# VUG NEWSLETTER

Number 2

FEBRUARY 1975

The response to the first issue of the VUG Newsletter has warranted the distribution of issue number two. Many more people have expressed an interest in the VUG and these people are listed at the end of the Newletter.

Additionally, I encourage all members to dash off a description of their use of Votrax, including their problems. As you can see several members have submitted such articles.

Vocabulary Exchange

I agree with your recommendations 1 and 3 for transcription notations, but think that a single space is a sufficient delimiter for phonemes. The commas are redundant and get in the way visually.

I would like to see speech rate and pitch placed under digital control. How do other users feel about this?

I like the format of the Newsletter. Listing of VUG members is very helpful in locating others with similar interests. Keep up the good work.

Richard L. Mercer

Vocalics

No one submitted anything for this section. Vocalics is the section to add some humor to the Newsletter. Come on - let your imaginations go!

Standard Phonetic Representations

I just received the VUG Newsletter and I think it's a great idea. I am the sole inventor of the voice synthesizer and a consultant to Federal Screw Works, Vocal Interface Division. Although I am not using the Votrax unit in an end user capacity, I am fully prepared to contribute to your Newsletter. I notice that you constantly refer to the IPA and its relationship to the programming rules of the Votrax unit. The synthesizer was designed around human speech and its components, not the IPA. The IPA is very incomplete in its description of speech structure. It says little about the dynamics of speech and the interaction of phonemes. The Votrax unit, particularly the VS6 is a dynamic synthesizer. To my knowledge, no one has been able to devise a parctical synthesizer of such low cost that produces good speech which utilizes the IPA. Unfortunately, the IPA is ubiquitous and universally accepted without question.

If I can contribute to your publication, please let me know.

Richard T. Gagnon

In response to Richard's letter above, VUG decided to follow up on his criticism of the IPA and asked him to submit a more inclusive article, which follows:

THE VOTRAX PHONETIC ALPHABET

It is obvious that the symbols used in the IPA are designed for universal, world wide usage. There are many more sounds in the English language, let alone the whole world of languages, than there are letters in our alphabet. Thus, combinations of letters and alternate pronunciation

of letters are necessary to encompass the universe of phonemes in our language. The Votrax phonetic vocabulary was derived to serve two purposes: 1) an alphanumeric system which could be typed by a regular typewriter or described by an ordinary keyboard data entry terminal 2) symbols that have meaning for Votrax users who are not familar with the IPA.

Also, there are so many departures from the IPA in synthetic speech generation that a complete break with the IPA is a serious consideration. The IPA does not take into account two important areas of articulation as far as English at least is concerned - articulatory HABITS and DIPTHONGIZATION of vowels.

Articulatory habits are the way we "connect" phonemes together and also the way a phoneme is interwoven into its phonetic environment. English is taken to be a very unphonetic language, but not as much as we have been taught to believe. The problem lies often not with the English treatment of phonetic components in its spelling of words, but with our interpretation and categorization of phonemes! For instance, the word ail is commonly accepted to have two phonemes, long A and L. Actually, it has three phonemes and would you believe the middle one is short I? The spelling is completely consistent with the phonetic components of this word, but not with OUR understanding of the constituent phonemes. The same argument holds true of the word air. The word ale is, of course, pronounced the same as ail. The I in the middle is not necessary to accurately describe the articulation of this word because it is our ARTICULATORY HABIT to always place a short i (the i in the word it) in between a long A and an L. It is likewise our habit to place the short i between the long E and an L. Short vowels such as the a in cat (AE) or the short e in bet when followed by an L, have a short u (UH) between the the vowel and the L.

Virtually all vowels in standard English are dipthongized, particularly the long vowels. Long I is a recognized dipthong, but the other long vowels also have a gliding dipthong character:

long A = A, AY
long E = I, E (the I here is short and is normally generated automatically by the VS6, but is represented by IE in the VS5.
long O = UH, O or OO, O
long U = IU, U

These glides are mentioned in the Votrax programming instructions and should normally be followed closely if the standard Midwest dialect is desired. The short vowels are glided as well. Programmed glides of short vowels are necessary with the VS5 but the glides are automatically generated in nearly all cases with the VS6. See the programming rules for your synthesizer.

It is not unusual for phonetically trained people to have trouble at first in attempting to program the Votrax, but by following the programming instructions provided with the unit good results can be obtained in short order.

Standard Phonetic Representations (cont'd)

Additionally, Robert Kooi and Wen C. Lin indicated that what follows is a possible correspondence between IPA and VS-6 phonemes.

| IPA | VS-6 | IPA | VS-6 |
|---|---|---|---|
| IY | E or E1 or Y | AX | UH2 |
| IH | AY or I | IX | IU |
| EY | A, AY | ER | ER or R |
| EH | EH or EH1 or EH2 or EH3 | AW | AH1, O1 |
| | | AY | AH1, Y |
| AE | AE or AE1 | OY | O1, EH3, Y |
| AA | AH or AH1 or AH2 | Y | Y1 |
| AI | UH or UH1 or UH2 or UH3 | W | W |
| | | R | R |
| AO | AW or AW1 or AW2 | L | L |
| OW | UH3, O1 | M | M |
| UH | OO or OO1 | N | N |
| UW | U or U1 | NX | NG |

| IPA | VS-6 | IPA | VS-6 |
|---|---|---|---|
| P | P | S | S |
| T | T or DT | SH | SH |
| K | K | V | V |
| B | B | DH | THV |
| D | D | Z | Z |
| G | G | ZH | ZH |
| HH | H | CH | T, CH |
| F | F | JH | D, J |
| TH | TH | WH | H, W |

Aaron Sawyer of the Foxboro Company sent the following Votrax-ASCII correspondence used in their system. I believe the motivation for the correspondence below is due to the octal representation of the phoneme and its corresponding ASCII octal number.

| PHONEME | ASCII | PHONEME | ASCII |
|---|---|---|---|
| PAO | C | G | \ |
| PA1 | > | H | [ |
| A | (space) | I | ' |
| A1 | F | I1 | K |
| A2 | E | I2 | J |
| AE | . | I3 | I |
| AE1 | / | IU | 6 |
| AH | $ | J | Z |
| AH1 | U | K | Y |
| AH2 | H | L | X |
| AW | = | M | L |
| AW1 | S | N | M |
| AW2 | 0 | NG | T |
| AY | ! | O | & |
| B | N | O1 | 5 |
| CH | P | O2 | 4 |
| D | ↑ | OO | W |
| DT | D | OO1 | V |
| E | , | P | % |
| E1 | < | R | + |
| EH | ; | S | ← |
| EH1 | B | SH | Q |
| EH2 | A | T | * |
| EH3 | @ | TH | 9 |
| ER | : | THV | 8 |
| F | ] | U | ( |
| UH | 3 | U1 | 7 |
| UH1 | 2 | Y | ) |
| UH2 | 1 | Y1 | " |
| UH3 | # | Z | R |
| V | O (letter) | ZH | G |
| W | - | null code | ? |

## Programs and Applications

Bruce Curran, Mary Hitchcock Memorial Hospital, Hanover, New Hampshire 03755, sent the following description of his use of Votrax.

The hardware configuration used for the Votrax system is shown in Figure 1. It allows the Votrax to be used in two separate environments. For development, the Votrax is connected to the Dartmouth Time-Sharing System. Here it is operated in conjunction with a separate terminal (see Figure 2) that allows the user to program strings of phonemes for output to the synthesizer. In our case we use an Imlac PDS-1 graphics terminal so that we may use the light-pen and graf-pen for interactive input and editing. The conversion from phoneme strings to binary is done through DTSS programs written in BASIC, which also allows novice users to be able to work with the unit more easily.

When the user has finished the development of his strings, they may be transferred to the NOVA 2/10, a stand alone real time system for verification of treatment set-ups in Radiation Therapy. The Nova monitors the various Cobalt-60 or electron machines in the center, waiting for a signal that a treatment has been set. The parameters associated with that particular patient and treatment are read and checked against the stored parameters on the master Linc Tape file. Any errors in the set-up are found by the FORTRAN program running on the Nova, and an audio message is put together telling the technician the erroneous setting and what the correct setting should be. The speaker to the particular treatment machine being checked is turned on, so that only the particular machine involved will receive the message, yet only one Votrax is needed for any one center.

Well, that's about as much as I can say at this point. Most of this

is not yet built though the design is fairly final.

Bruce Curran

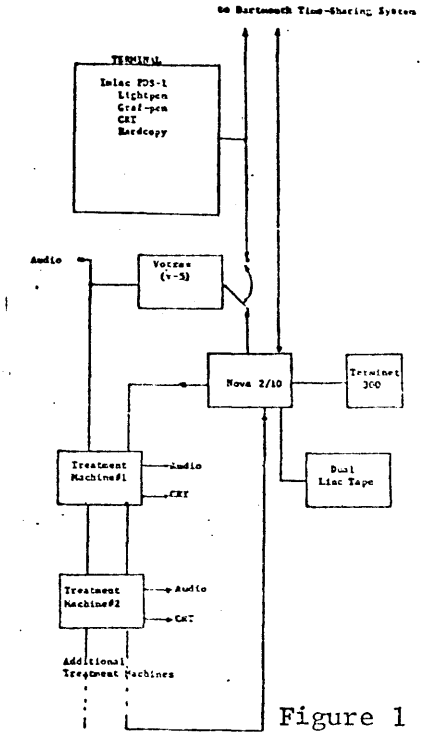


Figure 1

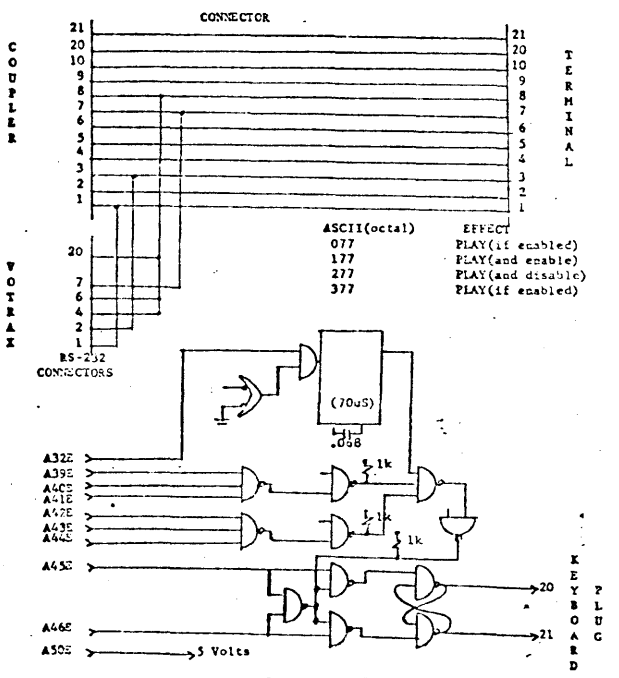


Figure 2

Robert P. Kooi and Wen C. Lin of Case Western Reserve University submitted the following description of their use of Votrax.

Case Western Reserve University has been primarily engaged in testing the intelligibility of the VS-6. Our current project concerning the Votrax is text-to-phoneme translation. We have a Vidicon with software capable of recognizing typewritten characters. Our goal is to have text from a book converted directly to speech using the hardware of our speech laboratory as shown in Figure 3. Since we are just beginning text-to-speech conversion, we are interested in any information concerning algorithms, results, pitfalls, etc. We presently have software which can enter, edit and store phrases and output them to the VS-6.

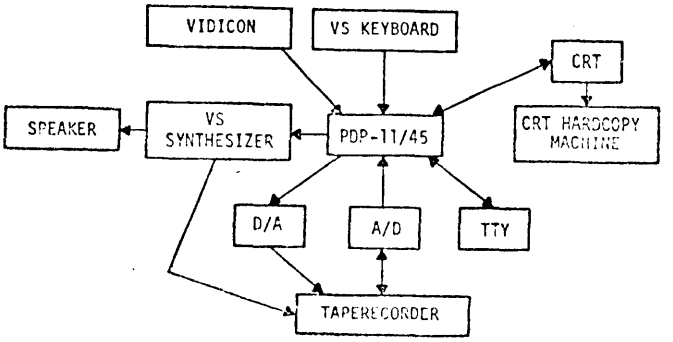


Figure 3

The following is a response by Edward Fronczak of the University of Michigan Computing Center. Perhaps more detailed information on the system will be forthcoming.

To access the University's Michigan Terminal System, a time sharing system for a dual processor IBM/360 Model 67 (soon to be replaced by a single processor IBM/370 Model 168) via either a 10-, 12-, or 16-button Touch-Tone telephone. Five Votrax VS-6 units support five telephone lines through Bell System 403E6 data sets with full-duplex modifications. The grapheme to phoneme translation is accomplished by a parsing algorithm which isolates

morph types in the output utterances and concatenates the corresponding phonemes for prefixes, roots and suffices with some spelling change analysis for suffixed words. The parser is supported by a sharable, core-resident tree-structured dictionary. Various device commands are supported for user augmentation or replacement of the resident dictionary and various Touch-Tone input functions.

## Hardware Corner

Edward Panofsky has supplied the following information on the previously reported circuit design error.

The Votrax TTL I/O BOARD SCHEMATIC, drawing number D534SC indicates an error that is in fact implemented in the device. IC13 and IC14 form a "fail-safe" counter that prevents the Votrax from looping. However, these counter chips require pins #6 and #7 to be grounded to be enabled to count. This error is easily corrected by soldering two small bare wires on the back of the printed circuit board from the pins to the ground trace near by. Refer to the drawing for exact locations. Take care to use a minimum of solder on the ground trace as it is very close to the edge of the board and must fit through the cards guides.

HINTS AND SUGGESTIONS: The TTL I/O BOARD (if you have that option) is the only board where you can actually see any components. The board can be plugged in either end first, however, the end of the board with the random discrete components on it goes toward the front panel. When you put the rear cover panel on, make sure the thumb screws are fairly tight, as this provides the grounding connection to the I/O connector. When you have completed the mod, remember to update the schematic.

I have included a parts layout for the use of anyone needing to modify or repair the I/O board.

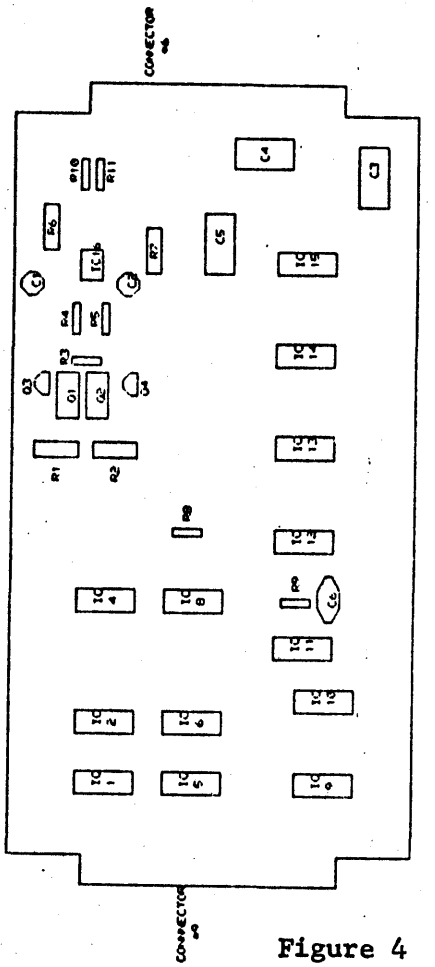

Figure 4

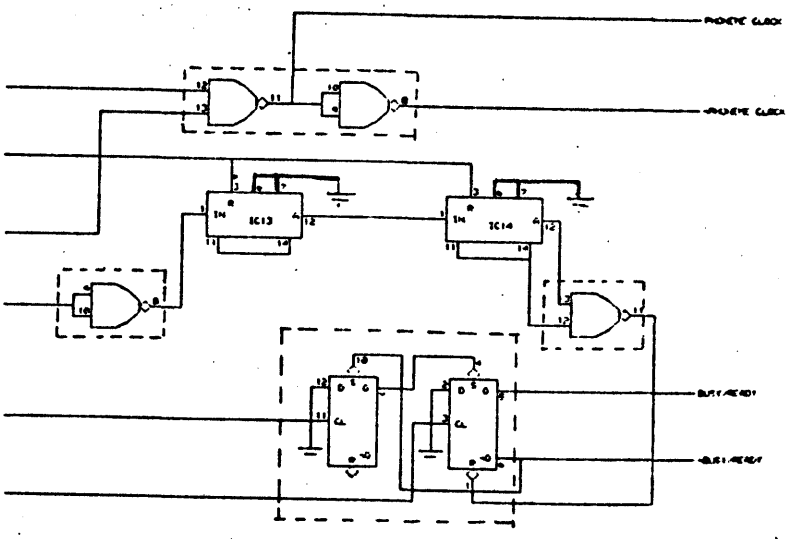

Figure 5

## Errors and Corrections

In VUG Newsletter Number 1 there was an error in the Computer Phonetic Representations Table. Line 7 should read:

| Phoneme | 1-Character | 2-Characters | Examples |
|---|---|---|---|
| ʌ | A | AI | but |

## Final Note

Thanks to all the members who were kind enough to take some time and tell us about their systems. I hope that this is just a start at a means of communications which could be very rewarding to us all. Please take a little time to submit a description of your system.

Honey Elovitz

## NEW VUG MEMBERS

### CANADA

Mr. Peter M. Carey
Lektromedia Ltd.
108 Leacock
Pointe Claire
Quebec, CANADA H9R 1H1
Phone: 514-695-8312
Application: Interfacing synthesizer into intelligent CRT terminal for computer aided learning

Dr. E. W. Channen, Director
School of Computer Science
University of Windsor
Windsor, Ontario N9B 3P4
CANADA
Phone: 519-243-4232 X730
Application: Used by students for various projects. Interfaced to PDP-11/20

### EUROPE

Antonio Borsellino
Laboratorio Di Cibernetica E Biofisica
Corso Mazzini, 20
16032 Camogli
ITALY
Application: Audio-display in computer simulation of normal and disturbed speech centers

Mr. E. Wulff
Data Logic Computer GmbH.
623 Frankfurt/M-80
IM Sechholder 11
WEST GERMANY
Phone: 0611/392024
Application: Used with DEC 116 and NOVA 1200

### USA

Mr. Gary Babcock
Code 5131
Naval Weapons Center
China Lake, California 93555
Phone: 714-939-3661
Application: To report status of a job via telephone. Controlled by a PDP-11

J. R. Barksdale
Code 5001
Navy Electronic Laboratory Center
San Diego, California 92152
Phone: AV 933-7502; 714-225-7502

Jeremy Knight
Lawrence Berkeley Laboratory
Building 50A - Room 1135
Berkeley, California 94720
Phone: 415-843-2740 X6359
Application: Talking teletype for blind programmers and computer center status via telephone

Art Lange
Hewlett-Packard Company
5301 Stevens Creek Blvd.
Santa Clara, California 95050
Phone: 408-246-4300

Paul McCann, Jr.
Naval Undersea Center
Code 3531
S. Rosecrans St., (Pt. Loma)
Bldg. 1 - Room A217
San Diego, California 92132
Phone: AV 933-7714; 714-225-7714
Application: Research fire control facility as an operator voice-alert

Ernie Nassimbene
% IBM
P.O. Box 66
Los Gatos, California 95030
Phone: 408-227-7100 X5303

Patrick FitzHenry
University of Illinois at Urbana
Savoy, Illinois 61874
Phone: 217-333-3162

Prof. Charles E. Hallenbeck
Dept. of Psychology
University of Kansas
Lawrence, Kansas 66045
Phone: 913-864-4131

Robert Redding
Foxglove Associates
P.O. Box 3498
Lawrence, Kansas 66044
Application: Information System

Scott I. Allen, M.D.
Building 12A - Room 2033
National Institutes of Health
Bethesda, Maryland 20014
Phone: 301-496-5361
Application: Use with System Engineering Laboratories 810B Computer, Model 6 synthesizer

Mr. W. A. Scanga
AAI Corporation
P.O. Box 6767
Baltimore, Maryland 21204

D. Aaron Sawyer
Dept. 332
The Foxboro Company
Neponset Avenue
Foxboro, Massachusetts 02035
Phone: 617-543-8750 X2029
Application: VS-6 interfaced to a PDP 11/45 with 8K

Carl Bixby
Interface Systems, Inc.
5 Research Drive
Ann Arbor, Michigan 48103
Application: Incorporated into multiplexed multiline audio response units which is interfaced to most popular mini-computers

Bob Chencinski
Vocal Interface Division
500 Stevenson Highway
Troy, Michigan 48084

Prof. John Eulenberg
Computer Science Department
Michigan State University
East Lansing, Michigan 48824
Phone: 517-353-0831
Application: Computer assisted instruction, communication aids for the blind, artificial language development two-way video systems. Interface to CDC 6500, PDP 11/45 and Interdata mini-computer

Mr. Edward J. Fronczak
University of Michigan
Computing Center
1075 Beal Avenue
Ann Arbor, Michigan 48105
Phone: 313-764-2121
Application: Used with Univ. of Michigan Terminal System. Provide access via Touch-Tone telephone. Five VS-6 units support five phone lines

Richard T. Gagnon
307 Wadsworth Lane
Birmingham, Michigan 48010

Fred Gruhl
G.M. Research Labs
G.M. Technical Center
Warren, Michigan 48096
Phone: 313-575-2941
Application: Remote task pacing and alarm messages

Dr. Anthony Miltich, II
Audiology Services
915 S. Gd. Traverse
Flint, Michigan 48502
Phone: 313-234-8782
Application: Research in clinical hearing testing for diagnostic purposes

Prof. Morteza A. Rahimi
Computer Science Department
Michigan State University
East Lansing, Michigan 48824
Phone: 517-353-0831
Application: Computer assisted instruction, communication aids for the blind, artificial language development, two-way video systems Interface to CDC 6500, PDP11/45 and Interdata mini-computer

Ms. Miriam M. Schaefer
Flint Board of Education
923 E. Kearsley Street
Flint, Michigan 48502
Phone: 238-1631 X411
Application: Computer assisted instruction in elementary grades in both reading and arithmetic. Interfaced to Hewlett-Pakcard 2000C and 2000F

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Phone: 617-543-8750 X2029

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Texas A&M
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Washington, D. C. 20375
Phone: 202-767-2953

Dr. Rodney Johnson
Code 5403D
Naval Research Laboratory
Washington, D. C. 20375
Phone: 202-767-3012

Hernan I. Otano
Chief, Electromechanical Unit
National Air & Space Museum
A&I Building - Room 2273
Washington, D. C. 20560
Application: Used in the new National Air & Space Museum in conjunction with the museum's Automation Central Control System

Theodore Nykreim
Boeing Company
Box 3707 - MS 77-30
Renton, Washington 98124
Application: Oral warning display to pilots. Replacement of prerecorded passenger announcements on airplanes

Biometry Div., Clinical Cancer Center
University of Wisconsin
307 North Charter Street
Madison, Wisconsin 53706
Application: VS-5 synthesizer in a computer voice response system under program control of PDP-12 with 8K memory

Gregg C. Vanderheiden
Cerebral Palsy Comm. Group
922 ERB - 1500 Johnson Drive
University of Wisconsin
Madison, Wisconsin 53706
Application: Exploration of use for vocal output for non-vocal physically handicapped children and adults