# Programmed Learning in a Two-Person Speech System*

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1. In a manner not anticipated a few years ago, the sequence and control techniques of programmed learning may be utilized in the manipulation of a two-person conversation. My purpose in this talk is to discuss programmed learning in terms of a speaker-listener pair, or more exactly, in a two-person speech system. The important inputs and outputs of this two-person learning operation may be viewed from a system orientation. One basic problem is to identify the relevant variables of the tutor's "information" and teaching technique, and to provide a corresponding account for the activities of the student.

2. The first two-person learning form is the natural learning situation and it is found in any family. With neither special training nor electronic apparatus, it is a 90% safe bet that through an extended conversation the mother will succeed in teaching the child to speak her dialect before the child reaches five years of age. Such a two-person instructional relationship, which is often called the Socratic dialogue, assumes the tutor has both information and teaching technique. The student is viewed as cooperating through conversational interaction with the tutor. The student attempts to acquire information, attitude or skill, and in the end, to approximate the speech behavior of the tutor.

3. A learning program provides a carefully sequenced arrangement of all the materials a good tutor might present to the student. Material is included or excluded on the basis of its relevance to a specified educational objective. The student has the programmed material he is to learn presented to him in "conversational fashion"

by a teaching machine; he makes frequent responses to this material and immediately receives confirmation or correction of each response. This presentation, response, confirmation event typically requires on the order of one minute. In the body of the learning program, these events must be carefully graded, considerably more detailed than textbooks or other educational materials, and so arranged that the student can independently proceed from the first event in the program to the last one without difficulty. For example, to meet an educational objective of 95% accuracy in phonetic transcription of isolated English syllables, a learning program was prepared which caused a student to hear, transcribe, and immediately check his transcription of 1600 or more syllables[1]. On the completion of a program, a student must be able to demonstrate he can meet a specified objective. If he cannot, the program must be revised.

4. The automated teaching situation permits a student to work through a learning program at his own best rate with the aid of a mechanical tutor, the teaching machine. In this instance, a teaching machine presents a learning program to the student, and thereby performs the functions of the tutor. The responses each student makes while completing the program provide a detailed record of his learning attempts which may be used to revise and refine both the learning program and the teaching machine.

With a simple teaching machine and learning program, our students have achieved 95% accuracy in transcription of isolated English syllables in 4 to 12 hours[2]. The mean time was 6–7 hours – when the students had the same dialect as the voice being trancribed. In learning speech production of selected consonant sounds, foreign students have been able to reduce the number of deficient sounds 63%[3]. Fifteen to 90 minutes per sound was the time range. The mean was 53 minutes per sound. The sounds were English; the learners were foreign students from several countries. While the results in speech production are better than chance they are still considerably below the target of 90% accuracy. Work is underway to increase the efficiency of the system and extend it to larger units in connected speech.

5. Teaching machines for speech learning cost money. Good tutors are scarce and expensive. Students are plentiful. The presentation function of the teaching machine is performed by a student in a two-person learning program. For this approach, we have gained

useful information from programmed learning theory, game theory, psychiatric work on dyads, system analysis and other areas.

While materials are being developed for several speech learning tasks, because of its simplicity, only one example from speech intelligibility will be presented in this brief time[4]. Two students, A and B, are each given a complete but complementary set of materials; each has one-half of a complete learning program and sufficient instructions to play the tutor role for the other person. After working through the set of instructions A and B begin saying "words" to each other. In the beginning a matching pattern is employed. A looks at his list and sees: 1. latter, 2. ladder. If number 2 is the test word, A will say: "latter, ladder, (pause), ladder." If he receives the word correctly, B replies: "ladder two." A replies "correct". B looks at his list and pronounces his test material while A responds. And so on. When an error occurs, the word is marked, and both A and B work to correct it. From the example, if B had replied: "latter one", A would record the error and then repeat; if repetition was not sufficient as a clue, context would be added: "A step ladder is used for climbing." Other error correction procedures are also employed. When 12 words are correctly identified in sequence, A and B move to the next condition, and by degrees, to larger units.

Our initial work in two-person learning programs centered on speech intelligibility. The technique may be used for speech learning of units both larger and smaller than words. Person A and person B may be, but need not be similar in background. The data collected from the error and time records of each pair are used to guide the refinement of the two-person system. Error data can be entered into a confusion matrix; frequency of occurrence of particular materials in the program may be regulated on the basis of error information. When used in this way, programmed learning serves as a means of instruction for the student, and an instrument for collection of data on the speech learning process for the researcher.

6. Three possibilities for acquiring speech control of various language units are considered here. First, the natural learning situation, and second, the automated instruction situation are discussed. Third, in the two-person system, the listener controls the speaker in a way that ensures that the speaker quickly adapts to the changing requirements of the listener. Thus, the social aspect of the natural learning situation and the control techniques of auto-

mated instruction are combined to provide a highly flexible speech centered learning operation.

### References

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