environment, exercises included only those errored phonemes which were confused with it at least 10% of the time. The order in which the phonemes were presented for drill was

based on the overall correct score for each phoneme according to increasing difficulty. The answer sheet given to subjects, which shows the drill groups and their order, is shown in Appendix M.

Subjects were seated facing the speaker. Each exercise consisted of two parts - a discrimination task and an identification task. In the discrimination task, the subject heard two syllables, the target syllable twice or the target syllable with a confusion syllable. The subject was asked to make a same-different judgement. In the identification task, the subject heard the same phrase as in the NST recording, "You will mark _____ please". The subject was asked to verbally respond with the syllable he thought he heard. Each pair combination in the discrimination task and each syllable in the identification task was presented twice in random order except for one which was arbitrarily chosen to be presented three times. Subjects were given 100% feedback regarding the accuracy of their responses as well as an opportunity to hear the correct and errored syllables for comparison. They were also asked to produce the target and errored sounds with which they were having difficulty. It took approximately two and a half to three sessions to complete the exercises after which the process began over again. Exercises which were found to be easy were sometimes omitted on subsequent presentations. Figure 4.1 is a flow chart of the work.

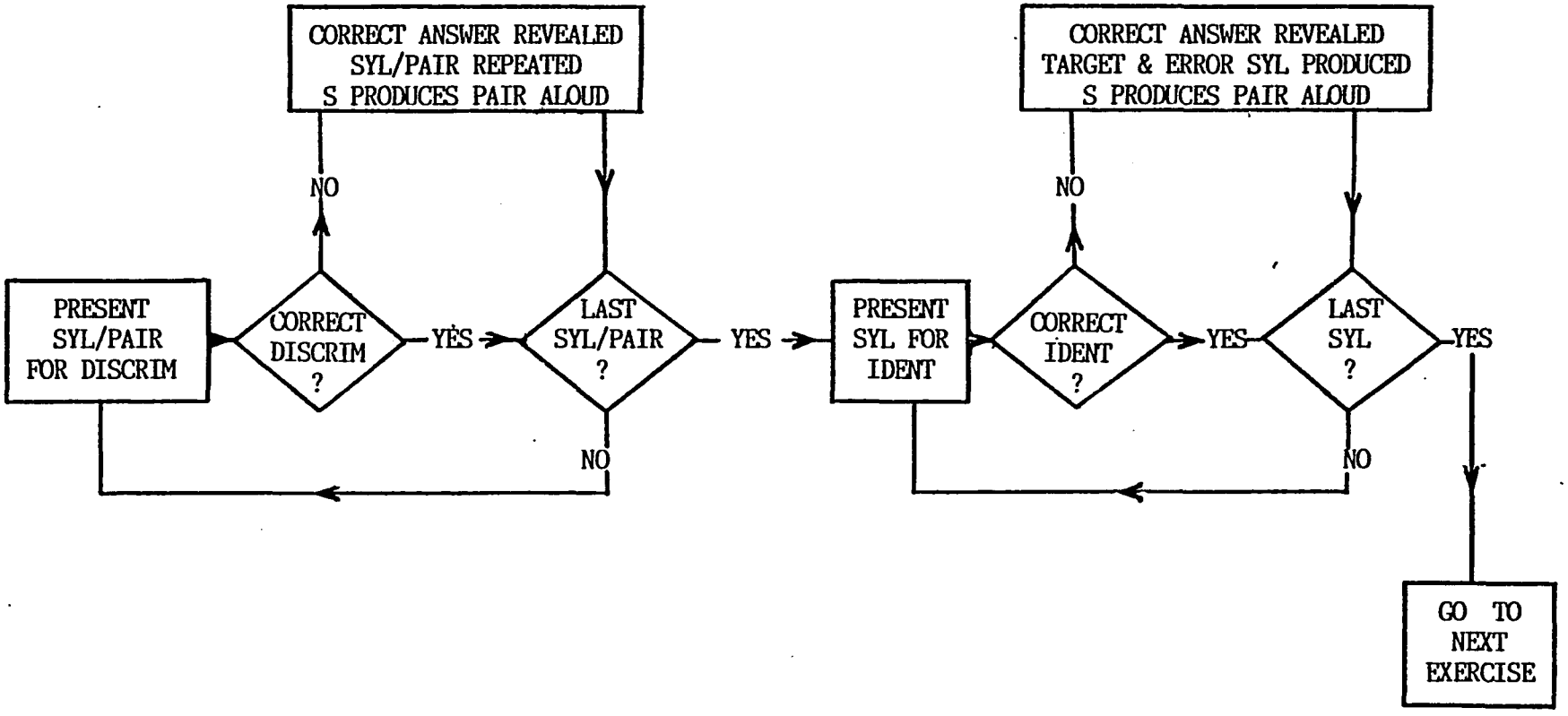

Figure 4.1: Flowchart of consonant recognition training

The following is an outline of the procedures used for this group:

Lesson I

A. Introduction (ten minutes)
    1. Purpose
        a. To improve listening skill
            i. increase concentration - for now become aware of level of concentration
            ii. learn to make use of available cues
        b. To improve sound recognition ability
    2. Method
        a. explanation and discussion
        b. practice drills

B. Consonant recognition drill (thirty minutes)

C. Discussion (ten minutes)
    1. When does communication break down for you?
    2. Hearing vs. Listening - what is the difference?
    3. Three components of listening (Weaver,1972) - willingness, capacity, habit

D. Exercise - relate essence of sentence (ten minutes)
Related sentences with topic given - Ordman and Ralli:**About the Weather**

Lesson II

A. Consonant recognition drill (thirty minutes)

B. Discussion - Factors affecting how we hear - explanation of subject's audiogram (fifteen minutes)

C. Exercise (fifteen minutes)
    1. Current events articles, first paragraph - establish topic
    2. Stories with title given - explain point of story
        a. Haug and Haug - **Hospital Waiting Room**
        b. Haug and Haug - **Congressman's Wife**

Lesson III

A. Consonant recognition drill (thirty minutes)

B. Discussion - Factors affecting how we hear (fifteen minutes)

C. Exercise (fifteen minutes)
    1. Relate essence of sentence

Related sentences with topic given - Ordman and Ralli: **At the Restaurant**

2. Stort story with title given - explain point of story
   Ordman and Ralli: **He Always Wins**

Lesson IV

A. Consonant recognition drill (thirty minutes)

B. Discussion - How previous knowledge aids comprehension (fifteen minutes)

C. Exercise (fifteen minutes)
   1. Relate essence of sentence
      Unrelated sentences with part of sentence given - **Auditec of St. Louis Auditory Training Tape** (lesson 1, 1-10)
   2. Current events articles, first paragraph - establish topic

Lesson V

A. Consonant recognition drill (thirty minutes)

B. Discussion - Improving Listening Skills - preparing for the listening situation (fifteen minutes)

C. Exercise (fifteen minutes)
   1. Conversation in noise - Topic: **A Typical Day**
   2. Relate essence of sentence
      Related sentences without topic given - Ordman and Ralli: **At the Movies**

Lesson VI

A. Consonant recognition drill (thirty minutes)

B. Discussion - Improving Listening Skills - while in the listening situation

C. Exercise (fifteen minutes)
   1. Stories without title given - explain point of story
      a. Broberg: **Not Bad**
      b. Haug and Haug: **Honesty is the Best Policy**
      c. Ordman and Ralli: **Shrewd Management**
   2. Stories without title given - answer questions at end
      Broberg: **Columbus and the Egg**

Lesson VII

A. Consonant recognition drill (thirty minutes)

B. Discussion - Strategies of hearing impaired toward listening situations (fifteen minutes)

C. Exercise (fifteen minutes)
   1. Relate essence of sentence
      Unrelated sentences with key word given - **Auditec of St. Louis Auditory Training Tape**
   2. Current events article - answer questions

Lesson VIII

A. Consonant recognition drill (thirty minutes)

B. Exercise (fifteen minutes)
   1. Story without title given - answer questions
      Osgood: **Kick Me Once and Kick Me Twice and Kick Me Once Again**
   2. Relate essence of sentence
      Related sentences without topic given - Jeffers and Barley: **Clerk**
   3. Story without title given - explain point of story
      Haug and Haug: **Golfer's Day Off**

C. Discussion - summary of training program (fifteen minutes)

For the consonant recognition training, subjects were informed that they would be hearing nonsense syllables in the presence of noise; some of the sounds would be easy to distinguish, some would be difficult but possible to distinguish with practice, however others might be impossible to distinguish. They were instructed to do the best that they could, maintain a high level of concentration, and in cases where repeated attempts to make distinctions proved unsuccessful, to note the sounds which were problematic for them. It was explained that these sounds might be discriminable under more favorable listening conditions.

Chapter 5
Results

In this study, 20 subjects were scheduled for a total of 13 sessions during the course of approximately three months: one screening test, two pretraining test sessions, eight training sessions and two posttraining test sessions. Nineteen subjects completed the entire protocol. One subject, from the synthetic only group, completed all but the final posttraining test session.

The data consist of 12 scores for each subject (four measures on each of three tests), resulting in a total of 240 data points. In the case of the one subject who could not attend the final session, the missing data were treated in the following manner: the mean change in performance from the first posttest session to the second was calculated for the other 19 subjects for each test separately (NST, RSPIN-PL, RSPIN-PH). The scores from the first posttest of the subject were then changed to the same degree and in the same direction as the mean change, to obtain estimates of each measure for the second posttest. The raw scores of all subjects for each experimental condition are listed in the Appendix N.

The experiment was designed to measure the effects of auditory training on three tests of speech perception ability, using two different methods. Analysis of the data included a 2x3x4 (Method by Test Type by Test Period) analysis of variance (Winer, 1971). The factors of Test Type and Test Period were within subject variables while the Method factor was a between subjects variable. The Method factor was defined by two levels (synthetic only versus

synthetic plus analytic). The Test Type factor was defined by three levels (NST, RSPIN-PL, RSPIN-PH), and the Test Period factor was defined by four levels (pretest 1, pretest 2, posttest 1, posttest 2).

The mean speech recognition scores for each test in each training group and each test period are given in Table 5.1. Standard deviations are provided in parentheses. Table 5.2 summarizes the main effects and interactions from the results of the analysis of variance. As noted previously, arc sine transformations were applied to the raw data in order to increase the homogeneity of the variance; the transformed scores were then used in the analysis.

Two main effects and one interaction effect were shown to be statistically significant. The main effect of Test Type ($p < .001$) was not judged to be of relevance due to the design of the experiment. Recall that adaptive testing had established a separate SN ratio for each test in an attempt to approximate a 50% score during pretesting. As is evident from Table 5.1, while test results at the first pretest ranged from 41.7% to 56.2%, indicating that the 50% point had been successfully approximated, the RSPIN-PH results on average were higher than the other two tests. The main effect of test was due, at least in part, to this occurrence.

The results also reveal a highly significant main effect of Test Period ($p < .0002$), a finding extremely relevant to the study. Figure 5.1 demonstrates the change in scores as a function of Test Period, collapsed across Test Type and Method factors. The mean values are shown in Table 5.3. The figure illustrates that while there was no change in performance during the no-treatment control

Table 5.1

Mean Test Scores as Probability of Correct Response

By Method of Instruction, Test Type and Test Period

Standard deviations are shown in parentheses.

		Test Period			
Test	Method	Pretest 1	Pretest 2	Posttest 1	Posttest 2
NST	SS	.417 (.0952)	.430 (.0887)	.456 (.0994)	.436 (.0704)
	SA	.487 (.0861)	.463 (.0958)	.510 (.1124)	.507 (.0568)
RSPIN PL	SS	.408 (.0744)	.460 (.1218)	.464 (.1195)	.481 (.1234)
	SA	.440 (.1135)	.428 (.1555)	.472 (.1617)	.476 (.1487)
RSPIN PH	SS	.468 (.1331)	.480 (.2024)	.542 (.2363)	.594 (.2106)
	SA	.562 (.1097)	.544 (.1640)	.628 (.1443)	.666 (.1098)

SS = Synthetic Only Group

SA = Synthetic Plus Analytic Group

Table 5.2

3-Way ANOVA By Method Of Instruction
By Test Type By Test Period

Source	Sum of Squares	DF	Mean Square	F	Tail Prob.
Method (M)	.17459	1	.17459	1.67	.2129
Test (T)	.86705	2	.43352	8.22	.0011
Period (P)	.26608	3	.08869	7.96	.0002
M x T	.08199	2	.04099	0.78	.4674
M x P	.02078	3	.00693	0.62	.6042
T x P	.11691	6	.01949	2.48	.0274
T x P x M	.00339	6	.00056	0.07	.9985
Residual	.84781	108	.00785		

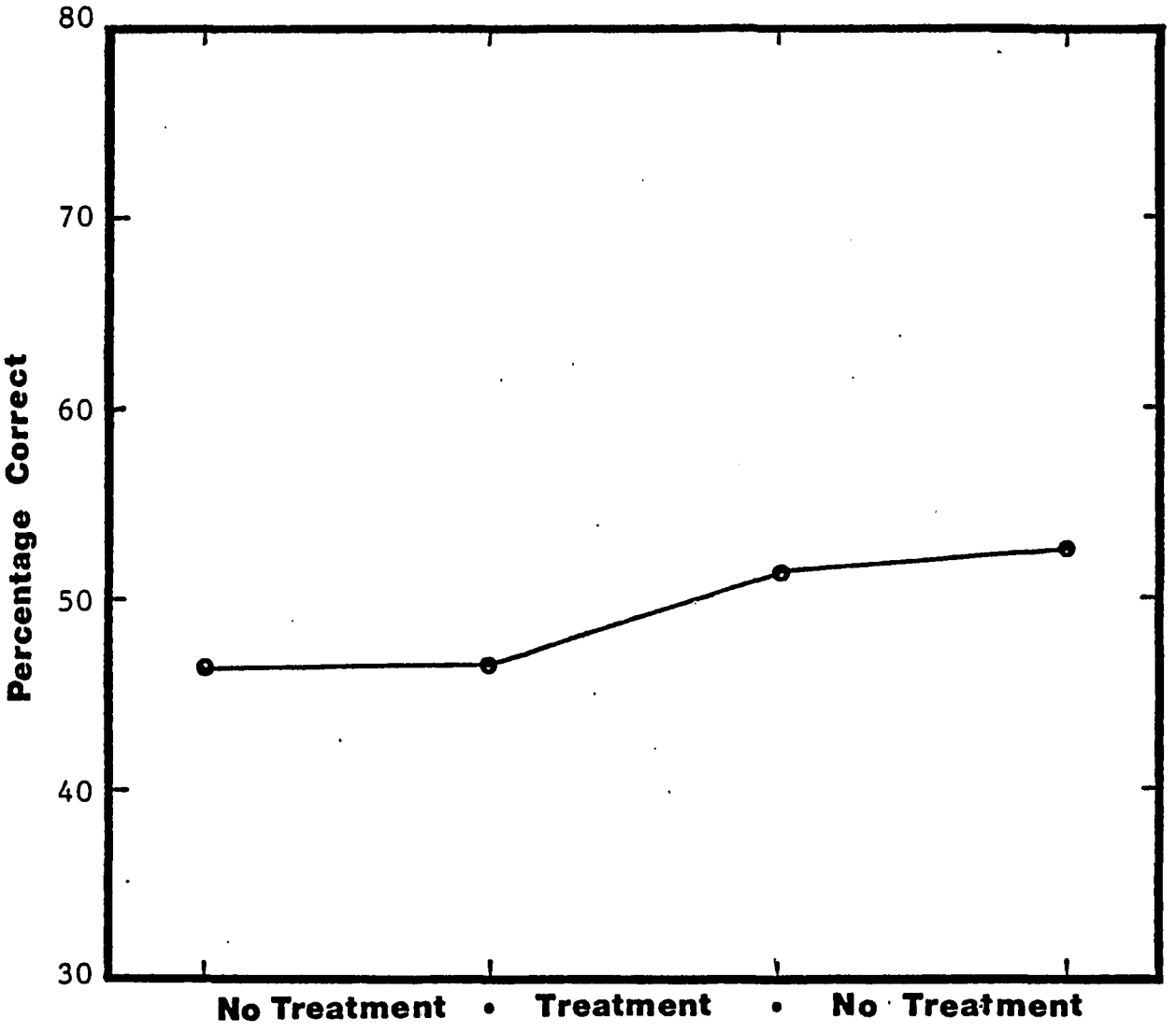

Figure 5.1: MEAN TEST SCORE FOR EACH TEST PERIOD WHEN METHOD AND TEST ARE COMBINED

condition, scores did improve during the treatment phase. During the post-treatment phase, little change is evident. The Tukey Test (Guilford, 1965) was used to determine the source of the significant findings from the analysis of variance, which was found in the separation between the second pretest and first posttest conditions ($p<.01$).

Since there was no difference between the two pretest scores, the improvement in posttest scores may be attributed to some aspect of the treatment process. Furthermore, since there was no return towards baseline in the final posttest session, it may be concluded that the gains achieved during training were retained during the month following the end of treatment. Therefore, in answer to the first question posed, auditory training did result in significant improvement in speech perception performance.

The third main effect, that of Method, did not prove to be statistically significant nor were any of the interactions associated with it. Figure 5.2 illustrates the change in scores for the synthetic only and synthetic plus analytic groups as a function of Test Period, collapsed across the Test Type factor. Table 5.3 provides the mean values on which the figure is based. It demonstrates how both groups follow similar patterns. Therefore, in answer to the second and fourth questions posed, differences in training approach did not make a statistically significant difference in the auditory training gains found and there were no differential effects of training approach on the three measures used.

Table 5.3

Mean Test Scores as Probability of Correct Response

By Method of Instruction and Test Period

Collapsed Across Test Type

Standard deviations are shown in parentheses.

	Test Period			
Method	Pretest 1	Pretest 2	Posttest 1	Posttest 2
SS	.431 (.1063)	.456 (.1421)	.488 (.1549)	.503 (.1519)
SA	.496 (.1124)	.478 (.1454)	.536 (.1518)	.549 (.1370)
Total	.463 (.1127)	.467 (.1429)	.512 (.1540)	.526 (.1479)

SS = Synthetic Only Group

SA = Synthetic Plus Analytic Group

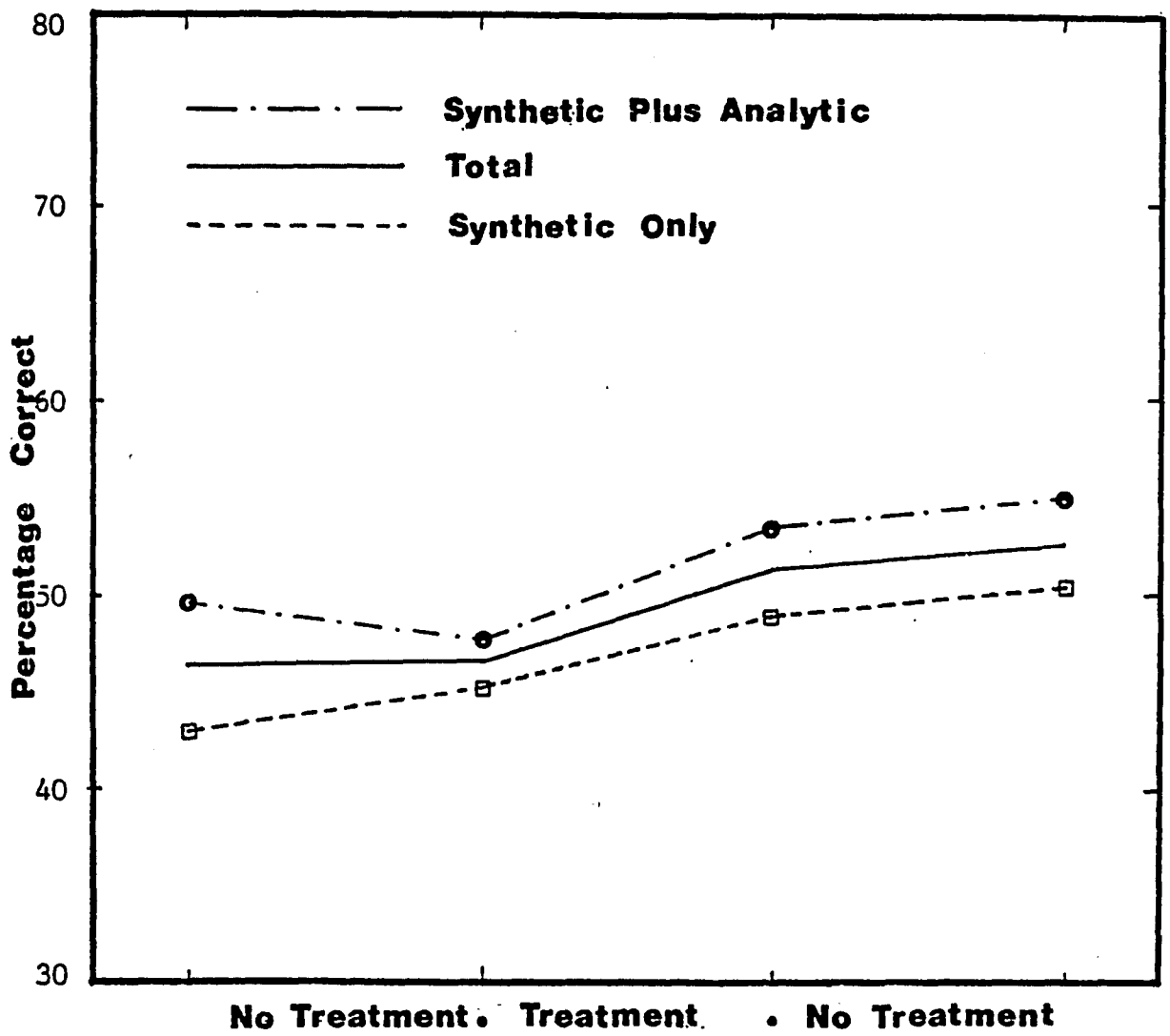

Figure 5.2: MEAN TEST SCORES FOR EACH TEST PERIOD AND EACH METHOD WHEN TEST IS COMBINED

To answer the third question and to investigate further the significant interaction between Test Type and Test Period ($p < .027$), three one-way analyses of variance were performed, one for each test. Table 5.4 summarizes the results for the NST material, and the mean scores for all three tests as a function of Test Period appear in Table 5.5. Figure 5.3 illustrates the change in scores as a function of Test Period. While an improvement in scores is shown between pretest and posttest conditions for the NST, this change was not found to be statistically significant, and therefore, must be attributed to chance. A summary of the results from the analysis of variance for the RSPIN-PL material is shown in Table 5.6. Marginal significance was reached for the Period factor ($p < .049$). The Tukey Test revealed that the gap between the pretest 2 and posttest 1, however, was not statistically significant. In view of this, the improvement in scores cannot be attributed to the treatment process.

The results of the analysis of variance for the RSPIN-PH material, summarized in Table 5.7, demonstrated that statistical significance ($p < .001$) was also achieved here. The Tukey test revealed separate groupings for pretests and posttests ($p < .05$). Figure 5.3 demonstrates this improvement in scores of the posttest over the pretest sessions. During the last posttest, not only is the improvement retained, but there is a trend toward continued improvement. Therefore, in answer to the third question, the results indicate that gains attributable to auditory training were convincingly reflected only in one measure of speech perception ability, the PH items of the RSPIN test.

Table 5.4

Mean Test Scores as Probability of Correct Response

By Test Type and By Test Period

Collapsed Across Method of Instruction

Standard deviations are shown in parentheses.

	Test Period			
Test	Pretest 1	Pretest 2	Posttest 1	Posttest 2
NST	.452 (.0955)	.447 (.0914)	.483 (.1070)	.471 (.0722)
RSPIN PL	.424 (.0948)	.444 (.1370)	.468 (.1384)	.478 (.1330)
RSPIN PH	.515 (.1156)	.512 (.1823)	.586 (.1854)	.630 (.1675)

Table 5.5

1-Way ANOVA of NST Data By Test Period
Collapsed Across Method of Instruction

Source	Sum of Squares	DF	Mean Square	F	Tail Prob.
Period	.02299	3	.00766	1.91	.1393
Residual	.21695	54	.00402		

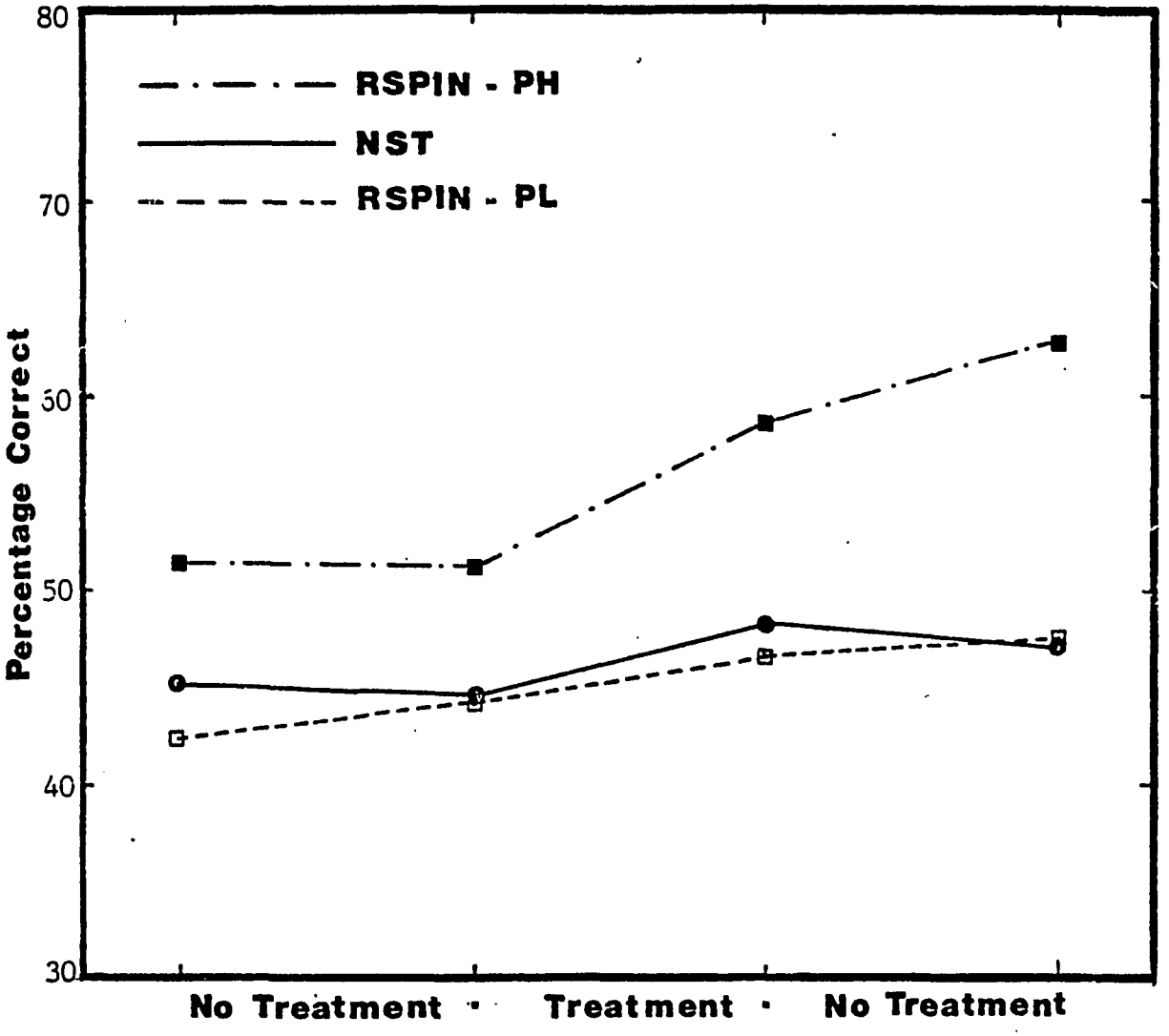

Figure 5.3: MEAN TEST SCORES FOR EACH TEST PERIOD AND EACH TEST TYPE WHEN METHOD IS COMBINED

Table 5.6

1-Way ANOVA of RSPIN-PL By Test Period
Collapsed Across Method Of Instruction

Source	Sum of Squares	DF	Mean Square	F	Tail Prob.
Period	.04981	3	.01660	2079	.0492
Residual	.32134	54	.00595		

Table 5.7

1-Way ANOVA of RSPIN-PH by Test Period
Collapsed Across Method of Instruction

Source	Sum of Squares	DF	Mean Square	F	Tail Prob.
Period	.31019	3	.10340	6.13	.0012
Residual	.91139	54	.01688		

In attempt to gain insight into any attributes which may have been connected with improvement on the RSPIN-PH material, several Pearson Product Moment correlations were performed. An overall improvement score for the PH material was obtained for each subject by subtracting his/her average posttest score from his/her average pretest score. Five attributes were considered -- three were characteristics of the subject and two were components of the testing. Regarding the subject, it was of interest to know whether poorer hearing ability would affect the degree of improvement; correlations were performed using first the pure tone average in the aided ear and then the aided speech discrimination score. In addition, a correlation with subject age was performed to see if the older subjects were less receptive to the effects of training. Results of the statistical analysis revealed no statistically significant correlations at the .05 level.

Regarding the testing, the purpose was to determine whether task difficulty related to degree of improvement. Specifically, correlations were performed using the SN ratio at which the test was performed, and the RSPIN-PH score obtained at the first pretest. In the case of the latter, it may be recalled that an attempt had been made to approximate a 50% score for all subjects. Although the mean data clearly reflect that the 50% score was approximated, the procedure resulted in varying degrees of success for individual subjects, as can be seen in the raw data. Results indicated, however, that neither correlation was statistically significant.

In addition to describing the improvement in scores in terms of the arithmetic difference between two percentage scores, an

alternate approach may be used which involves applying a method proposed by Boothroyd (1978, in press). Schiavetti, Sitler, Metz, and Houde (1984), in a recent study evaluating the model, found it to be extremely robust and recommended that further applications to the model be investigated. Based on probability theory, it assumes that speech perception depends upon independent sources of information. The probability of making an error in perception when two independent sources of information are present should equal the product of the separate error probabilities for each. The log of the error probabilities are therefore additive.

In terms of this study, if the effect of training (one source of information), is assumed to be equivalent to multiplying, by a factor k, the sources of independent information available to the listener before training, then it can be shown that the expected relationship between the posttraining score, P_b, and the pretraining score, P_a, is

$$\log(1 - P_b) = k.\log(1 - P_a)$$

Thus,

$$k = \log(1 - P_b)/\log(1 - P_a)$$

The last formula was used to calculate k for each subject from an average of the pretraining scores and an average of the posttraining scores. A mean k value of 1.36 was obtained. This result may be interpreted to mean that the effect of training was equivalent to increasing by 36% the sources of independent information that had been available to the subjects before they had been trained. This does not, of course, mean that the percentage correct increases by 36%. The fact that two sources of information

are independent implies that some of the information is shared and some is not. Only the information that is not shared will increase the percentage scores. These issues are discussed in the early literature on the Articulation Index (French & Steinberg, 1947; Fletcher, 1953; see also Boothroyd, 1978; Flanagan & Levitt, 1969).

The change in scores may also be represented in terms of a scatterplot in which the average pretest scores appear on the abscissa and the average posttest scores appear on the ordinate. Such a scatterplot is shown in Figure 5.4. In cases where no improvement occurred, the points fall along the diagonal. As can be seen, most of the points fall above the diagonal, indicating improvement following training. The curved line represents the predicted scores for P_b given a k value of 1.36.

Another way of describing the improvement in scores is as an equivalent change in SN ratio which would result in a similar improvement. Superimposing the obtained improvement on the performance intensity function for sentences as obtained by Miller et al. (1951), one finds that the equivalent change in SN ratio amounts to 2.4 dB.

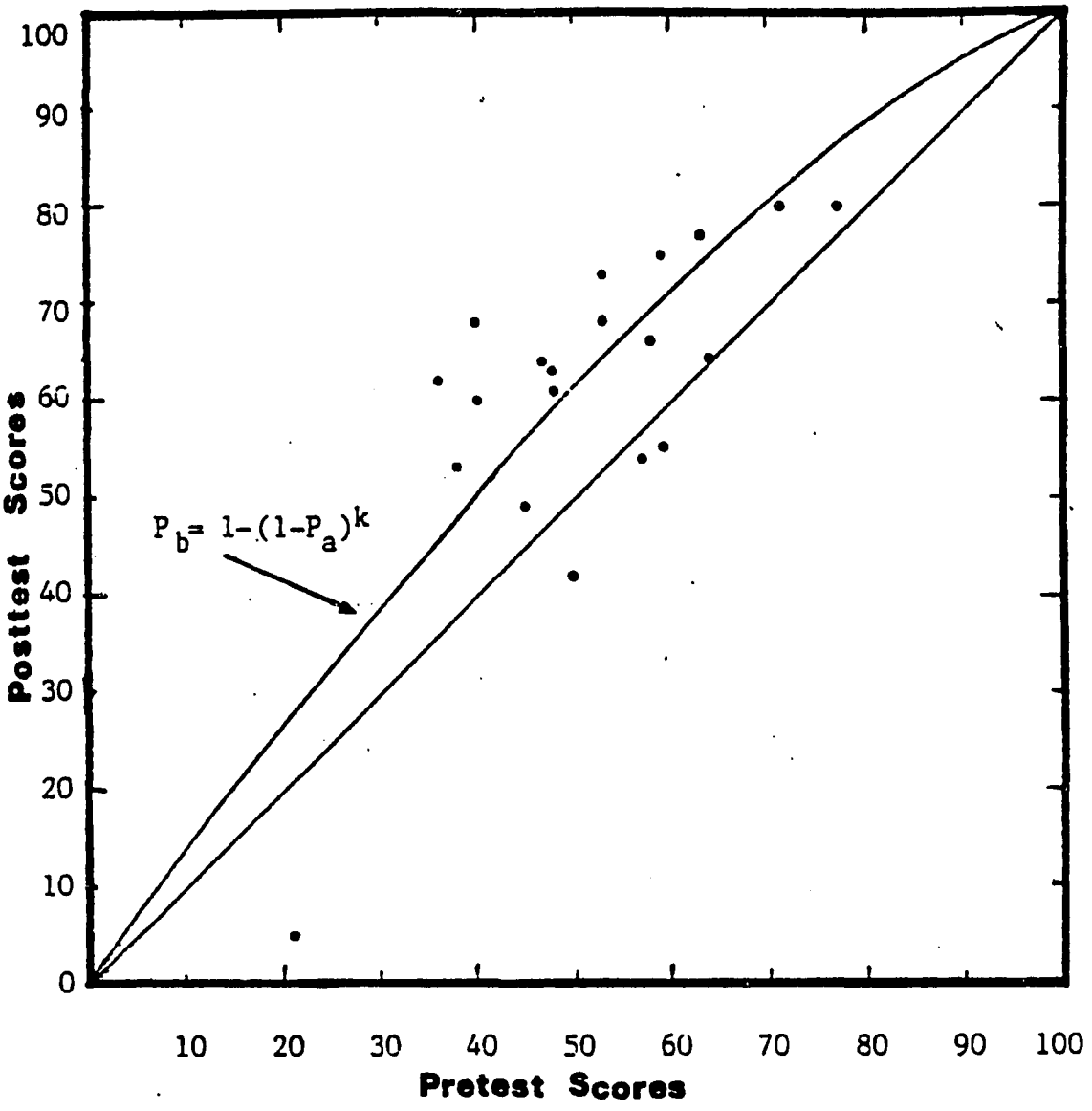

Figure 5.4:SCATTERPLOT OF AVERAGE PRETEST SCORES AGAINST AVERAGE POSTTEST SCORES FOR RSPIN-PH MATERIAL

Chapter 6
Discussion

In this section, the results of this experiment will be discussed and compared with previous findings. Clinical implications of these data will also be discussed.

The first finding derived from this research was that formal auditory training resulted in a statistically significant improvement in speech perception performance. These results are in agreement with previous findings. It may be recalled that most of the published studies in the area had also found improvement on at least one measure. Differences in the magnitude of improvement vary among studies, which is not surprising given the differences in procedures and subject attributes. Where gains are quite modest, as is often the case, it is not clear whether the problem lies more in the ineffectiveness of the methods or the insensitivity of the measuring tool (McCarthy & Alpiner, 1982). In some studies, the problem of ceiling effects may be a contributing factor (Pitzer, 1971). In the present study, the problem of ceiling and/or floor effects was successfully avoided through the use of an adaptive pretesting procedure by which a 50% score was approximated for subjects on each test during the first session.

Within a given study, a wide range of improvement among subjects is often seen, which was the case in this investigation also. It is not clear which variables account for individual differences. In this study, a correlational analysis using several variables was performed, but none yielded a significant correlation with degree of improvement. Bode and Oyer (1970) found no

statistically significant correlation with intelligence. They reported that older subjects showed greater gains in discrimination scores than younger subjects, but this was not tested statistically. Walden et al. (1981) noted that the greatest performance increases could not be grouped according to such variables as degree or duration of hearing loss, or motivation. Unfortunately, the area of auditory training gains and subject attributes is one which has been virtually ignored in the literature.

A major limitation in the experimental design of many of the studies in this area is the absence of a no-treatment control group. One reason may be the ethical consideration of withholding therapy from some subjects. Another may be the difficulty identifying subjects. The design used in this study, in which therapy was postponed so that the subjects could serve as their own controls, solves both of these problems. It has the added advantage of matching extraneous variables well. Potential disadvantages include the fact that such a design increases the overall time period of the experiment, thus increasing the likelihood of both attrition, and changes in the subjects (e.g. deterioration in hearing, changes in hearing aid performance) which could confound the results. In this study, attrition did not turn out to be a major problem and it was determined that the hearing losses of the subjects remained stable, by comparing thresholds before and after the experiment. Hearing aid outputs were monitored throughout the experiment. It is recommended, therefore, that this experimental design be considered

for use in future investigations in the area of aural rehabilitation.

A second issue addressed in this study was whether or not method of instruction mattered i.e. was time more productively spent using a synthetic only or synthetic plus analytic approach. The results demonstrated no significant difference in performance between the two groups. This suggests that both approaches were equally successful in producing change. This may be interpreted to mean one of two things: it is possible that the four hours of analytic exercises and the extra four hours of synthetic exercises resulted in equivalent improvement. Alternatively, the four hours of synthetic training given to both groups may have been sufficient to produce the measured change in scores. Given the design of the experiment, it is not possible to test either hypothesis. Subjective responses on the part of subjects were mixed. In answer to the question, "What changes in the program would you make?" one subject suggested that the program could have been shorter and another felt there could have been less repetition. On the other hand, some members of the study have continued therapy as part of the regular aural rehabilitation program provided at Brooklyn College. Sanders (1982) has suggested that for some hearing aid users, only a couple of sessions may be necessary, and a decision for each person must be made individually.

The finding that the two methods were equivalent differs from that obtained by Walden et al. (1981). In their study, the group receiving individual consonant recognition drill performed better than the group receiving group auditory training in the standard

program. They were, however, using an auditory/visual sentence recognition task, not an auditory-alone task. Unfortunately, the authors do not describe the components of the group auditory training in the standard program. As mentioned by the authors, due to the design, one cannot separate the effect of the consonant recognition task itself from the individual attention given that group. In the present study, where all received private sessions, the consonant recognition training was not an added advantage. There are many other differences between the two studies, however, which could account for different results. In the Walden et al. study, all subjects were new hearing aid users. The consonant recognition training may have afforded them an opportunity to accustom themselves to aided sound. In the present study, the majority of the subjects had had hearing aids over a year. Another difference between the studies is the age of the subjects. The mean age of subjects in the Walden et al. study was 40 with a range of 19 to 68. They stated, "These results are encouraging, but they cannot be used as a basis for arguing that consonant recognition training should be used exclusively, or even with every population of hearing-impaired patients. Such a highly structured, intensive approach probably is not appropriate for either a geriatric or pediatric population" (p. 214). While the present study did not show the consonant recognition training to be a disadvantage, it did not prove to be an advantage either.

An additional question addressed was whether or not training would be reflected differently on various test measures. Since the

only statistically significant finding occurred using the RSPIN-PH material, it suggests that the main skills acquired during training were focused listening and especially greater and more conscious use of contextual cues. This is similar to the findings reported by Nittrouer et al. (1976) in a sample of deaf pre-teenagers. In further support of this finding, Colten (1975) found no significant improvement in recognition of the three specific phonemes drilled, and theorized that the increase in word scores may have been due to an increase in the subjects' listening skills.

Walden et al. (1981) found, however, significant improvement on a nonsense syllable test given to the group which received consonant recognition training. In this case as well, the age of the subjects may have been a factor, especially given that Colten's subjects were also drawn from a geriatric population. Procedural differences may also have played a role. For example, in the Walden et al. study, both consonant recognition testing and training were performed in quiet. They opted not to use noise to equate pretraining performance levels for the nonsense syllables since it "would have [had] the effect of eliminating certain of the less dominant acoustic cues from the auditory signal"(p.213). In the present study,noise was included during both testing and training, with the rationale that since the subject's problems were present especially in noise, they should try to discover those available cues which may be present. Additionally, there was the hope that what was learned from the nonsense syllable task could be carried over to the sentence test, where noise was present.

Auditory training was not found to significantly improve the

PL sentences of the RSPIN test, providing further support to the notion that increased use of context caused the change in PH scores. To some extent these sentences, although designed to be contextually neutral, were regarded as puzzling and referred to as "nonsense" sentences by some of the subjects. Since, during the training, subjects were taught to to reject such an utterance in favor of one that made sense, it is possible that on some items, subjects may have rejected the right answer in favor of one that was wrong, if the wrong answer made more sense to them.

A very encouraging finding was that improvements after training were not lost in the month following training. If anything, there was a trend toward continued improvement. Future research should address itself to extending these findings with this population. Nittrouer et al (1978) found with their sample of deaf pre-teenagers that following a seven month break in training, performance scores on an auditory task returned to baseline levels. Clearly, more work on this important issue is needed.

Clinical Implications

The importance of a study such as this one lies also in the answers it can provide for the clinician. The results of this study support the inclusion of some type of formal auditory training in programs of aural rehabilitation with adults, although they do not support any approach in particular. Since the improvement was seen only in the PH sentences, it suggests that effective listening while taking advantage of contextual cues is an important feature of training.

This does not necessarily mean that the analytic training was useless. While the analytic exercises were taking place, subjects may have been learning to increase their concentration levels as well as their tolerance of extraneous noise, though they did not learn to recognize secondary cues of phoneme recognition. In discussing a study on visual training, Montgomery et al. (1984) suggested that what might have changed was the visual attending behavior, i.e. "strategies and habits rather than improved visual discrimination per se". Since there was no difference in the two groups in the present study, it is possible that both groups may have changed in this respect.

It is also possible that there may have been improvement in the recognition of some of the sounds, but given the limited number of presentations of the NST, it is not possible to determine this from the present research. In addition, it should be noted that the NST samples only consonant manner and place perception. If the subjects had improved in their perception of voicing or vowels, the test could not have reflected it. On the other hand, the test was so designed because errors in voicing and vowel perception are relatively rare in the population for which the test was developed.

Whether or not a person can be taught to take advantage of secondary cues for phoneme recognition is an important and unresolved issue. Walden (1984) pointed out that there are many possible causes of consonant errors besides spectrum shaping in speech recognition in the hearing-impaired, such as alteration in the location and distinctiveness of phoneme boundaries, and

differences in short-term memory strategies and processes. Some of them may be amenable to training and some may not. As he recommends, further research is needed on the speech perception process in general and the discovery and use of secondary cues in particular.

In addition to the more conscious use of context, it is possible that a change in attitude was partially responsible for the observed change in subjects. Bate (1980) has suggested that "there is good reason to believe that much of the improvement clients often experience is attributed to changes in attitude and confidence rather than in specific auditory discrimination skills"(p.333). In discussing the effects of training, the majority of subjects emphasized an increased willingness to continue listening despite adverse listening conditions. An example is the following comment: "This program helped me to listen more and use my head plus my ears. I don't give up if I can't hear everything -- I stay in there and find that I can put words together."

What then do these results suggest to the clinician regarding the inclusion of consonant recognition in auditory training programs with this population? It should be pointed out that while the analytic training was neither more nor less beneficial as reflected on the three tests of speech perception ability, subjective impressions by participants appeared to demonstrate a preference for the synthetic components of the training. In answer to the question "From which types of practice material, if any, did you derive benefit?", no subject ranked the nonsense syllable as greatest in importance and several subjects were quite negative about the

practice. The following is an example from the comments of one subject: "I found all the practice material encouraging but I question the exercise in distinguishing like sounds. I found this frustrating and tiring. The hearing problem is frustrating enough and I don't believe that this has sharpened my hearing."

This type of comment, considered in light of the findings of this study, argues against the inclusion of consonant recognition training. Future research, however, should address itself to the interaction of subject attributes and procedural variables. It has been recommended, for example, that the inclusion of analytic training should depend on the personality of the individual (O'Neill, 1966). During this study, for example, it was observed that certain subjects appeared to depend too much on their global skills, often revealing, as described by Bergman (1951) "a tendency to jump at a minimum of auditory cues and give unrelated answers" while others demonstrated a reluctance to respond unless they were virtually certain. It is possible that a more analytic type of training would be more appropriate for the former type of subject.

It should be kept in mind that, because this was a research project, it differed in some ways from the typical clinical situation. For example, since the subjects knew they were part of a research project, it may have had a differential effect on their behavior. Indeed, they were all people who were willing to volunteer for a research project in the first place. Another example relates to the issue of fees. According to Garstecki (1984a), "Fees, regardless of amount, are necessary to serve to

motivate clients to assume responsibility for progress in their program"(p.130). The fact that subjects were not charged did not appear, however, be a confounding factor. Instead, in this project, subjects seemed to motivated by their appreciation that they were getting something for nothing. Several subjects expressed such feelings. This notion is supported by the lack of attrition during a difficult program, which included one hour training sessions twice a week and particularly, four taxing test sessions.

Walden (1984) has noted that clinical experience using traditional methodologies in adult aural rehabilitation has not always been satisfactory. It has already been shown, however, that most of the published studies on auditory training with adults demonstrated improvement of some form. This apparent contradiction can be explained in a number of ways. The first reason may relate to the fact that the magnitude of the improvement is relatively small in many cases, despite the statistical significance of the findings. A second reason relates to the limited quantity of total studies on this subject. While this may be due, in part, to less interest in this topic over others, it may also be that many more studies have been conducted, but not published, due to the lack of positive findings. In particular, it is likely that at least some of the advocates of auditory training, who have published programs without research findings, have conducted research without obtaining conclusive findings in support of their approaches.

It has already been suggested that the lack of adequate measures of progress may be responsible, at least in part, for the limited demonstration of success of auditory training programs both

clinically and in research. In this study, the PI sentence material of the RSPIN test was shown to successfully reflect improvement from training. Schow and Nerbonne (1982) have recommended that the RSPIN test be incorporated as part of a comprehensive evaluation tool. It can be seen from the raw data that there was a great deal of individual variability, and while the test was sensitive enough to reflect differences in group means, it would be less effective as a measure of individual change. Furthermore, one of the problems with evaluating such programs using any speech perception task is that there may be certain changes taking place that are not reflected in the scores. For example, a number of subjects in this study volunteered for the project because they owned hearing aids, but did not wear them frequently. They reported that, as a result of their participation in the program, they had increased their hearing aid usage.

Part of rehabilitation sometimes includes learning to increase one's tolerance level so that one may be able to wear the hearing aid at a higher volume. In this study, any such improvement to this factor could not be measured because during testing, the hearing aid was consistently set at the same level in order to control the variable of listening level. This was another element that was observed to have changed among some subjects, but was not reflected in the data.

Another limitation which arises in the pre/post speech testing situation involves guessing strategy. Van Tassell and Hawkins (1981) found significantly different amounts of improvement on an

audiovisual task without administering training, by changing the instructions. They performed a study using three groups of normal-hearing subjects, with each group given the task twice. For the first set, all subjects were given the same set of instructions, in which the subjects were neither encouraged to nor discouraged from guessing. For the second set, one group was given the same instructions; a second group was encouraged to guess since the instructions stated that the subject would receive two cents for each correct response; the third group was discouraged from guessing since in the instructions it stated that while the subject would receive two cents for each correct answer, he/she would lose four cents for every error. They found that the Reward Guessing group performed significantly better than the Punish Guessing group on the posttest. They then compared this improvement with therapy studies and concluded that the magnitudes were similar. Montgomery et al. (1981) reinterpreted the data as suggesting that it was not an increase in the willingness to guess but rather a suppression from guessing effect in the Punish Guessing group that was being seen.

While it has already been suggested that attitude may be responsible for a change in scores, one must not assume that this change in attitude is necessarily as simple as a changing of the instructions. Subjects with normal hearing do not carry in their memories a cache of negative experiences associated with wrong guesses. In the case of the hearing-impaired, many have become extremely sensitive to errors in guessing and recall with mortification every detail of what they perceive to be extremely embarrassing experiences. Simply suggesting that they venture a

guess by no means assures that they will do so. In fact, one of the advantages of listening exercises for this type of person may be to encourage educated guessing and demonstrate how the client can be right despite his/her reluctance. During this study, it was noted how some subjects had to be encouraged to guess during the exercises even though there was no penalty for wrong answers.

Whether or not a person is willing to venture a guess during the test situation does not necessarily predict what the person is doing in the real-life situation. Furthermore, there may also be a difference between the person's willingness to try actively to make sense out of what he heard and his willingness to act upon it (e.g. through responding). The point is that the test situation is at best a crude measure of potential changes.

The conclusion which may be drawn from the above is that other methods are needed to complement the information obtained through speech tests. One potential way to evaluate progress which has not been explored sufficiently is what I will refer to as the information test. A distinction can be made between what a person knows regarding what he can do to improve communication and what he actually does. Many clients entering the rehabilitation program may feel themselves victims of their hearing losses. A great boost to their self-confidence and morale may be learning that they make errors in their listening and conversation strategies, which if corrected, may lead to more successful communication. In some cases, they may have already been using some of them, but haphazardly. With greater consciousness, they can achieve greater success. The

knowledge of these available strategies can certainly be measured. At the same time, any errors in understanding can be uncovered.

Ward and Gowers (1981) have already used this technique in a study on teaching hearing tactics to elderly subjects. A recent instruction manual published by Volta (Castle, 1984) on telephone use includes a booklet containing questions on the material, thus providing an opportunity to test the student's knowledge of the various units, including an excellent section on listening strategies.

While it is recognized that an information test has its own limitations (including some which it shares with tests of speech perception), it might serve to complement the current types of measures of auditory training and aural rehabilitation progress. Future research should address this question while continuing the search for other methods to chart progress.

Chapter 7
Summary and Conclusions

Summary

The need for formal auditory training with hearing-impaired adults is an area of great controversy. Furthermore, among those who agree on the need, there is disagreement about the form it should take. Some rehabilitation audiologists reject entirely the use of auditory training exercises in favor of a counseling-oriented approach (e.g. Fleming, Birkle, Kolman, Miltenberger, & Israel, 1973). Others support a "synthetic" approach to auditory training which uses only sentence-length materials, and emphasizes effective listening skills and utilization of situational and linguistic redundancy (e.g. Sanders, 1982). Still others incorporate a synthetic approach along with an "analytic" one, which includes exercises in specific consonant recognition (e.g. Owens, 1978). Few quantitative data, however, are available to support any of the above opinions.

The purpose of the present study was to determine (a) whether performance on tasks of speech recognition would improve in response to training (b) whether synthetic plus analytic training would produce more improvement than synthetic alone (c) whether any benefits of training would be revealed differently on analytic and synthetic measures of speech perception.

Auditory training was given to twenty hearing aid owners, aged 56 to 79 years with mild to moderate sensorineural hearing losses. Ten of the subjects received only synthetic training. They were given practice in listening to sentences, paragraphs, and stories,

and were trained in effective listening and the use of linguistic and contextual redundancy. The second group spent half of their time on synthetic training and the other half on analytic training in which they were required to identify phonemic units in nonsense syllables. Analytic training materials were adapted from the City University of New York Nonsense Syllable Test (NST) using information on item difficulty established by Dubno and Dirks (1982). Training for both groups consisted of eight, one-hour, private sessions. All drill materials were presented in noise, the signal-to-noise (SN) ratio varying with the difficulty of the task.

Each subject was given three tests of auditory perception: The NST, the low predictability (PL) items of the Revised Speech Perception In Noise (RSPIN) test, and the high predictability (PH) items of the RSPIN test. These tests vary in the relative degree of linguistic/contextual information available and were selected in order to gain insight into the type of knowledge and skills acquired during training. Each test was administered at a SN ratio that provided a score of approximately 50%, as determined with an adaptive procedure using multitalker babble at the beginning of the study.

Each subject was tested on four occasions: (a) at the beginning of the study, (b) after one month of "no treatment", (c) after a month of intensive auditory training (d) after a further month of "no treatment". All testing was performed in sound field using the subject's own hearing aid. The preferred hearing aid output, as chosen by the subject at the first session, was measured using a

hearing aid test box so that the aid could be set at the same output (±1 dB) for all subsequent sessions.

Conclusions

The major findings of this study were:

1. Formal auditory training resulted in a statistically significant improvement in the speech recognition performance of the subjects.

2. The improvement in speech recognition performance was maintained in the month following the end of training.

3. Given the eight-hour length of the program, both methods were equally successful in effecting change. The factor of method of instruction was not found to be statistically significant.

4. The PH material of the RSPIN test was the only test which revealed a statistically significant improvement that could be attributed to the training.

5. No readily apparent attribute of the testing or the subjects appeared to account for the individual variability noted in degree of improvement.

Although these results do not support either approach to formal auditory training with hearing-impaired adults, they do offer support for the inclusion of some type of formal training in programs of aural rehabilitation. Moreover, they suggest that the benefits of such training come from more effective listening, especially in the exploitation of linguistic redundancy.

Future research should address itself to the following questions:

1. What are the long term effects of auditory training i.e. are

gains which were attained through training, retained beyond the month following the end of training?

2. What is the length of the training period which would result in a plateau in performance, for each type of training method and each type of test? It may be that shorter periods of training are sufficient to effect the changes as found in the present study, or that one approach arrives at a plateau earlier. Alternatively, longer periods may reveal advantages for one type of training.

3. Are there attributes of a subject which would make a given training method more effective?

APPENDICES

APPENDIX A: Consent Form

The purpose of this study is to measure the effects of auditory training on the recognition of speech. Subjects should be hearing aid owners with no worse than a moderate degree of hearing loss.

The program will consist of 4 test sessions and 8 training sessions, all approximately one hour each. The tasks will involve listening and responding to speech in various levels of background noise. In addition, there will be instruction and discussion during the training sessions on how to take more advantage of auditory cues. Subjects are free to withdraw at any time and for any reason.

Adrienne Rubinstein
Brooklyn College

I agree to participate as a subject in the study described above.

Name_____ Date_____

APPENDIX B: Letter to Subjects

I am writing to you about a project which I think may be of interest to you. At the Brooklyn College Speech and Hearing Clinic, we are planning a program designed to investigate the effects of auditory training with hearing-impaired adults. Auditory training consists of a set of activities designed to help a hearing-impaired person make better use of his hearing. These activities involve listening to speech while learning how use the available cues which make the message easier to understand.

The program will involve techniques currently used in many clinics and will be offerred free to volunteers meeting the requirements of the project. All participants must own a hearing aid and the degree of the hearing loss must be suitable to the project.

Candidates for the program will be given a hearing test and hearing aid check at no charge at the Brooklyn Speech and Hearing Clinic. The actual training will take place at the College over the course of four weeks (eight one-hour private sessions in total). All testing and training will be scheduled at your convenience (days, evenings, weekends).

We think you will find it an educational and interesting experience. In addition, the results will be used to increase our ability to help people who have hearing loss.

If you are interested in this program or would like more information, please contact:

Adrienne Rubinstein
Brooklyn College
Speech and Hearing Center
Boylan Hall - Room 4400
Bedford Ave. and Ave. H
Brooklyn, New York 11210
(718) 780-5186

APPENDIX C: Descriptive Data On Subjects

Synthetic Only Group

SUBJECT	AGE (in years)	PURE TONE AVERAGE (in dB)	DISCRIMINATION SCORE (in percent)	DURATION OF HEARING LOSS (in years)
1	66	16	84	8
2	74	47	82	10
3	72	57	98	20
4	63	50	74	10
5	74	47	86	6
6	59	41	82	5
7	76	63	50	20
8	73	35	92	3
9	79	51	48	3
10	72	37	70	15

Synthetic Plus Analytic Group

SUBJECT	AGE (in years)	PURE TONE AVERAGE (in dB)	DISCRIMINATION SCORE (in percent)	DURATION OF HEARING LOSS (in years)
1	57	52	98	10
2	62	48	70	4
3	75	50	44	20
4	65	28	88	4
5	66	57	56	6
6	76	43	80	5
7	56	31	76	5
8	78	45	78	5
9	75	48	74	15
10	73	45	76	15

APPENDIX D: City University of New York
Nonsense Syllable Test (NST) Items

Subtest: 1	2	3	4	5	6
BA	BA	PA	PEE	POO	OB
DA	DA	TA	TEE	TOO	OD
GA	GA	KA	KEE	KOO	OG
LA	VA	FA	FEE	FOO	OV
RA	THA	THA	THEE	THOO	OTH
YA	ZA	SA	SEE	SOO	OZ
WA	MA	SHA	SHEE	SHOO	OM
JA	NA	HA	HEE	HOO	ON
		CHA	CHEE	CHOO	ONG

Subtest: 7	8	9	10	11
OB	EEB	EEP	OOB	OOP
OT	EED	EET	OOD	OOT
OK	EEG	EEK	OOG	OOK
OF	EEV	EEF	OOV	OOF
OTH	EETH	EETH	OOTH	OOTH
OS	EEZ	EES	OOZ	OOS
OSH	EEM	EESH	OOM	OOSH
	EEN		OON	
	EENG		OONG	

8. JA
7. GA
2. DA
5. RA
8. JA
1. LA
6. YA
4. BA
3. WA
1. LA
6. YA
4. BA
3. WA
1. LA
6. YA
4. BA
3. WA
7. GA
2. DA
5. RA
8. JA
1. LA
6. YA
4. BA
3. WA

Appendix F: Revised Speech Perception In Noise Test
Divided into Four Forms

FORM A

PH

2. You cut the wood against the GRAIN.
5. The cop wore a bullet-proof VEST.
7. His pants were held up by a BELT.
8. Paul took a bath in the TUB.
10. Maple syrup is made from SAP.
12. They played a game of cat and MOUSE.
13. The thread was wound on a SPOOL.
15. The crook entered a guilty PLEA.
17. A bear has a thick coat of FUR.
19. To open the jar, twist the LID.
22. Tighten the belt by a NOTCH.
23. The cookies were kept in a JAR.
26. The marksman took careful AIM.
27. I ate a piece of chocolate FUDGE.
30. John's front tooth had a CHIP.
31. At breakfast he drank some JUICE.
34. Our cat is good at catching MICE.
37. The stale bread was covered with MOLD.
39. How long can you hold your BREATH?
40. His boss made him work like a SLAVE.
42. Air mail requires a special STAMP.
43. The bottle was sealed with a CORK.
46. Cut the bacon into STRIPS.
47. Throw out all this useless JUNK.
50. The shipwrecked sailors built a RAFT.
1. Kill the bugs with this SPRAY.
3. How much can I buy for a DIME?
5. We shipped the furniture by TRUCK.
8. My T.V. has a twelve-inch SCREEN.
9. That accident gave me a SCARE.
11. The king wore a golden CROWN.
12. The girl swept the floor with a BROOM.
14. The nurse gave him first AID.
15. She faced them with a foolish GRIN.
17. Watermelons have lots of SEEDS.
18. Use this spray to kill the BUGS.
20. The teacher sat on a sharp TACK.
22. The sailor swabbed the DECK.
25. He tossed the drowning man a ROPE.
28. The boy gave the football a KICK.
29. The storm broke the sailboat's MAST.
32. Mr. Brown carved the roast BEEF.
33. The glass had a chip on the RIM.
36. Her cigarette had a long ASH.
39. The soup was served in a BOWL.
42. The lonely bird searched for its MATE.

43. Please wipe your feet on the MAT.
45. The pond was full of croaking FROGS.
46. He hit me with a clenched FIST.
48. A bicycle has two WHEELS.

PL

1. Miss Black thought about the LAP.
4. Miss Black would consider the BONE.
6. Bob could have known about the SPOON.
8. He wants to talk about the RISK.
9. He heard they called about the LANES.
11. She has known about the DRUG.
12. I want to speak about the CRASH.
14. I should have considered the MAP.
17. Ruth must have known about the PIE.
18. The man should discuss the OX.
21. They heard I called about the PET.
24. Bill cannot consider the DEN.
27. She hopes Jane called about the CALF.
28. Jane had a problem with the COIN.
30. Paul hopes she called about the TANKS.
31. The girl talked about the GIN.
33. Mary should think about the SWORD.
34. Ruth could have discussed the WITS.
36. You had a problem with the BLUSH.
39. We have not discussezd the STEAM.
42. Tom is considering the CLOCK.
44. You should not speak about the BRAIDS.
45. Peter should speak about the MUGS.
47. He has a problem with the OATH.
49. Tom won't consider the SILK.
2. Mr. White discussed the CRUISE.
4. Miss White thinks about the TEA.
6. He is thinking about the ROAR.
7. She's spoken about the BOMB.
10. You want to talk about the DITCH.
13. We're discussing the SHEETS.
16. Betty has considered the BARK.
19. Tom will discuss the SWAN.
21. You'd been considering the GEESE.
23. They were interested in the STRAP.
24. He could discuss the BREAD.
26. Jane hopes Ruth asked about the STRIPES.
27. Paul spoke about the PORK.
30. Mr. Smith thinks about the CAP.
31. We are speaking about the PRIZE.
34. Harry had thought about the LOGS.
35. Bob could consider the POLE.
37. Ruth has a problem with the JOINTS.
38. He is considering the THROAT.
40. We can't consider the WHEAT.
41. The man spoke about the CLUE.
44. David has discussed the DENT.

47. Bill heard Tom called about the COACH.
49. Jane has spoken about the CHEST.
50. Mr. White spoke about the FIRM.

FORM B

PH
2. My turtle went into its SHELL.
4. I cut my finger with a KNIFE.
7. Greet the heroes with loud CHEERS.
9. That animal stinks like a SKUNK.
10. A round hole won't take a square PEG.
13. The Admiral commands the FLEET.
14. The bride wore a white GOWN.
17. I can't guess so give me a HINT.
18. Our seats were in the second ROW.
20. The boat sailed across the BAY.
22. That job was an easy TASK.
25. The shepherd watched his flock of SHEEP.
27. David wiped the sweat from his BROW.
30. The bad news came as a SHOCK.
31. A spoiled child is a BRAT.
33. The drowning man let out a YELL.
34. A rose bush has prickly THORNS.
36. The dealer shuffled the CARDS.
39. The railroad train ran off the TRACK.
40. My jaw aches when I chew GUM.
43. He caught the fish in his NET.
44. Bob was cut by the jacknife's BLADE.
46. Tom fell down and got a bad BRUISE.
47. Lubricate the car with GREASE.
49. Cut the meat into small CHUNKS.
1. The doctor X-rayed his CHEST.
4. The workers are digging a DITCH.
7. The duck swam with the white SWAN.
8. Your knees and your elbows are JOINTS.
11. Raise the flag up the POLE.
14. The detectives searched for a CLUE.
16. The steamship left on a CRUISE.
19. Tree trunks are covered with BARK.
20. The meat from a pig is called PORK.
22. Ruth poured herself a cup of TEA.
23. We saw a flock of wild GEESE.
25. How did your car get that DENT?
26. She made the bed with clean SHEETS.
28. The team was trained by their COACH.
29. I've got a cold and a sore THROAT.
31. She wore a feather in her CAP.
32. The bread was made from whole WHEAT.
34. Spread some butter on your BREAD.
35. The cabin was made of LOGS.
38. The lion gave an angry ROAR.
39. The sandal has a broken STRAP.

41. He's employed by a large FIRM.
43. Her entry should win first PRIZE.
46. The airplane dropped a BOMB.
48. A zebra has black and white STRIPES.

PL

3. Miss White won't think about the CRACK.
4. He would think about the RAG.
7. The old man talked about the LUNGS.
8. I was considering the CROOK.
11. Bill might discuss the FOAM.
12. Nancy didn't discuss the SKIRT.
14. Bob has discussed the SPLASH.
16. Ruth hopes he heard about the HIPS.
18. She wants to talk about the CREW.
19. They had a problem with the CLIFF.
21. You heard Jane called about the VAN.
23. We could consider the FEAST.
24. Bill heard we asked about the HOST.
27. I had not thought about the GROWL.
30. He should know about the HUT.
33. I'm glad you heard about the BEND.
34. You're talking about the POND.
36. Nancy had considered the SLEEVES.
38. He can't consider the CRIB.
40. Tom discussed the HAY.
42. She's glad Jane asked about the DRAIN.
43. Bill hopes Paul heard about the MIST.
46. We're speaking about the TOLL.
49. We spoke about the KNOB.
50. I've spoken about the PILE .
2. Mary had considered the SPRAY.
3. The woman talked about the FROGS.
5. Miss Brown will speak about the GRIN.
6. Bill can't have considered the WHEELS.
9. Mr. Smith spoke about the AID.
10. He hears she asked about the DECK.
12. You want to think about the DIME.
13. You've considered the SEEDS.
15. Ruth's grandmother discussed the BROOM.
17. Miss Smith considered the SCARE.
18. Peter has considered the MAT.
21. The old man considered the KICK.
24. Paul could not consider the RIM.
27. I've been considering the CROWN.
30. We've spoken about the TRUCK.
33. Mary could not discuss the TACK.
36. Harry might consider the BEEF.
37. We're glad Bill heard about the ASH.
40. Nancy should consider the FIST.
42. They did not discuss the SCREEN.
44. The old man thinks about the MAST.

45. Paul wants to speak about the BUGS.
47. You're glad she called about the BOWL.
49. Miss Black could have discussed the ROPE.
50. I hope Paul asked about the MATE.

FORM C

PH

1. His plans meant taking a big RISK.
2. Stir your coffee with a SPOON.
5. The plow was pulled by an OX.
6. The old train was powered by STEAM.
9. Let's decide by tossing a COIN.
10. The doctor prescribed the DRUG.
13. Hold the baby on your LAP.
15. The dog chewed on a BONE.
17. The war was fought with armored TANKS.
20. They drank a whole bottle of GIN.
22. The witness took a solemn OATH.
25. They tracked the lion to his DEN.
26. The cow gave birth to a CALF.
28. The scarf was made of shiny SILK.
29. The super highway has six LANES.
31. For dessert he had apple PIE.
32. The beer drinkers raised their MUGS.
35. The rude remark made her BLUSH.
37. We heard the ticking of the CLOCK.
39. He killed the dragon with his SWORD.
41. Mary wore her hair in BRAIDS.
44. We're lost so let's look at the MAP.
45. No one was injured in the CRASH.
47. My son has a dog for a PET.
48. He was scared out of his WITS.
3. It's getting dark, so light the LAMP.
4. To store his wood he built a SHED.
6. The mouse was caught in the TRAP.
8. The airplane went into a DIVE.
9. The firemen heard her frightened SCREAM.
11. He wiped the sink with a SPONGE.
14. The papers were held by a CLIP.
17. The chicks followed the mother HEN.
20. The fur coat was made of MINK.
21. The boy took shelter in CAVE.
23. Eve was made from Adam's RIB.
24. The boat sailed along the COAST.
26. The judge is sitting on the BENCH.
29. Cut a piece of meat from the ROAST.
31. The heavy rains caused a FLOOD.
32. The swimmer dove into the POOL.
34. Let's invite the whole GANG.
35. The house was robbed by a THIEF.
37. Bob wore a watch on his WRIST.

40. The secret agent was a SPY.
41. The rancher rounded up his HERD.
44. Ann works in the bank as a CLERK.
45. A chimpanzee is an APE.
48. The bandits escaped from JAIL.
50. The landlord raised the RENT.

PL

1. Betty knew about the NAP.
2. The girl should consider the FLAME.
5. They heard I asked about the BET.
7. Mary knows about the RUG.
10. He was interested in the HEDGE.
12. Jane did not speak about the SLICE.
13. Mr. Brown can't discuss the SLOT.
15. Paul can't discuss the WAX.
16. Miss Brown shouldn't discuss the SAND.
18. David might consider the FUN.
19. She wants to speak about the ANT.
22. He hasn't considered the DART.
25. We've been discussing the CRATES.
27. We've been thinking about the FAN.
28. Jane didn't think about the BROOK.
30. Betty can't consider the GRIEF.
33. Harry will consider the TRAIL.
36. Tom is talking about the FEE.
38. Tom had spoken about the PILL.
39. Tom has been discussing the BEADS.
42. Tom could have thought about the SPORT.
43. Mary can't consider the TIDE.
46. He hopes Tom asked about the BAR.
47. We could discuss the DUST.
49. Paul hopes we heard about the LOOT.
1. We're considering the BROW.
3. I am thinking about the KNIFE.
4. They've considered the SHEEP.
6. He's glad we heard about the SKUNK.
9. The girl should not discuss the GOWN.
11. Mr. Smith knew about the BAY.
14. We did not discuss the SHOCK.
16. Mr. Black has discussed the CARDS.
18. Mr. Black considered the FLEET.
20. We are considering the CHEERS.
21. Sue was interested in the BRUISE.
24. Miss Smith couldn't discuss the ROW.
25. I am discussing the TASK.
28. Paul should know about the NET.
29. Miss Smith might consider the SHELL.
32. You cannot have discussed the GREASE.
33. I did not know about the CHUNKS.
35. I should have known about the GUM.
36. Mary hasn't discussed the BLADE.

38. Ruth has discussed the PEG.
41. We have not thought about the HINT.
44. The old man discussed the YELL.
45. They're glad we heard about the TRACK.
48. The boy can't talk about the THORNS.
49. Bill won't consider the BRAT.

FORM D

PH

2. The baby slept in his CRIB.
3. The watchdog gave a warning GROWL.
5. The natives built a wooden HUT.
7. Unlock the door and turn the KNOB.
10. Wipe your greasy hands on that RAG.
13. The wedding banquet was a FEAST.
15. Paul hit the water with a SPLASH.
16. The ducks swam around on the POND.
19. Bob stood with his hands on his HIPS.
20. The cigarette smoke filled his LUNGS.
22. The cushion was filled with FOAM.
23. Ruth poured the water down the DRAIN.
25. This nozzle sprays a fine MIST.
26. The sport shirt has short SLEEVES.
29. She shortened the hem of her SKIRT.
32. The guests were welcomed by the HOST.
35. The ship's Captain summoned his CREW.
37. The flood took a heavy TOLL.
38. The car drove off the steep CLIFF.
40. The policeman captured the CROOK.
41. The door was opened just a CRACK.
43. The sand was heaped in a PILE.
46. Household goods are moved in a VAN.
48. Follow this road around the BEND.
50. The farmer baled the HAY.
3. Playing checkers can be FUN.
4. The doctor charged a low FEE.
7. Get the bread and cut me a SLICE.
9. The sleepy child took a NAP.
10. Instead of a fence, plant a HEDGE.
12. Drop the coin through the SLOT.
13. They fished in the babbling BROOK.
16. The widow's sob expressed her GRIEF.
17. The candle flame melted the WAX.
19. He was hit by a poisoned DART.
20. Ruth had a necklace of glass BEADS.
22. The singer was mobbed by her FANS.
25. The fruit was shipped in wooden CRATES.
28. The candle burned with a bright FLAME.
31. We swam at the beach at high TIDE.
33. He got drunk in the local BAR.
34. A termite looks like an ANT.

36. The sick child swallowed the PILL.
38. The burglar escaped with the LOOT.
41. He rode off in a cloud of DUST.
44. The bloodhound followed the TRAIL.
46. On the beach we play in the SAND.
49. She hated to vacuum the RUG.
50. Football is a dangerous SPORT.

PL

1. Bob heard Paul called about the STRIPS.
3. Paul has a problem with the BELT.
5. They knew about the FUR.
6. We're glad Ann asked about the FUDGE.
8. Jane was interested in the STAMP.
11. Miss White would consider the MOLD.
12. They want to know about the AIM.
15. The woman discussed the GRAIN.
16. You hope they asked about the VEST.
19. We should have considered the JUICE.
21. The woman considered the NOTCH.
23. The woman knew about the LID.
24. Jane wants to speak about the CHIP.
26. Bob should not consider the MICE.
28. Ruth hopes she called about the JUNK.
29. I can't consider the PLEA.
32. Paul was interested in the SAP.
35. He's glad you called about the JAR.
37. Miss Smith knows about the TUB.
38. The man would not discuss the MOUSE.
41. Ann was interested in the BREATH.
42. You're glad they heard about the SLAVE.
45. The man could consider the SPOOL.
48. Peter knows about the RAFT.
50. She hears Bob asked about the CORK.
1. You were considering the GANG.
2. The boy had considered the MINK.
5. He wants to know about the RIB.
8. She might have discussed the APE.
11. The old woman discussed the THIEF.
14. You were interested in the SCREAM.
15. We hear they asked about the SHED.
18. I haven't discussed the SPONGE.
21. Ruth will consider the HERD.
23. The old man discussed the DIVE.
24. The class should consider the FLOOD.
26. I'm talking about the BENCH.
27. Paul has discussed the LAMP.
29. You knew about the CLIP.
30. She might consider the POOL.
32. Bob was considering the CLERK.
35. The man knew about the SPY.
37. The class is discussing the WRIST.

39. They hope he heard about the RENT.
40. Mr. White spoke about the JAIL.
42. Miss Brown might consider the COAST.
43. Bill didn't discuss the HEN.
45. The boy might consider the TRAP.
47. He should consider the ROAST.
48. Miss Brown spoke about the CAVE.

APPENDIX G: Revised Speech Perception In Noise
Adaptive Testing/Practice Material

LOW PROBABILITY

25. He was interested in the SOAP.
28. Miss White spoke about the SAUCE.
30. He has considered the ITCH.
31. He had a problem with the PLUMS.
35. He has been discussing the ACHE.
37. Bill should have considered the HOOD.
39. They are discussing the CURL.
40. Nancy had known about the COUGH.
41. Jane heard he called about the BUS.
43. He is discussing the GIFT.
45. She is considering the SHELF.
7. Harry was discussing the MAIL.
50. Ruth is considering the CLOWN.
1. She had spoken about the SCAR.
3. Mr. Smith might discuss the MILL.
6. Ruth couldn't know about the SHRIMP.
7. We were discussing the GAS.
8. She's been considering the CONE.
11. I'm glad Tom asked about the SPOUT.
13. Paul heard they asked about the RICE.
16. They want to speak about the TRASH.
18. Paul is considering the DRILL.
19. The woman talks about the BEACH.
21. You should discuss the FLUTE.
24. Paul wants to speak about the PALM.

HIGH PROBABILITY

2. Camels store water in their HUMPS.
4. I built the model from a KIT.
5. The loud noise made him jump with FRIGHT.
9. The winning card was an ACE.
10. Tom wore a tie and a white SHIRT.
12. Her skin broke out in a RASH.
14. The child threw bread crumbs to the DUCKS.
15. Paul chopped down the tree with his AXE.
17. He's as stubborn as a MULE.
20. Hospitals should be free of GERMS.
22. Let's slide down the hill on a SLED.
23. He weighed the meat on a SCALE.
26. You led them on a merry CHASE.
27. The swimmer was attacked by SHARKS.
29. Stainless steel will never RUST.
32. The robber committed a CRIME.
33. The secret message was in CODE.
34. Broil the steak on a charcoal GRILL.
36. Ruth sat on the living room COUCH.
38. A bee can give a painful STING.
42. The soap washed away the DIRT.
44. Jane was dressed in a skirt and BLOUSE.

46. Animals are kept in the ZOO.
48. His face was concealed by a MASK.

APPENDIX H: Instructions For NST

Now you are going to hear a list of nonsense syllables such as "DA", "EETH", and "OM". As you can see you have answer sheets. On your answer sheets are listed all the possible answers for each item. After you hear a nonsense syllable you are to put a mark through the syllable that you believe you heard. In each case you must mark one and only one syllable for each test item.

The test will proceed this way. You will hear the phrase "You will mark" and the nonsense syllable. You are to put a mark through the syllable you believe you heard. After you have completed all the items on the first page, you will turn to the second page and proceed with those items. In some cases you will hear the same sound more than once. In other cases some of the sounds listed on a page will not be presented. After each item you are to put a mark through the syllable you heard.

Do not be concerned if the test seems very difficult to you. If you lose your place or become confused, let me know and I will stop the test. Do you have any questions?

APPENDIX I: Nonsense Syllable Test
Sample Answer Sheet

BA	VA	ZA	DA	THA	NA	GA	MA
BA	VA	ZA	DA	THA	NA	GA	MA
BA	VA	ZA	DA	THA	NA	GA	MA
BA	VA	ZA	DA	THA	NA	GA	MA
BA	VA	ZA	DA	THA	NA	GA	MA
BA	VA	ZA	DA	THA	NA	GA	MA
BA	VA	ZA	DA	THA	NA	GA	MA
BA	VA	ZA	DA	THA	NA	GA	MA
BA	VA	ZA	DA	THA	NA	GA	MA

APPENDIX J: Post-Training Questionnaire

As you know, this training program was part of a research project. Your candid comments would be extremely helpful. Please use the following questions as a guide in giving me your feedback. You need not answer every question, nor be confined to comment only on these questions.

1. In general, have you found the training program beneficial? Has it helped you communicate more effectively or has it made little or no difference?

2. Has it provided you with any new insights? Of the information provided, what have you found especially useful?

3. How has it, if at all, changed your behavior or attitudes? (e.g. regarding your hearing aid, towards difficult communication situations, etc.)

4. From which types of practice material, if any, did you derive benefit? (e.g. related sentences, unrelated sentences, current events, jokes, short stories, nonsense syllables).

5. Can you describe any specific instances in which participation in the training program helped you in an actual situation?

6. Has your participation in this program been detrimental in any way?

7. What recommendations for changes in the program would you make?

LESSON I

Ordman and Ralli - **What People Say: ABOUT THE WEATHER** - p.5

1. Isn't it beautiful outside now?
2. I can't wait for the warm weather.
3. Is it cold enough for you?
4. I think we'll have rain before the day is over.
5. There was a blizzard last night.
6. We had only one day of rain while we were away.
7. Do you think we'll have a White Christmas?
8. The weather's been so changeable lately.
9. It was snowing a little while ago.
10. Thank goodness! The sun has come out.
11. Do you think we'll need our umbrellas?
12. It's not cold enough to wear a fur coat today.
13. It's so warm I'm not going to wear my coat.
14. We drove all the way home in the pouring rain.
15. It's not the heat. It's the humidity.

Auditec of St. Louis Auditory Training Tapes - Lesson 1

1. Let's stop for breakfast and have some wheatcakes and sausage.
2. She eats much less when she dines alone.
3. The tulips and crocuses are a sure sign of spring.
4. After the test was over, the child quit worrying.
5. Is the dog wagging his tail, or is the tail wagging the dog?
6. She's coming to stay during summer vacation.
7. It will be hard to save money with the baby coming.
8. Fill the glass to the brim with the fine wine.
9. You may go to the cave but hurry back.
10. I heard running feet near the back door.

Ordman and Ralli - **Shop Worn** - p.21

Mr. Fisher was the proud father of a new baby girl, as his friends at the office were well aware. He had boasted so much about her, and had passed out so many free cigars, that some of his fellow workers thought they'd better pay a visit to the new daughter. So a group of them dropped around at the Fisher home one Sunday afternoon. They saw the baby and met the other members of the Fisher family, including the four year old son.

One of the men said to the little boy, "How do you like your new sister?"

"She's okay, I guess," the four year old replied, "but I'd rather have had a brother."

"Then why don't you exchange her?" asked his father's friend, jokingly.

"We can't do that," said the boy, "we've already used her for five weeks."

Haug and Haug - **Hospital Waiting Room** - p.98

Three men were in the hospital waiting room when the nurse rushed in and said to the first man, "Sir, you're the father of twins."

"Hey, isn't that a coincidence?" he replied. "I'm a member of the Minnesota Twins baseball team." Later the nurse came and said to the second man, "sir , you're the father of triplets."

"Gee," the man exclaimed. "Another coincidence! I'm with the 3M Company."

The third man jumped to his feet, grabbed his hat and said, "I'm getting out of here. I work for 7-UP!"

LESSON II

Ordman and Ralli - **What People Say: ABOUT TIME.** - p.8

1. What time does the show begin?
2. What time do you have?
3. It's just three o'clock.
4. This watch keeps very good time.
5. What time shall I meet you?
6. I left home before 8:30 this morning.
7. We got home at 4 A.M. on New Year's morning.
8. The train is due at 1:25 P.M.
9. It took us three and a half hours to drive home from the country.
10. Will you have dinner with us on Tuesday evening at 7?
11. Will you meet me for lunch on Saturday at 1:30?
12. Will you come to my house for coffee at 4:30 on Thursday?
13. We'll expect you at 8 o'clock on Wednesday evening.
14. I have an appointment at 2:15 this afternoon.

Smith - **Familiar Questions** - p.23

1. How do you feel?
2. Did the mail come?
3. What's on TV tonight?
4. Are we out of milk?
5. What's for supper?
11. What time is it?
12. Are you finished with the paper?
13. Did you hear the bell?
14. Are the kids home?
15. When did he call?

6. Where's the cat?
7. Would you mail this?
8. Are you getting up early?
9. What's the date today?
10. Could you see who's at the door?
16. Have you got two quarters?
17. Can we open the window?
18. Who's in the kitchen?
19. Would you get off the phone?
20. Can I get in the bathroom?
21. Will you please shut up?

Jeffers and Barley - **Telephone** - p.74

1. The telephone is ringing.
2. Will you please answer the telephone?
3. I'll get it.
4. Who is it?
5. I'll call him back.
6. Your line is always busy.
7. I'm expecting a call.
8. You must have the wrong number.
9. Just a minute, I'll call her.
10. Your phone was out of order.
11. I can't hear you.
12. I was sorry to miss your call.
13. Please leave a message when you hear the beep.
14. Some people always call at dinnertime.
15. Please call before ten o'clock.
16. Do you have an amplifier on your phone?
17. I always call long distance when the rate is the lowest.
18. Did you buy your phone or do you rent it?

Auditec of St. Louis Auditory Training Tape - Lessons 2-3

1. I tend to think the trend is up.
2. I bought this material because it's of unusual weave.
3. The puppy is so homely he's cute.
4. I bought a new pair of shoes to go with this coat.
5. It was a beautiful sunny spring morning.
6. The tree will bear many apples this year.
7. Leave the car here and carry the things the rest of the way.
8. By wearing a sunny face he's drumming up business.
9. Is it true that they took away his knife?
10. Some people tend to act dumb when it comes to handling money.
1. She was elected to the senior citizens' hall of fame.
2. After the excitement of the party everything returned to normal.
3. We made a special trip to the great wall of China.
4. If you don't mind stir the batter for the pancakes.
5. The new restaurant is opening soon.
6. All I want is a cup of coffee and a sandwich.

Haug and Haug - **ESP** - p.97

Last year, a course in extrasensory perception was taught at an

Eastern university. A sign on the classroom door read:

"ESP LAB - no need to knock - we know you're there!"

Ordman and Ralli - **The Courtesy of the Road** - p.6

It was a beautiful Sunday in Spring, and traffic on the highway was heavy. A lady who had recently learned to drive a car, whizzed up to a cross-road where the traffic light was red. She jammed on the brakes, stopped the car with a jerk, and of course, she stalled the engine.

The light turned green while the lady was struggling with her starter. The line of cars in back of her began to get longer and longer. To make it worse, the driver of the car right behind her started blowing his horn.

This was too much for the lady. She got out of her car and walked to the car behind, where the driver had his hand on the horn. She glared at him and said:

"Perhaps you'll be good enough to start my car. I'll stay here and blow your horn at you."

Haug and Haug - **Life After Death** - p.100

"Do you believe in life after death?" the boss asked one of his younger employees.

"Yes, sir."

"Well then, that makes everything just fine," the boss went on. "About an hour after you left yesterday to go to your grandfather's funeral, he stopped by to see you."

Jeffers and Barley - **Streaking** - p.129

When streaking began in 1973, everyone was surprised. It began at the University of Florida and the University of Maryland. It spread fast. Before long thousands of students all over the United States were streaking. But not all streakers were students. A banker streaked down Wall Street. In Paris, tourists streaked under the Eiffel Tower. At West Point, cadets streaked across the parade ground. They were followed by furious officers in uniform. Streakers were everywhere. Someone streaked through a 747 jet going to London. In Alaska, some streakers ran through eight-degree weather. Why did people streak? One man said, "To keep the world safe for goldfish."

Streaking will be remembered as one of the shortest-lived fads

of our times.

Broberg - **Longevity** - p.87

How long do animals live? Have you any idea what is the longest living mammal? According to Alan Devoe, life-span and size go together. Alan Devoe is a naturalist. He should know about the longevity of animals for he has made a study of just that.

Large animals live longer than small animals. Animals that are vegetarians, or that eat mixed kinds of food, live longer than those that are meat-eaters. Sluggish, cold-blooded animals can live longer than warm-blooded mammals. So, what do you think is the longest-living of all the animals?

A giant tortoise is probably the longest-living animal. Tortoises often weigh 500 to 600 pounds. A tortoise of that size is usually around 200 or 300 years old. What about elephants? Most elephants become decrepit at 50 or 60 years of age. Sometimes, but not very often, an elephant lives to be 100 yers old. What about the life span of a fish? Carp live to be about 60 to 75 years of age. Some insects live just a few hours. The may-fly is such an insect. Other insects, such as the queen bee, may live at least 15 to 20 years. A termite sometimes lives more than 30 years. What are the longest-lived birds? Parrots, owls, ostriches and eagles share the longevity record among the birds. They may live to be 100 years old.

LESSON III

Ordman and Ralli - **What People Say: AT THE DINNER TABLE** - p.33

1. Will you have sugar on your grapefruit?
2. Please pass the salt and pepper.
3. Is the roast too rare for you?
4. Help yourself to the radishes and celery.
5. These lima beans were frozen, but I think they taste like fresh.
6. Will you have some gravy?
7. Have another roll; they're home-made.
8. Pass your plate for some more roast beef.
9. I like a green salad, don't you?
10. I'm glad you like my cherry pie.
11. Will you have cheese and crackers?
12. Will you have cream in your coffee?
13. How much sugar do you want?
14. Shall we go into the living room and sit by the fire?

Ordman and Ralli - **What People Say: AT THE GARAGE** - p.41

1. You want me to fill it up?
2. Do you want unleaded gas or regular?
3. You should have the oil changed.
4. This is not the self service island.
5. That front tire on the left is low. It could use some air.
6. I'd better check all the tires.
7. We charge $3.50 to wash your car.
8. You'd better put the chains on. The roads are very slippery.
9. The engine sounds fine.
10. It will be $6 a day for parking.
11. Please leave the ignition key in the car.
12. You're out of windshield wiper fluid.
13. Bring the claim check with you when you want the car.

Auditec of St. Louis Auditory Training Tape - Lessons 6-8

3. baby - The baby was very fat and healthy.
4. hospital - After she became ill she went to the hospital.
5. supper - As usual it's almost time for supper.
6. truth - If you tell the truth you will be trusted.
7. market - You can find some interesting items in the flea market.
8. mean - I fear that he will be mean to me.
9. play - After she dries the dishes we'll play the game.
10. car - Send the car after the rest of them.
1. thread - As you get older it gets harder to thread a needle.
2. lunch - What do you want for lunch: hotdogs, hamburgers or chop suey?
3. loft - The children were busy playing in the hay loft.
4. tree - She worked very hard to finish the family tree.
5. business - She went to town to do some business.
6. grandma - Grandma always makes such nice bean bags for us.
7. road - You can't go until nine because the road is under construction.
8. bat - Lend me your bat; mine is broken.
9. glasses - She needs her glasses to thread the needle.
10. road - It's over a mile from the field to the road.
1. secretary - A good secretary always has a pen and pencil handy.
2. china - She collects cups and saucers of bone china.

Haug and Haug - **Repairman's Problem** - p. 99

A gang of country road repairmen were way out in the country to fix a road when they discovered they had left their shovels back in town. They phoned the county engineer to report their problem.

"I'll send the shovels out right away," said the engineer. "Meanwhile, lean on each other."

Haug and Haug - **Congressman's Wife** - p.101

The Congressman's wife shook him vigorously in the middle of the night. "Wake up, John!" she whispered frantically. "There's a thief in the house!"

"No way," he replied. "In the Senate maybe. In the House -- never!"

Ordman and Ralli - **He Always Wins** - p.37

The ace salesman of a certain company was transferred from New York to Chicago. His boss sent along a letter, explaining that while he was the company's best salesman, he had one serious vice - gambling. When he arrived, his new boss said: "Young man, I'm sorry to hear that you like to gamble. What sort of thing do you bet on?"

"Anything," answered the salesman. "For instance, I'll bet you $25 that you have a scar on your right shoulder."

"I'll take that bet," said the sales-manager, and peeled off his coat and shirt. There wasn't a sign of a scar , and the sales-manager felt that he had won more than a mere bet as he pocketed the $25. He wrote to the New York office about the incident, and boasted that he had already taught the young man a lesson.

In a few days he received this reply: "He wins again. Before he left, he bet me $200 that he would have the shirt off your back five minutes after he met you."

Broberg - **Not Bad** - p.57

Two goats were munching grass outside a motion picture studio. They had been used in a movie and were waiting for their owner. They were outside the cutting room. Just then someone threw some surplus film out of the window. One of the goats started to munch on the film. The other goat looked up and asked, "How is it?"

"It's not bad," said the first goat, "but I liked the book better."

LESSON IV

Ordman and Ralli - **What People Say: AT HOME** - p.17

1. Please answer the doorbell.
2. Has the mail come this morning? Are there any letters?
3. We need another lamp in this room.
4. Please turn the radio down; it's too loud.

5. Where did you put the evening paper?
6. These books should go back to the library.
7. I'm expecting a telephone call.
8. The man is coming to wash the windows.
9. Please put the groceries away.
10. Hang your overcoat in the hall closet.
11. Have you fed the cat today?
12. The floor in the kitchen ought to be waxed.
13. Who burned that hole in the rug?
14. Please empty the ashtrays.
15. Let's rearrange the furniture in this room.

Ordman and Ralli - **What People Say: AT THE RESTAURANT** - p.81

1. Do you have a reservation?
2. Have you given your order?
3. Will you have a cocktail?
4. The price of the entree includes soup or salad, dessert and coffee.
5. The special today is veal parmesan.
6. The shrimp cocktail is $1.50 extra.
7. Will you have roast beef, roast lamb or roast pork?
8. You'll have to wait aboout 15 minutes for chops or steak.
9. We serve french fried potatoes with the steak.
10. What vegetables do you want?
11. Will you have lettuce and tomato salad, or cole slaw?
12. Will you have a large cup of coffee, or demi-tasse?
13. The dinner includes your choice of any of the desserts.
14 I'm sorry; we have no more hard rolls.
15. Will there be anything else?
16. I'll bring your change in a few minutes.

Auditec of St. Louis Auditory Training Tape - Lessons 9-10

1. eggs - I love hard-boiled eggs in my potato salad.
2. boy - All the little boy needed was some soap and water.
3. careful - If you're not careful you'll be in the doghouse.
4. magician's - They all enjoyed the the magician's tricks.
5. garden - If you want flowers in your garden you must weed.
6. breakfast - Let's have wheatcakes and bacon for breakfast.
7. income - The company's gross income was up from last year.
8. answers - The answers to those questions are on the back page.
9. camp - He was very late arriving at boot camp yesterday.
10. dance - Choose your partner, the dance band is starting.
1. scouts - He joined the boy scouts last fall.
2. chew - It's very hard to chew with new false teeth.
3. cake - She baked a large birthday cake for the party.
4. test - If you pass this test you will win a trophy.
5. pool - They have a large heated swimming pool in ther back yard.
6. collie - We have a pet collie, his name is Pal.
7. picnic - They had beer and pretzels at the company picnic.

8. Miss America - It was just her fate to become Miss America last year.
9. election - Your secretary called to remind you that it is Election Day.
10. walk - The children learned how to cake walk.

Haug and Haug - **Honesty - The Best Policy** - p.50

"Ethics are vital to the successful businessman," said the man to a friend. The two men were just leaving to go to lunch. "To give you an example, an old customer paid his account today with a hundred dollar bill. As he was leaving, I discovered that he had mistakenly handed me two hundreds stuck together. Immediately the question of ethics arose. Should I tell my partner or not?"

Ordman and Ralli - **She Needed Practice** - p.101

Mark Twain was given to much swearing, a habit that was most distressing to his quiet little wife. She tried every way she could think of to persuade him to give up swearing, but to no avail. One day, when they had been married a scant two years, she was sitting in the living room of their home, working on a square of embroidery. She heard her husband go into the study, which was next-door to the living room. He must have found something wrong there for he started to swear, and he seemed to be enjoying himself so fully that she decided to make one final protest. She knew scolding him would do no good, so she began writing down his phrases on a scratch pad. Then she waited. In a moment or two, he opened the door of the living room and came in. She began at once to swear at him, refreshing her memory from the notes that were screened by her work-basket. Her husband stood transfixed with surprise for a moment. Then he got the idea and smiled broadly. "You've learned the words, my dear," he said, "but you haven't got the tune."

Ordman and Ralli - **Shrewd management** - p.93

A troopship was moving cautiously through heavy ocean swells. Submarines were in the neighborhood. One of the soldiers on board was a magician and practiced sleight-of-hand at odd moments. Captain Sweeny asked him to put on a show to ease the tension. As an extra attraction, Captain Sweeny had a parrot who could talk. The magician began with a card trick. During the applause the parrot screamed, "I saw that. It went up your sleeve." The next trick was harder. The magician used a lighted cigarette and a glass of water and they both disappeared. Again the parrot screamed, "I saw that. It went up your sleeve." The parrot slayed them! Before the magician could do another thing, a torpedo from a submarine hit the ship, and it was every man for himself. As darkness fell, the magician found a lifeboat and managed to climb into it. He rowed

slowly around. A moment later, he heard a flutter of wings, and there was the parrot. The magician rowed all night. The parrot never said a word. When daylight came, the magician looked for other survivors, and only then the parrot spoke. "Okay, I give up, what DID you do with that ship?"

Broberg - **Columbus and the Egg** - p.86

After Christopher Columbus returned to Spain, there were many people who were jealous of him. These people were always ready to find fault with him. They asked: "Who is this Columbus? What has he done that's so special? He's just a pauper pilot from Italy, isn't he? Couldn't any other sailor cross the ocean the same way he did?"

One evening, Columbus was at a dinner given in his honor by a fine, Spanish gentleman. Some of the people who were faultfinders were also at the dinner. They were proud, conceited men. They made Columbus feel very uncomfortable.

The men said, "You have discovered strange lands beyond the sea. But what of that? Anybody can sail across the ocean. Anybody can go along to the islands on the other side. It is the simplest thing in the world."

Columbus made no reply. But after a while, he took an egg from a dish. He said to the men at the table, "Who among you gentlemen can make this egg stand on end?"

One by one those at the table tried. Everyone of the gentlemen tried, but no one was able to stand the egg on end. Then they all said it could not be done. Columbus took the egg. He struck its small end very gently so as to break the shell just a little bit. After that, it was easy to make the egg stand on end.

"Well, gentlemen," said Columbus, "What is easier to do than this which you said was impossible? It is the simplest thing in the world. Anybody can do it - once he has been shown how."

LESSON V

Ordman and Ralli - **What People Say: LOOKING FOR AN APARTMENT** - p.49

1. We may have something in a few months.
2. I can show you a 2 1/2 room apartment for three hundred dollars a month.
3. Would you like an apartment with a terrace?
4. There is a swimming pool for the use of tenants only.
5. The building will be ready for occupancy in three months.
6. We require a three year lease.
7. The living room gets a lot of sunlight.

8. This building is a cooperative.
9. A 4 1/2 room apartment sells for fifty thousand dollars.
10. Maintenance is two hundred dollars a month.
11. This building is equipped with central heating and air conditioning.
12. We don't allow dogs or children.
13. It's a quiet block. There isn't much traffic.
14. It's located in a two-fare zone.
15. I'm sorry. We have no vacancies at this time.

Ordman and Ralli - **What People Say: AT THE BANK** - p.89

1. Have you cashed a check here before?
2. That identification is satisfactory.
3. How do you want it? Are twenties okay?
4. There is no charge for checks.
5. Do you want to open a regular checking account or a money market account?
6. Please make out a deposit slip.
7. Income tax forms are on the second floor.
8. You'll have to see one of the managers.
9. This check has not been dated.
10. Will you endorse it, please?
11. You can get your statement at that window over there.
12. May I have your bank book?
13. Traveler's checks are issued at the window marked "Foreign Dept."
14. You must have a savings account at this bank before you can open a checking account.
15. Please make out a deposit slip.

Auditec of St. Louis Auditory Training Tape - Lessons 11-13

5. marriage - They're planning to celebrate their 25th anniversary tomorrow.
6. furnishings - The house has wall to wall carpeting in all of the rooms.
7. marathon - His face was beet red from the long run.
8. phobia - My grandmother has a deep-seated fear of falling.
9. sailing - They took their sailboat with them on their summer vacation.
10. leather - His belt was made from genuine cowhide.
1. bundle-up - You better take a coat and hat along in case it gets cold.
2. vegetables - Please pass the potatoes to Mr. Smith.
3. pastries - We had a bake sale at church last Saturday afternoon.
4. vacation - They stayed at a lovely motor lodge in the Smokies.
5. car - Did you put a nickel in the parking meter?
6. meal - She likes pot roast and mashed potatoes.
7. chores - Everybody gets a little tired of raking leaves in the fall.

8. delicious - Last night's dinner was fit for a king.
9. greetings - Everyone is well and sends their best wishes.
10. sports - He has all of his fishing needs in his bait box.
1. Independence Day - The Fourth of July parade was a beautiful sight to see.
2. sweetener - She likes cream and sugar in both her coffee and tea.
3. relocating - The moving van will be here sometime today to pick up our furniture.
4. amateurs - There will be a talent show in the park tonight.
5. recreation - Did you ever take the boat ride on the lake?
6. vegetation - Our neighbor has trumpet vines growing all over his garage.
7. communication - She always draws a happy face on her letters.
8. song - The music you heard is "Tea for Two".
9. purchase - He had a rush order for one thousand test tubes.
10. actors - People in show business seem to thrive on it.

Conversation - **A Typical Day**

1. Do you usually sleep through the night or do you wake up one or more times?
2. At about what time do you get up in the morning?
3. What do you generally have for breakfast?
4. Name an activity you often do in the morning.
5. What is your favorite meal?
6. What do you usually do in the afternoon?
7. Do you like to watch TV in the evening?
8. What is your favorite program?
9. Do you prefer to stay up late?
10. Is there any hobby or activity you would like to do more often?

LESSON VI

Ordman and Ralli - **What People Say: AT THE MOVIES** - p.101

1. It's lucky we came early, or we never would have gotten a seat.
2. Please ask that woman to stop talking.
3. Why do people bring small children to a picture like this?
4. This is the first time I've been to a movie in months.
5. Can you see all right?
6. Let's move further back.
7. Isn't he a wonderful actor?
8. I wish they'd turn off the air-conditioning; I'm freezing.
9. Do you want to stay and see the first part over again?
10. I think she was better in the picture we saw last winter.
11. Do you have any tissues?
12. I like it when they show coming attractions.
13. This movie is nothing like the book.

14. That was a wonderful show. I enjoyed it a lot.
15. Come on, let's go. This is where we came in.

Ordman and Ralli - **When a Stranger Stops You** - p.57

1. Which way is Grand Central Station?
2. How do I get to Macy's from here?
3. Does this bus go to Brooklyn?
4. Can you tell me how far the Hilton Hotel is from here?
5. Does this train stop at 34th Street?
6. Which bus do I take to Penn Station?
7. Which way is Nostrand Avenue?
8. I'm trying to find Brooklyn College.
9. Which train do I take to get to Coney Island?
10. Does the bus stop at this corner?
11. Excuse me, but you just dropped this package.
12. Do you have any spare change?
13. Does this bus go in the direction of King's Plaza?

Auditec of St. Louis Auditory Training Tape - Lessons 14-16

1. appetizer - You have a choice of dressing for your salad.
2. storage - We found a moth in your wool coat.
3. table games - Which do you prefer, chess or checkers?
4. scout - The boy received a pocket knife for his birthday.
5. trust - If you have enough faith, any problem can be solved.
6. nutrition - Many people eat only health foods.
7. holiday - The children and some adults were hoping for a white Christmas.
8. medical - Do you have enough health insurance to cover the operation?
9. communication - He went to the telephone booth to call home.
10. dessert - Do you want ice cream on your peach pie?
1. nature lover - The white birch is one of my favorite trees.
2. nature - Many types of birds come to our bird feeder each morning.
3. musical instrument - Do you play the piano by ear or do you read music?
4. shade - You'll need a cap if you stay out in this sun.
5. connection - The cord was too short to reach the wall plug.
6. flowers - We need some peat moss for the garden.
7. vacation - Pack your suitcase, we'll be leaving tonight.
8. weather - We will leave early to beat the heat.
9. game - Do children still play leap frog?
10. advertisement - Find a room for rent in the paper.
1. gift - He received an expensive pen and pencil set for his birthday.
2. relaxation - A friendly chat over a cup of coffee does wonders.
3. dinner - The cook made corned beef hash for supper.
4. flavors - Which would you like, dutch chocolate or strawberry?
5. traveling - The hitch hiker was headed for California.

6. communication - The telephone company has sold many touch tone sets the past year.

Jeffers and Barley - **Rubber** - p.128

Hernando Cortez was the Spanish conqueror of Mexico. When he came to the New World, he discovered something unknown to Spain. It was a peculiar property of a tree. This tree produced a gum. When formed into a ball, it bounced. A practical use for this new material was discovered by Joseph Priestly, an English chemist. He used a piece of the gum to rub out some pencil marks. It worked much better than bread crumbs. the usual substance for erasing marks. Priestly called it "rubber."

Osgood - **Kick me Once and Kick me Twice and Kick me Once Again**

There's no point in getting mad at machines, I suppose. Machines are dumb, inanimate objects, after all. Yet who among us has not, from time to time, worked up a case of frustration, resentment, and hatred over a car, a typewriter, or a soft-drink machine. People have been known to yell at machines, to hit and kick and even shoot at them. The advantage of getting mad at a machine and beating up on it is that machines (unlike people) don't harbor grudges.

At least they haven't until now.

In all these years of telling stories about weird things people do, none has struck me as more paradigmatic of our times than the story of the fellow who put a coin in a soft-drink vending machine at a gas station and the machine ate the money and produced no soft drink, and the man pulled the coin-return lever and the coin did not return and he shook and banged on the machine but no coin came back and no soft drink came out. And he kicked the vending machine on the front and then on the side, getting angrier all the time. And finally he reached in his pocket and took out a gun and pointed it at the machine in its vital parts, destroying it forever. It had eaten its last coin. It had failed to deliver its last soft drink. Somebody saw it all happen and turned the man in. He was arrested. Convicted. A clear case of vendicide if ever there was one.

Bad luck for him that there had been a witness, because otherwise he'd have gotten away with it. Dead machines don't tell tales. Live ones don't either, for that matter. They don't know who you are. Can't remember a thing. No way a machine can turn you in.

But wait.

Here is Robert Wenger of Monroe, Wisconsin, trying to withdraw

some money from his bank account. It's Sunday, and all he wants is ten dollars, and he knows there's enough money in his account because he deposited forty dollars just the day before.

But the automatic bank teller refused to listen to reason. Wenger then does what people often do when they get mad at machines. He hits it. Right in the face with his fist. Had the teller been a real human being, Wenger would probably not have punched him (or her) in the nose. But this wasn't a him or a her. It was an it. And it was now a broken it, requiring $298 worth of repairs, as the bank people discovered when they reopened for business the next day.

By that time, of course, Wenger was long gone, but the machine turned him in. It remembered who had punched it in the nose. Wenger. Wenger, eh? Wenger, Robert L.

The computer memory said to itself, "I'm gonna get that guy if he comes in here again. In fact, even if he doesn't. Here's his name. Here's his address." It was an open-and-shut case, and Wenger was the assailant, all right.

He's been convicted of criminal damage.

So if you get mad at a machine, remember this. Machines are not as dumb as they used to be. Make sure, before you kick it, that it doesn't know where you live.

LESSON VII

Jeffers and Barley - **Phrases Used When Back-Seat Driving** - p. 77

1. Watch it!
2. Watch out!
3. Please be careful.
4. Slow down.
5. You're going too fast.
6. You'd better get over to the right.
7. The light is green.
8. You just went through a stop light.
9. You make me nervous.
10. Can't you drive more carefully ?
11. I'd slow down if I were you.
12. Please slow down on the curves.
13. I wish you'd keep your eyes on the road.
14. You're a mile from the curb.
15. Aren't you driving too slow to be in the fast lane?
16. Do you have to pass every car on the road?
17. I'd rather we took longer getting there and arrived safely.
18. Stay on your side of the road.
19. Did you see that stop sign?

20. There's a stop light ahead.
21. You'd better get in the right lane. We're almost there.
22. What do you mean next time you're going to buy a motorcycle?

Jeffers and Barley - **Forgetfulness** - p. 77

1. Where in the world did I leave my glasses?
2. Have you seen my car keys?
3. She is always leaving her purse.
4. I'll think of it in a minute.
5. My mind is a blank.
6. I can't remember where I put it.
7. Where do you suppose I put it down?
8. I wish I could remember everything I ever read.
9. I used to know that but I've forgotten.
10. Did you remember to turn out the light before you left?
11. I can't remember his name.
12. I'm sorry - I've forgotten your name.
13. Are you sure you locked the door?
14. I missed my appointment with the dentist.
15. I have a poor memory.

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1. Grandma makes better pie crust than anyone I know.
2. She has a double chin from eating so much.
3. That restaurant has fast service.
4. Have you ever seen a coal mine?
5. The hot weather just left me weak.
6. There's a morning glory vine in your front yard.
7. The salesman said to take your choice.
8. I could never tell a joke very well.
9. The children were playing hide and seek last night.
10. He is a good athelete, especially at pole vault.
1. She deserves a pat on the back for all her work.
2. She got everything except the kitchen sink for her birthday.
3. Pink petunias are lovely in a window box.
4. The young couple moved to the west coast.
5. I'd like a thick chocolate milk shake.
6. Did you ever climb the sign boards when you were young?
7. I used to use water wings before I learned to swim.
8. She had sore feet after shopping all day.
9. Where did you leave your shoes when you took them off?
10. He left his tackle box on the fishing pier.
1. The bill is paid in full with this check.
2. Always put your zip codes on all of your mail.
3. Open the cool air vent and you'll be much more comfortable.
4. The men's wear shop in town is having a sale.
5. The sun beam is very warm and cozy.

Jeffers and Barley - **Fish Cough** - p.127

This may be of special interest to fishermen. Did you know that fish cough? This is a fact discovered by the Environmental Protection Agency. By using polygraphs, fish were monitored. It showed trout normally coughed as often as three times a minute. Sunfish cough about once every five minutes. Why do they cough? The water is contaminated by residues of mercury and copper. When these pollutants get into fresh water they make fish cough. Trout, sunfish, salmon, and blue gills try to rid their gills of debris by coughing. It is just as natural as anyone clearing his throat. If the coughing continues, it could be a warning our lakes and streams are becoming more contaminated with pollutants.

Conversation - **Living in New York**

1. Where have you lived besides Brooklyn?
2. Do you like living in New York?
3. How often do you go into Manhattan?
4. Do you usually travel by subway, bus or car?
5. Where do you like to buy your clothes?
6. In which supermarket do you do your food shopping?
7. What do you like the most about living in New York?
8. Do you think Mayor Koch does a good job?
9. Have you ever thought of moving to another country?
10. Does most of your family live in this area?
11. How often if ever, do you go to the theatre or museum?

LESSON VIII

Haug and Haug - **High Cost of Living** - p. 37

1. The cost of living has gone up tremendously in the last few years.
2. It seems as though food prices go up every day.
3. Our rent was raised thirty-five dollars last month.
4. Our utilities are unbelievably high.
5. To lower our gasoline bill we bought an economy car.
6. Last month I had to pay my income taxes.
7. The interest rate on the loan was very high.
8. We paid seventy-five dollars for our telephone bill last month.
9. We had to borrow seven hundred dollars from the bank.
10. I hope the new administration can lower the high cost of living.
11. Gasoline prices are expected to increase.
12. Inflation seems to affect everyone.

Jeffers and Barley - **Idiomatic Expressions of Emotional Stress** - p.80

1. I nearly died laughing.
2. I was bowled over at the suggestion.
3. He had a splitting headache.
4. I was so cold I nearly froze to death.
5. She was blinded by tears.
6. I almost broke my neck to get there on time.
7. My heart stood still.
8. She turned green with envy.
9. She broke his heart.
10. The noise nearly drove me crazy.
11. I had my eye on that chair.
12. He lost his head in the argument.
13. Someone is pulling my leg.
14. I nearly coughed my head off.
15. He must have a hollow leg.
16. I'd give my right arm for a cup of coffee.
17. We cracked up over the joke.
18. The story curdled my blood.
19. She cried her heart out.
20. She was crushed by the turn of events.
21. She was so embarrassed she almost sank through the floor.

Jeffers and Barley - **Clerk in a Shop** - p. 80

1. May I show you something?
2. Are you being helped?
3. These pants are on sale.
4. What size do you wear?
5. They tend to run large.
6. This is marked down to $30.
7. It is an excellent buy.
8. They're from our designer section.
9. Do you like this?
10. Why not try them on?
11. I'm sure this will fit.
12. The material is wash and wear.
13. The color suits you.
14. Our alterations are free.
15. Is it cash or charge?
16. I think you need a smaller size.

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6. The child seems to have grown up in only a wink of an eye.
7. Do you have enough money to buy that car?
8. Everybody should put out bird seed in the winter.
9. He even has a ship to shore radio on his boat.
10. The person at the door asked for the man of the house.
1. Let's go out for a hot fudge sundae.
2. Ice skating is a wonderful sport for a child.
3. She put whipped cream on the upside down cake.
4. The baby sitter will be late arriving.
5. Have you seen the man on the moon lately?
6. Danny's turtle won the turtle derby at the fair.
7. It's okay to eat fried chicken with your fingers.
8. Have you ever seen a June bug in May?
9. The first mate took the helm at the harbor entrance.
10. Can you believe it, she won the race?
1. The little girl waved goodbye to her grandmother.

2. The boy was dirty from playing in the coal bin.
3. Very often you weep today about things that never happen tomorrow.
4. They had a lovely picnic out in the woods.
5. She lived out west of the Mississippi during her childhood.
6. Have you ever been to a county fair?
7. The men arrived early to pave the street.
8. Make sure that you get your fair share.
9. It's not whether you win or lose, but how you play the game.
10. We have a gentleman's bet on the New Year's bowl game.

Haug and Haug - **Golfer's Day Off** - p.66

At breakfast, Mr. Smith suddenly announced that he didn't have to go the the office that morning.

"Listen," said his wife, "don't think you're going to run off and play golf today and leave me with all this work."

"Golf is the furthest thing from my mind," the husband protested. "And will you please pass the putter?"

Scott - **Head Noises** - p.103

By now you have discovered for yourself that the statement, "I can't hear a thing" is not entirely accurate.

There are lots of things that can be heard, if you listen for them, and many of them can give pleasure and provide stimulus even if one has a profound loss. The "soundless" world is, luckily, a pretty rare thing.

Indeed, a lot of people with a hearing loss complain that their world is anything but soundless. These people have head noises, sounds which come and go and which nobody else can hear. These sounds certainly do not give pleasure and can be a source of great annoyance to the sufferer.

They can sound like a train constantly passing though your head, like bells jangling in your own bell tower, or like an irritating high-pitched whistle forever at your ear. They are not like voices, but can interfere with the reception of speech unless you make a conscious effort to "LISTEN OUT".

Everyone who experiences them want to know what they are. Why do I have this noise? Does it mean that my hearing will go entirely? Will more and more noises come? Will they ever go away?

It seems that mostly only people with a hearing loss experience them. Sometimes a person with a migraine can experience such a sound on a temporary basis, or a patient with a high fever can

complain of noises which aren't there. After sitting in a noisy place, people often have "ringing in the ears" but that is a kind of echo of the noise they have heard. It in itself is a warning to keep away from that sort of noise, because too much exposure could result in hearing loss. An interesting thing is that people who are born deaf do not seem to have head noises.

There are lots of theories abut head noise, or "tinnitus" as it is called. Here are some of them. First, there is the theory that says that what you are hearing is real - it is the sound of your blood pounding through the veins and other body noises which you didn't notice before because you were so much more interested in outside sounds.

Then there is the idea that some of the nerve endings are dying off and because of this do not respond correctly and keep on sounding until they finally no longer respond at all. Or that the hearing circuits as a whole are faulty and respond to other stimuli, like cold or fatigue, by making sound sensations.

Yet another theory says that we are programmed from childhood on, to expect a certain amount of sound daily, which we consider "normal". When there is a loss, we feel that we must supply our own sounds to make up the quota, as it were. So, either physically or mentally we do this and produce our own. Unfortunately, having trained ourselves to produce this illusion, we are unable to cut it off and are left with a sort of sound Frankenstein.

You can find, of course, objections to any or all of these theories. You are still left with a sound whch cannot be medically cured and is troubling you.

For someone who has any type of head noise, the most useful thing is to provide yourself with alternative distractions. Listen to things outside, learn to look at the world much more acutely than you do now. Miss nothing.

It makes sense to have both a general medical check-up and pay a visit to your otologist. Sometimes they may recommend some form of treatment.... Do not forget that auditory training can be a help with head noises. Perhaps it is the relaxation and knowing more about hearing that lessens the tension. As you realize that you have hearing potential, that even a little hearing can be useful to you, and that there are ways of developing your listening attention and discrimination, perhaps you become less anxious about the condition. Maybe it is the increased attention to listening which helps. Often the wearing of a hearing aid has helped to reduce the annoyance of this condition.

What ever the reason, it is interesting that every writer about hearing rehabilitation reports that, as people practice their listening exercises, they begin to become less bothered by their head noises. Listening OUT does seem to help.

APPENDIX L: Discussion Material

Factors Contributing to How We Hear

I. The volume of the speech
  A. Degree of hearing loss
  B. Degree of amplification
  C. Intensity of speaker's voice
  D. Distance from speaker

II. Clarity of the Speech
  A. Clarity of the speaker - foreign accents, poor diction, quick rate, etc.
  B. Distortion caused by the hearing loss
  C. Distortion caused by the hearing aid
  D. Distortion caused by the channel e.g. radio, loudspeaker, telephone
  E. Acoustics of the room, e.g. echo

III. Distractions
  A. Presence of background noise
  B. Nonauditory distractions, e.g. visual

IV. Physical/Emotional State
  A. Motivation
    1. interest
    2. feelings of failure
    3. family attitudes
  B. Fatigue
  C. Health

V. Previous Information
  A. From knowing person
  B. From knowing subject/situation
  C. From knowing language

How Previous Knowledge Aids Understanding
(e.g.I bought a pair of _____)

I. Knowledge of Language
  A. Clues based on meaning e.g. missing word should be
    1. an object
    2. likely to be bought
    3. in pairs
  B. Clues based on grammar e.g. missing word should be
    1. a noun
    2. plural
  C. Clues based on knowing the sounds that can occur in English and sound alike (i.e. can be easily confused with one another)
  D. Clues based on intonation and stress (e.g. shout/whisper, rate,

pause, emotions)

I didn't buy a big house,_____
I didn't buy a big house,_____
I didn't buy a big house,_____

II. Knowledge of Speaker
  A. Clues based on person's speech pattern, dialect
  B. Clues based on knowledge of frequent topics of conversation and choice of words
  C. Clues based on knowing the meaning of particular gestures and facial expressions

III. Knowledge of Situation or Subject of Conversation

Until now, you HAVE been taking advantage of these clues to some extent. The goal is to make you more conscious of them so you may use them maximally. Due to these clues, much of the message can be predicted. Some parts of the message are less predictable (e.g. hearing a new name), making them more difficult. Therefore, you must use two kinds of information:

1) the part of the message you did hear
2) any additional knowledge which can help you to fill in the gaps in order to figure out the whole mesage

Improving Listening Skills

I. Preparing for the Listening Situation
  A. Improve your chances of predicting the message
    1. learn topic of conversation
    2. obtain an agenda for meetings
    3. read reviews and synopses of plays
    4. stay aware of current events
    5. keep informed of the interests of friends and family
  B. Try to stay healthy, rested and relaxed
  C. Practice listening
    1. develop the desire to listen; suppress the desire to talk in excess
    2. set aside a time for the express purpose of improving your listening skill
    3. try to bring your habitual listening level to the level of your listening capacity
  D. Become aware of your own biases

II. While in the Listening Situation
  A. Don't be afraid to guess
    1. take advantage of previous knowledge
    2. be flexible and change your mind when later information contradicts what you thought was said
    3. remember that filling in what you missed by guessing works only if used along with **careful listening**
  B. Listen carefully

1. look for ideas, not isolated words
2. don't give up if you miss the beginning. You may figure it out later or it may not have been important.
3. in very difficult listening situations, you may at least be able to establish topic of conversation
3. keep alert and attentive; avoid distractions
   a. paraphrase what was said. In addition to helping you stay focused, this will provide confirmation that you have understood correctly.
   b. question the speaker's intent or purpose
4. relax
5. don't stop listening too soon - continue listening to confirm that you have correctly interpreted the intent of the speaker

C. Learn to use spare time -- analyze errors. When you miss information, were you daydreaming, preoccupied, distracted by an attribute of the speaker, still handling earlier information, hearing an emotionally loaded subject, etc.

Strategies of Hearing-Impaired Towards Listening Situations
(Which do you use? Which should you use?)

1. Assume that others are to blame when you can't understand (e.g.mumbling).
2. Pretend to understand; bluff.
3. Do most of the talking.
4. Pretend to be occupied to avoid listening or having someone talk to you.
5. Ask someone to tell a story you already know (so you'll know what is being said).
6. Stop trying to listen.
7. Ask for repetition when you don't understand.
8. Avoid places where you'll be called upon to listen.
9. Tell people how to talk to you so that you can best understand them (e.g. not when the water is running).

APPENDIX M: Consonant Drill Exercises

(For /d/)

A)1. EED
2. EEB

B)1. OOD
2. OOB

(For /z/)

C)1. ZEE
2. THEE

D)1. EEZ
2. EEV

(For /m/)

E)1. EEM
2. EEN

(For /n/)

F)1. EEN
2. EEM
3. EENG

(For /ŋ/)

1. EENG
2. EEN
3. EEM

H)1. OONG
2. OOM
3. OON

(For /ʃ/)

I)1. SHEE
2. CHEE

J)1. SHOO
2. SOO

(For /tʃ/)

K)1. CHEE
2. SHEE

L)1. CHOO
2. SHOO

(For /s/)

M)1. EES
2. EETH

(For /k/)

N)1. KEE
2. TEE

O)1. OOK
2. OOP
3. OOF

(For /t/)

P)1. EET
2. EEK
3. EETH

Q)1. OOT
2. OOF

(For /g/)

R)1. EEG
2. EEB
3. EED

S)1. OOG
2. OOD
3. OOB

(For /h/)

T)1. HOO
2. FOO

(For /b/)

U)1. EEB
2. EED

V)1. OOB
2. OOD

(For /p/)

W)1. PEE
2. TEE
3. KEE

X)1. POO
2. KOO
3. FOO
4. HOO

Y)1. OOP
2. OOT
3. OOF
4. OOTH

Z)1. EEP
2. EET
3. EEK

(For /f/)

AA)1. FEE
2. THEE

BB)1. FOO
2. HOO

CC)1. EEF
2. EET
3. EEK
4. EETH

DD)1. OOF
2. OOP

(For /θ/)

EE)1. THEE
2. TEE
3. FEE

FF)1. THOO
2. FOO

GG)1. EETH
2. EEP
3. EET
4. EEK
5. EEF

HH)1. OOTH
2. OOT

(For /v/)

II)1. EEV
2. EEB
3. EED
4. EEG

JJ)1. OOV
2. OOB

(For /ð/)

KK)1. EETH
2. EEB
3. EED
4. EEV

LL)1. OOTH
2. OOB
3. OOD
4. OOV

APPENDIX N: Raw Data

R A W D A T A

Synthetic Only

	NST				RSPIN-PL				RSPIN-PH			
	Pretest		Posttest		Pretest		Posttest		Pretest		Posttest	
	1	2	1	2	1	2	1	2	1	2	1	
1	30.77	39.01	36.81	42.86	36.00	44.00	50.00	48.00	50.00	56.00	64.00	82.00
2	39.01	36.81	41.21	42.30	48.00	56.00	64.00	70.00	28.00	44.00	66.00	58.00
3	59.89	60.99	54.95	57.69	48.00	52.00	52.00	56.00	42.00	38.00	46.00	74.00
4	51.65	52.75	53.85	51.10	40.00	32.00	44.00	44.00	36.00	6.00	2.00	8.00
5	36.26	46.70	36.81	46.15	36.00	44.00	52.00	56.00	46.00	50.00	72.00	54.00
6	46.70	43.40	49.45	36.26	32.00	30.00	34.00	38.00	50.00	46.00	60.00	62.00
7	34.07	39.01	62.64	41.21	38.00	64.00	56.00	46.00	54.00	64.00	46.00	64.00
8	48.90	45.05	50.55	45.60	38.00	50.00	40.00	52.00	46.00	48.00	64.00	64.00
9	34.07	36.81	35.16	39.56	56.00	58.00	50.00	48.00	68.00	86.00	80.00	80.00
10	35.71	30.22	34.61	33.45	36.00	30.00	22.00	23.05	48.00	42.00	44.00	48.42

Synthetic plus Analytic

	NST				RSPIN-PL				RSPIN-PH			
	Pretest		Posttest		Pretest		Posttest		Pretest		Posttest	
	1	2	1	2	1	2	1	2	1	2	1	
1	45.60	50.00	55.49	48.90	34.00	28.00	42.00	44.00	64.00	42.00	62.00	74.00
2	52.20	48.90	55.49	51.65	58.00	44.00	62.00	68.00	58.00	22.00	74.00	62.00
3	47.25	43.96	44.50	42.86	50.00	42.00	52.00	46.00	56.00	58.00	50.00	58.00
4	40.66	50.00	56.04	54.40	40.00	34.00	42.00	24.00	58.00	70.00	68.00	60.00
5	40.11	37.91	54.40	51.10	36.00	28.00	30.00	42.00	70.00	46.00	60.00	72.00
6	36.26	33.52	39.56	46.15	34.00	48.00	48.00	36.00	46.00	54.00	38.00	46.00
7	64.83	67.58	76.37	60.04	66.00	76.00	74.00	70.00	50.00	68.00	70.00	80.00
8	54.39	50.00	48.35	58.79	48.00	54.00	52.00	58.00	70.00	72.00	82.00	78.00
9	50.55	43.96	39.56	45.05	42.00	50.00	54.00	54.00	56.00	70.00	78.00	76.00
10	56.04	37.36	40.66	48.35	32.00	24.00	16.00	34.00	34.00	42.00	46.00	60.00

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