

A PERSONAL COMPUTER-BASED WORD LEARNING SYSTEM
FOR APHASIC PATIENTS

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In order to facilitate development of a computerized word-learning system for aphasic patients, digitized data of a set of picture cards and the corresponding speech sounds were compiled on the disk memory of the personal computer. Using this data set, preliminary programs for a personal computer-based word learning system were developed.

Characteristics of the data set and programs will be described in this paper.

Scheme of the Personal Computer-based Word Learning System

The learning program is basically based on pointing responses to displayed picture cards. A set of picture cards are displayed on the monitor display of a personal computer. The speech sound corresponding to one of the displayed picture cards is output through a D/A converter, and the patient makes a response by pointing to a displayed picture card. All the responses and program operations are performed through a touch panel. Several variations on this fundamental program were prepared according to slight changes in the training procedures.

Picture cards were digitized using an image reader and speech signals are digitized by using an A/D converter. The digitized data were stored on a cartridge disk of the personal computer.

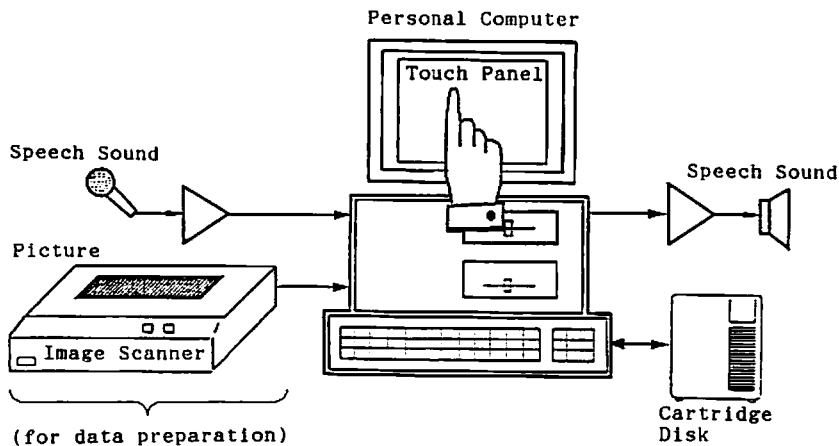


Fig. 1. Hardware configuration of the personal computer-based word learning system for aphasic patients.

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Noun Learning

Based on an examination of several existing word lists for the rehabilitation of aphasics, 350 fundamental nouns were selected as a training set. Color picture cards were newly drawn for these words, and they were read into the computer through an image reader. They were digitized in 208 X 120 picture elements with 3 bit color information. The speech sounds for these words were also digitized by an A/D converter and stored in the computer. The A/D conversion was performed with 10kHz sampling and 12 bit digitization. The stored data were about 9.5 Mbytes in total. All the nouns are labeled with categories (food, plant, animal etc), learning levels (low, middle, high) and associated scenes (breakfast, dining room, school etc).

Pointing Program

A specified number of picture cards chosen from the data on the disk are displayed on a monitor display. The number of picture cards to be displayed at one time can be specified at the beginning of the program. A speech sound corresponding to one of the displayed pictures is output by the computer. The patient is asked to point to a displayed picture through the touch panel. The computer tells the patient whether the response is correct or not by displaying a O or X mark on the picture pointed to. Then, the next speech sound is output. The speech sounds are output in random order. The number of repetitions of each speech output for each displayed picture and also can be specified at the beginning of the program. When the patient is not certain about a answer, he can ask the computer to output the speech sound again by selecting an appropriate icon-menu through the touch panel. He can also pass the current response by selecting ?-icon on the display. At the end of the training series for the currently displayed picture set, he can listen to the speech sound of the selected picture by touching the desired picture, before proceeding to the training of another set of picture cards.

Naming Program

A single picture card is displayed on a monitor display at one time. The patient tries to recall the name of the object in the picture, and, if he cannot, he can ask the computer to present several subsidiary cues which are memorized in the computer. These cues are the sound of the short sentence explaining the object, the sound of the initial syllable, letters etc. The patient can select a desired cue through the icon-menu. Data of subsidiary cues for the present set of nouns are now being drawn up and stored in the computer.

Verb Learning

100 fundamental verbs were selected as a learning set and the patterns of combination with case particles were determined for each verb. The case particles taken into consideration were

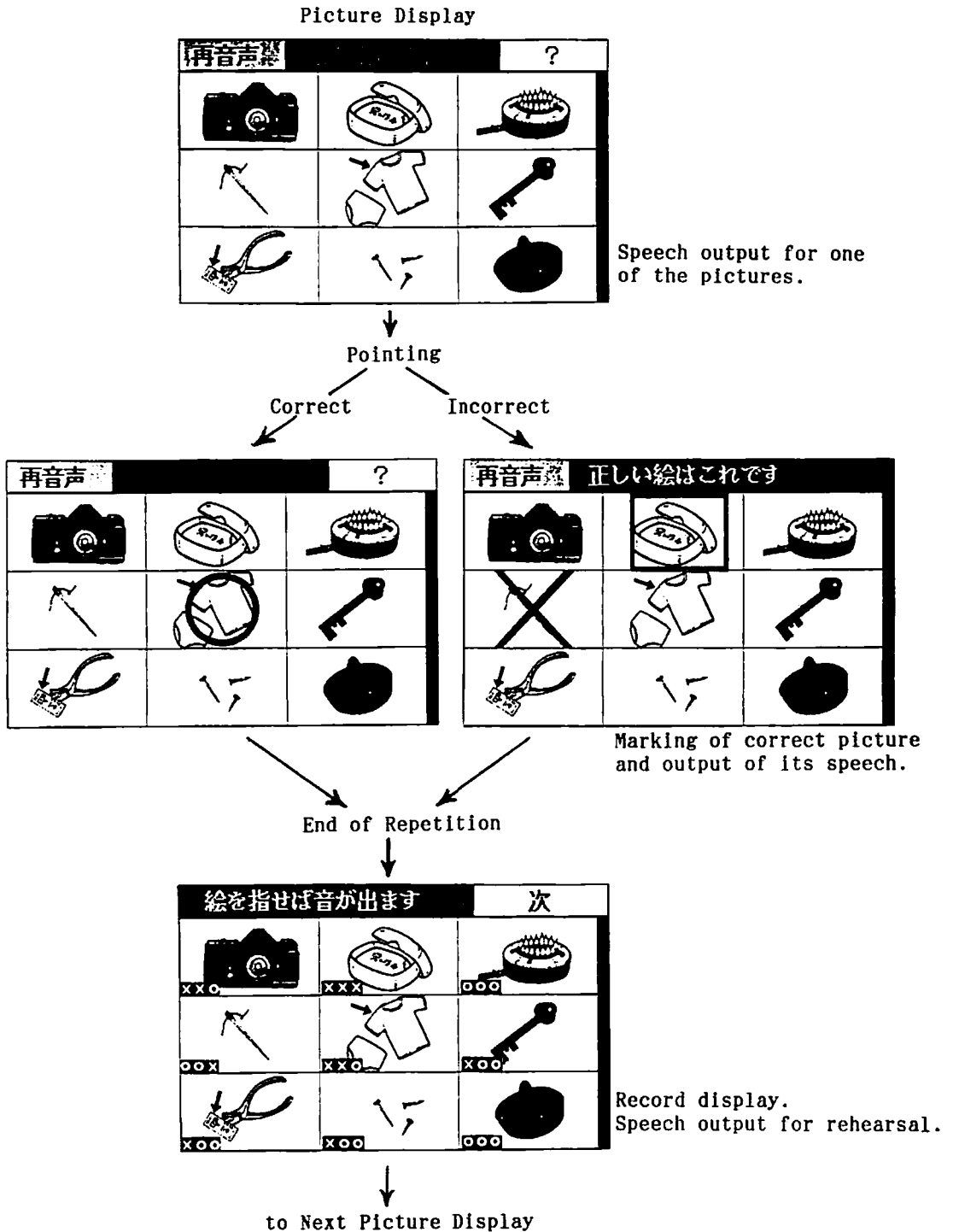


Fig. 2. Examples of display during the noun learning program.

as follows.

"ga"	nominative
"o"	accusative
"o"	path
"de"	locative
"de"	instrumental
"ni"	dative
"ni"	destination / goal
"to"	concomitative

For a given combination of verb and case particle, simple sentences were constructed using appropriate nouns. For each verb-particle combination, up to 4 or 5 sentences were prepared, when possible, using different nouns. Picture cards (black and white in this case) were drawn for every simple sentence. The number of picture cards are about 350 in total.

Pointing Program

The program flow is essentially the same as that for nouns except that the program provides a special mode of picture card presentation as an introductory step in verb learning in which only a set of pictures having the same verb or noun are presented.

Particle Learning Program

A single picture card is displayed at one time, and, instead of a sentence, the speech sounds of only the noun and the verb are output. A set of hiragana characters representing the Japanese case particles are displayed, and the patient is asked to point to an appropriate particle.

A preliminary test is now being conducted on the practical application of the system to the training of aphasic patients.

Reference

1) Kiritani, S., H. Imagawa, S. Saito, and S. Shibata : Personal Computer-based Word Learning System for the Aphasic Patients. 1989 Autumn National Convention Record, J. IEICE. Part-1, A-60, 1-63, 1989.